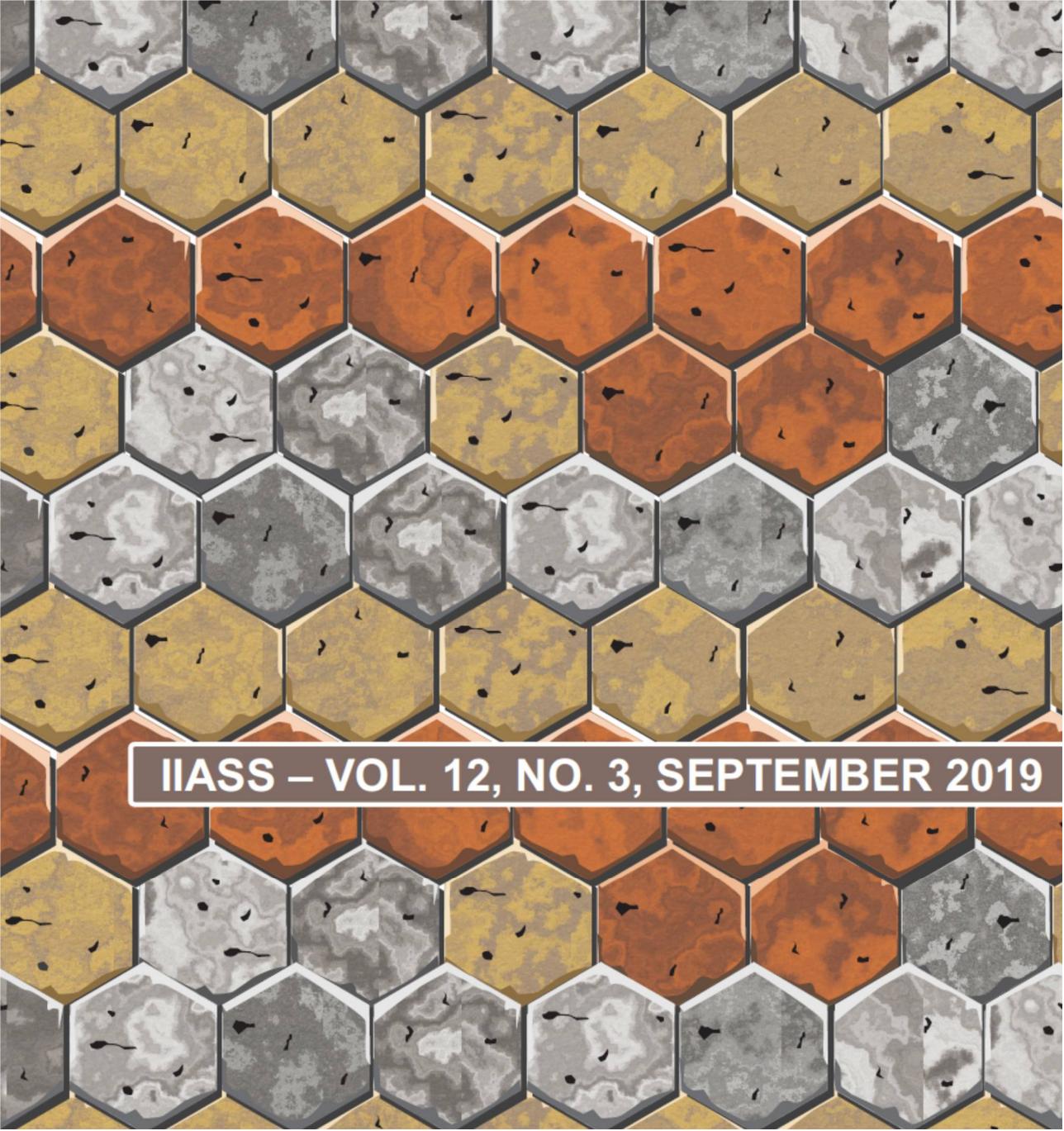


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FROM INDUSTRY 4.0 TO TOURISM 4.0

Saša Zupan Korže ¹

| 29

Abstract

The fourth Industrial revolution has affected all disciplines, economies and industries. Technology, the key enabler for Industry 4.0, also has a tremendous influence on tourism. The purpose of the study is to explore how the concept of Industry 4.0 has been embraced by tourism. Even though academics have paid an increased attention to the concept of Industry 4.0 in the last few years, the scholarly research on Tourism 4.0 remains at a preliminary stage. This is an exploratory type of paper with a descriptive presentation of results. Data were collected from secondary sources and processed by using the method of content analysis. Findings reveal, firstly, different use of the term Tourism 4.0 among governments, tourism policy makers, practitioners and scholars; secondly, tourism stakeholders have already widely implemented the technologies of the fourth industrial revolution that are suitable for designing tourism services. The study supports the Tourism 4.0 to become a global paradigm and contributes to the body of literature on technological changes in tourism.

