Journal of Hospitality and Tourism Technology

Progress on information technology in hospitality and tourism

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Guest editorial

Development and trend of information and communication technologies in hospitality and tourism

1. Introduction
Information and communication technologies (ICTs) allow instant dynamic communications and information dissemination at low cost. As such, they have become an indispensable part of people’s lives and have brought about radical changes to the hospitality and tourism industry (Buhalis and Law, 2008). The increasing adoption and continuous improvement of ICTs in the service delivery process is no longer an option. It has become a requisite for hospitality and tourism organizations to develop and maintain sustainable competitive advantage (Buhalis, 2000a).

In the pre-internet era, tourism organizations and destinations relied on analogue, expensive and time-consuming processes to communicate with their customers. Information search was a very complicated task (Vogt and Fesenmaier, 1998). Hospitality firms manually managed their business processes ranging from guest reservations, to check-ins and registrations. Without the technological support, collaborations and communications among different departments and across firms have been conducted through telephone and fax, making hotel operations very labor-intensive and inefficient. Distribution to customers was carried out indirectly through intermediaries raising major dependencies on tour operators and travel agencies for all principals (Buhalis, 2000b). The adoption of ICTs in the hospitality and tourism industry came in light in the 1950s when the American Airlines first adopted the computerized reservation systems (CRS). Despite its reliance on human operations, CRS largely reduces heavy manual operations and increases productivity and efficiency of hotel daily operations (Buhalis, 1993). Later, in the 1980s global distribution system (GDS) were launched as travel supermarkets. GDS connect individual systems of different tourism firms so that travel agencies can book different services via a unified platform. At this stage, the adoption of ICTs largely varied among hospitality and tourism firms, and was mostly limited to large companies because of the high cost and expenses involved. The rapid development of technology enabled hospitality and tourism practitioners to develop their information systems (IS) to digitalize management, marketing and operations. In the hotel applications, ICTs can assist hotels in the areas of reservations, guest accounting, room management, telecommunications, safety and security, energy management and back office. Each individual IS is linked to a central management system via network connection to facilitate both strategic and operational functions (Buhalis, 2003; Sheldon, 1997).

The proliferation of the internet since its emergence in the 1990s has generated various strategic implications for the hospitality and tourism industry and revolutionized the business landscape of business firm (Buhalis, 1998). The most noteworthy one is the development of websites, which serve as a direct distribution channel for hospitality and tourism managers to reach their customers and conduct online marketing (Law et al., 2014).

Tourism and hospitality products and experiences are intangible in nature (Neuhofer et al., 2015). The Internet allows travelers conveniently access a wide range of information related to the service products without any time and geographical constraints. This dramatically changed tourists’ purchase behaviors, as they can make more informed decisions. The internet also changed how destinations managed and promoted themselves online through tourism stakeholder networks (Mistilis et al., 2014). eCommerce and online
shopping were quickly identified as a result of website quality and customer satisfaction toward purchase intentions (Bai et al., 2008; Law et al., 2010; Qi et al., 2008). Gradually a new paradigm for tourism and electronic commerce emerged in the marketplace (Cho and Fesenmaier, 2001). Soon the importance of search engine marketing and search engine optimization for discoverability and distribution channel management became apparent (Paraskevas et al., 2011).

In the 2000s, social media revolutionized the internet and evolved into Web 2.0. Different from Web 1.0 or traditional websites, Web 2.0 enables two-way communication between hospitality firms and customers (Leung et al., 2013). Using social media applications, such as Facebook, Twitter and TripAdvisor, customers have equal opportunities to create and spread information not only to hospitality and tourism firms but also to other customers. This has largely shifted the power from firms toward customers and forced tourism and hospitality organizations to rethink their engagement with consumers (Xiang and Gretzel, 2010; Fotis et al., 2011). More importantly, social media enabled the development of online consumer-generated reviews, which had direct impacts on online word-of-mouth (WOM) (Ye et al., 2011; Ye et al., 2009; Zhang et al., 2010). Increasingly there is a significant relationship between online consumer reviews and business performance of hotels (Ye et al., 2009; Viglia et al., 2016). Harnessing the “Wisdom of Employees” from online reviews is also becoming critical for human resource management (Stamolampros et al., 2019).

Personal computers were subsequently developed into mobile devices, which have become very popular among customers as these devices are more portable and convenient. In response, hospitality and tourism firms frequently incorporate various mobile technologies into their operations. Hotels develop their own mobile applications to allow guests to perform check in, access their rooms and communicate with service staff. Smart technologies have also been integrated into guest room design, ranging from in-room features to guest amenities. Hotel guests can adjust in-room settings based on their preferences with just a few clicks on a smart device. Currently, hospitality and tourism managers have applied a wide variety of technologies to their daily operations, such as self-service kiosks, robotics and artificial intelligence. These technologies do not only enhance operational efficiencies and replace labor resources but also seek to provide seamless customer experiences. At the destination, smart phones and the applications that emerged paved the way for social media context-based mobile marketing to facilitate personalization and contextualization of service (Buhalis and Foerste, 2015).

ICT applications in the hospitality and tourism industry have witnessed dramatic growth through smart mobile technologies. A plethora of ICT applications have thus enabled hospitality and tourism firms to reduce costs, enhance productivity, facilitate innovation and provide customization in the service delivery process. ICTs have played, and will continue to play, a key role in the relationship between firms and consumers. Consumers are no longer passive and seek various experiences before, during and even after the consumption of services (Neuhofer et al., 2015). ICT applications in tourism and hospitality further transcend into more customer-centric tools that focus on the strategic integration of innovative technologies to facilitate co-creation of valuable customer experiences (Buhalis and Leung, 2018). Interestingly leadership, rather than technology, is the most significant driver for innovative technology adoption by tourism and hospitality organizations (Spencer et al., 2012). With smart technologies and more innovative technologies underway, smart hospitality and tourism gradually revolutionize the industry globally (Boes et al., 2016; Buhalis and Amaranggana, 2014). Hospitality and tourism managers will increasingly collect, consolidate and analyze their consumer data to generate insights about consumer needs, which turn standardized services into personalized...
experiences. Interoperable and interchangeable ICT infrastructures will increasingly enable tourism and hospitality business to use interconnected systems to maximize effectiveness and efficiency.

