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AUGMENTED REALITY AND FACIAL RECOGNITION TECHNOLOGIES. BUILDING BRIDGES BETWEEN THE HOSPITALITY INDUSTRY AND TOURISTS DURING PANDEMIC

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Abstract: *The huge crisis that the world is facing today, COVID-19 pandemic, reshaped the business-as-usual way of working and planning. The purpose of this research is to identify how emerging new technologies, such as augmented reality and facial recognition, used in AR Media application (FutureSocialWeb Project) can contribute to increasing the competitiveness of tourism companies in the context of COVID. Secondary research methodology was adopted while data were collected through a comprehensive literature review. This review utilized journals, newspaper articles, United Nations World Tourism Organization statistics, up to date governmental data, and website materials on COVID-19 impact over tourism industry. In addition, we used literature review concerning augmented reality and facial recognition technologies to emphasize that the future of tourism around the world is already highly depend on how we forward innovation in the industry. Further on, the article stresses several development opportunities for the AR Media FutureWeb application, to better respond to hospitality industry digitization needs. The results of the study were also approached from a managerial point of view.*

Key words: *hospitality, augmented reality, facial recognition technology, COVID-19, online social network*

1. Introduction

In our days, if you are a tourism provider, it is critical to not only keep track of the latest technology trends in the hospitality industry, but to move with the times, because the industry is highly competitive and those who do not adapt are left behind. Keeping your finger on the pulse is especially essential within the context of COVID because customer expectations and requirements are continually shifting.

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Revfine (2020a), a knowledge platform for the hotel, hospitality & travel industry, published at the beginning of 2020 some general technology trends in hospitality, along with tech trends that serve as a solution to the coronavirus pandemic and associated shifts in consumer behaviour: 1. Voice Search & Voice Control, 2. Contactless Payments, 3. Robots in Hotels & Restaurants, 4. Chatbots, 5. Virtual Reality, 6. Mobile Check-In, 7. Recognition Technology, 8. Artificial Intelligence, 9. Internet of Things (IoT), 10. Augmented Reality, 11. Cybersecurity, 12. Big Data (Revfine, 2020).

Two of these trends were selected and used as key concepts for this scientific endeavour: augmented reality and recognition technologies. These trends were chosen being the closest to the characteristics of the AR media application. AR Media is an online social network developed as an output of the project known as: "Empirical modelling and experimental development of emerging technologies tools for online social networks" (FutureSocialWeb). This project aims to study the emerging technologies in the field of information and communication technology in relation to online social networks, more specifically studying the adoption manner and perceptions of potential users of these technologies, assessing the general impact on the socio-economic environment. The complex project offers state-of-the-art Web 3.0 solutions for the study of emerging technologies that will impact the future of economic and social interactions (FutureWeb, 2020).

The main functions and functionalities of AR Media application are the following: identification of persons based on the information contained in the database with members of the social network, the possibility of creating a group of friends to manage your personal profile, friends, incoming messages, the possibility of adding an unlimited number of members; the possibility of adding members' personal data; possibility of sending personal messages between members; possibility of posting public messages with text and images to all members of the social network; possibility to evaluate posts with LIKE; possibility to track a member's activity, etc. (FutureWeb, 2020).

The main conclusions drawn from this study will be used to improve the marketing plan of AR Media application, mostly by identifying how these new technologies, augmented reality, and facial recognition, used in such application, can contribute to increasing the competitiveness of tourism companies in the context of COVID pandemic.

In order to accomplish these purposes, the researchers conducted a deep study of the literature with the aim of answering the following questions: What does the tourism industry look like in the context of COVID?; Can AR be a solution to the challenges faced by the tourism industry during this period?; What is the importance of AR before and during the pandemic?; How can we use Facial Recognition Technology in the Hospitality Industry?; What are the development opportunities of the AR media application in the hospitality industry?

The article is organized in the following sections: 1. Introduction - presenting the purpose of this paper; 2. Literature review - placing the problem of the tourism industry in the context of COVID; 3. Methodology - findings and perspectives regarding the AR and Facial Recognition technologies in the hospitality industry 4. Results and discussions – presenting in a structured manner the main findings from the research and determine how these emerging new technologies, augmented reality, and facial recognition, used

in AR Media application can contribute to increasing the competitiveness of tourism companies in the context of COVID; 5. Conclusions – presenting the main conclusions of the research.

2. Literature Review

Philosopher John Gray stated in an influential piece in April 2020: "The crisis through which we are living is a turning point in history" (Gavira, 2020). It certainly turned out to be a turning point for travel. The long-lasting health crisis wreaked economic havoc and forged long lasting changes in travel. The mass tourism model that had emerged after World War II and peaked in 2019 reaching 1.3 billion worldwide tourists, according to the WTO, came to an end with the first outbreak of the COVID-19 virus. Economic literature would refer to this period as the "Golden Age of Travel," similar to other boom eras such as the Second Industrial Revolution. Post-crisis tourism will have certain similarities to society 200 years before: a two-tier world where only the upper classes were able to travel internationally to experience new places first-hand. Home became the epicentre of life and leisure for most of the world population, with staycations and visiting friends and family the new priorities for most travellers. As a result, the travel industry goes through a massive downsizing process between 2020 and 2023, facing dramatically smaller levels of global demand.

History has shown that global tourism has been exposed to a wide range of crises in the past. The first two decades of this millennium brought major events that affected this industry. An analysis by Gössling, Scott and Hall (2020) brings to the attention the most relevant disruptive events, which took place between 2000 and 2015: the September 11 terrorist attacks in 2001, the severe acute respiratory syndrome (SARS) outbreak in 2003, the global economic crisis unfolding in 2008/2009, and the 2015 Middle East Respiratory Syndrome (MERS) outbreak. None of these events led to a longer-term decline in the global development of tourism, which reinforced the idea that tourism is a system resilient to external shocks. Nevertheless, the coronavirus outbreak effects give us enough evidence to believe that the impact and recovery from the COVID-19 pandemic will be unprecedented.