Keywords: Industry 4.0, Tourism 4.0, technology, new paradigm

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Introduction

After the turn of the millennium, the technologies have become sophisticated and integrated in such a way that they have been transforming societies and the global economy (Schwab, 2016). In parallel, the Internet has grown at unprecedented scales to become ubiquitous in all economic and social aspects of life (Diez-Olivian et al., 2019). Market development, internationalisation and growing competitiveness have led to the emergence of the so-called Fourth Industrial Revolution and the concept of Industry 4.0 (Piccarozzi et al., 2018).

¹ Saša Zupan Korže, Ph.D., assistant professor, is a lecturer (of law, tourism, economics, entrepreneurship), researcher and consultant.

The term Industry 4.0 was coined by the German government in the context of its high-tech strategy in 2011 (Rodič, 2017). At its early stage, it was related to the 'factories of the future' or 'smart factories'. For Diez-Olivan et al. (2019: 92) 'smartisation' of manufacturing industries "has been conceived as the fourth industrial revolution or Industry 4.0, a paradigm shift, propelled by the upsurge and progressive maturity of new Information and Communication Technologies (ICT) applied to industrial processes and products«. However, the paradigm of Industry 4.0 has become global (Rodič, 2017).

From 2011 on, there have been several attempts in professional and academic publications to determine the concept of Industry 4.0. To the present, the determination remains non-consensual (Pereira and Romero, 2017; Piccarozzi et al., 2018).

In academic papers, Industry 4.0 is determined as "an emerging concept – an umbrella term for new industrial paradigm that embraces a set of future industrial developments regarding Cyber-Physical System, Internet of Things (IoT), Robotics, Big Data, Cloud Manufacturing and Augmented Reality (AR)... which ... are enabling an intelligent manufacturing environment" (Pereira and Romero, 2017:1207). Park (2017) understands Industry 4.0 as hyper automation and hyper connectivity based on artificial intelligence (AI), big data, robotics and IoT that can overcome the gap between the physical and cyber systems in order to increase productivity and intensify industrial production. Digital manufacturing technology, network communication technology, computer technology and automation technology are the so-called "Key Technology Enablers for Industry 4.0" (Pereira and Romero, 2017: 1211).

According to the European Parliament (2016:20), Industry 4.0 "describes the organisation of production processes based on technology and devices that autonomously communicate with each other along the value chain in virtual computer models". For Schwab (2016), Industry 4.0 is characterized by a range of new technologies that are fusing the physical, digital and biological worlds. It is based on megatrends of the following technological drivers:

- physical – autonomous vehicles, 3D printing, advanced robotics, new materials;
- digital – internet of things, distributed ledger technologies/block chains, technology-based platforms and
- biological – genetics.

The combination of the above-mentioned drivers have been disrupting entire industries, their related distribution and consumption; it enables the creating of new business models and absolute customisation of products and services (Schwab, 2016). Customisation of services is particularly important in tourism.

Over the past six decades, tourism has experienced continued expansion and became one of the largest and fastest-growing industries in the world; international tourist arrivals worldwide are expected to reach 1.8 billion by 2030 (UNWTO, 2017).

Heterogeneous businesses in the field of tourism (e.g. tour organizers and mediators, transfer companies, hotels, restaurants etc.) are offered tremendous opportunities for development. However, their future will be heavily impacted by social, economic, political, environmental and technological changes and challenges. Technology advancement is definitely one of four megatrends that are likely to have significant impacts and relevance in tourism development (OECD, 2018).

The deployment of cutting-edge technologies of Industry 4.0 is known for its disrupting effect that impacts many sectors, including tourism (Manjari, 2018). Technological evolution in tourism has already been, in certain cases, described by a new term – Tourism 4.0, which is based on new paradigm in industry, Industry 4.0 (What is, n.d.). Due to extensive growth of the tourism sector and its contribution to economy, it is important to research how the term Tourism 4.0 has been used and understood up to present and how the fourth industrial revolution and its key enabling technologies have been embraced by this important service sector.

Despite the rising interest in technological changes in tourism and vigorous participation of demand and supply sides of the market in it, the research on Tourism 4.0 have been sparse. Thus, the purpose of this paper is to contribute to the academic research on Tourism 4.0 by answering to the following research questions:

- When did the term Tourism 4.0 appear?
- How has the term Tourism 4.0 been used and understood up to now?
- What kind of key technology enablers for Industry 4.0 have been mostly used in tourism?