Because of the important role of ICT in the hospitality and tourism development, this special issue called for review papers on the progress of technology in tourism and hospitality in different specific topics to publish a collection of critical review papers.

2. The papers of the special issue

This special issue received very good responses from around the world, and the guest editors are pleased to present a wide range of review papers on progress of ICT in tourism and hospitality. Readers can find review papers on different aspects, such as the progress of robotics, virtual and augmented reality (AR), smart tourism, technology acceptance, technology use and wireless technology in tourism and hospitality. In the following paragraphs, the guest editors provide a brief overview of the papers in this special issue. These contributions provide researchers with very rich information on progress of ICT in tourism and hospitality within two decades.

2.1 Progress on robotics in hospitality and tourism: a review of the literature. The paper by Stanislav Ivanov, Ulrike Gretzel, Katerina Berezina, Marianna Sigala and Craig Webster provides a comprehensive review of research on robotics in travel, tourism and hospitality by analyzing 131 publications published during 1993-2019. This paper identifies “Robot,” “Human,” “Robot manufacturer,” “Travel/tourism/hospitality company,” “Servicescape,” “External environment” and “Education, training and research” as research domains. Moreover, by identifying the research gaps, this paper offers some directions for future research on robotics in tourism and hospitality.

2.2 Progress on smart tourism research. The paper by Fuad Mehraliyev, Youngjoon Choi, and Mehmet Köseoglu reviews 96 articles published from 1995 to 2017 focusing on smart tourism. Smart tourism has been identified as a popular concept that focuses on sustainability and efficiency through the application of smart technologies. This paper identifies the smart tourism research life cycle, collaboration trends, social structure, disciplinary approaches and foundations, categorization of research topics and methodological approaches, as well as the gaps and suggestions for future research.

2.3 Research progress on virtual reality (VR) and augmented reality (AR) in tourism and hospitality: a critical review of publications from 2000 to 2018. The paper by Wei Wei examines the main developments of virtual reality (VR) and AR research in hospitality and tourism by reviewing and analyzing 60 papers from 2000 to 2018. This paper synthesizes the stimuli, dimensions and consequences of VR/AR-related user behavior experience, and the progress on the theories and research methodologies, offering a useful background concerning what remains to be achieved. Then, this paper offers some directions for tourism and hospitality research on VR and AR applications.

2.4 Analyzing recent augmented and virtual reality developments in tourism. The paper by Sérgio Moro, Paulo Rita, Pedro Ramos and Joaquim Esmerado to analyze recent AR and VR development in tourism adopts a text mining and topic modeling approach to analyze a total of 1,049 articles for VR and 406 for AR. This paper shows that most of research study using AR is based on mobile technology, and wearable devices still show few publications, a gap that is expected to close in the near future. Moreover, there is a lack of research adopting big data/machine learning approaches based on secondary data.

2.5 Progress on wireless technologies in hospitality and tourism. The paper by Julio Navio-Marco, Luis M. Ruiz-Gómez and Claudia Sevilla-Sevilla reviews the progress of wireless technologies in tourism and hospitality since 2000. Wireless technologies are a set
of ICTs involving radio transmission (such as mobile or satellite technologies) that are extensively used in tourism and hospitality but those have not yet been studied comprehensively. This paper opens the field to other technologies (such as Zigbee or Bluetooth), and in particular highlights the large role-played by satellite technology in tourism and how this is reflected in the literature. Moreover, this study highlights the importance of wireless technologies in a sensor-based convergence between the physical and digital world.

2.6 A bibliometric analysis of knowledge development in smart tourism research. The paper by Abbie-Gayle Johnson and Ioanna Samakovlis examines the production of smart tourism knowledge thereby revealing the development of the concept through collaborative networks. This paper is useful for academic researchers and industry practitioners to aid their understanding of smart tourism research development identify the underlying context and aid in coherent development of the concept.

2.7 From sci-fi to sci-fact: the state of robotics and artificial intelligence in the hospitality industry. The paper by Lisa Nicole Cain, John H. Thomas and Miguel Alonso Jr. reviews the extant hospitality and tourism literature on the state of robotics and artificial intelligence (AI) in the service industry. This research examines and discusses implications for internal and external customer service, legal and ethical issues and theory. Moreover, this paper highlights the current areas of research on this emerging topic and identifies areas for future application and study.

2.8 Progress on technology use in tourism. The paper by Wenjie Cai, Shahper Richter and Brad McKenna provides a review of key issues which has been discussed in tourism research in relation to technology use. By applying the scheme developed in the IS discipline, this study provides new insights into the development of technology in tourism. In addition, it gives us the opportunity to suggest a research agenda by identifying research gaps and future research collaboration opportunities between these two fields.

2.9 Reviewing the progress on information and communication technology in the restaurant industry. The paper by Pilar Moreno and Pilar Tejada identifies the progress of research of ICT in the restaurant industry by reviewing the main academic contributions from the area of hospitality and tourism. Given the fact that ICT in the restaurant industry remains a largely unexplored subject, this paper can offer a useful tool for researchers who pursue advances in this field, by providing an overview that outlines the main aspects that need further research.