According to Marques Santos et al. (2020), the peculiarity of the current situation is foremost reflected by the spread of the virus, its geographical coverage and the measures implemented by governments to stop its dissemination (mobility and travel restrictions, lockdown, confinement, closure of shops and hotels, etc.).

First identified in December 2019 in Wuhan, the capital of the Chinese province of Hubei, this infectious disease quickly spread across the world in just a few weeks. First novel coronavirus case was reported outside China (in Thailand) on the 13th of January 2020. As a response, on 30 January 2020 the World Health Organization (WHO) declared the COVID-19 outbreak a "Public Health Emergency of International Concern" and, on 11 February, named the new disease COVID-19. Almost a month and a half later, on the 11th of March 2020, WHO declared COVID-19 pandemic. (UNWTO, 2020).

As response to the COVID-19 pandemic, governments were forced to take measures to stop the disease and the spreading of the virus, such as lockdown, confinement, and

travel limitations. Hall, Scott and Gössling (2020) identified four broad areas of nonpharmaceutical interventions (NPIs) undertaken by most of the governments, that have a negative effect on the tourism industry:

a. Social distancing: reduces the capacity of hospitality operations, such as restaurants, to be able to host guests while the most extreme measures require the closure of operations to prevent social contact.
b. Bans on public gatherings and closure of public places: affect tourist activities but they also limit the hosting of events, meetings, and conferences.
c. Restrictions on domestic and international travel: in many countries, this has meant `stay at home` orders and domestic restrictions on moving between jurisdictions except for permanent residents and essential services and closure of international borders except to returning nationals and permanent residents/visa holders (Wilson et al., 2020).
d. Quarantine requirements.

Between April and May 2020, 100% of all worldwide destinations introduced travel restrictions in response to the COVID-19 pandemic, through the closure of borders for tourists and suspension of international flights (UNWTO, 2020). UNWTO Barometer has also revealed that 97 destinations (45%) have totally or partially closed their borders for tourists, 65 destinations (30%) have suspended totally or partially international flights and 39 destinations (18%) were implementing the closing of borders in a more differentiated manner by banning the entry for passengers from specific countries of origin.

By analysing facts and numbers officially communicated by worldwide organizations, this section of the paper aims to provide an overview of the pandemic impact on the tourism industry and its stakeholders. However, to clearly understand the downsize picture, it is important to stress that, unlike other economic sectors, the tourism sector faces serious difficulties in carrying out its activities during a lockdown. Considering that "tourism refers to the activity of visitors, [which] is a traveller taking a trip to main destination outside his/her usual environment, for less than a year, for any purpose (business, leisure or other personal purpose) other than to be employed by a resident entity in the country or place visited" (United Nations, 2010), any restriction on people movement within and between regions/ countries will have a negative effect on this industry.

This tendency was clearly highlighted by the UNWTO World Tourism Barometer released in July 2020, which showed a 98% fall in international tourist numbers in May when compared to 2019 (UNWTO, 2020a). The same report stated that the industry faced a 56% year-on-year drop in tourist arrivals between January and May, which translates into a fall of 300 million tourists and US$320 billion lost in international tourism receipts, more than three times the loss during the Global Economic Crisis of 2009. Four month later, the same organization released its latest industry Barometer (UNWTO, 2020b) announcing a 70% fall in international arrivals for the first eight months of 2020. The rapid dynamic of the pandemic, along with intensified policy responses with direct impact over tourism would cause international arrivals to plunge 81% in July and 79% in August, traditionally the two busiest months of the year and the peak of the Northern Hemisphere summer season. As compared to the figures announced in May, the value of loss in export revenues from international tourism has

more than doubled, reaching 730 billion US dollars.

Following its gradual reopening of international borders, Europe recorded comparatively smaller declines in arrivals in July and August 2020 (-72% and -69%, respectively). The recovery was short-lived however, as travel restrictions and advisories were reintroduced due to an increase in contagions. On the other side of the spectrum, Asia and the Pacific recorded the largest declines with -96% in both months, reflecting the closure of borders in China and other major destinations in the region. Overall, UNWTO predicts an overall drop close to 70% for the whole of 2020 (UNWTO, 2020b).

The virus affected virtually all parts of the hospitality value chain. Hotel businesses were forced to play defence, by temporarily closing units, laying off employees, cutting salaries and other costs. A set of global hospitality reports, released by STR highlights that in 2020, compared to 2019, three relevant key performance metrics for a hotel business were severely down (see Table 1 below). In Europe specifically, the occupancy rate level was the lowest for any September on record (STR, 2020a), while both the Middle East and Africa hit their lowest absolute occupancy and RevPAR levels for any September on record (STR, 2020c). Moreover, almost 20% of hotel rooms worldwide closed temporarily in 2020. (STR, 2020f)

Table 1

Estimated impact of pandemic on hotel industry performance

	Europe	Central/ South America	Middle East	Africa	U.S.	Canada
Key Performance Indicators	Dropdown %					
Occupancy	-51.70%	-58.10%	-30.80%	-61.20%	-32.20%	-49.80%
Average daily rate (ADR)	-27.20%	-26.70%	-13.50%	2.70%	-24.10%	-28.00%
Revenue per available room (RevPAR)	-64.80%	-69.30%	-40.10%	-60.20%	-48.50%	-63.90%

