Ultimate transformation: How will automation technologies disrupt the travel, tourism and hospitality industries?

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Abstract:
Companies from the travel, tourism and hospitality industry have started adopting robots, artificial intelligence and service automation technologies (RAISA) in their operations. Self-check-in kiosks, robotic pool cleaners, delivery robots, robot concierges, chatbots, etc., are used increasingly by tourism companies and transform the ways they create and deliver services. This paper investigates the impact of RAISA technologies on travel, tourism and hospitality companies – their operations, facilities design, marketing, supply chain management, human resource management, and financial management. The paper emphasises that in the future companies will divide into two large segments – high-tech tourism companies offering standardized cheap robot-delivered services, and high-touch companies, which rely on human employees.

Key words: robots, artificial intelligence, service automation, self-service technology, chatbots, travel, tourism, hospitality, transformation

1. Introduction

Every generation witnessed technological breakthroughs that revolutionised the tourism industry. In the middle of the 19th century the train made travel of tourist groups feasible and the first organised trips emerged. In the first half of the 20th century, the car added a great deal of flexibility to the selection of tourist routes and contributed to the democratisation of travel. The jet planes in the second half of the 20th century made long haul destinations accessible and affordable for the working middle class. At the end of the 20th and beginning of the 21st century, the GDSs, Internet, social media, websites and mobile applications (Benckendorff, Sheldon, & Fesenmaier, 2014), made the world smaller and changed the rules of the business of and competition among travel, tourism and hospitality companies. Now the tourism industry is facing a new revolution, one more powerful, transformative and with longer term implications than the previous changes. Tourism is entering the robotics era.

While during the previous tourism revolutions humans played a central role in the system, both as customers/tourists and as service providers/employees in tourism companies, the new realities would induce changes to both the demand and the supply sides of the tourism system. The robotics revolution in tourism means that we should no longer expect that a hospitality employee or a customer is a human being, but a broader perspective needs to be adopted. Robots can serve as tourism/hospitality service providers (Ivanov, Webster & Berezina, 2017), but as customers of as well (Ivanov, 2018; Ivanov & Webster, 2017a).

The advances in robotics, artificial intelligence and service automation technologies (RAISA) (Bhaumik, 2018; Miller & Miller, 2017; Russell & Norvig, 2016) allow companies from various sectors to use RAISA in order to decrease costs, streamline operations, eliminate waste, and improve productivity and efficiency, which leads to huge transformations in the way businesses (will) operate (Agrawal, Gans & Goldfarb, 2018; Davenport, 2018; Makridakis, 2017; Talwar, 2015; Talwar *et al.*, 2017). Travel, tourism and hospitality industries are not an exception to the adoption of RAISA (Collins et al., 2017; Kuo, Chen & Tseng, 2017; Murphy, Hofacker & Gretzel, 2017). Robots are being used to greet guests at hotel receptions, serve food as waiters in restaurants, deliver room service orders, clean floors and swimming pools, cut grass at hotels' green areas, provide information at airports, and cook food in automated kitchens (Ivanov, Webster & Berezina, 2017). Self-service kiosks are used by hotels for check-in/out, or by travel agencies and tourist information centres for provision of information about the destination (Kim & Qu, 2014). In restaurants, customers can order food via kiosks, or tablets installed on the tables, or choose different kinds of sushi from coloured bowls moving on a conveyor belt (Collins et al., 2017; Kim, Christodoulidou & Choo, 2013). They can also have their pizza delivered to their home by an autonomous car or a drone (Lui, 2016). Travellers can search for travel information and book a trip via a chatbot (Nica, Tazl & Wotawa, 2018) and can enter their hotel room with a mobile application on their smart phones (Cheong, Ling & The, 2014; Torres, 2018). The speedy flow of passengers through airports is facilitated by self-check-in machines, self-service baggage drop-off, and automated passport control with face recognition (del Rio *et al.*, 2016; Gures, Inan & Arslan, 2018; Kazda & Caves, 2015; Ueda & Kurahashi, 2018). While self-service kiosks have been around for some time, robots make their first steps into the service business (van Doorn *et al.*, 2017; Wirtz *et al.*, 2018). For the moment, robots

seem quite clumsy in their interactions with humans and navigation through the premises of hotels, restaurants and airports. However, with advances in robotics, we can expect that robots would become much more capable of serving guests and implementing various tasks beyond the 3D (dirty, dull and dangerous) tasks which human beings do not want to implement, hence widening their potential application and adoption by tourist companies. This paper elaborates on the transformations these RAISA technologies would bring to travel, tourism and hospitality companies in the future.