The introductory section is followed by explaining the methodology and major findings about Tourism 4.0. The paper ends with the discussion

regarding the results of empirical research, its limitations and a proposal for further research.

Methodology

The research on Tourism 4.0 is still in its formative stage. Therefore, the exploratory type of research was chosen to achieve the research goals and descriptive method to present the results.

Data collection was conveyed in the systematic internet research procedure in the period from January to July 2019. Mega search engine of National and University Library (NUK, n.d.) was used for searching the scholarly papers published in major scientific databases that proved to be the most complete in terms of collection of scientific publications. Google Scholar and Google search engines were used to search additional relevant documents.

The process of identification of relevant documents consisted of the following systematic steps: key phrases identification, documents identification, quality assessment, data extraction and data analysis.

Within the first step, the basic key word Tourism 4.0 was used for searching the existing literature. In the second step, other key phrases were used to identify the documents by selected topics. In the second step, additional phrases, based on the key technology enablers of Industry 4.0, were used as the framework for further research in the context of tourism, travel and hospitality (e.g. robotics in tourism/hospitality, big data in tourism, virtual/augmented reality in tourism/hospitality etc.). Google Scholar and Google search engine were used to extract documents such as online media articles and other online documents, published by governments, professionals, corporations and individuals. The third step focused on the quality assessment of the selected documents. The publication time of documents was used as an important criterion in assessing the relevance of particular information. Only documents from 2015 on were taken in the fourth step, which was concentrated on data extraction. A thematic content analysis was carried out in which bottom up coding scheme was adopted.

The next level comprised a more in-depth approach. Data extraction and data analysis within the context of this research were intertwined. Data collected in the data extraction phase were thoroughly analysed. The combination of condensation, comparison, compilation and description methods were used to present the findings.

Results

Research findings are organised in three subparts. The first and the second subpart give answer to the first and the second research question, while the third subpart addresses the third research question. In the first subpart, different uses of the term Tourism 4.0 are presented for each of the countries that have already implemented the term Tourism 4.0. The second part reveal how the term Tourism 4.0 is dealt with in scholarly papers. The third subpart condemns and compiles examples of the implementation of key enabling technologies of Industry 4.0 in the context of tourism services.

The use of the term Tourism 4.0 by governments and tourism policy makers

The results reveal less than ten countries that have already implemented the term Tourism 4.0 mostly in documents, published by governments or governmental institutions, policy makers and tourism public-private partnerships. Those countries are clustered in two groups:

- European countries – Portugal, Finland, Italy, Spain, Turkey and Slovenia;
- Southeast Asian countries – Thailand, Bali, Malaysia.

The first country that used the term Tourism 4.0 seemed to be Portugal. However, the term Tourism 4.0 – used in 2016 – had not much in common with key technology enablers for Industry 4.0. Actually, it was related with the initiative of promoting the entrepreneurship, with support of travel and tourism start-ups, and with facilitating innovations in tourism (Turismo de Portugal, 2017). Portugal presented the above-mentioned initiative under the name of Tourism 4.0 (Ferreira Nunes, 2016). The same year, the project was announced as one of the four finalists of UNWTO for receiving the award for Excellence and Innovation in Research and Technology in Tourism (UNWTO Awards, 2016). The term Tourism 4.0 was again used in 2018, in the wine tourism project – ‘Wine Tourism 4.0’ – to promote ecotourism tourism in the Alentejo region (Wines, 2018).

In Finland, Tourism 4.0 comprises the action programme that aims to ensure the growth of tourism industry with various measures (Tourism 4.0 key projects, 2017). The Tourism 4.0 action programme is a package of measures to promote international growth and renewal of Finnish tourism in 2018 and 2019. The government should grant EUR 16 million to the programme that consists of tourism marketing, reinforcement of the digital competence of tourism business, development in the year-round supply and furthermore, for reducing and streamlining the regulation (ibid.).

In Italy, Tourism 4.0 is related to digital innovations in transport and related activities, within hospitality and culture. Italians were aware that the technologies of intelligent travel, e.g. robots, self-driving vehicles, chat-boots, artificial intelligence, big data etc. have been rapidly changing the world of travel. Thus, Italy's Osservatorio Nazionale del Turismo concluded a partnership with a private corporation to go in step with new trends (Milano, 2017). In Italy, the application of Industry 4.0 in tourism has been named Tourism 4.0 and is related mostly with the analysis of big data, digitalisation and the Internet of Things and Machines (Abrogio, 2017). At the beginning of 2018, one of the largest banks has announced a deal with the Ministry of Culture to invest EUR 5 million in the following three years for the project 'Pact for Tourism 4.0', which also includes technical innovation (Edwards, 2018). To acquire technological competencies in Industry 4.0 and its transfer into tourism, one of the academies in Verona promotes an executive master study in hotel management and digital tourism 4.0 (Masterin, n.d.).