For Europe, Central/ South America, Middle East, and Africa, the figures indicate percentage change from September 2019 to September 2020, while for U.S. and Canada, only the third quarter is taken into consideration (percentage change from Q3 2019). Source: STR, (2020a), STR, (2020b), STR (2020c), STR, (2020d), STR, (2020e)

In order to have an overview of the negative impact COVID-19 pandemic has on the hospitality industry on a country level, the authors considered the results of the England Occupancy Survey (EOS), a monthly research that measures bedroom and bed-space occupancy across the serviced accommodation sector – from large hotels to small B&Bs and farmhouses in the United Kingdom. As this report states, room occupancy decreased by 36% to 47% in August 2020, whilst bedspace occupancy decreased by 27% to 35%, when compared to August 2019. In August 2020, room supply decreased by 7.5% when compared to August 2019. Meanwhile, room demand decreased by 47.6% when compared to the same month last year. RevPAR, which is the total room revenue divided by the total number of available rooms, decreased by 58% to £32.88 in August 2020 when compared to the same month last year. (Visit England, 2020)

While tourism is slowly returning in some destinations, most members of the UNWTO Panel of Tourism Experts expect international tourism to recover only in the third quarter of 2021, followed by those who expect a rebound in the first part of next year. However, around 20% of experts suggest the rebound could occur only in 2022. (UNWTO, 2020b) At the time of writing, the number of COVID-19 infections worldwide exceeded 45 million cases of COVID-19 and deaths have surpassed 1.1 million (31 October 2020; ECDC 2020). This extremely worrying evolution, along with travel restrictions and people scared and hesitant to leave their homes and comfortable surroundings put more pressure on hotels, obliging them to make urgent adjustments in their strategies as they try to survive and generate revenue. According to United Nations (2020), recovery of tourism destinations and companies will be fully dependent on:

- their capacity to take advantage of technology to better understand and monitor travellers' needs and trends,
- create and market innovative experiences,
- use digital platforms to enhance the competitiveness and agility of MSMEs to reach customers,
- provide added-value jobs,
- implement effective heath protocols.

Innovation could focus on adopting digital models for managing the sector and creating new jobs, as well as new sustainable products and experiences that link travellers with nature and creative industries, empower communities and promote safe journeys through technology (United Nations, 2020).

3. Methodology

According to Snyder (2019), literature review as a research method is more relevant than ever. Building a research on and relating it to existing knowledge is the building block of all academic research activities, regardless of discipline. Knowledge production within the field of business research is accelerating at a tremendous speed while at the same time remaining fragmented and interdisciplinary. Despite all the advantages of this method, its use has not been overly prevalent in business research, but it is increasing (Snyder et al., 2016; Verlegh and Steenkamp, 1999; Witell et al., 2016). By using explicit and systematic methods when reviewing articles and all available evidence, bias can be minimized, thus providing reliable findings from which conclusions can be drawn and decisions made (Moher et al., 2009).

In the new technologies area of research, the amount of information is in a continuous change. New perspectives and opportunities arise very often and is especially important to keep in touch with all these changes.

Considering the novelty of the AR media application, we considered it opportune to study in detail the literature about the new technologies (augmented reality and facial recognition technologies). The main conclusions will be used to determine the impact these emerging technologies have on the AR Media.

3.1. AR, before and during the pandemic. Can AR be a solution to the challenges faced by the tourism industry during this period?

The internet and digital technologies are transforming our world. The growth of Information and Communication Technology has delivered such a vast amount of information that the term "information society" was created to refer to a society characterized, above all, by the global and massive scale in which raw data are created and disseminated (Ariso, J.M., 2017). The rise of the Fourth Industrial Revolution (4IR, or Industry 4.0), and its associated technological developments like augmented and virtual reality, Artificial Intelligence and machine learning, as well as the Internet of Things (IoT) are opening the doors for the virtual world (TravelDailyNews, 2020).

Augmented reality (AR) it is a term that gets the tech elite excited yet is often misunderstood and hard to define. While it has bubbled around in the world of business for decades, it is only in recent years has been starting to make the jump to the consumer world. The technology with which you could see more than others see, hear more than others hear, and perhaps even touch, smell and taste things that others cannot, deserve a proper attention in the tourism industry too (Epuran et all, 2019). AR is the technology to create a "next generation, reality-based interface" (Jacob, 2006). According to a Statista report, the AR market across the globe is predicted to nurture from 5.91 billion to 198 billion U.S. dollars by the year 2025. AR trends have materialized as a constructive tool for different businesses. It allows them to transform the way customers observe their surroundings (Alsop, T., 2020).

Several examples have shown that AR can aid tourist organizations and professionals towards reaching a wider audience by serving as the delivery technology of appealing multimedia content and mobile applications, fine-tuned to various knowledge levels. AR information systems can also help tourists in accessing valuable information and improving their knowledge regarding a tourist attraction or a destination, while enhancing the tourist experience and offering increased levels of entertainment throughout the process (Fritz et al., 2005). Furthermore, one of the keys to AR adoption within the travel industry has been the general change in consumer lifestyles over the past decade.

Traveling is always an innovative and learning experience. With modernized devices and tools, AR in travel and tourism comes exceedingly useful for hotel tours, booking enabling information, no language barriers, as well as superior navigation. Over recent times, augmented reality has become increasingly popular within the travel industry. This is primarily because it enables hotels and other businesses operating in this field to enhance the physical environments, they are trying to encourage customers to visit, including local sights and hotel rooms. Modern customers are already in the habit of using their smartphone a lot, even when they travel, so the step towards using AR apps on those phones is not a big one. Augmented Reality is already pleasing to the eye by boosting travel experiences with inventive mobile applications.