The rest of the paper is organised as follows. The next section provides a very focused review of related literature on robots, artificial intelligence and service automation in travel, tourism and hospitality. Then the pros and cons of using RAISA technologies are discussed in Section 3. Section 4 delves deep into the impacts of RAISA on the operations, marketing, financial management, human resources and supply chain management of travel, tourism and hospitality companies. Section 5 summarises the key findings, elaborates the managerial implications, future research directions, and concludes the paper.

2. RAISA technologies research in travel, tourism and hospitality

2.1. Self-service technologies in travel, tourism and hospitality

Research on self-service technologies (e.g. check-in or information kiosks at hotels or airport, ticket machines at train stations, baggage drop off counters and automated biometric fingerprint scanners at airports, self-ordering kiosks and conveyor belts in restaurant, etc.) in travel, tourism and hospitality has been quite extensive, probably due to the early adoption of this technology in the industry (e.g. Ahn & Seo, 2018; Bogicevic *et al.*, 2017; Chen et al., 2015; Kattara & El-Said, 2013; Kaushik, Agrawal & Rahman, 2015; Kelly, Lawlor & Mulvey, 2017; Kokkinou & Cranage, 2013; Kucukusta, Heung & Hui, 2014; Neo *et al.*, 2014; Oh, Jeong & Baloglu, 2013; Oh *et al.*, 2016; Wei, Torres & Hua, 2016). They are much less expensive and sophisticated than robots, hence they are widely used worldwide and travellers are accustomed to them although they may prefer to be served by human employees rather than use kiosks. Research shows that, in general, self-service technologies improve customers' experience due to convenience and ease of use (Susskind & Curry, 2016), decrease customer waiting times (Kokkinou & Cranage, 2013) and overall travellers' satisfaction (Bogicevic *et al.*, 2017), although customers' preferences towards self-service technologies vary by culture, type of technology, hotel category and target market segments, or stage in the occupancy cycle in a hotel (Kattare & El-Said, 2013). They also decrease the costs and service errors and improve the profitability of travel, tourism and hospitality companies (Chathoth, 2007).

2.2. Artificial intelligence in travel, tourism and hospitality

Artificial intelligence research in travel, tourism and hospitality (outside research on robotics which is reviewed in the next paragraph) has gained momentum. Researchers have applied artificial intelligence (neural networks, machine learning) in forecasting tourism arrivals/demand/expenditure (Law, 2000; Palmer, Montano & Sesé, 2006; Sun *et al.*, 2019) and hotel occupancy (Law, 1998), identification of destination attributes (Santos Silva *et al.*, 2016), sentiment analysis of online reviews (Kirilenko *et al.*, 2018; Ye, Zhang & Law, 2009), analysis of the impact of online reviews on hotel performance (Phillips et al., 2015), analysis of hotel

employee satisfaction (Tian & Pu, 2008), market segmentation (Kim, Wei & Ruys, 2003), forecasting waste generation rates in hotels (Azarmi, Alipour & Oladipo, 2017) or their energy demand (Casteleiro-Roca *et al.*, 2018) to name just a few of the numerous directions of research in the field. The application of facial recognition systems at airports has been studied by Del Rio *et al.* (2016), while Nica *et al.* (2018) develop a chatbot for recommendations in tourism. As a whole, authors agree that artificial intelligence provides great opportunities for data analysis (including big data) and identification of patterns in them that help decision making and automation of some processes in tourist companies. In general, however, research has largely focused on the application of artificial intelligence in a travel, tourism or hospitality setting, rather than on its impacts on the industry and the transformations it would trigger.