2.10 A critique of the progress of eTourism technology acceptance research: Time for a hike? The paper by Shahab Pourfakhimi, Tara Duncan and Willem Coetzee reviews 74 academic journal articles to evaluate eTourism technology acceptance literature and to illustrate current gaps in the field. This paper highlights that the majority of this research in this field has been conducted within a narrow theoretical scope, and this has led to contemporary theoretical and philosophical advancements in understanding the psychological, sociological and neuroscientific aspects of consumer behavior not yet being mirrored in the eTourism technology acceptance research. This paper assists researchers in developing alternative research agendas and diversifying the theoretical foundations of eTourism technology acceptance research.

2.11 Google trends in tourism and hospitality research: a systematic literature review. The paper by Gorete Dinis, Zélia Breda, Carlos Costa and Osvaldo Pacheco conducts a review of the literature that used search engine data on tourism and hospitality research, namely, Google Insights for Search and Google Trends. Google Trends data use in tourism and hospitality research has increased significantly from 2012 to 2017, mainly for:
tourism forecasting/nowcasting;
knowing the interest of users’ search for tourist attractions or destinations;
showing the relationship between the official tourism statistics and the search volume index of Google Trends; and
estimating the effect of one event in tourism demand.

This paper by reviewing the existing literature increases awareness of its potential uses in tourism and hospitality research and facilitates a better understanding of its strengths and weaknesses as a research tool.

2.12 Social media analytics in hospitality and tourism: a systematic literature review and future trends. The paper by Farshid Mirzaalian and Elizabeth Halpenny reviews the hospitality and tourism studies that have employed social media analytics to collect, examine, summarize and interpret “big data” derived from social media. The study highlights advancements in social media analytics and recommends an expansion of approaches, not only common analytical methods, such as text analysis and sentiment analysis but also infrequently used approaches, such as comparative analysis and spatial analysis.

2.13 Progress on the role of information and communication technologies in establishing destination appeal: Implications for smart tourism destination development. The paper by Ante Mandić and Daniela Garbin Pranić analyses the role of ICTs in establishing destination appeal and reflects on implications for smart tourism destination development. The focus is on identifying and analyzing technological solutions, considering six elements shaping tourism destination appeal, namely, attractions, public and private amenities, accessibility, human resources, image and character and price. This paper provides a number of practical implications for smart destination development and suggestions for future research.

2.14 Progress on Airbnb: a literature review. The paper by Daniel Guttentag reviews the extant literature on Airbnb – one of the most significant recent innovations in the tourism sector – to assess the research progress that has been accomplished to date. By reviewing 132 peer-reviewed journal articles from various disciplines, this paper provides a concise summary of Airbnb knowledge and suggests some areas for future research, as well this can assist industry practitioners as they adapt to the recent rapid emergence of Airbnb.

3. Conclusion
Tourism and hospitality areas have been strongly influenced by the rapid development of ICT in the past few decades (Law et al., 2014). The fast development of internet has tremendously revolutionized the tourism and hospitality industries (Buhalis, 2003). Using the internet, Web 1.0, and then Web 2.0/social media environments have effectively connected the travelers and tourists around the world from one hand, and the tourism and hospitality businesses from other hand much more than ever before (Buhalis and Law, 2008). The rapid development and adoption of IT in tourism and hospitality industries influenced the behavior of consumers, such as information search, purchase decision and post-purchase behavior, as well as the suppliers marketing and management approaches (Law et al., 2014).

Smart systems can dynamically interconnect all stakeholders and empower a tourism and hospitality ecosystem to support value cocreation for all. Contextual information and real-time services will be driving the future use of cutting edge technology for tourism and hospitality (Buhalis et al., 2015; Buhalis and Leung, 2018; Buhalis and Sinarta, 2019).

Because of the important role of IT on the hospitality and tourism development, several studies have reviewed this role. However, most of previous review papers generally focused on the progress of IT in tourism and hospitality areas, and have not focused on specific topics.
Therefore, the current special issue can be considered as a collection of a number of high-quality critical review papers on the progress of IT in tourism and hospitality in different specific topics. As such, the special issue aims at two audiences: academics involved in hospitality and tourism research to understand the future agenda for research in this area, and practitioners to figure out the trend of applications of ICT in tourism and hospitality industry. The special issue editors believe that this special issue can shed light on progress and application of ICT in hospitality and tourism, and open new areas for future research and investigation. The guest editors and authors gratefully acknowledge the valuable comments and encouraging support of Cihan Cobanoglu (Editor-in-Chief of JHTT) during the preparation of this special issue. The reviewers also deserve the heartfelt recognition of the special issue editors for their remarkable contribution to the quality of this special issue. As usual, they were diligent, meticulous, constructive and extremely competent.