As the world waits out the coronavirus pandemic, leisure travel is on hiatus and people are glued to their screens, searching for ways to explore the physical world. The concept of "virtual tourism" is suddenly being promoted and tested on a global scale

(Gregory, 2020). AR has the potential to truly revolutionise all aspects of travelling as the next iteration of our interface with technology, and a truly immersive one (CreativePool, 2020). In a March 2020 article, Nielsen called the coronavirus pandemic an "unexpected catalyst" for the adoption of augmented and virtual reality (AR and VR) to assist with the shopping experience. Budget cuts and advertising pullbacks are giving companies in industries like retail, accessories, and entertainment new reasons to explore AR's and VR's benefits (Williamson, 2020) and the hospitality industry is not an exception. Unlike other purchases, travel tends to be heavily researched, as customers require lots of information before they arrive. In addition, this need for information does not stop when the customer arrives. AR can serve to ensure much of this information is available to them, 24/7, at times it is most relevant (Revfine, 2020b). AR offers an excellent selling experience and augmented environments, which can be enhanced in diverse ways in the tourism sector. This is primarily because it enables hotels and other businesses operating in this field to enhance the physical environments, they are trying to encourage customers to visit, including local sights and hotel rooms. In the hospitality industry, it is critical to not only keep track of the latest technology trends in the hospitality industry, but to move with the times, because the industry is highly competitive and those who do not adapt are left behind (Revfine, 2020).

According to Papagiannis (2020), AR has three important functions: visualization, annotation, and storytelling.

• AR is a powerful visualization tool. It allows you to bring an object or concept into a reality that is otherwise imagined, inaccessible or difficult to grasp, and can even help to make the invisible visible.

• Annotation with AR helps guide you through the completion of a task, navigate a new environment or even provide real-time descriptions of what is happening around you.

• AR makes new modes of storytelling and creative expression possible with experiences unfolding in both our homes and public spaces. Introducing new and alternate perspectives, it changes the way we tell, share, and even remember stories.

These strengths have been highlighted recently in the hospitality industry. In a post-coronavirus world of tourism, tourists will be back, gradually, but they will no longer condone the "fast-food" mass tourism of the past. Instead, they will demand meaning in their travels: meaningful causes, meaningful places, meaningful stories. Applications of AR help us overcome the isolation of COVID-19 lockdowns. Crisis can sometimes be the key to the development of emerging technologies, and the current outbreak may become a springboard for the growth and popularization of AR, a technology that has been underestimated and underutilized in the past.

In a new state of play – where travellers will be extremely cautious in terms of future bookings as well as which destinations to select – the closer they can be brought to the real experience the more inclined they will be to make a decision, as well as an actual booking, for when lockdowns and social distancing restrictions have levelled out into a new normal. The future, therefore, lies in a very different world from the traditional, often cost-intensive, bricks-and-mortar visitor centres stocked with printed materials (with short shelf lives) into entirely online information and

bookings facilities that have the ability to always stay current. At a time when government funding, post-COVID-19, will now be even more constrained, a "digital-first" approach will be the renewed value proposition that DMOs (Destination Marketing Organisation) need to stay relevant.

However, ramping up these digital opportunities will require a significant mind-shift in the way DMOs plan and utilise their marketing budgets, as they evolve to become "digital-first" and move away from more traditional and increasingly less effective forms of marketing such as printed materials. Not least because these are not environmentally friendly anyway (OpenAccessGovernment, 2020).

In essence, AR technologies afford the market a "try before you buy" opportunity (Sol, 2020). Already revolutionizing what many DMOs do, as well as the way they do it, they also present significant revenue opportunities. With COVID-19 ravaging the tourism and hospitality business, AR can make users feel like they are really experiencing the computer-generated world they find themselves in. As Chandola says, it offers a try-before-you-buy experience which will give people a taste for travel, leading to a revival in holidays (Chandola, 2020).

3.2 Facial Recognition Technology in the Hospitality Industry

In the hospitality industry, Facial Recognition Technology (FRT) became an ideal solution that could simultaneously facilitate authentication, offer consumers a seamless experience and improve security. However, despite the increasing use and promising opportunities for all hospitality businesses, to date, the literature does not offer any insight into the adoption of FRT in hospitality, marking a critical research gap. Yet, understanding FRT adoption would help facilitate its effective deployment, and will help businesses design the appropriate management, marketing, security, and information-system (IS)-related strategies. Moreover, an effective deployment will stimulate the development of service models that will allow consumers to learn how to use FR, thus likely optimizing the authentication task altogether.

In line with novel service models, FRT systems are promising in hotels, as they can optimize legacy consumer tasks (e.g., authentication, payment) and increase security. Performance expectancy, trust in organization, and positive anticipated emotions significantly influenced intentions, while congruity with self-image and effort expectancy significantly influenced performance expectancy (Morosan, 2020).

In an article published in 2020, Revfine (2020c) presents ways Facial Recognition Can Be Used in the Hospitality Industry. This are:

1. Security and Access - One of the main ways facial recognition can be deployed within the hospitality industry is for security and access purposes. Within a hotel setting, this might mean using the technology to grant guests access to their hotel room, while in airports, it might be used in place of boarding passes and passport checks. When it comes to security, the technology can also be vital in helping to identify troublesome guests, or guests who have previously been removed from the premises. Moreover, facial recognition can be used by law enforcement, airport security teams and similar organisations for more critical security matters.

