



The digital revolution in the travel and tourism industry

Tonino Pencarelli¹

Received: 13 February 2019 / Revised: 30 October 2019 / Accepted: 22 November 2019 /

Published online: 27 November 2019

© Springer-Verlag GmbH Germany, part of Springer Nature 2019

Abstract

The digital revolution is radically changing the world we live in. Sensors in smart homes are able to interconnect devices such as thermostats, washing machines, television sets, laptops, tablets, and other objects to the Internet of Things platforms. New digital technologies have introduced important innovations in factories, hospitals, hotels, cities and territories. Industry 4.0 is signaling the end of well-established patterns and is asking scholars, managers and citizens willing to survive in this ever-changing and increasingly complex environment to observe it through different lenses and new paradigms. The tourism sector, also, is very much involved in digital transformations, increasingly qualifying them with expressions such as Tourism 4.0 or Smart Tourism. What impact does the digital revolution have on tourism? What do tourism 4.0 and smart tourism have in common? What are the main differences? Adopting a conceptual approach and focusing on the travel and tourism industry, our work aims to provide a point of view and some preliminary answers to the above questions. In paragraph 1 we illustrate the main changes brought about by the digital revolution 4.0 in industry, the Web, and tourism. Then, the concepts of tourism 4.0 and smart tourism are compared in Sect. 2. Section 3 illustrates how the consumer experience of digital tourists changes before, during, and after the trip. Paragraphs 4 and 5 illustrate the challenges of tourism destinations and tourism ecosystems in the smart perspective. In the final section of the paper, we highlight that in the near future it will not be possible for tourism ecosystems and territories to only take into account digital innovations, but they will have to include smart tourism perspectives like sustainability, circular economy, quality of life, and social value; they should also aim to enhance tourism experiences and to increase the competitive advantage of smart tourism destinations. Tourism 4.0 technologies need to be geared toward the improvement of the quality of tourism practices, assuming smartness and sustainability as the right paradigm for improving the quality of life and the social value of both guests and local residents.

Keywords Smart tourism · Smart destination · Digital traveler · Tourism innovation · Tourism 4.0 · Tourism ecosystem

1 Digital revolution: industry 4.0, web 4.0, and tourism 4.0

The digital revolution phenomenon is gaining increasing attention in managerial literature and also in tourism management studies (Buhalis and O'Connor 2005; Aldebert et al. 2011). Werthner et al. (2015) underline that digital disruptions are closely related to issues concerning digital infrastructure and that there are several ways to structure and discuss research topics in the field of digital revolution. In particular, the Authors identify five layers: (1) individual, (2) group/social, (3) corporate/enterprise, (4) network/industry, and (5) government/policy. In this paper we consider the industry layer (§1), the individual and group level (digital travelers, §3), and also the tourist destination layer (§4), which involves territory, companies, local communities, and the ecosystem level; the latter includes corporate and government strategies and policies (§5). In recent years, literature about the digital revolution has referred to the fourth industrial revolution and, above all, to Industry 4.0 (Schwab 2016). Several scholars (Lom et al. 2016) underscore how the very expression 'Industry 4.0' (or I4.0) tends to incorporate certain key elements that can refer to multiple sectors, in a fusion between physical and virtual worlds that integrates physical and computational processes. According to Lu (2017a), the fourth industrial revolution, or Industry 4.0 which originally began in Germany, is closely related to the internet of things (IoT), cyber physical system (CPS), information and communications technology (ICT), enterprise architecture (EA), and enterprise integration (EI). Thanks to the internet of things (IoT) and the internet of services (IoS), objects and services are connected by sensors, RFID, and cellular telephones in a common network that enables the interaction between goods and other objects and allows service vendors to offer value proposals to clients via the Internet. Another concept associated with I4.0 is the smart factory, which utilizes integrated cybernetic and physical systems to assist people and machines in the execution of tasks. The goals of I4.0 are to achieve higher levels of efficiency, productivity, and automation, with features such as high digitalization, customized production, human machine interaction, and value added services and business. Industry 4.0 not only increases flexibility in manufacturing, but also offers mass customization and better quality. It thus enables companies to cope with the challenges of producing increasingly individualized products and value offerings with a short lead-time to market and higher quality. According to some scholars (Lom et al. 2016; Lu 2017b), the concept of Industry 4.0 is a general term used to technologically qualify the value chains of organizations, referring to the capacity to integrate complex machines and devices with networked sensors and software. While there is no unanimous definition of Industry 4.0, this expression can be used as a collective term that includes many modern automation systems, data exchanges, and production technologies that deal with the digital transformation able to transform existing business models in many sectors (Sari 2018). In short, Industry 4.0 is a follow up to the fourth industrial revolution, able to change the business models of many economic sectors thanks to the integration of the industrial internet and to the recent evolution from Web 1.0 to Web 4.0. Therefore, we can define Tourism

4.0 as the new tourism value eco-system based on the high tech service production paradigm and characterized by the same six common principles of I4.0: (a) interoperability, guaranteed by the standardization of communication codes; (b) virtualization, through which cybernetic systems can control physical processes; (c) decentralization, in which every computer or technological device has autonomous decision making capability even within centrally-controlled procedures; (d) real-time data gathering and analysis capability; (e) service orientation, towards clients both external and internal to organizations (Grönroos and Gummerus 2014); (f) modularity, which allows flexible adaptation to changes through the substitution and/or expansion of individual modules. The salient feature of Tourism 4.0 and I4.0 is network-based horizontal integration to facilitate internal cooperation, followed by vertical subsystem integration within the enterprise to create flexible offering systems, and finally, engineering integration along the entire value chain to personalize the product for the customer, also promoting co-created value processing with customers. Cyber-physical systems permit the convergence of the physical and digital worlds by establishing a global network for business both in the manufacturing and the tourism sectors. In the fourth industrial revolution two key factors emerge: integration and interoperability, that is, the ability of two systems to understand each other and to use each other's functionality in exchanging data and sharing information and knowledge (Lu 2017a).

Closely connected to the concept of Tourism 4.0 and I4.0 is the term internet of things (IoT), an umbrella that covers multiple aspects of the extension of the Internet and the Web into physical reality by means of devices equipped with sensors able to detect and connect physical and digital entities through appropriate technologies. In particular, the study conducted by Miorandi et al. (2012) highlights several key features that must be supported by IoT, such as: the heterogeneity of devices, requiring suitable network architecture and protocols to allow them to communicate; interconnectivity, so data can be shared and managed via wireless technology, a prerequisite for large-scale distribution of technology; optimization of energy usage and device batteries; location and tracking capability of devices and connected objects, e.g. in transport systems; capability of connected objects to automatically react to a change of situation and find an appropriate solution, thanks to built-in intelligence in the system; security and privacy protection as a necessary condition for user acceptance. In the context of IoT, every object must be identifiable and be able to interface with the physical environment, even passively. Ultimately, the system of the internet of things implies that every thing communicates, every thing is detectable, every thing interfaces. This system of interconnectivity may also be manifested as the internet of services, internet of people, or internet of energy where the connections are not limited to only things, but refer to services, people, and energy networks, as well (Lom et al. 2016). The study by Gelter (2017) focuses on the implications and effects of digital technologies on tourism, highlighting several important tendencies. First of all, there has been an evolution in technological devices such that they are significantly changing people's lifestyles and habits, from the ever more powerful smartphones and tablets to 'smart' watches, bracelets, glasses and lenses—i.e., customizable, wearable accessories. The latter are able to generate forms of augmented reality in which information stems from an experience based on real life but a virtual