The special issues editors specifically express their gratitude to the following reviewers: Alisha Ali (Sheffield Hallam University, UK), Muslim Amin (Taylor’s University, Malaysia), Fabrizio Antolini (University of Teramo, Italy), Albert Barreda (Missouri State University, USA), Dimitrios Buhalis (Bournemouth University, UK), Mark Anthony Camilleri (University of Malta, Malta), Katarzyna Czernek (University of Economics in Katowice, Poland), Yudi Fernando (Universiti Malaysia Pahang, Malaysia), Ulrike Gretzel (University of Southern California, USA), Daniel Gutten tag (College of Charleston, USA), Dai-In Han (Manchester Metropolitan University, UK), Stanislav Ivanov (Varna University of Management, Bulgaria), Abbie-Gayle Johnson (University of Nottingham, UK), Jalayer Khalilzadeh (Temple University, USA), Rob Law (The Hong Kong Polytechnic University, China), Andy Lee (The University of Queensland, Australia), Ante Mandić (University of Split, Croatia), Sérgio Moro (ISCTE - University Institute of Lisbon, Portugal), Cristian Morosan (University of Houston, USA), Saeed Pahlevan Sharif (Taylor’s University, Malaysia), Sangwon Park (The Hong Kong Polytechnic University, China), Shahab Pourfakhimi (University of the Sunshine Coast, Australia), Noel Scott (Griffith University, Australia), Marianna Sigala (University of South Australia, Australia), Babak Taheri (Heriot-Watt University, UK), Garry Tan Wei Han (Universiti Tunku Abdul Rahman, Malaysia), Rohkshad Tavakoli (Taylor’s University, Malaysia), M. Claudia tom Dieck (Manchester Metropolitan University, UK), Dan Wang (The Hong Kong Polytechnic University, China), Man Ling (Elise) Wong (Taylor’s University, Malaysia), Ian Yeoman (Victoria University of Wellington, New Zealand), Sungsik Yoon (University of Nevada, USA), Ryan Yung (Griffith University, Australia), Benxiang Zeng (Charles Darwin University, Australia) and Lu Zhang (Michigan State University, USA).

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References


**Further reading**

Progress on robotics in hospitality and tourism: a review of the literature

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Abstract

Purpose – This paper aims to provide a comprehensive review of research on robotics in travel, tourism and hospitality, and to identify research gaps and directions for future research.

Design/methodology/approach – This paper analyzes 131 publications published during 1993-2019, identified via Scopus, Web of Science, ResearchGate, Academia.edu and Google Scholar. It offers quantitative analysis of frequencies and cross-tables and qualitative thematic analysis of the publications within each of seven identified domains.

Findings – The paper identifies “Robot,” “Human,” “Robot manufacturer,” “Travel/tourism/hospitality company,” “Servicescape,” “External environment” and “Education, training and research” as the research domains. Most research studies are dedicated to robots in restaurants, airports, hotels and bars. Papers tend to apply engineering methods, but experiments and surveys grow in popularity. Asia-Pacific countries account for much of the empirical research.

Research limitations/implications – The analysis was limited to publications indexed in four databases and one search engine. Only publications in English were considered. Growing opportunities for those who are anxious to publish in the field are identified. Importantly, emerging research is branching out from the engineering of robots to the possibilities for human/robot interactions and their use for service providers, opening up new avenues of research for tourism and hospitality scholars.

Practical implications – The paper identified a myriad of application areas for robots across various tourism and hospitality sectors. Service providers must critically think about how robots affect the servicescape and how it needs to be adjusted or re-imagined to ensure that robots and employees can augment the service experiences (co-)created within it.

Originality/value – This is the first study to systematically analyze research publications on robotics in travel, tourism and hospitality.

Keywords Robotics, Research agenda, Servicescape, Robonomics, Robot adoption, rService

Paper type Literature review
Travel, tourism and hospitality have served as application areas for robotics for quite some time. The first publication dealing with the topic was published in 1993 by Schraft and Wanner and presented an aircraft cleaning robot. Much of the research at the beginning was performed by engineers, and only recently tourism/hospitality researchers actually entered the field and added a tourism/hospitality social science flavor to robotics research (Berezina, 2018; Collins et al., 2017; Ivanov et al., 2017, 2018; Kuo et al., 2017; Murphy et al., 2017a, 2017b; Tung and Law, 2017; Tung and Au, 2018; Tussyadiah et al., 2017; Tussyadiah and Park, 2018). The growing interest in robotics in travel, tourism and hospitality raises the need for a systematic review of research on the topic and an identification of future research avenues in the field. Such a meta-analysis is currently missing from the literature. Therefore, this review paper looks into the academic literature on robots and its relevance to the travel, tourism and hospitality industries.

The concept of the robot is not particularly old, only being coined in 1920 by Karel Capek in his play R.U.R – Rossum’s Universal Robots (NPR, 2011), and it took several decades before the concept was incorporated fully into popular culture. By the 1950s, Hollywood and popular culture had broadly disseminated the concept of the robot and inspired robot development. By 1956, the first company to produce a robot, Unimation, was founded (International Federation of Robotics, 2012). Today, industrial robots are widely used in agriculture (Driessen and Heutinck, 2015), manufacturing (Pires, 2007), warehousing and logistics (Min, 2010), transportation (Maurer et al., 2016) and medicine (Schommer et al., 2017). Service and social robots (Agah et al., 2016; Ferreira et al., 2017; Wirtz et al., 2018) are commonly used in education (Timms, 2016) and eldercare (Glende et al., 2015). While there may be colloquial understandings of what a robot is, there is also a more technical and industry-accepted definition. A robot is defined as an “actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform
intended tasks” (International Organization for Standardization, 2012: n.p.). The paper adopts this definition to guide the review.

The incorporation of robotics came relatively late to the industries involved in travel, tourism and hospitality, probably because many of the services provided require sophisticated reactions to the needs of the customer. While some automobile factories were largely staffed by robots by the mid-1990s, it was only in 2015 that a hotel predominantly staffed by robots opened (the Henn-na Hotel in Japan, www.h-n-h.jp/en/). While most hotels and hospitality operations are not as automated as the Henn-na Hotel in Japan, there are increasing concerns regarding the way in which such robotic and artificial intelligence technologies will be incorporated into travel, tourism and hospitality (Ivanov et al., 2017; Murphy et al., 2017b). At present, robots are used in hotels for such tasks as checking guests in, vacuuming floors, delivering things to guests, offering concierge services and other common chores. Robots are also involved in many other services in tourism and related industries, such as preparing drinks, entertaining guests, guiding guests and offering information to guests (Ivanov et al., 2017). As application areas expand, more (and more diverse) research will be needed to inform development and implementation efforts. A meta-analysis of relevant existing literature can provide important guidance in this respect (Gretzel and Kennedy-Eden, 2012).