2. Customer Service - The technology can also be used by those within the hospitality industry to deliver a greater level of customer service. For example, facial recognition can allow employees to quickly identify guests, perhaps before they even check-in, and deliver more personalised greetings and a more tailored service. If a company has a customer reward scheme, members may be given the option to upload a photo during the sign up. Facial recognition can then allow that company to instantly identify members and provide them with rewards. The technology may also identify returning customers, allowing them to be rewarded too.
3. Payment Authorisation - Facial recognition also has a role to play in helping to authorise payments, making that process more efficient. Companies like MasterCard have already implemented systems powered by facial recognition, where a customer can confirm a payment using the camera on their phone, or a camera supplied by the vendor. In terms of how this can be used by those in the hospitality sector, imagine a hotel where guests go to a kiosk, check out using facial recognition and confirm their payment in the same way, with no need to interact with a single hotel employee. Kiosks can also be used in restaurants, allowing customers to pay seamlessly on their way out.
4. Research and Information - Finally, to understand customers, improve services and optimise processes, hotels and other companies need to be able to gather feedback and data. This is an area where the uses for facial recognition may be less immediately obvious, but where those uses can be extremely beneficial. The technology can be set up for market research purposes, helping companies to know exactly how many people are in a location at a particular time. Additionally, it can be used to draw conclusions about customers too, reading their expressions to ascertain their mood, or their facial features to ascertain their age or gender. Most impressively, this data can be gathered automatically, at any time of the day or night.

FRT uses facial images for authentication/verification and are a part of the broader group of biometric systems (Jain et al., 2011). While the use of FRT in hotels is still in its infancy, FRT has been deployed in air travel and cross border settings (Farrell, 2016). For example, NEC systems have been successfully deployed in air travel (e.g., automatic border control gates in the European Union, British Airways self-boarding systems in Los Angeles) (Miracle, 2018).

Hotel services are fundamentally grounded in the notion of selling to consumers temporary access to service facilities at a hotel property, including access to guest areas (e.g., guestroom, suite, pool, gym, business center), and guest services such as food, beverage, and Internet or entertainment products. Access and services are granted based on a consumer's authentication and promise of payment. Generally, when the service episodes end, consumers pay for the access/services and check-out. While this legacy service model remained fundamentally unchanged for the past 50 years, today's societal dynamics are posing several challenges to hotels, such as the need to reduce fraud and increase consumers' security (Chan & Lam, 2013), the increasing appetite of consumers for personalized services (Chathoth et al., 2014), and the development of online platforms for consumers to express their sentiment regarding their service

experiences (Nusair et al., 2013). This increasingly complex environment caused a recent paradigm shift in hotel services, according to which consumers' experiences should be seamless (Kim, 2016). Yet, due to the service bottlenecks it produces, the initial authentication of guests arriving on the property represents an important barrier to a seamless service experience.

Facial recognition allows clients to easily check-in and check-out without time waste (Unal and Tecim, 2018). The hospitality corporation records that the facial recognition machine can learn the customer's ID photo during check-in and check-out within 1-3 min (Parvez, 2020). Check-in and check-out with facial recognition present hotels offer self-service aptitudes to customers; therefore, it is not required to wait at the front desk. At first, Marriott International Hotel Group installed a facial recognition system in their hotels with the association of Alibaba's Fliggy travel service platform. In two different Marriott hotels in China guests now have the option to bypass the traditional check-in desk and instead head to a kiosk. There, facial recognition technology scans their face, identifies them, and provides them with a key card, all in the space of around one minute.

To offer a seamless experience that is highly valued by guests and to address this bottleneck, hotels have deployed new technologies and service models aimed at increasing authentication automation, such as self-service kiosks, mobile self-check-in systems, messaging platforms that provide insight into consumers' estimated arrival time, and scheduling additional staff during the busiest hours. Yet, despite hotels' best efforts, authentication bottlenecks may still exist, and they cause frustration for both consumers and staff. In addition, relinquishing the legacy manual authentication to automated information-system (IS)-based authentication may increase security risk. However, among the multitude of IS solutions available to hotels, one particular type of IS – facial recognition systems (FRT) – stand out due to their ability to provide accurate and efficient automated authentication while decreasing security risk (NEC Corporation, 2018).

One of the challenges for hotel managers and others within the hospitality industry looking to introduce facial recognition is balancing the benefits with privacy for customers. Indeed, many people have concerns about facial recognition because it means even more data about them being collected and stored. Furthermore, many people fear their data being sold on to other companies against their will and dislike the idea of businesses being able to track their every move. Privacy concerns attributed to using facial recognition techniques were also exposed by the results of a qualitative study conducted in 2019, having as a main purpose to test and evaluate the functions and modules of an online social network based on facial recognition using augmented reality, by the team of specialists within the FutureWeb project. (FutureWeb, 2020). A marketing study was carried out based on group interviews, which consisted in organizing and conducting three focus groups among users of social networks plus a qualitative research based on the method of in-depth interview.

The research endeavour aimed at finding out the opinion of the subjects on the following matters: 1. Reasons, criteria, and options for choosing social networks. 2. Knowledge of AR applications. 3. Opportunity to integrate new AR technologies into social networks. 4. Problems with functionality, usability, and design of the online social network with facial recognition using the augmented reality application -AR Media,

developed as part of the FutureWeb project. 5. Proposals to improve the augmented reality application - AR Media, developed as part of the FutureWeb project. These have also become the main objectives of the proposed interview guide for the realization of focus groups. At the same time, the research highlighted a number of proposals and recommendations made by interview subjects on the functionality, usability and design issues of the online social network with facial recognition using the augmented reality app - AR Media, developed within the futureWEB project as well as ideas generated, which could improve this application.