Tourism 4.0 is considered "almost totally digitized sector" in Spain. Yet, the only available data related to Tourism 4.0 is about launching the Touriscoin, a new cryptocurrency, by a private corporation from Alhambra. Tourscoin should make payments and contract services presumably with 'zero intermediaries' (Pino, 2018).

Turkey announced to develop and invest in the latest concept named 'Tourism 4.0' to support the development of digital marketing in tourism in 2017 (Digital Tourism, n.d.). However, there has been no data available about the further progress of the concept.

In Thailand, Tourism 4.0 is a policy implemented by the government dedicated to five goals: to develop tourism intelligence centre system, to promote digital tourism, to improve E-document system, to change the organisational culture and to enhance research and development (Five pillars, 2017). In 2018, the University of Phayo, Bangkok, decided to organise a new educational program with the title 'Tourism 4.0: The Impact of digital disruption'. The decision has been a result of government awareness of the changes in tourism business models (Evensi, 2018). Various talks have been organised about Tourism 4.0 on a yearly basis (Tourism 4.0, 2018)."

The government of Bali is trying to develop smart destinations, utilizing information and technology to cope with younger and more tech-savvy tourists (Millennials) that are always connected to internet platforms. Therefore, the government has started to educate people about new

technologies in Tourism 4.0: about blockchain, big data, virtual and augmented reality (Capturing Millennial, 2018).

In Malaysia, Tourism 4.0 is about designing digital ecosystem for reaching Chinese tourist; digital technologies should enhance tourism offer and improve tourist experience (Tan, 2018). Malaysia Smart Tourism 4.0 initiative is to take tourism sector to the next level utilising opportunities in the digital age. Public-private partnerships will provide digital ecosystem in the country for targeted marketing (Restanis, 2018).

In Slovenia, the term Tourism 4.0 appeared in 2018. It was related to a paradigm of Tourism 4.0 and to a research project implemented in the country (Kick-off meeting, 2018).

The term Tourism 4.0 as a new paradigm is used 'for the current trend of big data processing collected from a vast number of travellers to create personalised travelling experience; it is based on a variety of modern high-tech computer technologies' (What is, n. d.). It leverages the 4th Industrial revolution technologies such as AI, IoT, big data analysis, cloud computing, virtual and augmented reality (ibid.) (see Figure 1). The new paradigm transfers the concept from Industry 4.0 to tourism with the aim of transforming the perception of tourism and business around it (Arctur, 2018).

In Tourism 4.0 research project, the research team – consisted of consortium of three universities in Slovenia and a private computer company – aims to research the Tourism 4.0 paradigm and its possible implementation in the next three years. The aim of the project is to develop appropriate ICT tools and an ecosystem, which will enable collaboration between key stakeholders in tourism and through new business models (Kick-off meeting, 2018). The project should be co-financed by the Slovenian government.

In September 2018, the project was presented on UNWTO World Tourism Day in Budapest as an example of Slovenia being Tourism 4.0 'Living Lab'.

Figure 1: Tourism 4.0 understood in Slovenia



Source: <http://en.turistica.si/blog/2018/09/10/launch-of-the-tourism-4-0-project/>

At UNWTO level, the term Tourism 4.0 was first mentioned at the 22nd Session of the UNWTO General Assembly – Special Session on Smart Tourism in September 2017. Yet, the term was used in the context of facilitating innovation in tourism sector and stimulating the tourism entrepreneurial ecosystem (Conference note, 2017).

The above examples give a thorough insight on how differently governments, tourism policy makers and practitioners use and understand the term Tourism 4.0. There is a wide range of ideas and activities put 'under the umbrella of Tourism 4.0' in different countries, e.g. fostering tourism entrepreneurship, implementing tourism action programmes, encouraging tourism digital innovations, designing tourism digital ecosystems etc. However, most of them are related to technological changes of the fourth industrial revolution, adapted to tourism. While tourism is characterised mostly by services (and not by physical products) which are co-created by their users, it is logical that the paradigm of Tourism 4.0 is slightly different to the paradigm of Industry 4.0.

Understanding of Tourism 4.0 by scholars

Until the middle of 2019, there have only been a few scholarly papers that included the term 'Tourism 4.0'. However, none of the papers have been published in the highly-ranked journals on tourism.