This paper examines how the academic literature has evolved with regard to robotics and the travel, tourism and hospitality industries. The value of the paper lies in its summary of relevant academic literature, its depiction of state-of-the-art research in this context and its identification of research gaps that can inform future research efforts. Because robotics will be increasingly used in these industries, such a comprehensive review of the literature can also provide important practical insights for robot design and implementation.

1.2 Purpose

The purpose of this study is twofold. First, this paper aims to provide a comprehensive review of research on robotics in travel, tourism and hospitality. Second, based on the analysis of available literature, this paper will identify research gaps and directions for future research.

2. Methodology

2.1 Data collection

The intention was to gather as comprehensive as possible a picture of English-language academic research linking the study of robots to travel, tourism and hospitality. Data were collected during July-August 2018. The world’s two largest databases with scientific publications (Elsevier’s Scopus and Clarivate’s Web of Science) served as the main source of data. The authors implemented extensive searches in the two databases by using a combination of two search words in the title, abstract and key words of the publications:

(1) search word 1 – robot; and

(2) search word 2 – travel, tourism, hospitality, leisure, recreation, hotel, hostel, lodging, accommodation establishment, restaurant, bar, travel agency, tour operator, travel agent, airport, airline, port, ship, bus station, bus, train station, train, event, car, rent-a-car, car rental, museum, casino, theme park and amusement park.

The authors read the title and the abstract of every publication displayed in the search results. If the paper was considered relevant for the research, the full text was obtained. In total, 92 relevant publications were identified in Scopus and 80 in Web of Science – 72 of them appeared in both databases, 20 were included only in Scopus and 8 appeared only in
Web of Science. As Scopus and Web of Science, although extensive databases, are far from comprehensive, the authors enriched the publications list by looking for relevant publications with the same search word combinations in the two largest archive websites with academic publications (Academia.edu and Researchgate.net) and the most popular free academic search engine – Google Scholar. In this way 55 additional publications were identified. In total 154 relevant publications were found through all five sources (Scopus, Web of Science, Academia.edu, Researchgate.net and Google Scholar). After deleting all duplicates the final dataset included 131 publications (Appendix).

2.2 Data analysis

For each publication in the data set, the following characteristics were obtained: type of publication (journal article, conference paper or book chapter), year of publication and full reference. The full text of each publication was read and the paper was classified according to the following criteria:

- research focus – whether the paper adopted a supply-side perspective regarding the discussion of the topic (i.e. the view point of the company), a demand-side perspective (i.e. the view point of the customer) or both perspectives, although one of them might be prevailing;
- tourism sector focus of the paper – the individual travel/tourism/hospitality sectors such as hotels, restaurants, bars, airports, museums, etc., or all sectors in general;
- research methodology (research approach applied in the paper) – engineering, experiment (field, laboratory), survey (questionnaire, interview), content analysis of customer reviews, observation, biometrics (eye-tracking, skin response, etc.), mathematical modelling/optimization or the paper was conceptual/descriptive. The “engineering” group consisted of all technical methods that dealt with the actual design, programming and manufacturing of a robot;
- country of focus – country in which data was collected, if empirical research was implemented; and
- research domains – seven broad research domains were identified based on the focal actor/action domain: 1) Robot – design, mobility, navigation, information processing, communication, functionality, appearance, autonomy, etc.; 2) Human (customer and employee) – perceptions and attitudes/acceptance, adoption of robots, use behavior, robot mediated interaction, robot personalization, etc.; 3) Tourist company – the impact of robots on its operations, human resources, marketing, finances, etc.; 4) Robot manufacturers – robot development agenda, pricing of robots, resources used, partnerships with other companies, etc.; 5) Servicescape – changes in servicescape owing to the use of robots, active adjustments to servicescape/workflow, robot friendliness of tourism/hospitality facilities, etc.; 6) External environment – legal and ethical issues arising from the use of robots, impact of robots on labor market, etc.; and, 7) Education, training and research in robotics in travel, tourism and hospitality.

It should be noted that a paper could deal with more than one tourism sector, methodology, country of focus and/or research domain. Hence, the grouping of papers according to these criteria is not mutually exclusive.

The paper applies both quantitative and qualitative analyses of research publications on robotics in travel, tourism and hospitality. The quantitative analysis is based on frequencies, cross-tables and respective test statistics (Chi-square test). Because of the small number of publications per year, the 27-year period between the first publication in the data
set (Schraft and Wanner, 1993) and the latest one (Claveau and Force, 2019) was divided into five 5-year blocks (the first one with 7 years owing to the small number of publications) to facilitate the quantitative analysis. The qualitative analysis involves thematic analysis of the publications within each of the identified domains.

3. Findings

3.1 General overview

Tables I to III elaborate the quantitative results. The findings reveal several key trends:

First, after a modest start with only 5 publications in total in 1993-1999 and 5 in 2000-2004, the number of publications jumped to 13 in 2005-2009 and 33 in 2010-2014 before reaching 75 in 2015-2019. It is important to note that at the time the research was conducted, the most recent five-year interval was not over yet; consequently, the study included several publications from 2019 that appeared online through early publication services but did not include all research that would eventually be published in 2019. Nevertheless, this time period has already proved to be the most productive in terms of the number of publications. The research on robots in travel, tourism and hospitality is gaining strong momentum and one may expect it to significantly increase in the future, in line with the actual adoption of robots by tourist companies.