reality is created which proposes virtual, alternative worlds that supplant real life. Technological progress has made 3D printing not only possible but realistically accessible; for example, personalized souvenirs can be printed for tourists. Action cameras, or 180° double lens cameras, are becoming popular with tourists who use them to document their travel experiences and upload directly to their social media pages. Lastly, robotics normally relegated to factories are finding applications in tourism, as well; they are used in the transportation sector (self-driving automobiles or airplanes) or in the hospitality sector, in hotels for example, where robots are able to carry out routine tasks like booking and managing rooms. On a path that runs parallel to hardware evolution, rapid innovation is taking place for internet-specific software, so that the terms Tourism 4.0 and Web 4.0 are very closely connected, serving as evidence of the evolution of the Internet over the last twenty years. The first internet and web use dates back to the 1990s, a time period that we can call Web 1.0, where people used the Internet mainly in a passive way, limiting their activity to searching for information and carrying out simple communications via e-mail or discussion forums. Web 2.0 encompasses the 2000–2010 decade, characterized by people exhibiting a more interactive online behavior, user-generated content, and a philosophy of sharing content through new technological devices and new social media like Facebook, Twitter, YouTube, and so on. Web 2.0 was based on interactive processes for people and tourist communities to share and collaborate on websites that favor online booking and allow and encourage the public to create content. Recently, the Internet has transitioned into Web 3.0, a definition that has not yet fully solidified or found unanimous agreement as to its content. It refers mainly to an “intelligent” web concept characterized by more connection and more opening, and it represents a new web that entails semantic web technologies, distributed data bases, machine learning, recommendation agents, and artificial intelligence technologies. The emphasis is on machine-facilitated understanding of information in order to provide a more productive and intuitive user experience. In short, in the Web 3.0 era, smart agents, virtual worlds, personalized websites, semantic web, and integrated games affirm themselves; here, tourists can experience virtual reality and post their reviews of suppliers, and companies can engage in data mining and use “intelligent machines” that can learn, using AI technology (where the adjective intelligent is defined by the Cambridge Online Dictionary (<http://www.dictionary.cambridge.org>) “designed to be able to react to changes or different situations in a similar way to humans”) to provide better consumer experiences to their clients. Now, the expression Web 4.0 is becoming more and more frequent as it connects this idea, this attempt at a new concept, to the paradigm of Industry 4.0. If this expression were applied to the tourism sector, we can see how the recent innovations would affect it; for example, the advent of autonomous travel advisors and electronic agents that not only permit tourists to compare prices and to plan and book their travels more easily, but also provide them with a personalized, “digital travel friend” in the form of an electronic agent who will accompany them for the entire journey and will handle all matters related to travel. The e-Agent will be designed as a screen-less smartphone or wearable device (such as a piece of jewelry, a watch, or goggles). People will be able to talk to it like you talk to a friend to obtain information or communicate with the Web 4.0. Moreover, three-dimensional technologies

will find widespread applications and brain-computer interfaces (BCI) or brain-machine interfaces (BMI) could be able to wire into the human brain through external devices to improve vision, movement etc., thus opening up new experiences for travelers in the future by directly connecting them to virtual reality (VR), augmented reality (AR), and digital friends of Web 4.0. However, the full impact of Web 4.0 is not yet clear, although it will plausibly usher in an era of even greater integration between smart systems and people's everyday lives. It will be possible to provide tourists with the most relevant information to guide them in their purchasing decisions, facilitate their movements, and make their tourism experiences more pleasant, thanks also to the feasibility of offering flexible, targeted offer packages and pairing travelers with intelligent electronic agents. Webpages will be better planned and designed to increase the user-friendliness of technological devices, especially smartphones, allowing tourists to obtain useful information faster, thereby improving their travel experience. Thus, information can be saved, along with documents, photos, and videos, to be accessed later not only on local hardware but also, thanks to cloud technology, on computers that are made available to companies and people by specialized suppliers. The digital economy is contributing to the so-called Big Data phenomenon, i.e., the vast amounts of digitalized data that is spread throughout the web and 'fed' by a proliferation of sensors incorporated in the Internet of Things and by the numerous digital tracks that people leave when conducting both online and offline activities. The new technologies transform this data into valuable marketing information that can profile tourists' consumer behavior and expectations. In this way, fine segmentation processes are put into action and personalized value proposals are offered, so as to improve travel experiences, make them unique and truly memorable, and foster traveler loyalty. In short, the advent of the fourth industrial revolution, the evolution of technological devices, and the development of the internet are having a profound impact on tourism, qualifying the current period as the "era of Tourism 4.0", where the digital revolution is modifying the behavior of tourists, businesses and tourist destinations, projecting them towards a smart perspective.

2 From tourism 4.0 to smart tourism

Digitalization has significantly changed the travel and tourism industry, transforming it into a 'smart' sector, in other words, an innovative and technologically advanced sector that is fully immersed in the paradigm of Industry 4.0. As we head towards Tourism 4.0, therefore, we ask: what lies behind the expression, *smart tourism*? Gretzel et al. (2015a) and Femenia-Serra et al. (2019) underscore how the term 'smart' represents a by-now common buzzword used to describe the technological, economic, and social advances spearheaded by technologies that rely on sensors, Big Data, new forms of connectivity and information exchange (e.g. the IoT, IoS, wireless communication or RFID, and near field communication or NFC), its meaning closely matching the capacity to deduce and reason in an intelligent way. Physical structures such as homes and factories are also given the 'smart' label (smart home and smart factory) to describe the integration between physical and digital worlds.

Technological support devices are also becoming ‘smart’ devices; phones become ‘smartphones’, credit cards become ‘smartcards’, a television becomes a ‘smartTV’ and all share the common features of multi-functionality and the power of connectivity. Furthermore, the ‘smart economy’ is that which is supported by technologies that facilitate collaboration and connection between and among people. Lastly, the term ‘smart cities’ has been used to identify urban contexts that have adopted innovative technology to optimize the use of resources and to favor efficient governance processes that aim for sustainability and high quality of life for the citizenry. In other words, a Smart City is a city that brings together technology, government and society, including six components: smart economy, smart mobility, smart environment, smart people, smart living and smart governance (Lom et al. 2016; Lu 2017b). With reference to tourism, ‘smart’ is a term used for a variety of initiatives, such as using Big Data to differentiate demand (segmentation), adopting cloud computing as an external memory bank in which to store data and information, or providing access to free wi-fi or sensors strategically placed to let objects and physical, cultural, and service (e.g. transportation) resources connect and communicate with tourists’ mobile phones within the territorial context of destinations. This sector lends itself well to the ‘smart’ designation, as tourism is a sector that features easily digitalized, information-rich value propositions that spotlight the role played by new technologies. Its technological evolution has been constant and significant (Buhalis and Law 2008).