2.3. Robots in travel, tourism and hospitality
In a recent paper, Ivanov et al. (2019) implemented a comprehensive review of 131 publications on robotics in travel, tourism and hospitality published from 1993 until 2019 and concluded that research in the field had been largely driven by engineering and only recently a social science perspective was added to it. Most of the studies on service robots in tourism (outside the engineering domain) are conceptual. Murphy, Hofacker & Gretzel (2017), for example, reviewed current research on robotics in tourism and identified directions for future studies. In another paper the same authors (Murphy, Gretzel & Hofacker, 2017) investigate conceptually the anthropomorphism of service robots in tourism and hospitality. Ivanov, Webster & Berezina (2017) provide an overview of the practical application of robots and service automation by travel, tourism and hospitality companies, and outlined the potential areas of their adoption. Tung & Law (2017) identify the research opportunities in human-robot interactions in tourism and hospitality, while Tung & Au (2018) focus on exploring customer experiences with robotics. Additionally, Ivanov and Webster (2018) elaborate the costs and benefits of the adoption of robots for travel, tourism and hospitality companies, while Ivanov and Webster (2017b) delve into the implications of robotic technologies for the design of hospitality facilities. Furthermore, Ivanov and Webster (2017a) and Ivanov (2018) emphasise that tourist companies should broaden their definition of a customer and consider the possibility that in the future, they would need to serve robots as tourists.

On an empirical level, Kuo, Chen, & Tseng (2017) conducted 20 interviews with academics and practitioners and developed a SWOT analysis of the adoption of robots by hospitality companies in Taiwan, Tussyadiah, Zach & Wang (2017) assess people's attitudes towards self-driving taxis while Tussyadiah & Park (2018) deal with customers' evaluations of hotel service robots. Customers' attitudes towards the adoption of robots by tourist companies have been investigated by Ivanov, Webster & Garenko (2018) for a sample of young Russian adults, Ivanov, Webster & Seyyedi (2018) for a sample of Iranian tourists, and by Ivanov & Webster (2019a, 2019b) for a sample of over a thousand respondents globally. In general, authors find that customers have mostly positive attitudes towards robots in tourism. The services that relate to information provision, delivery of food and various items, or housekeeping are perceived by respondents as more appropriate for robotisation, while services that require tourists to subordinate their bodies to a robot (e.g. massages, babysitting or hairdressing) are not considered as acceptable for automation.

3. The pros and cons of RAISA technologies

Like every technology, robots, artificial intelligence and service automation have their advantages and disadvantages compared to human employees (Ivanov, 2017) which make them more or less attractive to travel, tourism and hospitality companies.

3.1. Advantages of RAISA technologies

✓ *RAISA technologies could work 24/7*. Unlike human employees who can work 40-60 hours a week depending on their job position, legal regulations, health and mental condition and work urgency, RAISA technologies are available 24/7, 168 hours a week. A hotel would need at least 5 receptionists to have a non-stop working reception, something that could be achieved with one kiosk only.

✓ *RAISA technologies could implement various tasks and expand their scope with software and hardware upgrades*. A kiosk would need only a new software package in order to be used for another purpose. A new block answers and set of rules would allow a chatbot to be able to provide relevant answers to customer queries. On the other hand, human employees would need training that may be significant and time consuming depending on the new tasks they have to implement.

✓ *RAISA technologies could fulfil their work correctly* following the scripts of service procedures *and do this in a timely manner*.

✓ *RAISA technologies could provide constant or improving quality of their work*. This advantage is a natural consequence of the previous one – every service a kiosk or a robot provides follows a predetermined procedure which is followed exactly, hence guaranteeing constant quality of their services, which could be increased through software and hardware upgrades.

✓ *RAISA technologies could do routine work repeatedly*. Unlike human employees, robots and kiosks can perform the same task numerous times, without complaints and they do not need to be motivated to do it.

✓ *RAISA technologies do not go on strikes, spread rumours, discriminate customers or employees, quit their job without notice, show negative emotions, shirk from work, ask for pay increases, get ill etc.* This makes the life of managers in a company much easier. In fact, we can argue that every strike of human employees is a step towards the automation of tasks they currently perform. Although some recent publications claim that artificial intelligence is prone to discrimination (Paterson & Maker, 2018), RAISA technologies by themselves do not discriminate people. If some people feel discriminated because of decisions taken by technology, it is the fault of the humans who programmed and trained the robots/algorithms, not the technology itself.