In their research on measuring technology for online purchase intention in hotel industry in Malaysia, Allamy et al. (2018) use the term Smart Tourism 4.0. In this case, Smart Tourism 4.0 is an initiative of the

Malaysian government to take tourism on the next level of utilising the opportunities in the digital era. However, authors simply refer to the Tourism 4.0 governmental action plan for further tourism development without giving any further determination of 'Tourism 4.0'.

Papathanassis (2017: 212) used the term Tourism 4.0 in relation to digital transformation and intelligent automation in tourism, referring the "Tourism 4.0-related technologies such as cloud computing, mobile internet, robotics, AI, autonomous vehicles and even 3D-printing". However, these technologies are mentioned in the context of having considerable impact on the skill requirements and on the composition of the global tourism workforce (ibid.), but not in the context of determination of the term Tourism 4.0.

Manjari (2018) considers Tourism 4.0 as a new stage of tourism development compared to E-tourism and M-tourism, where:

- E-tourism refers to digitalisation of tourism establishments and encompasses setting up commercial relationship using the Internet to offer tourism-related services, e.g. hotel reservation, flight or car service;
- M-tourism is understood to represent accumulated tourism-related interactions acquired through mobile devices (e.g. GPS, electronic maps, information about points of interest, shops, restaurants etc.).

Tourism 4.0 exemplifies broader scopes and deeper aspects than e-tourism and m-tourism: it refers to a "current trend of big data processing collected from a vast number of travellers to create a personalized travelling experience". It could be viewed as an "exhortation trying to put the Industry 4.0 and tourism altogether" (ibid.).

However, when comparing different stages of tourism development, Manjari (2018) ignores the term/concept of 'smart tourism', which has been studied intensively by several authors for the last few years. The definition of smart tourism seems to be close to understanding the term Tourism 4.0. E.g., for Hunter et al. (2015: 105) smart tourism is a "social phenomenon arising from the convergence of information technology with the tourism experience". According to Gretzel et al. (2015) smart tourism describes the increasing reliance of tourism destinations, providers of tourism services and tourists on emerging forms of information communication technologies and other cutting-edge technologies that allow massive amounts of data to be transformed into a value proposition.

There have been only two scholarly studies found related to 'Tourism 4.0' so far:

- The first one is of Yildiz and Davutoglu (2018) about the transition of tourism to Tourism 4.0 and the use of technologies of Industry 4.0 in the context of tourism.
- The second is of Starc Peceny et al. (2019) about challenges in marketing a paradigm shift of Tourism 4.0.

According to Yildiz and Davutoglu (2018: 230), "there are not many tangible examples of the implications of Industry 4.0 in the tourism sector". However, authors state that among heteronomous tourism subsectors, only tourism travel sector has made by far the most changes toward Tourism 4.0. These changes has happened due to the fact that many people – when buying a plane ticket or book an accommodation – prefer the Internet to travel agencies. In tourist accommodation, there are no notable improvements other than the hotels managed by robots (ibid.).

Starc Peceny et al. (2019) refer to Tourism 4.0 as to a new paradigm. Tourism 4.0 should "unlock the innovation potential in the whole tourism sector" with the help of key enabling technologies of Industry 4.0 (e.g. IoT, big data, blockchain, AI, virtual and augmented reality). It is also about establishing collaborative ecosystems, involving local inhabitants, local authorities, tourists, service providers and governments that can co-create an enriched tourism experience in the physical and digital world. In this new collaborative ecosystem, the key enabling technologies from Industry 4.0 should be harmonised with the Tourism 4.0 principles. The focus of Tourism 4.0 ecosystems are the local communities and not only tourists. Authors point out the marketing of the new paradigm Tourism 4.0 as one of the important issues in the way of its successful implementation.

Up to present, the project on Tourism 4.0, implemented in Slovenia, seems to give the best outlines about Tourism 4.0. Undoubtedly, it is by far the most communicated approach on the web. The authors advocate the position that Tourism 4.0 is a new paradigm, which needs to be marketed well to be accepted by practitioners and academia. The paper strongly indicates similarities between the concept of Industry 4.0 and Tourism 4.0, particularly as the key technology enablers. Yet, the new paradigm of Tourism 4.0 encompasses the particularities of the tourism sector and its ecosystem.

Examples of key technology enablers for Industry 4.0 in subsectors of tourism

The importance of key technology enablers of Industry 4.0 in tourism is emphasized by several expressions, e.g.:

- 'The most widely used' (e.g. the Internet),
- 'An essential feature' (e.g. big data),
- The one that 'plays important role in tourism' (e.g. virtual reality),
- The one that 'creates network matching between buyers and sellers' (e.g. technology-based business models),
- The one that 'drives innovation and monetisation' (mobile technology),
- 'The most popular sphere' (e.g. robots and AI),
- 'The most visible sphere' (e.g. chatbots etc.).