Second, the majority of publications (78 or 59.54 per cent) are conference papers, whereas 47 (or 35.88 per cent) are journal articles. This result is logical, considering the fact that the field of robotics is rapidly developing and conference proceedings provide faster and more flexible (in terms of topics and methodologies) publication opportunities compared to journals, which usually use a prolonged review process and are more selective. Conference papers are also seen as more prestigious in most engineering and computer-science fields. The lack of books on the topic is notable as it suggests that robotics in tourism is currently not taught as a stand-alone subject and that the topic has not reached the maturity level at which researchers are able to publish comprehensive works or publishers become interested in supplying handbooks.

Third, more than half (70 or 53.44 per cent) of the publications adopt a supply-side perspective (i.e. the robot-related issues are discussed from the perspective of the company), 28 (21.37 per cent) refer to the demand-side (the robot-related issues are discussed from the perspective of the user/customer) and 33 (25.19 per cent) adopt both perspectives, although for many publications of the latter group, the supply-side perspective is much stronger than the demand-side. As a matter of fact, the overwhelming majority of publications that adopt a supply-side perspective only (63 out of 70 or 90 per cent) are either engineering papers (e.g. explaining the design of a robot with tourism application) or conceptual (e.g. discussing how tourist companies can use robots). However, results in Table I indicate that the number of publications that adopt a demand-side focus or present both perspectives is increasing since 2010 – papers deal not only with the design of the robot, its autonomy, navigation, etc., but also with human–robot interaction, user perceptions and acceptance of robots as service providers.

Further, the most popular tourism sectors are restaurants (42 or 32.06 per cent of analyzed papers), followed by hotels (25 papers or 19.08 per cent), airports (23 papers or 17.56 per cent) and bars (11 papers of 8.40 per cent), i.e. the sectors where robots can mitigate labor shortages (e.g. restaurants, bars, hotels), where spacious premises facilitate a robot’s navigation and make cleaning robots attractive (e.g. restaurants, hotels, airports), where tasks require low-level skills and can be easily divided or where there is considerable traffic flow that robots can help manage through the provision of information (e.g. airports). It is interesting to note that museums were initially quite popular among researchers (they were
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## Research methodology

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**Notes:**
- "Other" includes publications in Academia.edu, ResearchGate and papers indexed by Google Scholar, but not included in Scopus or Web of Science. Some papers are indexed both in Scopus and Web of Science;
- one paper can focus on more than one tourism sector; one paper can be classified in more than one research domain;
- more than one research methods can be applied in a paper.

Robotics in hospitality and tourism.
the focus of four out of nine papers published before 2004) but later lost their allure. A possible explanation might be the limited opportunities for commercialization of museum robots. Museums provide large spaces (hence facilitating robot navigation), a well-structured environment (premises do not change), and the information robots need to provide to visitors does not change often; hence, museums are excellent grounds for testing robot prototypes in controlled environments. However, the sheer number of hotels, restaurants, bars and airports globally and the number of robots they could employ, make them much more attractive from a commercial point of view, which may explain the shift in the tourism sector focus observed in research publications after 2005.

As far as the research methodology is concerned, more than half of the publications (74 or 56.49 per cent) use engineering methods related to robot design, navigation, face/object/speech recognition, autonomy, etc., whereas 58 (44.27 per cent) involve some form of a field or laboratory experiment (e.g. testing a robot’s capabilities in different restaurant settings). Surveys and interviews (27 publications or 20.61 per cent) have experienced growing popularity during the past 10 years, mostly because of the increasing number of publications with a focus on users/customers and generally more interest in the topic by social scientists. Observation (e.g. direct observation or reviewing surveillance camera recordings of robot behavior or human–robot interactions) has received considerable

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application as well (23 publications or 17.56 per cent), whereas innovative methods such as biometric methods are just entering the field (they were used in only four papers). Conceptual papers increased significantly after 2015 when tourism/hospitality researchers (not only engineers) entered more bravely into robotics and started publishing papers on various aspects of the application of robots in tourism/hospitality settings.

Japan leads by country of focus for empirical papers (24 or 18.32 per cent of all publications), followed by Germany, USA and China (Table II). Asia-Pacific countries (Japan, Republic of Korea, Macao, Taiwan and Thailand) are the empirical setting of nearly a third of all publications (39 or 29.77 per cent). Considering that Asia-Pacific countries have the highest concentration of robots in the world (IFR, 2018), such a result is not surprising. It is noteworthy that countries with demographic decline seem most interested in robotic labor.

Regarding the research domains, the findings reveal that most papers (104 or 79.39 per cent) concentrate on the robot itself, 81 (61.83 per cent) focus on the human, whereas 66 (50.38 per cent) discuss the impact of robotics on companies. Research in the servicescape domain has been initially quite modest, probably owing to the very small number of service robots in business, but since 2015 it has increasingly attracted the attention of tourism/hospitality researchers. The other three domains (robot manufacturers, external environment and education/training/research) are discussed in less than 10 per cent of the papers. However, research in two of these domains (external environment and education/training/research) seems quite recent, with all of the papers published in the past five years. This suggests growing concerns with the legal and ethical implications of the use of robots in service domains as well as emerging educational opportunities and needs.

Table III shows the cross-tabulation between the research domain (columns) and tourism sector focus and research methodology (rows). Results indicate that the papers are very concentrated in specific sectors, domains and methodologies. For example, most papers on airport robots fall within two domains – “Robot” and “Tourist company,” papers on restaurant and hotel robots – within “Robot,” “Human” and “Tourist company,” whereas all papers on robots for bars discuss robot design. Papers within the “Servicescape” domain deal with restaurant and hotel robots or with all tourism sectors. It is interesting to note that half of the papers within the “External environment” and “Education, training, research” domains do not have a particular tourism sector focus, but deal with all of them simultaneously, probably owing to the more general nature of the topics discussed in these two domains (e.g. ethics, training, education).