3.2. Disadvantages of RAISA technologies

✓ *RAISA technologies lack creativity*. At the current state of technological development service robots, kiosks or chatbots cannot invent new ways to deliver services to customers, regardless whether the innovation is in the form of a new service or a new way to deliver an existing service.

✓ *RAISA technologies will not be any time soon completely independent of human supervision* – e.g. for maintenance, monitoring of the service delivery process and human intervention in it when necessary (e.g. in case of service failure).

✓ *RAISA technologies lack personal approach.* The kiosks follow the service process script without deviation from it. Service robots and chatbots can adapt their responses on the basis of the specific interactions they have with humans (customers or employees).

✓ *RAISA technologies can work in structured situations* (at least for the moment). Chatbots and robots can provide answers to questions that include specific key words, which they recognise in order to activate a particular predetermined set of answers. Robot's navigation through the premises of a hotel also requires some navigation markers (Ivanov & Webster, 2017b).

✓ *RAISA technologies may (will) be perceived as a threat by human employees* (e.g. Neo-Luddism movement). People consider robots as a threat for their jobs and these fears are quite understandable. A recent study (Frey & Osborne, 2017) has revealed that 47% of jobs in the US could be lost due to computerisation. The fear of losing jobs and incomes, makes people perceive RAISA technologies as a threat for their survival. Humans would no longer need to compete with other humans for jobs, but with robots as well (Webster & Ivanov, 2019). Travel, tourism and hospitality companies that adopt RAISA technologies would need to consider these fears and address them.

The advances in robotics, artificial intelligence and service automation in the future would decrease and may eliminate some of the disadvantages of RAISA technologies compared to human employees, which combined with RAISA's decreasing costs and surging human employee costs would make RAISA technologies more attractive to companies and would stimulate their adoption.

4. How will RAISA technologies disrupt the tourism industry?

Figure 1 presents the main directions of the impacts of RAISA technologies in travel, tourism and hospitality companies. RAISA change the way companies operate and influence all the aspects of their value chain – marketing, operations, facilities design and maintenance, human resource management, financial management and supply chain management. Furthermore, the use of RAISA influences how customers perceive a company (i.e. its image) and the quality of its services, and how a company competes or cooperates with other companies. Each of these directions is elaborated below.
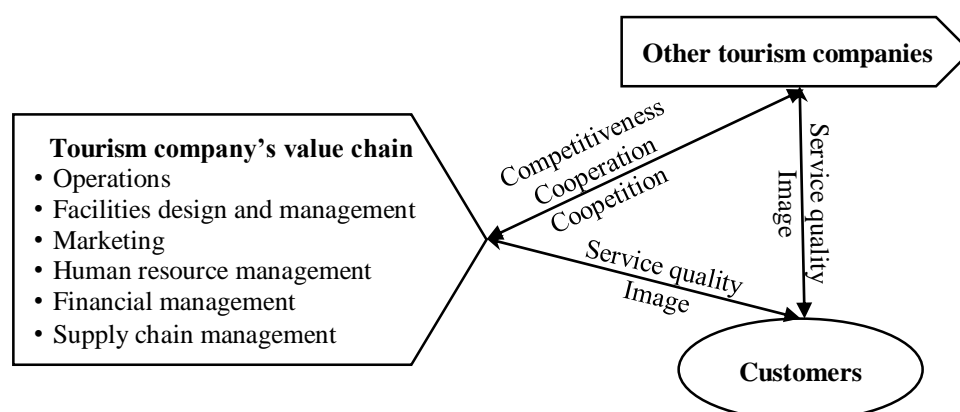
Figure 1. *Impacts of RAISA technologies on travel, tourism and hospitality companies*