The most widely used technical innovation in tourism is the Internet. In the 4th industrial revolution, it has become affordable to masses, as well as high-speed (European Parliament, 2015). In tourism, the Internet has been contributing to self-organised holidays and independent travels. In fact, it has shifted 'the balance of power from the providers of tourism services to consumers' – travellers and guest (ibid.). To providers of tourism services, it has brought two major advantages. The first one is the cost reduction: there can be fewer intermediaries than before, processes are streamlined and tourist companies can save time and expenses (Brain, 2017). The second major advantage of the Internet in tourism is related to marketing: on the Internet, geographical barriers disappear; tourism companies can easily enter foreign markets and reach more customers and customers can reach them (ibid.).

Big data are an essential feature of Tourism 4.0 (Manjari, 2018). The implementation of big data in tourism means having real-time information about tourists, their movements, their preferences, their buying decisions, their aspirations etc. Big data are collected from different sources, where tourists leave behind their digital fingerprints: on social media, on tourist portals, with robots and chat bots etc. (Dolgos, 2018). The advantage of extracted data by big data applications is that those data are based on actual tourist actions and not on data obtained by surveys. Thus, they are reliable, representative, detailed and include segmentation capacity; moreover, they allow the implementation of the useful predicting models to improve the efficiency of customer service (Kraus, 2017). Big data have already driven all marketing decisions and areas important to 'stay ahead of what customers need' (McCracken, 2018).

Virtual reality (VR) plays a big role in tourism. Tourists like to make a virtual journey to the existing or fictions places from the touch and 360-degree holidays videos with VR (Fes, 2018). In April 2018, a massive Virtual Reality Theme park was opened in Guizhou, China (Ashcraft, 2018). Some airlines have already committed to VR technology: in 2015, Qantas launched a pilot program showcasing virtual destinations (such as Kakadu National Park, Great Barrier Reef, Hamilton Island) to first class passengers (Manjari, 2018), while KLM has handed VR headsets to tourist flying from New York to Europe (Drescher, 2017).

Augmented reality (AR) technology is revolutionizing the traveller experience by making the planning journey more seamless, interactive, and simple (Augment, 2016). AR makes changes to a person's perception of their physical surroundings, when viewed through a particular device. The technology has similarities with VR, but AR does not replace the real-world environment, but augments it by overlaying digital components (Revfine, n.d.). AR technology makes it possible to layer digital enhancements over an existing reality or a real-life scenario. For tourism, this means that booking a hotel, accessing information while being there, navigating around the destination, translating written or spoken signs or conversations and locating dining and entertainment options can all be done simply through an app on mobile devices (Augment, 2016).

Mobile technology is the one that drives the innovation and monetisation of the tourism business (Meza, 2017). In hotels of the future, digital technologies could turn hotel rooms to a 'feel-good location'. Several actions can already be done in hotels simply by using mobile applications on smartphones, e.g. check-ins, checkouts, setting the room temperature etc. (Fes, 2018). For young travellers, the smartphone is becoming a room key, the menu, the bill (Majendie, 2018). In KViHotel Budapest, everything is controlled by the guest smartphone: guests can check-in by their apps from everywhere; the smartphone is the room key that controls everything in the room and can offer the concierge service (KViHOTEL, n.d.). Furthermore, in Slovenia's capital, Ljubljana, one of the hotels in the city centre also enables guests to check-in, pay and checkout with a mobile application. Guests receive the room-key via smartphone (Pušnik, 2018). Furthermore, there is also a strong link between airlines, airport and smartphone users (check-in etc.) (Grad, 2014). In the near future, mobile interface and devices will probably allow travellers to have their digital identity and carry it with them (World Economic Forum, 2018).

Wearable technology – smart watches, bracelets, glasses – is slowly becoming a reality in tourism. American Airlines has enabled boarding passes, gate change and baggage claim notifications on Apple Watch, Uber enables users to request rides and be notified of their arrival on the watch. Hotels are working with Apple Watch, enabling guest check-in, review reservation details, make last minute booking or door unlocking using wearable devices. The future of smart watches-enabled travel is much higher; however, the travel management companies are still rather technologically behind this trend (Dorsi, 2016).

New digital ledger technologies should enable trust and authenticity (Hausold, 2017); thus, there have been several ideas regarding how to provide quick transfer of money using digital ledger technology, how to pay with crypto assets, how to be rewarded for loyalty with crypto currencies, etc. (e.g. Pino, 2018; Starc Peceny et al., 2019). It is predicted that in the near future, digital ledger protocols (e.g block chains) should allow the travellers to go to the airport leaving their valet and identity document at home (Hausold, 2017).