In addition, smart tourism is distinguished by scientific and technological innovations that are people-oriented and sustainable, and that improve the quality of services and of tourism experiences through the application of ICTs. These are important preconditions for digital tourism to be affirmed and its efficacy is determined by the existence of interoperability as well as the presence of qualified social and human capital. In the context of tourism, this implies the capacity for heterogeneous organizations and people to interact, to share mutually advantageous objectives, and thus, to exchange information and knowledge using common communication codes. In essence, the concepts of Tourism 4.0 and smart tourism revolve around new digital technologies, which represent the technical platform that allows the two concepts to converge. Both concepts derive from the context of the fourth industrial revolution and are based on variables such as the Internet of Things, connectivity, digitalization processes, augmented reality, virtual reality, artificial intelligence, digital presence, and so on. Therefore, in our opinion, there are some distinguishing features of the two concepts that merit highlighting. First of all, while Tourism 4.0 mainly refers to the new hardware and software equipment of the technologies, the label “smart tourism” refers to a sustainability oriented use of the Internet and ICT, aimed at combining technological, human, and social resources to pursue sustainability principles in order to improve people’s quality of life and to enrich the customer’s tourism experience (Table 1). Smart tourism implies paying particular attention to sustainable mobility, social cohesion, protection of people’s privacy, and optimization of waste management as well as water and energy consumption in tourist locations. Moreover, smart tourism refers to the efficient and effective use of new technologies applied to tourism services subordinated to a sustainability vision for improving quality of life of people (individual, groups, citizens and tourists) in a tourism destination.

Table 1 Tourism 4.0 and Smart Tourism: a comparison. Source: our compilation

Items	Tourism 4.0	Smart Tourism
New hardware technologies	Yes	Yes
New software technologies	Yes	Yes
New ICT technologies	Yes	Yes
Sustainability vision	No	Yes
Paying special attention to privacy of people, groups and organizations	Not always; it depends on specific circumstances, e.g. the EU Regulation aimed at creating a European framework for security certification of ICT products and digital services, the so-called Cybersecurity Act	Yes
Paying special attention to social cohesion	No	Yes
Paying special attention to smart mobility and to optimization of waste, water and energy management	No	Yes
Paying special attention to citizens and tourists engagement and participation	No	Yes
Paying special attention to tourist destination facilities and to quality of life of people	Not always; it depends on specific circumstances, such as the characteristics of service contracts between service technologies providers and territories.	Yes
Tourists' behavior	Not necessarily attentive to socio-environmental sustainability	Usually attentive to socio-environmental sustainability
Efficiency orientation	High	High
Effectiveness orientation	Low	High

Finally, in a smart tourism vision, digital tourists are so inspired by the principles of sustainability that this vision would impact on their behavior; so, the conceptualization of ‘smart tourists’ would be associated with tourists displaying more responsible behaviors and who are attentive to the environment and to the host communities. In this article, ‘smart tourism’ refers to three ICT-supported components and levels: the smart tourism customer experience, the smart destination, the smart business ecosystem.

3 Smart tourism customer experience

In Tourism 4.0, the impact of digital technologies on travelers’ behaviors before, during, and after a trip assumes ever greater significance and weight, to the point of transforming traditional travelers into digital travelers and smart tourists. This has occurred thanks to the advent of the mobile world and smartphones (Wang et al. 2014). It is also due to the digitalization of processes within the tourist value system, particularly at the levels of distribution and the technological ecosystem that allow tourism companies, through websites and Apps, to prepare real-time offers and booking services for the various microsegments of tourists. Currently, in the pre-consumption phase of a trip, smart tourists can contemplate an enormous range of potential alternatives with a significantly higher number of choices available now compared to when internet technologies were not yet so widespread (Buhalis and Law 2008). The first phase begins with the dream; the next steps involve comparing alternatives, talking to friends and/or relatives, choosing the best option, planning the specifics of the trip in real-time contact with the service providers, booking it, and finally, purchasing the product. Most digital travelers use search engines before they have even chosen a destination and travel mode; they may then simply use their phone to make a reservation, especially for simple tourism products that are considered financially and emotionally low-risk and require little forethought and organization. For the purchase of more complex and higher risk tourism products, where personalized advice may be needed, the pre-consumption phase can include consultation with a travel agent. In general, digital travelers primarily go online to search for information because most of them believe that it is where they will find the best prices (Law et al. 2014). People find reviews and opinions posted by other users, consumer blogs, as well as content generated on social media platforms to be especially useful (Xiang and Gretzel 2010). Travelers consider this information to be reliable and helpful to them in the process of choosing a product with a good quality-to-price ratio and to avoid making a poor decision. Alongside this information, the new digital technologies allow smart tourists to use a smartphone, computer, special platforms, or smart lenses to “try out” offers in either augmented reality or virtual reality (Rese et al. 2017). In the former case, next to the reality being shown and using technological support, content of potential interest to the digital traveler can be added and viewed (Scholz and Smith 2016). With the latter, instead, the digital tourist can go on a virtual trip, engaging all of the senses in a non-real context, in the aim of honing his/her desires and expectations. In both cases, the tourist can experience unique sensations before even leaving home, getting a taste of what will

only be experienced during the trip. Availability of technology notwithstanding, the digital tourist must be put in a position to accept these new experiential trials, persuaded by the quality of the information, as well as the attractiveness, technological speed, and user-friendliness of the visualization device (Obeidy et al. 2017). Within the industry, the digital traveler has been given a new label: SoLoMo (Ejarque 2015), in other words, a staunch user of Social media, Local, because s/he is looking for information through localized applications to enhance the destination experience, and Mobile, because s/he is constantly connected to mobile devices. In fact, even in the consumption phase of the tourism product, the digital traveler is always connected and constantly downloads information on places, restaurants, hotels, other service providers, prices, events, local traditions, weather conditions, friends nearby, special offers, environmental emergency alerts, transportation timetables, etc. Smart tourists use Apps and other services to acquire, but also to share, information, photos, videos, and other content which is then used in their interactions with friends, relatives, and the social communities to which they belong (Tiago and Veríssimo 2014). This all takes place during the trip, turning the tourism experience into an occasion to engage the traveler's entire social network in his/her personal adventure in real time, through comments and reactions to the narrative being shared. Tourists tend to contextually use various social media to share content; this becomes a way for them to strengthen their personal identification and image and gain social support. This is especially true of generation Z (born after 1995), avid users of social channels like YouTube, Snapchat, and Whisper as they seek experiential, game-based entertainment (gamification) and move away from the more traditional media like Facebook and Twitter. Digital tourists are people who have become increasingly used to the multitasking approach to consuming and sharing of information, texts, videos, and messages, which may derive from new types of software, called Bots, that are able to automatically provide assistance thanks to artificial intelligence. Social platforms are also used in emergency or crisis situations, such as when a crime is committed or there has been a terrorist attack, during weather-related emergencies, political unrest, or health outbreaks; in these situations, smartphone technology and the sharing of information help to understand and resolve problems more quickly (Law et al. 2014). After the trip, or in the post-consumption phase, the digital tourist finds another occasion to affirm his/her identity and to give more meaning to the just-completed experience. Like they did during the trip, smart tourists turn to blogs or websites where they can share photos and videos with friends and the public afterwards, as well (Chen et al. 2018); however, once they return to their everyday lives, they can take time to go back and relive the travel experience through a more thoughtful retelling of it. Stories are built around a collage of various content elements that are personal and personalized, in which the storytellers establish a sort of personal brand which identifies them as experts in the eyes of their followers. In short, thanks to the new technologies, the overall tourist experience can be improved: the value offering can be optimized so that technology becomes an important means for avoiding the commoditization of traditional offerings. The best tourist experiences are those that engage all of the experiential realms, in an integrated mix of functional aspects connected both to the traditional service management processes and to the experiential items of the offering (Pencarelli and

Forlani 2018; Shobri et al. 2018), which also uses technology to facilitate value co-creation. In a value co-creation process (Prahalad and Ramaswamy 2004) between tourists and suppliers, the intensity of a customer's active participation and of the use of technology may vary (Neuhofer et al. 2012, 2014), resulting in different tourism experiences according to the intensity of the two variables. However, recent innovation developments are being applied in a way that substitutes technology for human contact. This represents one of the paradoxical trends currently taking place in the hospitality industry, which has been altered by technology that removes some of the interactions between the host and the customer or guest. Thanks to IT technology, guests can get their digital key and go to their rooms or even check out of many hotels just by using their smart phones, and they can do all this without ever coming into contact or interacting with anyone (Sari 2018). To date, it is not clear whether the overall tourist experience will be perceived as better or worse. So, new ICT technologies enrich experiential value propositions but also open new opportunities to digital travelers to be smart, becoming extraordinary generators of contents that are uploaded to the web through various social channels and then shared and commented on by friends and followers. Thus, tourists become animators and co-creators of the sector's ecosystem of information and communication value, favoring new social connections. Last but not least, smart tourists can, thanks to new technologies, strengthen their attention to social and environmental sustainability in their consumer processes during the trip.