Examining research domain and methodology, most papers in the “Robot” domain use engineering methods (71 publications in the domain or 68.27 per cent) or involve a field or laboratory experiment (49 papers or 47.12 per cent). The same methods are most popular in the “Human” domain, whereas papers within the “Tourist company” and “Education, training, research” are predominant and papers within the “External environment” are exclusively conceptual. The findings are logical because the topics discussed in each domain determine, at least to some extent, the method. Obviously, research on robot design, navigation, autonomy, etc., would require the application of engineering methods, whereas the more theoretical domain of “External environment” would call for conceptual papers.

We now turn our attention to the qualitative analysis of research publications within the framework of the seven domains.

3.2 Research domains
The research domains reflect the human and non-human actors and action domains that the existing literature on robotics in tourism and hospitality addresses. Figure 1 graphically
portrays these seven domains as well as their interactions. The robot domain describes various aspects that pertain to the robots themselves. These include all areas of their design, such as functionality, mobility and autonomy, with appearance being highlighted because of its prominence in the literature. The human domain includes both consumers and employees who are exposed to these robots. The third domain refers to robot manufacturers, meaning companies that provide the hardware and/or software as well as services, such as customization or maintenance, needed for implementing robots in tourism and hospitality contexts. The tourist company domain encompasses all functions within tourism and hospitality providers, ranging from operations to human resources to marketing and finances. The servicescape domain describes the space in which robotic services are (co-) created by robots, tourist companies, employees and consumers and which can be described in terms of its robot-friendliness. The external environment domain includes the legal, ethical, social and economic frames and conditions that shape and in turn shaped by, the introduction of robots into the tourism and hospitality context. Last, education, training and research institutions are treated separately from this external domain because of their particular role in influencing and understanding the other domains.

The diagram emphasizes the many ways in which these domains interact or overlap. While there are publications that are purely focused on robots, others acknowledge the influence of existing research/algorithms, company requirements, servicescape parameters and current manufacturing on their design. Many studies deal with the influence of robots on human perceptions and behaviors and some on the way humans influence robots. The way in which humans and robots interact or should interact with each other is also a popular topic, whereas possible robot-mediated interactions between customers and employees have not been studied as much. Robots impact the operations and general functioning of tourism and hospitality companies, and these companies, in turn, design servicescapes that influence what robots can and cannot do and what human actors experience. The literature further acknowledges that companies and manufacturers both use and facilitate research. This research influences robot design, as well as the training of
engineers and hospitality employees. The literature also points out that manufacturers now sell directly to consumers, enabling customers to bring their own robots into the servicescape. Robot adoption is also an important area of research and is influenced by the features of the robots, the availability, pricing and sales conditions set forth by the manufacturers, the customer and employee attitudes and skills shaped by educational and training institutions and the needs and innovativeness of companies. All these interactions happen within a particular external environment that either facilitates or hinders them. The following sections describe the specific themes that emerged within the seven domains in greater detail.

3.3 The robot
The design of the robot itself was identified as the most prominent theme in all studies collected for the purpose of this research. Table I shows that robot design for the travel, tourism and hospitality industry was discussed in 104 (79.39 per cent) out of 131 publications used in the current study. The earliest publication on this topic was written by Schraft and Wanner in 1993. Since then, the topic was steadily gaining attention and peaked in 2015-2019 with 53 relevant publications. Robot design for the hospitality and tourism industry was most frequently investigated in the context of the restaurant subsector (32 publications, 30.77 per cent), followed by airports (22 publications, 21.15 per cent) and hotels (17 publications, 16.35 per cent). A few articles on robot design were written in relation to bars, museums, train stations, guides, casinos and theme parks. Methodologically, these papers mainly relied on engineering (71 publications, 68.27 per cent) and experimental methods (49 publications, 47.12 per cent) or were conceptual in nature (39 publications, 37.5 per cent) (Table III).

Robot design research is essential for laying the foundation for robot applications in our field, both conceptually and technically. It ensures effective design and deployment of robots in the hospitality and tourism industry, as well as efficient execution of intended tasks. More specifically, the topics covered in these studies included robot appearance; mapping, path planning and navigation; collision/obstacle avoidance; vision calibration and image recognition (including object and facial recognition); object manipulation (e.g. dishes at a restaurant, luggage at the airport); socially interactive behaviors and levels of interactivity; and robot persuasiveness.

Studies on robot design may be further classified based on three main categories of robot use in the hospitality and tourism industry: autonomously functioning robots, robots interacting with other robots and robots interacting with humans. Autonomously functioning robots perform tasks independently. For example, such robots may include airport surveillance robots (Acaccia et al., 2006; Capezio et al., 2007; Donadio et al., 2018), robots cleaning tables at a restaurant (Acosta et al., 2006) or robots screening luggage at airports (DeDonato et al., 2014). Instead of dealing with the interaction of robots and humans, this stream of research focuses on precision and accuracy in robot design, navigation and vision.

Once robots engage in interactions with either other robots or humans, the research topics that are associated with these types of robots represent an additional layer of complexity, which is needed to ensure smooth operations in the interactive environments. Robot-to-robot interactions can result in the creation of multi-robot systems (MRS) that may offer enhanced performance to the hospitality and tourism organizations. For example, such MRSs have been considered for preparing airplanes for departure (El-Ansary et al., 2016), debris cleaning on airport runways (Öztürk and Kuzucuoğlu, 2016) and creating smart restaurants (Huang and Lu, 2017). The papers written in this domain concentrate on the
design of the entire system and optimization algorithms that would enable smooth robot interactions and cooperation.