It is, therefore, important that the hospitality industry takes these concerns seriously and takes steps to avoid misusing data. In some cases, one of the best solutions may be to make facial recognition an opt-in or opt-out service, so that users have a choice in the matter. Facial recognition technology can help hotel owners and others in the hospitality industry to improve the customer experience, make processes more efficient and enhance security. It allows for queues to be avoided, check-ins to be automated, and security and research to be more comprehensive (Revfine, 2020c).

4. Results and Discussions

The purpose of this research was to determine how these emerging new technologies, augmented reality, and facial recognition, used in AR Media application can contribute to increasing the competitiveness of tourism companies in the context of COVID. Some specific actions to realize this purpose and the results of the accomplished purpose are presented in Figure 1. These were developed based on the information gathered in the literature review section of this paper.

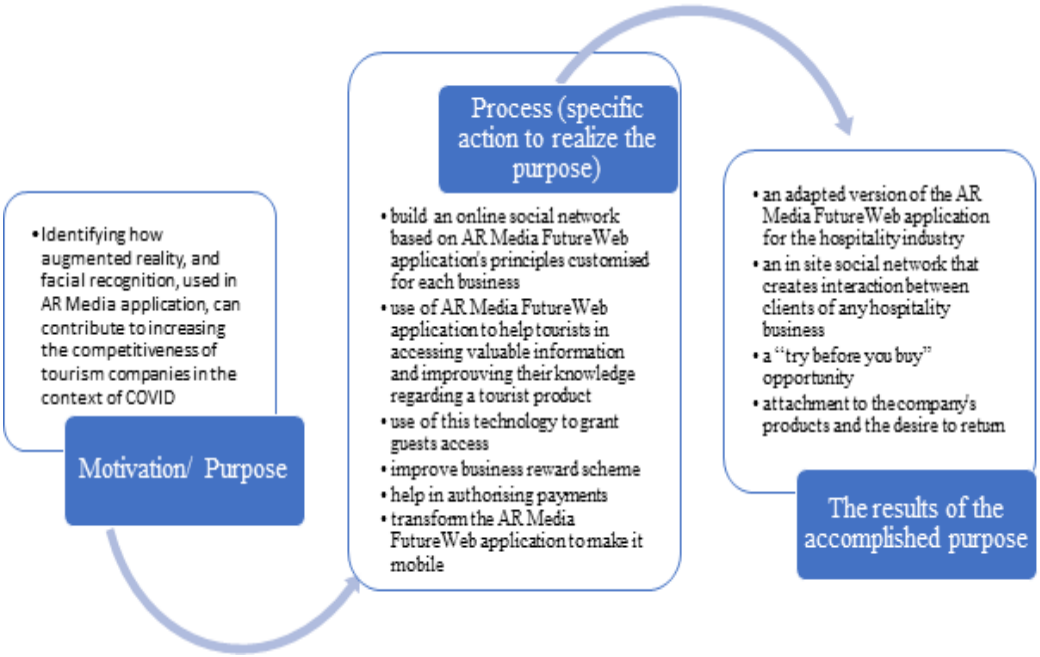

Fig. 1. *Purpose, Process and Results of Study*

For example, AR Media FutureWeb can be enabled for a DMO (Destination Marketing Organisation). Building an online network will bring together the people attracted by that specific destination. Such an application will help users find all the information they need about the destination. The venues within that DMO's location can be sold tickets online and in real-time, discounts can be offered in terms of future visits, or even enable the DMO to incorporate promotional add-ons like location quizzes or games that further enhance the visitor's experience towards making an actual booking. With the help of AR Media FutureWeb application can be possible to pick up visitor preferences to deliver a very personalised and trustworthy package. A powerful tool in a post-pandemic travellers' market.

This can be applicable in any hospitality business no matter if it is an accommodation unit, a restaurant, a transport company, a theme park, a museum or even for a tourist destination.

Build an in site social network in any hospitality business, based on AR Media Future Web principles, will facilitate interaction between clients. The closer they can be brought to the real experience, to interact with people who prefer the same type of tourist product, the more inclined are to get attached to the touristic product and access it when needed.

Use of AR information implemented in our application can help tourists to access valuable information and improve their knowledge regarding a tourist attraction or a destination, while enhancing the tourist experience and offering increased levels of entertainment throughout the process. All printed materials transformed into entirely online information and bookings facilities help them always stay connected. This will have a great impact in terms of cost on marketing campaigns and is also environmentally friendly.

Customer experience can be also improved by implementation of augmented reality tours on AR Media FutureWeb social network, by proposing to clients a "try before you buy" opportunity. This is a valuable experience in times of pandemic. Use of this technology can grant guests access to their hotel room, while in airports, it might be used in place of boarding passes and passport checks. The Facial Recognition Technology used by AR Media FutureWeb application can also ease the check-in and check-out procedure by using a client recognition module.

AR Media FutureWeb application can be used to improve business reward schemes. Members may be given the option to upload a photo during the sign up. Facial recognition can then allow that company to instantly identify members and provide them with rewards. It can also be used in authorising payments. The payment process is more efficient if the clients are recognized by the application.

An important step to accomplish the purpose of this paper is to transform the application to make it mobile. The trend is now for mobile application. This transformation will certainly contribute to the success of the application in the hospitality industry.

5. Conclusions

The future of tourism around the world will highly depend on how we forward innovation in the industry and adapt to new restraints while striving to overcome a global pandemic that is already changing the pre-existing tourism model. The acceleration of digitization during the pandemic leads to new development opportunities for the AR Media FutureWeb. The hospitality industry has been and is very affected during this period. From the in-depth study of the literature concerning augmented reality and facial recognition, several possible outcomes for the AR Media FutureWeb application were identified:

- an adapted version of the AR Media FutureWeb application for the hospitality industry
- an in site social network that creates interaction between clients of any hospitality business
- a “try before you buy” opportunity using AR Media FutureWeb application
- attachment to the company's products and the desire to return

These outcomes can contribute to increasing the competitiveness of tourism companies in the context of COVID. The purpose of our study was therefore accomplished.

