COVID-19 THE DAY AFTER: SMART TOURISM TECHNOLOGIES TO IMPROVE THE TOURISM INDUSTRY[1]

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Abstract

This systematic literature review aims at exploring the contribution of smart tourism technologies to improve the tourism industry amid COVID-19 and in the subsequent recovery phase. The systematic literature review was conducted following a two-stage approach: first, articles were selected following the PRISMA protocol and second, a content analysis was performed on relevant contributions. The literature suggests that most of the studies focus on the use of Automation Technologies as tools to guide the recovery of the industry, while only few studies on the role of smart tourism and destinations, virtual tours, social media, blockchain and crowd management. It draws the conclusion that although the pandemic has led, in a very narrow temporal framework, to a publication explosion on the impact of COVID-19 on tourism, there is still room for research on how smart tourism technologies can contribute to the recovery of the tourism industry. Finally, the paper highlights areas where future studies can be conducted and proposes some constructive suggestions about future development of smart tourism in the new normal.

1. INTRODUCTION

Tourism is defined as those "activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited." (OECD, 2002). Over the decades, tourism has experienced continued growth and deepening diversification to become one of the fastest growing economic industry in the world (UNTWO, 2021). In 2019, the Travel and Tourism industry contributed 10.4 percent to global GDP (WTTC, 2021). Figures reporting the number of international tourist arrivals witness the growing trend of the tourism industry; over the last three decades it has been recorded an increase in international tourist arrivals from 0.4 billion in 1990 to 1.5 billion in 2019, according to the United Nations World Tourism Organization (UNTWO, 2021b).

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Therefore, the high growth rate and intense diversification of the tourism industry, entail its increasingly globalized and exceptionally competitive nature (Cirstea, 2014) generating innovation needs to grand survival as well as to foster growth and performance (Bednarczyk, 2011; De Brentani, 2001; Fraj et al, 2015; Gomezelj, 2016; Nicolau and Santa-Maria, 2013).

Surprisingly, the innovation rate in this industry has been modest (Camison and Monfort-Mir, 2012; Civre and Omerzel, 2015; Hjalager, 2010). However, it has to be considered the difficulty of measuring the innovation rate of the tourism industry because, despite existing efforts such as the European Community Innovation Surveys (CIS) that aim to draw comparisons between different tourism businesses, it is reported the tendency of missing the innovations that are hidden and thus unreported (Jorgensen Nordli, 2017). This is especially true as the lack of radical innovations, for example, entails low innovation rates (Peters and Pikkemaat, 2008).

The burst of COVID-19, classified by the World Health Organization as a pandemic on 11 March 2020 (WHO, 2020), has exacerbated this need of innovation in the tourism industry, where either the development of new technologies or new uses of information and communication technologies (henceforth, ICT) represent the biggest innovations that can be applied to this industry (Law et al., 2014). To this end, smart tourism (hereinafter ST) can be defined as a social phenomenon arising from the convergence of ICTs with the tourism experience (Hunter et al., 2015). ST is revolutionizing operational and strategic management, bringing a wide business process re-engineering throughout the industry (Aldebert et al., 2011) and leading to changes in the organization of firms and in the tourism industry both in terms of tourism demand and in terms of processes and products of companies providing tourism services.

Tourism is one of the most affected sectors from the outbreak of the COVID-19 pandemic due to the almost total halt of international and domestic travel generated by mandatory testing, quarantines, the vaccination campaign running slower than originally expected and restrictions in global travel. As of 1 February 2021, 66 percent of all destinations worldwide have either completely or partially closed their borders for international tourism (UNWTO, 2021c). In this scenario, technology plays an essential role in controlling and managing the pandemic and will continue to be relevant even after COVID-19. Therefore, ST may enter as a driving force of the recovery phase for destinations. ST is the sum of all integrated efforts at a destination aimed at "using technologies innovatively to achieve resource optimization, effective and fair governance, sustainability and quality of life". (Gretzel et al., 2015). ST considers the technologies that are used in all the three travel phases: pre-travel, travel and post-travel wherein tourists' expectations and behavior may change (Buhalis and Amaranggana, 2015). The most significant technologies of ST are Privacy Preserving, Context Awareness, Cultural Heritage, Recommender Systems, Social Media, Internet of Things (IoT), User Experience, Real Time, User Modeling, Augmented Reality and Big Data (Kontogianni and Alepis, 2020). Previous health-induced crisis on tourism such as SARS, MERS, Ebola, avian influenza (Gossling et al., 2020) could not rely on ST as it was still in its infant phase. The current pandemic, instead, should take advantage of the role that ST could play in the recovery of the tourism industry. Therefore, given this framework, this study aims at answering the following research question: How can smart tourism technologies contribute to the recovery of the tourism industry?