4 Challenges facing tourism destinations in the context of smart tourism

Xiang et al. (2015) note that there has been a recent and growing academic interest in conceptualizing the smart destination; they cite, among others, the study by Lopez de Avila (2015) which qualifies the smart destination as “an innovative tourist destination built on an infrastructure of state-of-the-art technology, which guarantees the sustainable development of tourist areas, facilitates the visitor's interaction with and integration into his or her surroundings, increases the quality of the experience at the destination, and improves residents' quality of life”. According to the SEGITUR (2015) study for the Spanish Ministry of Tourism, a ‘smart tourism destination’ is one that is innovative and built with the most recent technologies to ensure: sustainable development of the area, accessibility to everyone, interaction between visitors outside and inside the territorial confines, and an enhanced tourism experience for visitors and quality of life for residents. Several authors (Buhalis and Amaranggana 2013; Boes et al. 2015; Buhalis and Amaranggana 2013, 2017) have highlighted how a smart destination qualifies as such when it offers the basic features of any territory dedicated to tourism, known as the 6 As (attractions, access, amenities, available packages, activities, and ancillary services). This means that the destination must have some tourist attractions, be accessible to people by means of an efficient transportation system, have hospitality and entertainment services, be promoted through package offers by tour operators, host activities to entertain tourists, and have available support services for everyday life such as banking and healthcare.

The accessibility of a tourist destination increases when Internet technology is available in various places of interest of the territory, thus allowing anyone, anywhere, and at any time to access efficient wi-fi networks, obtaining data and information much faster than they can just through conventional telecommunications phone services. The infrastructure and network challenge has become a critical success factor for destinations and, indeed, for the entire tourism industry, given that much of the information requested by travelers is sought and utilized during the actual travel phase, rather than during the planning phase. In tourist destinations, there is increasingly more room for companies and DMO to carry out contextualized marketing processes, such as SoCoMo marketing. According to Buhalis and Foerste (2015, p. 155), “SoCoMo marketing integrates social media, context-based and smart mobile devices capabilities. It combines the different aspects of social, location and proximity as well as mobile marketing to bring unprecedented opportunities for co-creation through the interrelations of personal information, content and dynamic inter-action with the users’ context”. However, the destination can be called ‘smart’ only when it effectively fits within the parameters of six specific dimensions: smart governance, based on transparent and inclusive territorial governance that encourages the active participation of the population; smart environment, in which the destination is oriented towards safeguarding the environment and sustainably managing resources, starting with energy; smart mobility, comprising modern forms of mobility and transportation that are ICT-connected, sustainable, and easily accessed by everyone; smart economy, founded on the creation of new businesses and new business models thanks to digitalization and smart technology; smart people, to whom the destination is connected, who represent trained and qualified human capital that can operate in the new digital ecosystem; smart living, defined by the quality of life and social cohesion of the inhabitants, as well as the presence of cultural offerings for tourists and destination guests. In essence, smart destinations share many of the same features as smart cities, where the presence of digital technologies parallels the paradigm of sustainability. As Buhalis and Amaranggana (2013) and Boes et al. (2015) have observed, a smart destination represents a place equipped with infrastructures and technological applications (cloud computing, IoT access-enabling sensors and internet services systems for end users, such as video maps, GPS, tag clouds, blogs, podcasting, Apps, etc.) that can foster the co-creation of value linked to the tourism experience and generate benefits for tourists, for in-sector companies, and the hosting community. The concept of smart destinations derives from that of smart cities. They have the capacity to respond to various types of needs, including daily livelihood, sustainable economic growth, and high quality of life through investments in human capital, an adequate level of government participation, and infrastructure that support the proper dissemination of information throughout the city (Buhalis and Amaranggana 2013). Gretzel et al. (2015b) stress that the concept of smart tourism alludes to a form of tourism that is supported by destination-level integrated efforts to gather and aggregate data coming from physical infrastructures, social connections, institutional and governmental sources, and human minds which, when combined with the use of advanced technology, transform data into local experiences and value proposals with a clear focus on efficiency, sustainability, and enriching experiences. According to Xiang et al. (2015, p. 143), “from the consumer’s perspective,

a destination is said to be smart when it makes intensive use of the technological infrastructure in order to enhance the tourism experience of visitors by personalizing and making them aware of both local and tourism services and products available to them at the destination". In our opinion, smart destinations are something more and something different from technological destinations: they cannot simply be limited to the efficient use of knowledge and information, but must allow these to also be used in an effective way that sublimates intelligence, that is, geared towards anticipating needs and making people do the right thing in complicated situations (Li et al. 2017); in other words, their use must be secure and protected so that it does not endanger the reputation and financial security of people and enterprises. Moreover, smart tourism destinations need to aspire to follow a sustainability paradigm, to improve the quality of life of people, to take care of the environment, and to enhance the economic performance of the actors within the tourism value system. In this way, smart tourism destinations can improve their comparative and competitive advantage in the global tourism market (Koo et al. 2016). As Gretzel et al. (2015a, p. 559) highlight, the smart destinations can be considered as integral part of the smart tourism ecosystem, and "indeed, the term "destination" practically refers to a tourism-based ecosystem".

5 The evolution of tourism's value ecosystem: the new managerial challenges

In this context, another ecosystem has also evolved, that of businesses involved in the co-creation of value for tourists, enterprises, and stakeholders. It includes all of the tourism businesses, institutions and other organizations that work to facilitate the exchange of tourism-related resources and to create value in the experiential offers made to and with smart destination visitors. Therefore, the ecosystem of tourism services value (Barile et al. 2017) includes actors that are directly involved in the process of creating experiential value (tourists, area residents, tourism service providers, transportation companies, tourism intermediaries), providers of support services (telecommunications, banks, payment services), social media platforms (Facebook, Twitter, Instagram, etc.), public entities that regulate the sector, support technologies for bookings (Sabre, Amadeus), tourism infrastructures (theme parks, museums, etc.), as well as enterprises belonging to other sectors (healthcare, commerce, etc.) but which support travelers and tourist information and welcome offices. Buhalis and Amaranggana (2013) highlight the importance of also having the complementary presence of public institutions and private entities to build digital networks and infrastructures that create value for digital tourists while respecting their right to privacy and the protection of their sensitive personal data. Barile et al. (2017) underscore the two-way relationship that exists between institutions and technology; on the one hand, public and social institutions influence the rise, diffusion, or demise of certain technologies, while on the other hand, technology determines the growth of the institutions themselves by making available to the actors (businesses, tourists, area residents, public institutions) platforms for collaboration and exchange that are instrumental to the co-creation of experiential value. Del Chiappa