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References

Alsop, T., 2020. *Augmented reality (AR) - statistics & facts*. Available at https://www.statista.com/topics/3286/augmented-reality-ar/. [Accessed 29 October 2020].

Ariso, J.M, 2017. Augmented Reality, Berlin Studies. *Knowledge Research*, Vol. 11, p.3.

Chan, E.S.W., Lam, D., 2013. Hotel safety and security systems: Bridging the gap between managers and guests. *International Journal of Hospitality Management*, Vol. 32, pp. 202-216.

Chandola, S., 2020. *Returning to a new normal with AR & VR*. Available at https://www.geospatialworld.net/blogs/returning-to-a-new-normal-with-ar-vr/, [Accessed 28 October 2020].

Chathoth, P.K., G.R. Ungson, L. Altinay, et al., 2014. Barriers affecting organisational adoption of higher order customer engagement in tourism service interactions, *Tourism Management*, Vol. 42, pp. 181-193.

CreativePool, 2020. *How AR can save the travel industry post-COVID*. Available at https://creativepool.com/magazine/features/how-ar-can-save-the-travel-industry-post-covid.23884. [Accessed 28 October 2020].

Epuran, G., Chiţu, I. B., Ivasciuc, I. S., 2019. The Augmented Reality Technologies in Tourism: A State of Art. *Risk in Contemporary Economy*, pp. 501-505.

European Centre for Disease Prevention and Control (ECDC) (2020). *COVID-19 situation update worldwide*, *as of 31 October 2020.* Available at: https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases, [Accessed 31 October 2020].

Farrell, S., 2016. How airports can fly to self-service biometrics. *Biometric Technology Today,* January, pp. 5-7.

Fritz, F, Susperregui, A, Linaza, M., 2005. Enhancing cultural tourism experiences with augmented reality technologies. Paper presented at the *6th International Symposium on Virtual Reality, Archaeology and Cultural Heritage* (VAST). Pisa, Italy.

FutureWeb, 2020. *About.* Available at https:// futureweb.unitbv.ro/index.php/en/despre-proiect-2, [Accessed 30 October 2020].

Gavira, M., 2020. *Possible futures for a post-pandemic travel industry*, part 4. Available at https://www.phocuswire.com/Futures-radically-different-travel-industry-part-4, [Accessed 28 October 2020].

Gössling S., Scott, D. and Hall, C.M., 2020. Pandemics, tourism and global change: a rapid assessment of COVID-19. *Journal of Sustainable Tourism*, 29(1), pp. 1-20. Available at https://www.tandfonline.com/doi/full/10.1080/09669582.2020.1758708, [Accessed 26 October 2020].

Gregory, T., 2020. 'Virtual tourism' is suddenly everywhere in coronavirus era. Will it stick?, Available at https://www.sfchronicle.com/bayarea/article/Virtual-tourism-is-suddenly-everywhere-in-15195780.php, [Accessed 28 October 2020].

Hall, C.M. Scott, D., Gössling, S., 2020. Pandemics, transformations and tourism: be careful what you wish for. *Tourism Geographies*, 22(3), pp. 577-598. Available at: https://www.tandfonline.com/doi/full/10.1080/14616688.2020.1759131, [Accessed 26 October 2020].

Jacob, R. J., 2006, April. What is the next generation of human-computer interaction?. In *Conference on Human Factors in Computing Systems: CHI'06 extended abstracts on Human factors in computing systems*, Vol. 22(27), pp. 1707-1710.

Jain, A.K., Ross A.A., Nandakumar K., 2011. *Introduction to biometrics*. New York, NY: Springer.

Kim, J., 2016. An extended technology acceptance model in behavioral intention toward hotel tablet apps with moderating effects of gender and age. *International Journal of Contemporary Hospitality Management*, 28(8), pp. 1535-1553.

Marques Santos, A., Madrid, C., Haegeman, K. and Rainoldi, A., 2020. *Behavioural changes in tourism in times of Covid-19*, Publications Office of the European Union, Luxembourg. Available at https://publications.jrc.ec.europa.eu/repository/bitstream/ JRC121262/report_covid_tour_emp_final.pdf, [Accessed 31 October 2020].

Miracle, V., 2018. *Facial recognition now used to board British Airways passengers at LAX.* Eyewitness News ABC7.

Moher, D., Liberati, A., Tetzlaff, J., and Altman, D. G., 2009. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine,* 151, pp. 264–269. https://doi.org/10.7326/0003-4819-151-4-200908180-00135.

Morosan, C., 2020. Hotel Facial Recognition Systems: Insight Into Guests' system Perceptions, Congruity With Selfimage, and Anticipated Emotions. *Journal of Electronic Commerce Research,* 21(1), pp. 21-38.

NEC Corporation, 2018*. Face Recognition Solution Lemon Tree Hotels* - NEC Corporation

Nusair, K.K., Bilgihan, A., Okumus, F. et al., 2013. Generation Y travelers' commitment to online social network websites. *Tourism Management*, Vol. 35, pp. 13-22.

OpenAccessGovernment, 2020. Augmented reality could boost travel and tourism marketing post COVID-19. Available at https://www.openaccessgovernment. org/augmented-reality-could-help-travel-and-tourism-post-covid-19/86034/, [Accessed 26 October 2020].

Papagiannis, H., 2020. *3 ways Augmented Reality can have a positive impact on society*. Available at: https://www.weforum.org/agenda/2020/04/augmented-reality-covid-19- positive-use/ [Accessed 28 October 2020].