To this end a systematic literature review on the role of ST technologies in a post-confinement scenario has been performed including all the studies conducted from the outbreak of the pandemic to 10 May 2021.

2. CONCEPTUAL FRAMEWORK

According to Xiang et al. (2015), the term "smart" has become a popular term to describe technological, economic and social developments fueled by smart technologies that rely on several technologies such as sensors, open API, Open Data, Big Data, new ways of connectivity between humans and machines, networked exchange of information.

Applied to the tourism industry, the term "smart" brought the concept of ST which refers to the use of technologies (e.g., internet, mobile communication and augmented reality) to collect great amount of data to provide stakeholders at a destination with real-time support and tourists with context-awareness as well as personalized experiences (Xiang et al., 2015; Hunter et al., 2015; Tu et al., 2014).

Gretzel et al. (2015) explain that ST originates from traditional tourism and more recently E-tourism. The difference between E-tourism and ST relies in the travel sphere considered and the core technology used. In essence, E-tourism merely handles the digital part of the experience during the pre- and post-travel phases of a trip, with websites being the core technology. Instead, ST aims at being a bridge between the digital and physical spheres of the travel experience, also including the on-site phase of a trip, with Big Data as the core technology.

To build successful strategies based on the ST concept, Gretzel et al. (2015) describe ST as comprising five layers: (1) a physical layer (transportation, resources, and service infrastructures); (2) a smart technology layer (business solutions and consumer applications); (3) a data layer (data storage, open data and data-mining applications); (4) a business layer (innovation based on the available technologies and data sources); and finally (5) an experience layer (technology and data-enhanced experiences' consumption). The technical infrastructure integrated into the physical layer of a destination creates the basis of all other layers as ST most innovative feature entails the connection between the physical and digital world. The physical layer enables the technology layer to develop the data layer with a useful and varied kind of data. Through the data layer, ST combines different kinds of data to boost innovation and allows the creation of a business layer. Services and applications created by the business layer using ST data enable the development of improved touristic experiences and sustainability goals in a destination. As a result, the experience layer considers tourists but also residents and hosts of a destination.

In cities, where tourism and events are considered a relevant component, technological investments and destination quality are often so interrelated that ST becomes part of the city planning benefitting both tourists and local residents (Margherita et al., 2020).

According to Gretzel et al. (2018), smart technologies form the foundation of ST. Derzko (2006) describes these technologies as those that sense (bringing awareness to everyday things), learn (using experience to improve performance), adapt (modifying behavior to fit the environment), infer (drawing conclusions from rules and observations),

predict (thinking and reasoning about next steps) and self-organize (self-generating and self-sustaining at technology level).

According to Zhang et al. (2012), the most significant technologies of ST are cloud services, IoT, and end-user internet service system. However, it is worth also mentioning Social Media platforms, User modelling, Big Data, Open Data and ubiquitous connectiveness. Cloud services enable the creation of multiple tourism applications and share information by providing scalable access (Margherita et al., 2020).

IoT contributes to data collection, information analysis and system automation with the introduction of a variety of sensors, chips, and actuators integrated extensively in the physical infrastructure of a destination. Finally, the end-user internet service system supports cloud services and IoT through applications and devices. These ST technologies are important in the interaction at all levels of stakeholders in the tourism context. Indeed, these technologies can contribute to the development of relationships among tourism and non-tourism stakeholders (Koo et al., 2016; Gretzel et al., 2015; Atzori et al., 2010; Dikaiakos et al., 2009). The adoption of technologies on existing infrastructure can increase the sustainability value of ITC (Lopez de Avila, 2015; Lamfus et al., 2015).