Robots in hotels and restaurants are probably the most popular sphere of new technological advances. They have been developed in combination of robotics and AI. There are a few examples of how hospitality and travel sector of tourism employ artificially intelligent robots.

- In Marriott hotel in Ghent, Belgium, the guests are welcomed by humanoid robot Mario. Mario talks to guest in 19 languages about events, bus schedules, breakfast buffet etc. (Hyland, 2017).
- At Hilton hotel in McLean, USA, humanoid robot Connie performs similar tasks as Mario does in Marriott (Threjos, 2016).
- In several hotels in the US, Aura, Botlr or Relay robots assist at delivery of towels, toothpaste or drinks to the hotel rooms (Wood, 2017). Robots look like rolling boxes and can communicate with guests only by display screens. To navigate around the hotel, they use Wi-Fi, sensors and 3D cameras (Martin, 2016).
- In Yotel hotel in New York, the futuristic storage robot in the lobby takes care of the guest luggage and put it in the storage lockers (Martin, 2016).
- In Turkey, they have been trying to use humanoid robot Robin in airports to guide people, show ads, etc.; the robot could be trained for hotels as well (Freifer, 2017).
- The Henna-na hotel (it means Weired Hotel), in south-western Japan, is the world's first 'no human employees' hotel. A robot, the humanoid one for Japanese speaking guest, and a dinosaur

for the English-speaking guests, assist guests with check-ins and checkouts. The visitor still has to punch a button in the desk and type information on a touch panel screen at the arrival. Guests' baggage is transported to the rooms by another robot. Facial recognition technology is used instead of a standard electronic key to open the hotel room (The Guardian, 2015). In only two years, the Japan's first robot-staffed hotel has been so successful that the hotel owner has been considering forming a network of 100 hotels with robot staff in the country (Freifer, 2017).

- Pizza Hut announced that it would hire robot waiters, Pepper, to take orders and process the payment at its fast-food restaurants. Pepper is an artificially intelligent robot that can read and respond to human gestures, expressions and the tone of voice. It allows customers to communicate with 'just like they would with friends and family' (Curtis, 2016).
- Royal Caribbean uses robots as bartenders (Venegas and Belarmio, 2018).
- A robot suitcase called Tavellmate is an example of robotics for dealing with luggage easily to traveller. An autonomous suitcase is able to follow its owner by itself. It uses anti-collision technology and has 360 degree turning capabilities. It eliminates the need for carrying, pulling or pushing the suitcase (8 Examples, n.d.).

Travelzoo's (2016), a global study on the acceptance of robots working in travel, showed that travellers expect robots to play a big part in their lives by 2020; three quarters out of more than 6,000 respondents would be comfortable with robots in travel sector. Although international travellers are largely positive towards the use of robots in their holiday destinations, some nations appear more cautious than others. Germans and French were the most averse to robotics and AI, while Chinese and Brazilians were the most positive. The main advantages that respondents see in robots are general efficiency, data retention and recall. More than three quarters of respondents think that robots would be better than humans at handling data (81 %) and dealing with different languages (79 %), while 76 % believe robots have better memories.

Probably the most visible manifestation of AI in tourism and hospitality at present are chat bots – virtual assistants, which are able to hold a natural language conversation with human through bots and chat apps (e.g. Amazon's Alexa). They are ideal for customer-centric businesses like tourism, particularly for carrying out basic requests for information. Dutch airlines KLM was one of the first to implement the use of bots and

chat apps sending their passengers boarding passes and flight information via Facebook Messenger, WeChat, Viber and other chat apps (Peterson, 2018). Some reservation platforms for tourist accommodation (e.g. Expedia) have already implemented travel chat bots. In Andas Singapore Hotel, ConsierGo – a chatbot with AI – communicates with guests through hotel's Facebook messenger account (Manjari, 2018).

When robots and chatbots perform tasks, they collect all kinds of data about hotel guests; therefore, they are becoming 'active mobile big data collectors'. Moreover, since they are machines connected to larger IoT networks, they have threefold usage. Firstly, they can serve as data collection points; secondly, they can interact with guests; and thirdly, they can complete other tasks (Hospitality technology, 2017).

Other evident examples of technical evolution of the 21th century are technology-based business models that create networks matching buyers and sellers (Schwab, 2016). Technology-based companies has become new members of some economic sectors (Brain, 2017). They make possible what can be called 'on demand economy', referred to by some as sharing economy. In tourist accommodation sector, Airbnb is by far the most known business model of this kind (Zupan Korže, 2018).