4.1. Operations

The most important and visible impact on operations of a travel, tourism or hospitality company from the adoption of RAISA technologies is the change of the service provider – *service is delivered by* a robot, a computer programme, a kiosk, or another *non-human agent.* The participants in the servicescape are different and human employees have a decreasing role it. This requires the *reengineering of service delivery processes* – new processes, activities, procedures, controls need to be implemented, new service operations manuals have to be developed and introduced to reflect the new service provider. However, the *service delivery system would be more structured and less flexible* compared to human-delivered services. The use of RAISA also means an *increased role of the customers in the service delivery* as they now perform some of the activities in the service delivery process that were once performed by the company's employees. The use of self-service technologies effectively transfers the responsibility for the initiation and implementation of the service delivery from the service provider to the customer – the customers are transformed into prosumers (= "producers" + "consumers"). Moreover, the use of RAISA leads to *increased service capacity* of travel, tourism and hospitality companies – more customers can be served simultaneously (even thousands in the context of chatbots) and for a particular period of time, thus *improving productivity* as well. As RAISA can work 24/7, do not get ill, complain, shirk from work, *the scheduling and planning of operations becomes much easier* and predictable. Furthermore, RAISA technologies mean *improved environmental sustainability* of operations due to reduced use of resources, less waste, elimination of unnecessary activities, and less energy consumption due to better energy demand forecasts (Casteleiro-Roca *et al.*, 2018).

4.2. Facilities design and management

One of the most important impacts of RAISA technologies on travel, tourism and hospitality companies is on the design of their premises. In the future, the premises of hotels, restaurants and airports, among others, would be used by a wide variety of mobile robots (wheeled, legged, flying or underwater) such as security robots, robot guides, robot waiters, companion/sex robots, pet robots, room service deliver robots, robotic vacuum cleaners / lawnmowers / pool cleaners, entertainment robots, delivery drones, etc. Regardless whether these mobile robots belong to the customers or to the hospitality companies, the latter would need to ensure the *robot-friendliness / robot-inclusiveness* of their premises, i.e. accessible for mobile robots (Ivanov & Webster, 2017b). Tan, Mohan & Watanabe (2016) define robot-inclusiveness of an environment in which a robot operates as how much the design of the environment takes into account the robot therein, i.e. whether it helps the robot fulfil its tasks. It depends on the design of the premises where the robot needs to operate in, their cleanliness, tidiness, signage, lightning, noise, physical barriers (e.g. doors, doorsteps, stairs), presence of people and dynamic of the environment, presence/lack of predetermined routes for robot movement, presence/lack of (artificial) landmarks and sensors to help robot navigation, etc. When the hospitality premises are more robot-inclusive, the same task can be performed by a less intelligent robot and vice versa: an environment that is not robot-inclusive would require a more intelligent robot to

navigate through it (Ivanov & Webster, 2017b). Therefore, when a hospitality company invests in robot-friendliness of its facilities, then it can use less intelligent (and cheaper!) robots in its operations. Moreover, it means that more types of customer-owned robots would be able to use them. Therefore, the robot-friendliness of hospitality facilities will be a new *competitive advantage* for travel, tourism and hospitality companies.

4.3. Human resource management

The adoption of RAISA would have both positive and negative implications for the human resource management of travel, tourism and hospitality companies. On the positive side, RAISA would *save employees' time* from performing tedious and repetitive tasks, which they could use for other more creative and revenue generating activities. For example, hotel room service employees could use a robot to deliver the orders to rooms and use the freed time for other activities in the restaurant. In this way, RAISA technologies are *enhancing* rather than replacing the employees – human employees improve their productivity and can implement more activities/tasks for the same amount of time. Additionally, RAISA would trigger changes in the required *skills* of employees – they would need more technical skills in order to be able to operate with and maintain the new technology, and communication and social skills to interact with the customers. Furthermore, the legislation in developed countries is quite stringent towards the termination of labour contracts, while low wages, night shifts and seasonality of many job positions make tourism less attractive compared to other sectors of the economy. RAISA would *solve some the problems with hiring and firing of employees*, especially seasonal personnel and immigrants – robots and kiosks can be leased/turned on during periods of high demand, and returned/turned off during off-season without the need to deal with the bureaucracies of labour laws. Moreover, due to the high employee turnover, travel, tourism and hospitality companies need to constantly train employees, which takes both time and money. RAISA can help companies *save part of the costs for training employees*. Ultimately, sometimes the adoption of RAISA technologies in a company would require its *reorganisation* – creation of new departments, job positions and communication links between them or elimination if existing ones.