Open data, which is also seen as an essential feature for smart development (Meijer et al., 2016), is defined as data which is freely accessed, used, modified and shared by anyone for any purpose. Indeed, a ST destination differs from a traditional one because it is a knowledge-based destination in which information is available to all stakeholders in a systematic and efficient way (Del Chiappa et al., 2015). The city of Marbella (Spain) with the project "Open Data Marbella" offers an example of this concept with open data service open to all citizens (SEGITTUR, 2015).

Another umbrella concept that includes several technologies within smart tourism is the one of Automation Technologies: this includes a vast array of technologies used to produce products and deliver services instead of human employees (Ben-Ari and Mondada, 2018). Some examples are IoT (Sendler, 2018), artificial intelligence (Ertel, 2017; Huang and Rust, 2018), social and service robots (Shit et al., 2016; Murphy et al., 2019). Their common characteristic is that a process is implemented, a product is produced or a service is delivered by a machine or an autonomous agent without the involvement of human employees. That is why automation technologies are not widely accepted by customers, employees, managers (Seyitoglu and Ivanov, 2020). Indeed, automation technologies are positively considered as they improve the quality and decrease the costs of goods and services, additionally they can increase the productivity of companies, improve the health and quality of life of people and create new business models (Webster and Ivanov, 2020). However, Automation Technologies are criticized because of privacy issues and because of potential job losses and technological unemployment arising from the replacement of human employees (Seyitoglu and Ivanov, 2020). Within the tourism industry, companies use automation for various processes (Ivanov and Webster, 2019). For example, robots are used for multiple purposes ranging from provision of information and room service delivery to guides in museums (Ben-Ari and Mondada, 2018; Seyitoglu and Ivanov, 2020).

On the one hand, convenience and cost advantage are the reason why some customers accept automation. On the other hand, others firmly oppose to automation because of its dehumanizing effect and lack of empathy in the service process (Ivanov and Webster, 2019).

Automation may encounter resistance also from employees afraid to lose their jobs (Li et al., 2019). Automation Technologies, create a technological shield between a tourism business and its customers but also between employees and customers as well as between customers themselves. Such distancing and lack of emotional involvement may lead to frustration in tourists and inhibit their use of Automation Technologies (Ivanov, 2019).

Within the concept of ST three purposes are identified: on the one hand, the data transformed by advanced technology helps to create on-site personalized smart experiences for the tourist. On the other hand, it helps create smart business value-propositions with a clear focus on efficiency, sustainability and experience. Finally, ST helps develop tourist destinations management strategies that guarantee the sustainable development of tourist areas, accessible to everyone. This increases the quality of the experience at the destination as well as residents' quality of life (Gretzel et al., 2015, SEGITTUR, 2015). According to Rocha (2021), computing and ICT coupled with Big Data and IoT enable governments and businesses to improve products and service delivery to citizens and tourists by analyzing the general and most common preferences, as well as being able to offer personalized services to each individual.

Therefore, researchers acknowledge the potential role of ST in enhancing the experience of the tourist, the livelihood of residents and the efficient use of resources in a destination (Gretzel et al., 2015; Gretzel et al., 2019).

3. METHODOLOGY

This systematic literature review was conducted following a two-stage approach: first, articles were manually selected following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol (Moher et al., 2009) and second, relevant contributions were content analyzed.

The PRISMA protocol provides a sound methodological framework to carry out the systematic review process and consist of the four stages of: identification, screening, eligibility, and inclusion. The search of the keywords "COVID-19" and "Tourism" was performed on 10 May 2021 on both Scopus and Web of Science (WOS), providing a total of 461 and 673 English articles respectively. After the elimination of duplicates, 795 articles were employed in the screening stage that has been conducted manually. Among the remaining articles, only 47 were included in this systematic literature review after the eligibility assessment that checked the articles' focus on ST. Therefore, of the articles initially retrieved from the two databases, only the 4.14 percent were relevant to this content analysis on the role of ST amid COVID-19 and in the recovery phase. Consequently, there is still considerable scope for further research in this field and, especially, there is still a lack of research that explains in a systematic and global way the contributions of ST technologies to the recovery of the tourism industry in a context of health-induced crisis (Ivars-Baidal, 2018).