and Baggio (2015) and Presenza et al. (2014) describe the tourism destination as a digital, business-based ecosystem consisting of a network of stakeholders—offering services to tourists—and of technological infrastructures—geared towards creating a digital environment—that supports cooperation, knowledge sharing, and open innovation processes. In many rural areas of certain European countries, e.g. in Italy, the situation is such that expanding the availability of broadband and ultra-wide band infrastructures, based on fiber optics and/or wireless technology, has become indispensable if national destinations are to keep pace and compete with international ones (TDLAB 2014). Within the new digital ecosystem, the conventional critical success factors in the competition between enterprises and territories are the subject of debate. The survival of traditional enterprises is seriously threatened by the new playbook rules established by digitalization. Consequently, these business entities are called to innovate and re-think the business model they have been using thus far to create value for tourists and to achieve satisfactory performance levels. It has become necessary for them to not only identify but also grasp how best to serve the new market segments led by digital tourists, without neglecting the more traditional segments. They must be able to (a) formulate new value propositions, (b) identify new value-conveying channels through a multi- or all-channel approach suitable for various types of tourists and new forms of client relations management, and (c) tap into new resources with new actors undertaking new activities in an effort to optimize and balance the income-to-cost ratio. The innovative processes required to face the challenges of the digital age should, preferably, take inspiration from the open innovation philosophy so as to share the innovation effort with other partners and interested stakeholders, given that it is (too) difficult for individual isolated enterprises to generate, on their own, any significant innovation that would have a high socio-economic impact in the new value ecosystem. Shared innovation implies that the various actors involved also share intangible resources such as knowledge and technology, along with human and relational capital, to consolidate the preexisting networks and access new value networks. In the tourism value ecosystem, each stakeholder can play a different role at different times, whether as a producer, a consumer, or an intermediary; this entails a profound revision of the stakeholder-tourist relationship as new arenas of collaboration open up, amply exemplified in the TripAdvisor and Airbnb business models (Gretzel et al. 2015b). In the new business-based digital ecosystem, information and the use of data have become critical sources of competitive advantage. Nevertheless, because they are more difficult for single organizations to manage individually, there has arisen the need to collaborate in order to produce and extract the value contained therein. For example, enterprises that specialize in proposing organized travel packages (traditional TOs and OTAs), booking websites, transportation companies, or advertising aggregators (TDLAB 2014) could be interested in first, understanding and foreseeing the future trends of digital travelers' consumption models and second, obtaining information available on the various social channels or from tourist information and welcome offices, i.e., information that could be acquired by aggregating data generated by processes connected to the IoT and the IoS. Access to this information and to Big Data necessarily requires the collaborative consent of tourists and, above all, the cooperation of various private and public actors, geared toward building data capital. Therefore,

competing cooperatively (coopetition) is one of the challenging game rules in the digital ecosystem, designed to avoid a situation in which the circulation of sensitive data becomes a competitive threat to the organizations involved, especially to those that cannot access it, whether because of organizational issues or limited resources.

Another threat to be avoided is the destruction of value (in the eyes of the tourist) caused by the circulation and diffusion of data that violates people's right to privacy (Neuhofer 2016). In this context, there has emerged a contradictory and ambiguous situation in which videos, images, and personal data are being freely shared online while, in contrast, there is a growing fear of losing one's right to privacy as information that is being circulated online is used for commercial purposes by the actors in the business ecosystem. Here, too, the rules of competition and the business models in the tourism sector have changed as disintermediation and re-intermediation have become more accentuated along the value chain, where traditional travel agencies are losing their competitive edge and the new electronic intermediaries, online platform managers, and big players like Google or Facebook—that use a public good for commercial purposes—are gaining ground and becoming more dominant. The market is seeing the emergence of new service providers that are dedicated to building connectivity between machines and between objects and people. Moreover, public institutions are playing an important role in the form of regulations and investments, thus helping to define the architectural infrastructures of the digital environments inside smart tourism destinations. In fact, in the new business ecosystem, besides the rules of competition changing, the actors and their roles are also evolving as new service providers join the value system; these can be website providers, providers of sharing economy platforms, new digital tour operators, providers of internet applications for fixed and mobile devices, search engines, Big Data analysts and managers, or social media management companies, and more. Furthermore, the digital environment transforms the relationship between the objects of governance at destinations and the local stakeholders, thus increasing the potential for the latter's involvement (Presenza et al. 2014). In the context of Smart Tourism ecosystems, the conventional tourist information and welcome structures must also evolve, as they are called to support digital visitors by providing them with updated and continuous information via mobile devices (Ejarque 2015), in addition to the traditional, paper-based print material. Marketing strategies and approaches go from the traditional push forms to pull marketing, in which information is accessed only by those who want to receive it. Moreover, other roles are also changing significantly for search engine marketing, for inbound marketing, and for social media marketing, as it has become vital for all tourism-related businesses to be visible on search engines and be spotlighted on social media channels so they can grow their online reputation by carefully managing digital word-of-mouth. In sum, there is a recognized need to develop digital marketing processes through innovation in both the informational and strategic components as well as the operational ones in traditional marketing practices (Kannan 2017). A further change in approaches to marketing, particularly on the part of intermediaries (TAs), will be evident in improvements in technological devices that allow tourism consumers to access augmented reality and virtual reality, that is to say, to meet digital consumers' demand for immediacy. Studies conducted by Scholz and Smith (2016), Javornik (2016), and Dacko (2017)

have shed light on how using augmented reality has become an increasingly commonplace part of marketing programs for it can provide digital information in real time to tourists and general consumers alike, giving them a new way to experience product previews by adding their own mix of objects, people, or places. Thanks to augmented reality, enterprises can create interactive forms of advertising, enjoyable entertainment experiences, original brand narratives, and other activities that can not only enrich tourists' consumption experiences but also increase their level of engagement and degree of loyalty. An added benefit is that sellers can increase the rate of proposal to sale, reduce the number of complaints and returns, guide clients' choice of point of sale, optimize warehouse management, and provide a means to offer personalized assessment of presales to consumers. In the context of tourism, one would expect smart travelers to appreciate contact with travel agencies that are able to propose experiences in augmented reality, either through applications offered directly at the point of sale, or through the mediation of Apps installed on fixed or mobile devices. A customer satisfaction study conducted on tourists involved in augmented reality experiences in a Korean theme park (Jung et al. 2015) shows, for example, that the people interviewed were more satisfied, perceived greater quality of service, and were very likely to recommend the innovative practices to friends and acquaintances. As regards new technologies used by enterprises to meet the demand for real time responses to digital consumers, Parise et al. (2016) underscore the importance of two possible solutions for managing client relationships, i.e., the remote expert and the digital assistant. Both are virtual agents that interact with consumers to answer questions and/or offer recommendations and suggestions anywhere, anytime, and in any format. The remote expert is especially useful in helping consumers in the pre-purchase phase, with texts and videos or direct contact with salespersons that can answer potential clients' questions in real time, helping them choose the product that best meets their needs. This solution is particularly suitable for purchasing decisions involving complex products, as the consultant can be pivotal in guiding the consumer to an informed choice. The second solution, the digital assistant, is already widely used in smartphone applications (*Siri* for Apple, *Google Now* for Android). It supports commercial enterprises by facilitating price comparison of similar offers or by proposing personalized promotions that improve clients' buying experiences; for example, some hotels have smartphone applications in order to provide personalized services before, during, and after a guest's stay. Certain augmented reality practices can also come under the digital assistant category, particularly those used to let potential clients "try out" products available in the agent's warehouse, through an enriched and personalized narrative. In other words, the smart tourism ecosystem works in an innovative space embedded in technology infrastructures that permit a sensitive managerial approach to environmental, cultural, and social issues by aiming to facilitate visitors' interaction with their surroundings, thus improving the quality of tourist experiences.