On the negative side, the use of RAISA technologies leads to changes in the *number* of employees in various departments, usually decreasing the number of employees whose tasks can easily be automated (e.g. reception, information provision, cleaning of common areas, menu ordering and food delivery, etc.). Furthermore, RAISA have the potential to eliminate or at least significantly decrease the number some entry-level jobs – receptionist, bell boy, housekeeper, waiter, cook, busser, dishwasher, cleaner, even driver (due to autonomous cars), hence significantly hindering the job opportunities for some social groups (people with low education or students looking for part-time jobs). In extreme cases, we see the emergence of *zero-employee properties* (or *automated hotels/motels/hostels*) in Japan, Korea, Bulgaria and other countries (Höykinpuro, 2015; Kim & Kim, 2018). Of course, it is all natural that these tendencies cause concerns among human employees, who may perceive RAISA technologies as a *threat* for their jobs and *resist* using them.

4.4. Financial management

From a financial perspective, the use of RAISA technologies allows for significant *labour costs savings* because RAISA work 24/7 and may serve numerous customers simultaneously. Additionally, RAISA can lead to *increased sales* – some customers, for example, may make an order for room service out of curiosity in seeing the robot delivering the order. On the other hand, RAISA technologies are associated with various financial costs (Ivanov & Webster, 2018):

✓ Acquisition costs – e.g. for purchasing a robot or kiosk, for purchasing a chatbot/payment for its development;

✓ Installation costs – for a robot or kiosk. It might be virtually zero for a chatbot;

✓ Maintenance costs – they include electricity consumption of the robot/kiosk, spare parts, periodic maintenance, repair works, etc., but could be very low for a chatbot;

✓ Software update costs;

✓ Costs for adapting the premises to facilitate mobility for robots – e.g. removing any barriers for robot's movement within a hotel;

✓ Costs for hiring specialists to operate and maintain the robots/kiosks/chatbots;

✓ Costs for training human employees to use them;

✓ Insurance costs for the robots/kiosks, insurance for damages caused by a robot, etc.

Although the prices of robots and kiosks have plummeted in recent years and will continue to decrease in the future as a result of technological innovations and competition among producers, the financial burden on a tourist company could be significant. A way to control the high acquisition costs would be *Robot-as-a-service* (RaaS) – i.e. renting/leasing a robot, rather than buying it (Corea, 2017; Ivanov & Webster, 2018). Robot manufacturers understand these concerns and already offer such financing options that transform the high upfront costs into regular more manageable monthly payments, similar to employee salaries and social/health security payments.

4.5. Supply chain management

The adoption of RAISA technologies allows the *integration of the information systems* of suppliers and travel, tourism and hospitality companies. This has already started in the beginning of the century, when tourism websites introduced back-to-back xml connections. These connections allow, for example, the inventory of hotels, rooms and their availability from one website to be visualised in another website. When a customer makes a booking in the second website, the booking goes directly to the first website without the need for human intervention. The integration, however, was mostly on the website level. RAISA technologies allow much further integration – for example a booking made by a customer through a travel chatbot of one company (e.g. a tour operator or online travel agency) could be automatically registered into the booking system of that company's supplier (e.g. hotel chain). Additionally, a smart fridge in a restaurant could make *automated orders* for food products whose inventory drops below a predetermined minimum.

4.6. *Marketing management*

RAISA technologies transform the marketing of travel, tourism and hospitality companies in various ways (Gentsch, 2019). In regards to *product and service quality*, the adoption of robots would change customers' expectations about what constitutes a travel / tourism / hospitality

product which may require a redefinition of its scope. Some hotel guests might consider that robot repair or sex robot rental services should be part of a hotel's offer, similar to swimming pools, spa centres, souvenir shops, and be available against additional payment. Additionally, RAISA could *enhance the perceived service quality* through new attractive and interactive ways of service delivery, communicating and engaging with customers – robots, chatbots, and service kiosks, for instance, could communicate in different languages and do this 24/7. RAISA can *create value for the customers* by making the service delivery process funny and entertaining. However, we should acknowledge that not all companies will succeed in the implementation of RAISA technologies. That is why in the future we will observe the division of travel, tourism and hospitality companies into two main large groups – *'high-tech' vs 'high-touch'* companies with various shades of grey in between them (see also Naisbitt, Naisbitt & Philips, 2001). 'High-tech' tourism companies will rely mostly on RAISA, while 'high-touch' ones will prefer to use human employees. Recent studies have confirmed that hotel guests could be segmented in these two large groups as well ('high-techies' and 'high-touchies') according to their attitudes and preferences towards robots in tourism (Ivanov, Webster & Garenko, 2018; Ivanov, Webster & Seyyedi, 2018).