Figure 1. PRISMA Flow Diagram

Source: Personal elaboration from http://prisma-statement.org/
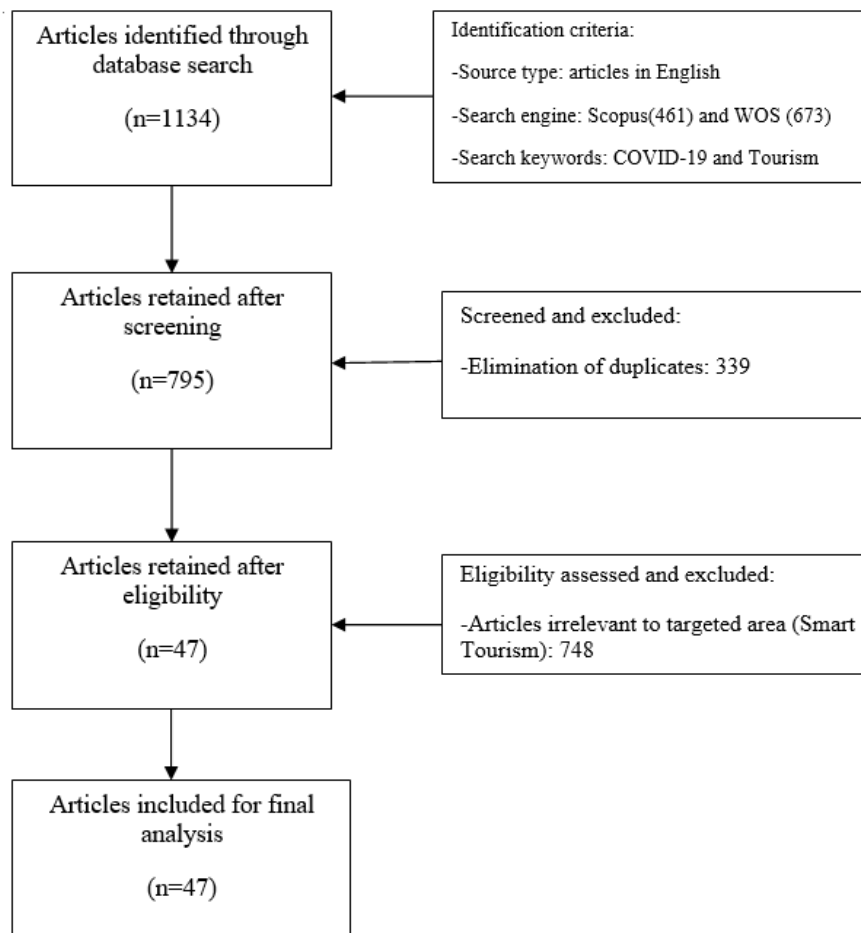
4. FINDINGS & DISCUSSION

This content analysis will be one of the first studies focused on the impact of ST on the performance of the tourism industry amid COVID-19 pandemic and the potential role ST could play in the recovery phase. The literature suggests that most studies focus on Automation Technologies for their ability to prevent the spread of the virus as well as to reduce human contact contributing to the decrease of risk perception.

Table 1 summarizes the findings of the 47 articles relevant for this content analysis and lists the studies in alphabetical order by first author. The column "Focus" lists if the focus of the article is on Smart Tourism Development as a general concept (SD), Automation Technologies (AT), Blockchain (B), Crowd Management (CM), social media (SM) or Virtual Tours (VT).