Lastly, the new digital ecosystem is seeing the rise of new professional figures who can manage the new processes linked to the tourism value system. While on one side, professional bloggers—considered real gurus—have come onto the scene, playing an important role as sources of information and guides to the choice of destination, on the other side of the job market, the need has arisen for digital

competences that are often, as yet, still lacking. The digital ecosystem needs people who are skilled in cyber security, design experts for 3D printing, social media managers, I4.0 project managers, Big Data scientists, content marketing experts, as well as a series of professional roles that, to date, remain difficult to fill in some European countries like Italy, for example; the obvious consequences of these skills shortages are the risks associated with delaying the digital growth of the travel and tourism sector. In this sense, it becomes paramount to quickly intervene in formation processes, starting from the high school level and involving technical institutes and universities in the push to innovate the formative offering so as to create or update the necessary digital competences that would allow Tourism 4.0 and Smart Tourism to take off.

6 Not to conclude: some theoretical and managerial implications and research perspectives

In light of what has been presented above, some considerations may be drawn, although perhaps only transitory ones, given that Tourism 4.0 and Smart Tourism are continually undergoing changes brought about by an intense technological and social evolution. First of all, we may safely assert that the digital revolution, the Internet of Things, Web 4.0 and the I4.0 paradigm are radically modifying the language and the concepts adopted in the tourism and travel industry. In fact, tourism has become 4.0 and everything is becoming “smart”; so, we talk about smart tourists, smart cities, smart destinations, smart glasses, smart cards, smart cars, smart ecosystems, and so on. Peceny et al. (2019) refers to Tourism 4.0 as a new paradigm, appearing with the quest to unlock the innovation potential in the whole tourism sector. This can be done with the advent of Web 4.0 and the help of key enabling technologies from Industry 4.0, such as internet of things, big data, artificial intelligence, virtual reality, and augmented reality. According to the Authors, by establishing a collaborative ecosystem involving local inhabitants, local authorities, tourists, service providers, and government, it is possible to co-create an enriched tourism experience in both the physical and the digital world. Thus, we can shift from a tourist-centered focus to a tourism-centered focus around the local community. As we pointed out above, new digital technologies (IoT, VR, AR, AI, connectivity, Web 4.0) represent the technical platform that allows the concepts of Tourism 4.0 and smart tourism to converge, having some overlapping content in the context of the fourth industrial revolution. Therefore, some important differentiation must be noted between the two concepts. While Tourism 4.0 mainly refers to the new ICT technologies and devices, in our opinion the term “Smart Tourism” refers to an efficient and effectual use of technological, human, and social resources to pursue sustainability principles in order to improve the quality of life of people in smart tourist destinations enriching customers’ tourist experiences. The technological developments that support mobile access, such as cloud computing and End-User Internet Service Systems are thus instrumental to facilitating smart tourism goals (Gretzel et al. 2015a). However, the debate is just beginning and it is still open, as is so well framed in Werthner et al. (2015). We agree with Xiang et al. (2015, p. 144) for example that

“the smart destination remains an emerging topic in tourism research that requires the integration of knowledge from a number of relevant and different fields, such as information systems, travel behavior, marketing, urban planning, destination management and governance, as well as the increasingly important data analytics and data sciences”. As regards smart tourists, the behaviors of digital travelers and the general public is changing dramatically as travelers are more and more inclined to take an active part in processes that concern them and are increasingly interested in utilizing social tools to affirm their own identity and personal reputation. Moreover, the way consumers collect information, evaluate, and buy tourism products and experiential value propositions has changed considerably and the new technologies have strongly increased their tendency to take part in value co-production and value co-creation processes. Digital technologies can enrich the traveler’s experience throughout the whole travel cycle (dreaming, planning, booking, experiencing, and sharing), opening new channels for more responsible and sustainable consumption behavior. Also the way the business of tourism works within this digital ecosystem has changed as the enterprises and the territories themselves are coming to grips with innovation in marketing and communication processes as they adopt a new digital language, adopting SoCoMo marketing strategies and inspiring managerial actions to sustainable principles. To this end, tourism organizations must be able to manage the knowledge referred to the overall tourism experience, both offline and online, and be open to innovation processes (Jaziri 2018). Furthermore, players in the tourism value system are affected by profound shifts in the competitive process which are due to emerging phenomena connected to e-tourism (Neidhardt and Werthner 2018), such as: (a) the entrance of new competitors, mainly due to the value chain re-intermediation process (websites, e-mediaries, online travel agents, infomediaries, customer review sites, etc.); (b) the exit or weakening of traditional players, i.e., travel agencies; (c) the change in traditional competitors’ competitive approach, i.e., implementing competitive strategies connected to business model innovation or introducing technology-based competitive methods oriented to single- or multi-channel approaches; (d) the massive use of digital technologies in marketing strategies, e.g. the use of Big Data to get prompt and accurate market analysis, segmentation and positioning, the use of the Internet to interconnect people, things and territories in order to enrich the experiential value proposition for tourists, or the implementation of social media marketing strategies over multiple devices (PC, smartphone, tablet); (e) the use of technologies to enhance the brick-and-mortar store atmosphere; (f) the use of new digital technologies to help companies and institutions to develop collaborative strategies to compete in new value ecosystems in the context of the emergent sharing economy, widely diffused in tourism; and (g) the need for professionals with digital skills to face the rapid and profound shifts in the tourism industry: new competences that are not always easily created through the traditional formation system.

In this current and changing scenario of digital revolution, further questions and theoretical implications arise for smart destinations and the tourism value ecosystem that can reveal new managerial challenges and open up new research paths. In our opinion, one initial aspect that will need to be clarified concerns the rules of the Web, a public good that allows anyone, anywhere, and at any time to share

information, also thanks to social networks, without having to ask for permission or pay media usage rights. The Web is designed to be open, and universally accessible and available. Nevertheless, in this context there arises the risk of opportunism due to the fact that some of the biggest web players like Google, Facebook, and Twitter are making money from the very rules that allowed their success. These companies are exploiting a public good for commercial ends by selling vast amounts of acquired data to companies and commercial buyers that then use it for their own targeted marketing campaigns or for R&D of new goods or services. Through these practices, the big social network websites are extracting and isolating information published by their users and creating closed commercial spaces. While internet users fully understand that websites like Amazon exist for commercial reasons, they are not as aware that platforms like Google and Facebook—that promote themselves as free websites offering free services—actually are not free at all, because the commodities being traded are the users themselves: users who have donated information.