Parvez, M. O., 2020. Use of machine learning technology for tourist and organizational services: high-tech innovation in the hospitality industry*. Journal of Tourism Futures,* ahead-of-print.

Revfine, 2020a. *The Latest Technology Trends in the Hospitality Industry*. Available at https://www.revfine.com/technology-trends-hospitality-industry/, [Accessed 29 October 2020].

Revfine, 2020b. *How Augmented Reality is Revolutionising the Travel Industry*. Available at https://www.revfine.com/augmented-reality-travel-industry/ [Accessed 26 October 2020].

Revfine, 2020c. *4 Ways Facial Recognition Can Be Used in the Hospitality Industry* Available at https://www.revfine.com/facial-recognition-hospitality-industry, [Accessed 2 November 2020].

Snyder, H., 2019. Literature review as a research methodology: An overview and guidelines*. Journal of Business Research*, 104, pp. 333-339. 10.1016/j.jbusres.2019.07.039.

Snyder, H., Witell, L., Gustafsson, A., Fombelle, P., and Kristensson, P., 2016. Identifying categories of service innovation: A review and synthesis of the literature. *Journal of Business Research,* 69, 2401–2408. https://doi.org/10.1016/j.jbusres.2016.01.009.

Sol, R., 2020. *How Virtual Reality Could Help the Travel & Tourism Industry In The Aftermath of the Coronavirus Outbreak*. Available at https://www.forbes.com/ sites/solrogers/2020/03/18/virtual-reality-and-tourism-whats-already-happening-is-it-the-future/#246f19c028a6, [Accessed 26 October 2020].

STR, 2020a. *Europe hotel performance for September 2020*. Available at https://str.com/press-release/str-europe-hotel-performance-september-2020, [Accessed 26 October 2020].

STR, 2020b. Central/South America hotel performance for September 2020. Available at https://str.com/press-release/str-centralsouth-america-hotel-performance-september-2020, [Accessed 26 October 2020].

STR, 2020c. *Middle East and Africa hotel performance for September 2020*. Available at https://str.com/press-release/str-middle-east-and-africa-hotel-performance-september-2020, [Accessed 26 October 2020].

STR, 2020d. *U.S. Q3 2020 hotel performance*, Available at https://str.com/press-release/str-us-q3-2020-hotel-performance, [Accessed 26 October 2020].

STR, 2020e. *Canada Q3 2020 hotel performance*. Available at https://str.com/press-release/str-canada-q3-2020-hotel-performance, [Accessed 26 October 2020]

STR, 2020f. *Evolution in benchmarking: Composite Comp Sets*. Available at https://str.com/data-insights-blog/evolution-in-benchmarking-composite-comp-sets, [Accessed 26 October 2020].

TravelDailyNews, 2020*. Navigating the new normal: The future of travel in a post-COVID-19 world*, Available at https://www.traveldailynews.com/post/virtual-tourism-ways-to-connect-and-travel-in-the-covid-19-pandemic, [Accessed 28 October 2020].

Unal, C., Tecim, V., 2018. The Use of Biometric Technology for Effective Personnel Management System in Organization*. KnE Social Sciences*, pp. 221-232.

United Nation World Tourism Organization, 2020a. *UNWTO World Tourism Barometer May 2020. Special focus on the Impact of COVID-19*. Available at https://webunwto.s3.eu-west-1.amazonaws.com/s3fs-public/2020-05/Barometer_May2020_full.pdf, [Accessed 29 October 2020].

United Nation World Tourism Organization, 2020b, October 27. *International tourism down 70% as travel restrictions impact all regions*. Available at: https://www.unwto.org/news/international-tourism-down-70-as-travel-restrictions-impact-all-regions, [Accessed 28 October 2020].

United Nations, 2010. *International Recommendations for Tourism Statistics 2008*, United Nations Publication. New York. Available at: https://unstats.un.org/unsd/publication/seriesm/seriesm_83rev1e.pdf, [Accessed 1 November 2020].

United Nations, 2020. *Policy Brief: COVID-19 and Transforming Tourism*. Available at https://unsdg.un.org/sites/default/files/2020-08/sg_policy_brief_covid-19_tourism_august_2020.pdf, [Accessed 29 October 2020]

Verlegh, P. W. J., and Steenkamp, J.-B. E. M. (1999). A review and meta-analysis of countryof-origin research. *Journal of Economic Psychology*, 20, 521–546. https://doi.org/10.1016/S0167-4870(99)00023-9.

Visit England, 2020. *England Occupancy Survey. August 2020 Results*. Available at https://www.visitbritain.org/sites/default/files/vb-corporate/visit_england-england_occupancy_survey_-_august_2020_final_report.pdf, [Accessed 4 November 2020].

Williamson, D.A, 2020. *The Pandemic Is Accelerating AR Adoption for Retailers and Entertainers.* Available at https://www.emarketer.com/content/pandemic-accelerating-ar-adoption-retailers-entertainers, [Accessed 28 October 2020].

Wilson, N., Barnard, L. T., and Baker, M., 2020. *Rationale for border control interventions and options to prevent or delay the arrival of Covid-19 in New Zealand*: *Final commissioned report for the New Zealand Ministry of Health*. Ministry of Health, Available at: https://www.health.govt.nz/system/files/documents/publications/final_report_for_moh_-_border_control_options_for_nz_final.pdf, [Accessed 31 October 2020].

Witell, L., Snyder, H., Gustafsson, A., Fombelle, P., and Kristensson, P., 2016. Defining service innovation: A review and synthesis. *Journal of Business Research*, 69(8), pp. 2863-2872.