Table 1. Summary of the 47 articles

Authors	Source Title	Year	Focus
Ahn	Curr. Issues Tour.	2021	AT
Barna & Semak	Balt. J. Econ. Stud.	2020	AT, SM

Bautista, Valeeva, Danilevich & Zinovyeva	IJCST	2020	CM
Christou, Simillidou & Stylianou	Int. J. Contemp. Hosp. Manag.	2020	AT
Dolnicar & Zare	Ann. Tour. Res. research	2020	AT
El-Said & Aziz	J. Travel Res.	2021	VT
Fennell	J. Sustain. Tour	2021	VT
Gossling	J. Sustain. Tour	2020	AT
Gretzel, Fuchs, Baggio, Hoepken, Law, Neidhardt, Pesonen, Zanker & Xiang	Inf. Technol. Tour.	2021	AT, VT
Guo, Liu, Song & Yang	Curr. Issues Tour.	2021	AT
Ilkhanizadeh, Golabi, Hesami & Rjoub	RFM	2020	VT
Ivanov, Webster, Stoilova & Slobodskoy	Tour. Econ.	2020	AT, VT
Kane, Zajchowski, Allen, McLeod & Allen	Ocean Coast Manag.	2021	AT
Ketter & Avraham	J. travel Tour. Mark.	2021	SM
Khodzhaliev, Zvorykina & Beloglazova	IIOAB J.	2020	SM
Kim, Kim, Badu-Baiden, Giroux & Choi	Int. J. Hosp. Manag.	2021	AT
Kurniawan, Nur Hidayat, Prasasti & Nur Rakhmad	ICOVET 2020	2020	AT
Lau	Inf. Technol. Tour.	2020	AT
Lee & Kim	Sustainability	2021	VT
Mohanty, Hassan & Ekis	Worldw.Hosp. Tour. Themes	2020	AT,VT
Norum & Polson	Convergence	2021	VT
Oliveira, Maia, Fonseca & Moraes	Anatolia	2021	AT
Onder & Gunter	Tour. Econ.	2020	B
Perez-Sanchez, Tian, Barrientos-Baez, Gomez-Galan & Li	Mathematics	2021	B
Petrovic	IIPSI BgDTransactions on Internet Res.	2021	AT
Qomariyah, Sari & Fajar	Int. J. Innov. Comput. Inf. Control.	2020	AT
Radojevic, Lazic & Cimbaljevic	Geogr. Pannonica	2020	SD
Ramos, Yamaka, Alorda & Sriboonchitta	Int. J. Contemp. Hosp. Manag	2021	CM
Rather	Curr. Issues Tour.	2021	SM
Ribeiro, Gursoy & Chi	J. Travel Res.	2021	AT
Saragih & Suyoto	WorldS4 2020	2020	AT
Seyitoglu & Ivanov	Int. J. Hosp. Manag.	2020	AT
Seyitoglu & Ivanov	Curr. Issues Tour.	2020	AT
Sharfuddin	Round Table	2020	AT
Shin & Kang	Int. J. Hosp. Manag.	2020	AT
Siwalette & Suyoto	WorldS4 2020	2020	AT
Streimikiene & Korneeva	Terra Economicus	2020	SD
Sun, Zhang, Tai , Wu & Mu	Sustainability	2021	AT
Thomas, Lal, Baby, Rabeeh, James & Raj	J. Biomed. Inform	2021	AT, SM
Tolkach & Pratt	JoHLSTE	2021	SM
Van, Vrana, Duy, Minh, Dzung, Mondal & Das	Sustainability	2020	AT
Wibowo, Santosa, Susilo & Purwanto	JoHLSTE	2021	SM
Woyo & Nyamandi	Dev	2021	VT
Wut, Xu & Wong	Tour. Manag	2021	SM

Xiang, Fesenmaier & Werthner	J. Travel Res.	2020	AT
Zeng, Chen & Lew	Tour.Geogr.	2020	AT
Zhang & Huang	Curr. Issues Tour.	2021	SM

Source: Personal elaboration from Scopus and WOS (10 May 2021

From this systematic literature review it emerges that most of the studies on ST and COVID-19 are focused on the use of Automation Technologies as tools to guide the recovery of the tourism industry. Among these technologies, the use of robots, artificial intelligence and IoT are the most studied. Very few studies focus on Smart Tourism Development (Streimikiene & Korneeva, 2020), Virtual Tours (Fennell, 2020; Ilkhanizadeh et al., 2020; Ivanov et al., 2020) Social Media (Ketter and Avraham, 2021; Khodzhaliev et al., 2020) Blockchain and Crowd Management (Onder and Gunter, 2020; Perez-Sanchez et al., 2020).