A second important topic regards the digital divide, that can deeply penalize those territories and touristic destinations that do not have a good network infrastructure necessary for the proper functioning of connections in digital ecosystems. This calls for public support policies to favor the development of such infrastructures, especially in rural, less developed areas. Moreover, Tourism 4.0 and smart tourism raise a further question, which requires awareness on the part of tourists, digital suppliers, and governments: the issue of cyber security. Security can concern the risk that personal government data can be used for unethical purposes, against people, and institutions. Moreover, there may be the danger that the tourism value system, totally dependent on the network connections allowed by the digital revolution, can be paralyzed if the network stops working or crashes, causing all activities to be blocked. Also, cyber-crimes could present a critical threat for tourism business ecosystems. We are aware that the issue concerns the effects of the fourth industrial revolution on all sectors of the economy and of the society, but we believe that even those involved in technology and tourism should seriously consider it and find solutions to avoid its verification. Furthermore, as travel, tourism, and hospitality companies have started to adopt robots, artificial intelligence and service automation (RAISA) in the form of chatbots, delivery robots, robot-concierge, conveyor restaurants, self-service information/check-in/check-out kiosks, and many others, it is important to understand from a theoretical and managerial perspective, the overall costs and benefits of the adoption of RAISA by travel, tourism, and hospitality companies (hotels, restaurants, event organizers, theme and amusement parks, airports, car rental companies, travel agencies and tourist information centers, museums and art galleries and others (Ivanov and Webster 2017). More generally, for managers and scholars of tourism management it is important to investigate and empirically test the future practical impact of the digital revolution on tourists (Tanti and Buhalis 2017), tourism businesses, and tourist destinations, as was recently suggested by Gretzel et al. (2015a) and carried out by Härting et al. (2017), for example. A further aspect to be explored in future research studies with important managerial challenges, concerns the impact of the sharing economy on the value ecosystem in tourism. In the contexts of urban mobility and hospitality, the advent of Uber and Airbnb highlights the disruptive effects these have had on the competitiveness

of taxi drivers and on traditional hotels. Moreover, sharing platforms in receptive contexts risk creating distortions in the resident housing market. Residents may be forced to move away from cities which would leave the historic centers populated only or mainly by tourists, who would then be penalized as they could not satisfy their desire for authentic experiences, in contact with the local population. In this way, there is the risk that new digital technologies could generate negative impacts on cities, making them very different from those inspired by the smart cities model. Finally, we hold that the most important challenge for the digital tourism ecosystem will be to better orient the new Tourism 4.0 technologies toward the improvement of the quality of tourism practices, assuming smartness and sustainability as the right paradigm to improve the quality of life and the social value of both guests and local residents in the tourist destinations. In addition, we firmly believe that new technologies connected to the Internet of Things, Internet of Services and Internet of People of the fourth industrial revolution (Industry 4.0) should draw inspiration from the smart cities paradigm, thus fulfilling the smart tourism concept. Last, but not least, in a high-tech world, the tourism and services industries cannot forget or underestimate the great importance of high touch relationships and human to human contacts to co-create value for tourists, workers, and local communities. In this sense, the new tourism ecosystem cannot be limited to digital innovation, but must necessarily include smart tourism perspectives like sustainability, circular economy, quality of life, and social value; they should also aim to enhance tourism experiences and to increase the competitive advantage of smart tourism destinations.

References

- Aldebert B, Dang RJ, Longhi C (2011) Innovation in the tourism industry: the case of Tourism@. *Tour Manag* 32(5):1204–1213. <https://doi.org/10.1016/j.tourman.2010.08.010>
- Barile S, Ciasullo MV, Troisi O, Sarno D (2017) The role of technology and institutions in tourism service ecosystems: findings from a case study. *TQM J* 29(6):811–883. <https://doi.org/10.1108/TQM-06-2017-0068>
- Boes K, Buhalis D, Inversini A (2015) Conceptualising smart tourism destination dimensions. In: *Information and communication technologies in tourism 2015*. Springer, Cham, pp 391–403. https://doi.org/10.1007/978-3-319-14343-9_29
- Buhalis D, Amaranggana A (2013) Smart tourism destinations. In: *Information and communication technologies in tourism 2014*. Springer, Cham, pp 553–564. https://doi.org/10.1007/978-3-319-03973-2_40
- Buhalis D, Foerste M (2015) SoCoMo marketing for travel and tourism: empowering co-creation of value. *J Destin Mark Manag* 4(3):151–161. <https://doi.org/10.1016/j.jdmm.2015.04.001>
- Buhalis D, Law R (2008) Twenty years on and 10 years after the Internet: the state of Tourism research. *Tour Manag* 29(4):609–623. <https://doi.org/10.1016/j.tourman.2008.01.005>
- Buhalis D, O'Connor P (2005) Information communication technology revolutionizing tourism. *Tour Recreat Res* 30(3):7–16. <https://doi.org/10.1080/02508281.2005.11081482>
- Chen T, Drennan J, Andrews L, Hollebeek LD (2018) User experience sharing: understanding customer initiation of value co-creation in online communities. *Eur J Mark* 52(5/6):1154–1184. <https://doi.org/10.1108/EJM-05-2016-0298>
- Dacko SG (2017) Enabling smart retail settings via mobile augmented reality shopping apps. *Technol Forecast Soc Change* 124:243–256. <https://doi.org/10.1016/j.techfore.2016.09.032>
- Del Chiappa G, Baggio R (2015) Knowledge transfer in smart tourism destinations: analyzing the effects of a network structure. *J Destin Mark Manag* 4(3):145–150. <https://doi.org/10.1016/j.jdmm.2015.02.001>