Apart from the rise of intelligent automation (robotics, AI and IoT), the other major technology trend in travel and tourism is the dominance of digital platforms. Powered by AI, the next wave of technical solutions will gather unprecedented amount of data for disparate systems via multiple touchpoints that travellers have with providers (World Economic Forum, 2018).

Conclusion

This paper is about the transfer of the concept of Industry 4.0 to tourism. Due to the important share of tourism in the global economy and its continuous growth for the last few decades, the effects of the fourth industrial revolution on tourism (demand and supply side) need closer attention.

The extensive Internet research of secondary sources gives answers to three research questions: firstly, when did the term Tourism 4.0 appear, secondly, how has the term been used and understood up to present and what are the most visible examples of technologies of Industry 4.0 in the context of tourism. Subsequently, the results indicate the parallels and differences between the concept of Industry 4.0 and Tourism 4.0.

It is almost generally accepted that the term Tourism 4.0 is rooted in Industry 4.0, where the combination of technological drivers has already disrupting entire industries, including tourism. The term Tourism 4.0 first appeared in 2016 in Portugal, while the term Industry 4.0 appeared for the first time in 2011 in Germany. In both cases, the term was coined by the public sector (governmental bodies or policy makers), not by academia. However, while the term Industry 4.0 (and not smart factories, smart technologies, etc.) has gradually become a research agenda among scholars, in tourism, research was more focused around 'smart cities, smart destinations, smart tourism', not around the concept or paradigm of Tourism 4.0.

The term Tourism 4.0 appeared in 2017 in the documents of governmental bodies, policy makers and professionals in less than ten countries (Portugal, Finland, Italy, Spain, Slovenia, Turkey, Thailand, Malaysia and Bali). The term was used as 'an umbrella term' for fostering tourism within the particular country, for enabling technological changes in tourism, for implementing new tourism 'ecosystem', etc. Yet, the technological changes in tourism – digitalisation, big data, robotisation, artificial intelligence, mobile technologies, virtual reality, distribute ledger technologies etc. have been the 'leading thread' in all documents related to Tourism 4.0.

Only five papers have been found that have certain characteristics of scholarly papers on Tourism 4.0, although none of them has been published in the high-ranking scientific journals on tourism (with journal citation index). Nevertheless, those papers provide the initial insight on what Tourism 4.0 might be (a concept, a paradigm) and all five of them relates it with the key technology enablers of Industry 4.0. It seems that the Tourism 4.0, explained in the latest manuscript of Starc Peceny et al. (2019), gives the best outline about Tourism 4.0. Moreover, it is by far the most communicated on the Internet and the one that connects academia with other stakeholders in the 'real-life' tourism. The paper indicates similarities between the concept of Industry 4.0 and Tourism 4.0, particularly in the field of key technology enablers. On the other hand, Tourism 4.0 encompasses the particularities of the tourism sector: service nature of the tourism outputs (not tangible products), co-creation of the tourism services by customers, high urge for customisation of services, etc.

The selected examples of practical use of technology enablers for Tourism 4.0 in different tourism sectors indicate that tourism has already been deeply following the steps of Industry 4.0. However, due to the diversity of tourism businesses and the nature of their output, the scope

and the scale of new technologies in tourism, it is slightly different from the one in Industry 4.0.

It is suggested that by 2030, AI might contribute up to EUR 13.33 trillion to the global economy (Busquets, 2019) and that digitalisation in travel might create up to USD 305 billion of value until 2025 (World Economic Forum, 2017). If these predictions are correct, technology might become the top driver in tourism.

There are a few limitations related to this research. The first one is subjectivity of the researcher, which might commonly accompany the selecting and processing the non-numerical data for content analysis. This argument might be related to the collection process and analysis of data for providing the answer to the third research question. As all available sources on the Internet (according to the researcher's knowledge) were included for getting the relevant data for answering the first and the second research question, there might be less limitation related to this part of the research.

The second limitation relates to the limited number of data available on the research topics and their quality. In academia, the kind of sources, used in this research, might be characterised by the term 'grey literature' or papers that are 'more driven by the practice than research'.

Thirdly, the topic of this research might be labelled 'non-academic'. However, the history of research gives evident examples of how certain topics or subjects do not become interesting for academic research at once, but within the course of a longer period of time. They depend on individual academic interest and trends, on policy of editors of scientific journals, on repeating and reinforcement, etc. (Rangus & Brumen, 2016).

Following the example of Industry 4.0 and considering the results of this study, it is suggested that Tourism 4.0 should find its place in academic research. Thus, further research on this subject is needed to conceptualise the Tourism 4.0 and, primarily, to clarify the difference between Tourism and 'smart' tourism.

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