The use of Automation Technologies in the tourism industry is highly debated in the literature (Ivanov et al., 2020; Ribeiro et al., 2021; Kim et al., 2021; Ilkhanizadeh et al., 2020; Christou et al., 2020). The first and probably more controversial point considers the economic benefit of highly automated businesses in the travel, tourism and hospitality industry in terms of lower fixed costs (related to lower number of employees if any) and cash outflow: Automation Technologies decrease the cash out flow of a business and help it to remain liquid. In addition, when these businesses encounter a prolonged drop in demand during epidemics, they do not need to lay off many, if any, employees (Ivanov et al., 2020). Automation Technologies are also a useful tool to enforce physical distancing during an epidemic which is crucial to limit the spread of the virus (Seyitoglu and Ivanov, 2020; Shin et al., 2020; Sun et al., 2021; Zeng et al., 2020).

An example of Automation Technologies is represented by the use of robots in tourism. Often a controversial topic due to the potential job losses, Zeng et al. (2020) show the relevance of their use amid the outbreak of the current pandemic to avoid human interaction and infection. Kim et al. (2021) explain how the perception of Automation Technologies like robot services in hotels has changed as a result of the pandemic: as a matter of fact, studies before the outbreak of the pandemic reflected a preference for human services rather than robot services in hotels. This preference has been reversed after the pandemic where instead tourists express a higher preference for robot services in hotels. Consequently, the pandemic may lead to a faster acceptance of service robots providing contactless services due to its potential to maintain social distancing and reduce anxiety regarding contagion through human interaction (Kim et al., 2021; Shin et al., 2020).

Christou et al. (2020) provide interesting insights regarding the preferences of tourists when it comes to the kind of Automation Technology, and specifically robots, they would be more comfortable to interact with. From this study it emerges how tourists favor the use of anthropomorphic robots (robots that resemble human faces and shapes) over any other type of robot. The use of anthropomorphic robots in tourism may result in an overall enhanced experiential value. Still, some resistance was expressed by tourists for the use of robots in a human-driven industry (Christou et al., 2020).

According to Saragih and Suyoto (2020) Blockchain technologies are increasingly becoming a topic of discussion in both research and industry. Therefore, the understanding of Blockchain technology and its impact on the tourism industry is crucial to grasp the benefits for the customers and suppliers as well as for the creation of new tourism products.

Additionally, according to Perez-Sanchez et al (2021), the efficient use of Blockchain technologies can help tourism businesses, and especially online travel agencies (OTA), to gain consumer loyalty.

During an epidemic, the importance of crowd management increases. This is confirmed by studies analyzing crowd management strategies in tourism to help the recovery of the industry (Bautista et al., 2020; Ramos et al., 2021). Ramos et al. (2021) emphasize the role of high frequency data to manage urban crowdedness as it can help improving visitors' experience as well as both public and private decision-making. Sun et al. (2021) also explore the opportunity to develop non-contact tourism that helps to avoid crowds through technology. However, this potentially increasing trend of the use of crowd management technologies still needs to be further developed in order to be considered efficient.

Some studies focus on the increasing trend of virtual tours (Fennell, 2020; Ilkhanizadeh et al., 2020; El-Said and Aziz, 2021). According to El-Said and Aziz (2021), some features of virtual tours such as their ease of use and ability to provide an enjoyable experience have the most influence on whether a person will consider choosing a virtual tour. Fennell (2020) claims the presence of a growing market for it as a surrogate of ecotour experience as it allows tourists to remain home while still giving employment to local guides. The potential target market of virtual tours includes persons with disabilities, elderly with accessibility needs but also sustainable citizens that wants to minimize their impact on the planet. To this regard, the use of drones in the development of virtual tours in open spaces became popular during the confinement period and it is expected that it will continue to display an increasing trend also in the future. In addition, drones might be used for those tourists that while being present at a destination would like to take photos from an aerial perspective (Ilkhanizadeh et al., 2020).

Very few studies investigated the use of digital applications as tools for rebranding destinations after Covid-19 (Norum and Polson, 2021; Kurniawan et al., 2020; Qomariyah et al., 2020). A relevant example is to be found in the design of a smart village application for the development of Eco-Tourism in Indonesia. Its purpose is to rebrand the destination with a human-centered approach. This is a UX design method that focuses on user experience and knowledge stressing the importance of user-generated content (Kurniawan et al., 2020).