- Della Corte V, D'Andrea C, Savastano I, Zamparelli P (2017) Smart cities and destination management: impacts and opportunities for tourism competitiveness. *Eur J Tour Res* 17:7–27
- Ejarque J (2015) Social media marketing per il turismo. Come costruire il marketing 2.0 e gestire la reputazione della destinazione. Hoepli, Milano
- Femenia-Serra F, Neuhofer B, Ivars-Baidal JA (2019) Towards a conceptualisation of smart tourists and their role within the smart destination scenario. *Serv Ind J*. <https://doi.org/10.1080/02642069.2018.1508458>
- Gelter H (2017) Digital tourism. An analysis of digital trends in tourism and customer digital mobile behaviour. *Interreg Nord*. https://resources.mynewsdesk.com/image/upload/t_attachment/ecdf34yro7o8jyvwm8ji.pdf
- Gretzel U, Sigala M, Xiang Z, Koo C (2015a) Smart tourism: foundations and developments. *Electron Mark* 25(3):179–188. <https://doi.org/10.1007/s12525-015-0196-8>
- Gretzel U, Werthner H, Koo C, Lamsfus C (2015b) Conceptual foundations for understanding smart tourism ecosystems. *Comput Hum Behav* 50:558–563. <https://doi.org/10.1016/j.chb.2015.03.043>
- Grönroos C, Gummerus J (2014) The service revolution and its marketing implications: service logic vs service-dominant logic. *Manag Serv Qual* 24(3):206–229
- Härting RC, Reichstein C, Härtle N, Stiefl J (2017) Potentials of digitization in the tourism industry—empirical results from German experts. In: *International conference on business information systems*. Springer, Cham, pp 165–178. <https://doi.org/10.1108/msq-03-2014-0042>
- Ivanov SH, Webster C (2017) Adoption of robots, artificial intelligence and service automation by travel, tourism and hospitality companies—a cost-benefit analysis. Prepared for the international scientific conference “Contemporary Tourism—Traditions and Innovations”, Sofia University, 19–21 October 2017. <https://ssrn.com/abstract=3007577>
- Javornik A (2016) Augmented reality: research agenda for studying the impact of its media characteristics on consumer behavior. *J Retail Consum Serv* 30:252–261. <https://doi.org/10.1016/j.jretconser.2016.02.004>
- Jaziri D (2018) The advent of customer experiential knowledge management approach (CEKM): the integration of offline & online experiential knowledge. *J Bus Res*. <https://doi.org/10.1016/j.jbusres.2018.05.029>
- Jung T, Chung N, Leue MC (2015) The determinants of recommendations to use augmented reality technologies: the case of a Korean theme park. *Tour Manag* 49:75–86. <https://doi.org/10.1016/j.tourman.2015.02.013>
- Kannan PK (2017) Digital marketing: a framework, review and research agenda. *Int J Res Mark* 34(1):22–45. <https://doi.org/10.1016/j.ijresmar.2016.11.006>
- Koo C, Shin S, Gretzel U, Hunter WC, Chung N (2016) Conceptualization of smart tourism destination competitiveness. *Asia Pac J Inf Syst* 26(4):561–576. <https://doi.org/10.14329/apjis.2016.26.4.561>
- Law R, Buhalis D, Cobanoglu C (2014) Progress on information and communication technologies in hospitality and tourism. *Int J Contemp Hosp Manag* 26(5):727–750. <https://doi.org/10.1108/IJCHM-08-2013-0367>
- Li Y, Hu C, Huang C, Duan L (2017) The concept of smart tourism in the context of tourism information services. *Tour Manag* 58:293–300. <https://doi.org/10.1016/j.tourman.2016.03.014>
- Lom M, Pribyl O, Svitek M (2016) Industry 4.0 as a part of smart cities. In: *Smart cities symposium Prague (SCSP)*. IEEE, pp 1–6
- Lopez de Avila A (2015) Smart destinations: XXI century tourism. In: *ENTER2015 conference on information and communication technologies in tourism*. Lugano, Switzerland, pp 4–6
- Lu Y (2017a) Industry 4.0: a survey on technologies, applications and open research issues. *J Ind Inf Integr* 6:1–10. <https://doi.org/10.1016/j.jii.2017.04.005>
- Lu Y (2017b) Industry 4.0: a survey on technologies, applications and open research issues. *J Ind Inf Integr* 6:1–10. <https://doi.org/10.1016/j.jii.2017.04.005>
- Miorandi D, Sicari S, De Pellegrini F, Chlamtac I (2012) Internet of things: vision, applications and research challenges. *Ad Hoc Netw* 10(7):1497–1516. <https://doi.org/10.1016/j.adhoc.2012.02.016>
- Neidhardt J, Werthner H (2018) *Inf Technol Tour* 20:1. <https://doi.org/10.1007/s40558-018-0115-x>
- Neuhofer B (2016) An exploration of the technology enhanced tourist experience. Doctoral dissertation summary. *Eur J Tour Res* 12:220–223
- Neuhofer B, Buhalis D, Ladkin A (2012) Conceptualising technology enhanced destination experiences. *J Destin Mark Manag* 1(1–2):36–46. <https://doi.org/10.1016/j.jdmm.2012.08.001>
- Neuhofer B, Buhalis D, Ladkin A (2014) A typology of technology-enhanced tourism experiences. *Int J Tour Res* 16(4):340–350. <https://doi.org/10.1002/jtr.1958>

- Obeidy WK, Arshad H, Huang JY (2017) An acceptance model for smart glasses based tourism augmented reality. In: AIP conference proceedings, vol 1891, no 1. AIP Publishing, p 020080. <https://doi.org/10.1063/1.5005413>
- Parise S, Guinan PJ, Kafka R (2016) Solving the crisis of immediacy: how digital technology can transform the customer experience. *Bus Horiz* 59(4):411–420. <https://doi.org/10.1016/j.bushor.2016.03.004>
- Peceny US, Urbančič J, Mokorel S, Kuralt V, Ilijaš T (2019) Tourism 4.0: challenges in marketing a paradigm shift. In: *Consumer behavior and marketing*. IntechOpen. <https://doi.org/10.5772/intechopen.84762>
- Pencarelli T, Forlani F (eds) (2018) *The experience logic as a new perspective for marketing management: from theory to practical applications in different sectors*. Springer. <https://doi.org/10.1007/978-3-319-77550-0>
- Prahalad CK, Ramaswamy V (2004) Co-creation experiences: the next practice in value creation. *J Interact Mark* 18(3):5–14. <https://doi.org/10.1002/dir.20015>
- Prezenza A, Micera R, Splendiani S, Del Chiappa G (2014) Stakeholder e-involvement and participatory tourism planning: analysis of an Italian case study. *Int J Knowl Based Dev* 5(3):311–328. <https://doi.org/10.1504/IJKBD.2014.065320>
- Rese A, Baier D, Geyer-Schulz A, Schreiber S (2017) How augmented reality apps are accepted by consumers: a comparative analysis using scales and opinions. *Technol Forecast Soc Change* 124:306–319. <https://doi.org/10.1016/j.techfore.2016.10.010>
- Sari EB (2018) Reflections of industry 4.0 to management of service enterprises: smart hotels. *Uluslararası Güncel Turizm Araştırmaları Dergisi* 2(2):33–40. <https://doi.org/10.30625/ijctr.451722>
- Scholz J, Smith AN (2016) Augmented reality: designing immersive experiences that maximize consumer engagement. *Bus Horiz* 59(2):149–161. <https://doi.org/10.1016/j.bushor.2015.10.003>
- Segittur (2015) Report on smart destinations. Building the future. <https://www.segittur.es/opencvms/expor/sites/segittur/.content/galerias/descargas/documentos-en/Smart-Destination.pdf>
- Shobri NDM, Putit L, Fikry A (2018) Blending functional and emotional experience with the experience economy model to understand resort experience. *Int J Innov Bus Strategy* 9(1):55–63. <https://business.utm.my/ijibs/issue/vol9-no1/97-blending-functional-and-emotional-experience-with-the-experience-economy-model-to-understand-resortexperience>
- Tanti A, Buhalis D (2017) *Inf Technol Tour* 17:121. <https://doi.org/10.1007/s40558-017-0081-8>
- TDLAB (2014) Piano strategico per la digitalizzazione del turismo italiano, Laboratorio per il turismo digitale, MIBACT. https://www.beniculturali.it/mibac/multimedia/MiBAC/documents/1460024515998_TD_Lab.pdf
- Tiago MTPMB, Veríssimo JMC (2014) Digital marketing and social media: why bother? *Bus Horiz* 57(6):703–708. <https://doi.org/10.1016/j.bushor.2014.07.002>
- Wang D, Xiang Z, Fesenmaier DR (2014) Adapting to the mobile world: a model of smartphone use. *Ann Tour Res* 48:11–26. <https://doi.org/10.1016/j.annals.2014.04.008>
- Werthner H, Alzua-Sorzabal A, Cantoni L, Dickinger A, Gretzel U, Jannach D, Stangl B (2015) Future research issues in IT and tourism. *Inf Technol Tour* 15(1):1–15. <https://doi.org/10.1007/s40558-014-0021-9>
- Xiang Z, Gretzel U (2010) Role of social media in online travel information search. *Tour Manag* 31(2):179–188. <https://doi.org/10.1016/j.tourman.2009.02.016>
- Xiang Z, Tussyadiah I, Buhalis D (2015) Smart destinations: foundations, analytics, and applications. *J Destin Mark Manag* 4(3):143–144. <https://doi.org/10.1007/s12525-015-0196-8>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Affiliations

Tonino Pencarelli¹ 

✉ Tonino Pencarelli
tonino.pencarelli@uniurb.it

¹ Department of Economics, Social and Political Studies (DESP), University of Urbino Carlo Bo,
Via Saffi, 42, 61029 Urbino, PU, Italy