RAISA allows the implementation of *automated pricing* of products based on sets of rules and *real-time data* on buyer behaviour of customers. At the extreme case, artificial intelligence would allow *personalised pricing*, i.e. separate price for every single customer based on his/her willingness to pay, leading to revenue maximisation. In economics, such personalised pricing is also known as perfect or first order price discrimination (Nechyba, 2017: 544). The dropping cost of RAISA solutions compared to human employees and the increases in their productivity mean that we can expect *lower prices* for mass 'high-tech' hospitality products (e.g. automated hostels and restaurant) and *higher prices* for exclusive 'high-touch' products delivered by human employees.

RAISA will change the *distribution* of tourism products as well. For example, it is already possible to order pizza or search for information about destination via digital voice assistants such as Amazon Echo. Travel, tourism and hospitality companies can develop applications (called 'skills' for Amazon Echo) which customers can install on their digital voice assistants and use them for bookings, similar to mobile phone applications. Furthermore, artificial intelligence allows companies to use *predictive analytics* and offer product suggestions based on customers' behaviour, planned holidays, birthdays, anniversaries or other criteria in anticipation of what customers would need before they have even thought they would need any such service. It can also be used in intelligent channel managers – software packages that automatically allocate the available capacity of a hotel by distribution channels on the basis of booking patterns and expected sales through each of them.

RAISA allow *automated communications with customers* via chatbots, voice assistants, kiosks, robots. On the one hand, this means that companies could communicate with more customers, and do this in numerous languages and at any time. On the other hand, the lack of human involvement in these automated communications may frustrate the customers, especially when they do not receive answers to their specific questions and cannot contact a human employee

to help. Finally, a company that adopts RAISA may boast *positive word-of-mouth* due to its *image of an innovative high-tech company.* However, it may also suffer *negative publicity* and be perceived as a company that puts profits before humans (Ivanov & Webster, 2018). Furthermore, customers may feel frustrated if they need to communicate with a chatbot or robot when they have a complaint. Therefore, even high-tech tourism/hospitality companies may need to keep human contact with their customers, especially in emotionally charged service situations like handling of complaints.

5. Conclusion

This paper contributes to the body of knowledge by elaborating the impacts of robotics, artificial intelligence and service automation on travel, tourism and hospitality companies – their operations, human resources, supply chain and financial management, facilities design, marketing. From a managerial perspective, the transformation that RAISA technologies will impose on companies will be profound and managers and employees need to be prepared for them. Of course, not every process, activity or task that can be automated, should be automated. Companies need to consider the costs and benefits of using RAISA technologies (Ivanov & Webster, 2018) and adopt only those that are relevant of their business. Employees should focus on upgrading their own skills rather than complain of being substituted by robots. Corporate training, online courses or university degrees (e.g. at Master level) could be suitable partial solutions in this direction.

The implications of RAISA technology in tourism will go beyond the tourism industry itself. Higher education institutions would need to amend the curricula of tourism and hospitality programmes and include a separate robotics module that would give students the knowledge and skill to work in the highly technological tourism industry of the future. Legislators and industry associations would need to reconsider the categorisation of accommodation establishments and F&B outlets and reflect the new technological realities. Labour unions should accept the fact that their members could not have guaranteed jobs as robots, kiosks, chatbots or digital voice assistance will implement many of the tasks human employees currently do. Agricultural, manufacturing, wholesale and retail companies and other suppliers to tourist companies may need to adopt RAISA as well and connect their information systems to the systems of tourist companies in order to allow automated ordering of supplies. Therefore, RAISA-induced transformation of tourism industry will have repercussions and spill-over effects in many other sectors of the economy and society.

Future research may focus on empirical case studies showing how different travel, tourism and hospitality companies transformed their operations through RAISA technologies. Research can shed light on the factors that facilitate or hinder the adoption of RAISA technologies in tourism, the willingness of managers to introduce them and how the resistance of employees can be overcome. Finally, research can elaborate on how RAISA technologies can contribute to sustainability and business stewardship in travel, tourism and hospitality.

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