During social distancing, Social Media became a powerful tool in the hands of tourism stakeholders aiming to remain connected with potential customers (Khodzhaliev et al., 2020). Indeed, the collection of user-generated content enabled them to connect with a wider audience, helped them to increase engagement and presence on Social Media through giveaways based on comments. Other techniques entailed the use of gamification to increase consumer engagement motivating customers with discount codes and proposing new tourist destinations for a post-confinement scenario. Therefore, behind a successful Social Media management it is crucial to have new marketing strategies. Thus, Social Media management became extremely important to overcome the negative consequences of COVID-19 pandemic as long as there is an effective marketing strategy planned behind it (Ketter and Avraham, 2021; Khodzhaliev et al., 2020; Rather, 2021).

Finally, ST also proves to be valuable for research due to, for example, its ease in gathering data that could be crucial for the recovery of the tourism industry. An example is explained by Wibowo et al. (2021) that introduces methodologies based on data from proxies

like Flickr and Twitter to study the impact of COVID-19 on destinations by assessing the number of photos uploaded before and after the outbreak of the pandemic.

5. CONCLUSIONS AND RECOMMENDATIONS

COVID-19 is disrupting global tourism as it is occurring as an unprecedent structural break. This phenomenon has led to a publication explosion in a very narrow temporal framework (Fassin, 2021). Therefore, this study provides an overview of the literature on the role of ST technologies in the tourism industry amid COVID-19 and in the subsequent recovery phase.

From the review of the literature, it emerged that most studies on ST and COVID-19 are focused on smart tourism technologies such as Automation Technologies (IoT, Artificial Intelligence, Virtual Reality, automated vehicles), Social Media, and applications developed with state-of-the-art technologies aiming to mitigate the effects of COVID-19 and in general epidemics, to enhance the consumer experience or to boost the rebranding of destinations after COVID-19. Indeed, Automation Technologies might help tourism companies to lower travelers' risk aversion by decreasing the perception of risk for infection. Therefore, at least in the initial phase, these technologies will be crucial to avoid the spread of the virus and to help to successfully start a safe recovery of tourism flows. However, there is not a clear indication of whether this will be a long-term strategy as it seems to be strongly related to the new risk perception arising from COVID-19. Since previous studies showed that risk perception is volatile and destination specific (Otoo & Kim, 2018; Rittichainuwat & Chakraborty, 2009; Seabra et al., 2013) it might be precipitous to invest rashly on technologies without relying on a long-term plan also involving scenarios in which individuals' risk perception is different, as such scenarios are plausible. Therefore, even though Automation Technologies alone cannot be a sustainable source of competitive advantage for tourism companies and destinations, they can complement other sources such as customized tourism experiences (Ivanov et al., 2020). Finally, practitioners should consider that the main objective of ST is to enhance users' experience and to support stakeholders at a destination (Buhalis and Amaranggana, 2015). Therefore, Smart technologies need to be developed keeping tourists and stakeholders at a destination as the main priority.

6. LIMITATIONS AND FUTURE RESEARCH

This study is not without limitations. First, the search on Scopus and WOS has been performed on 10 May 2021 and articles published after that date have not been included in this systematic review. Second, as COVID-19 literature is very recent and so is the application of ST to tourism amid health-induced crisis, there is still a scarcity of literature on this topic and this limits the identification of clear global patterns.

Future research should focus on the role of crowd management in the recovery of tourism, especially for mass destinations, as well as on the role of social media in helping tourism organizations to develop communication strategies that consider both travelers' reactions to fears and uncertainties related to the pandemic and that stress the benefits of traveling after COVID-19, while also highlighting the necessity of complying with health protocols (Boto-Garcia and Leoni, 2021). Finally, the new risk perception and higher risk

aversion led, during COVID-19 pandemic, to a higher acceptance of Automation Technologies in the tourism industry to maintain social distancing, reduce anxiety and fear of infection. Therefore, future studies should investigate whether this acceptance will continue in a post-pandemic scenario where fear of infection and risk aversion could eventually decrease.

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