Human–robot interaction in the hospitality and tourism industry may be observed through interaction with customers, for example, in the case of a robot waiter (Cheong et al., 2016; Lehmann et al., 2014), bartender (Foster et al., 2012; Keizer et al., 2014) or robot-guide (Joosse et al., 2017) and in the case of interaction with staff members, such as for airplane maintenance (Donadio et al., 2018). Once robots start interacting with humans, new research topics emerge that cover such behavior. For example, research studies related to the design of robots that will be interacting with humans evaluated levels of interactivity and ability to influence crowd flow (Caraian et al., 2015), socially interactive behaviors (Chung et al., 2016) and robot persuasiveness (Herse et al., 2018). A more detailed review of the studies on human–robot interaction is provided in Section 3.4.

3.4 The human

Issues related to robot use by consumers and employees are heavily researched within the tourism domain. However, studies mainly relate to interaction and adoption topics, and they do not equally cover (or do not cover at all) the four dimensions relating to human–robot interaction, namely, usability, social acceptance, user experience and societal impact (Weiss et al., 2009). Moreover, the majority of the studies is found in hotels, restaurants and bars and much less in other tourism sectors such as airports, trains, events and theme parks (Table III).

Most studies adopt an engineering and experimental approach, followed by survey and observation research (Table III). Earlier studies have focused on examining the technical dimensions of robot interaction (primarily with customers and less with employees), which are heavily influenced by functional dimensions – engineering capabilities and features of robots. For example, research has examined issues of localization, mapping, avoiding collision with or serving, guiding/following humans in various tourism contexts such as: public spaces (Burgard et al., 1999), restaurants (Tzou and Su, 2009; Yu et al., 2012), entertainment parks (Kober et al., 2012), museums (Thrun et al., 1999) and train stations (Shioimi et al., 2011). The aim of this stream of research was to perfect the functional capabilities of robots so that they can easily physically interact and behaviorally navigate with and around humans. In this vein, research focused on evaluating robot–consumer interaction using performance metrics such as response time of robots, accuracy of response to customers and robots’ understanding of people’s presence (Pinillos et al., 2016).

As the technical capabilities of the robots advanced and socio-emotional and intelligent capabilities that enable robots to carry out meaningful interactions with humans emerged (Neumann et al., 2014; Lehmann et al., 2014; Mokhtari et al., 2016), the focus of the research turned toward understanding the socio-psychological implications and dimensions of robot–human interactions. To that end, more studies started adopting a survey and observational approach for examining and understanding human reactions to robots. However, the majority of these studies focuses on the customer’s rather than the employee’s perspective.

From a customer perspective, most studies focus on soft dimensions of robot–human interactions such as: customer satisfaction, future use intentions, service quality evaluations of robot–human service provision (Yu, 2018); customer experience of service robot provision measured by customer embodiment, emotion, human-oriented perception, feeling of security and co-experience (Tung and Au, 2018); and, the duration and effectiveness of the interaction between a robot bellboy and hotel guests (Rodriguez-Lizundia et al., 2015).

Only three studies are identified that examine robot–human interaction from an employee perspective. In studying an industrial robot, El-Ansary et al. (2016) examined how
robots and employees can interact and complement each other to optimize performance (e.g., reliability, efficiency, accuracy of task) rather than focusing on understanding the impacts of robots on issues relating to job (re-)allocation, productivity, changes of job roles, employee re-training and re-ski
ing. Similarly, Osawa et al. (2017) discussed how hotels think of integrating robots within hotel operations rather than how to re-design job tasks, activities and descriptions because of robot exploitation. Tanizaki et al. (2017) provided a mathematical solution for determining shift scheduling between robots and employees that addresses the trade-offs of work timing and work content by aiming to satisfy both employee and management needs. However, all three studies focus on functional and technical issues rather than the soft issues resulting from robot–employee interactions.

The impacts of human–robot interactions are not only influenced by the robot’s characteristics but the situational context and user characteristics can equally influence robot–human interactions, as such interactions are socio-culturally interpreted and constituted. There are very few studies examining the moderating role of such factors. For example, Pan et al. (2013) and Sakamoto et al. (2009) measured guests’ responses in various human–robot interaction scenarios (e.g. social vs non-social, passive vs interactive) in hotels. Herse et al. (2018) studied the impact of language on robots’ persuasiveness for sales purposes in a restaurant. Yu (2018) examined the impact of customers’ cultural background on their service quality perceptions and satisfaction with robot interactions as well as their perceptions of robot smiling behaviors. Earlier, Giuliani et al. (2013) had found that nationality also influenced bar guests’ perceptions of socially acceptable robot behaviors. Only one study examined the impact of socio-demographic factors of customers on their adoption of human–robot interactions (Kortsha, 2014), although some studies provide preliminary findings that children tend to more easily build affinity relations with robots (Yu, 2018).

Finally, the studies focusing on customers’ adoption of robot services stress the positive role of the robots’ anthropomorphic characteristics and capabilities (in terms of how they move, look and behave) (Murphy et al., 2017a). Anthropomorphism is also a focus of the great number of engineering studies aiming to investigate how to increase and enhance robot–human interactions.

3.5 The robot manufacturer

While other technologies can be designed and created within tourism and hospitality companies (e.g. websites or global distribution systems), the materiality and complexity of robots requires them to be manufactured elsewhere. Tourism and hospitality providers therefore have basically two options: to buy or to rent them from robot manufacturers. A total of 11 papers were categorized as belonging to this robot manufacturing domain, but only one (Pransky, 2016) is actually focused primarily on it. It presents the summary of an interview with a robot entrepreneur and discusses commercialization challenges for robot manufacturers. It specifically illustrates the notion of Robots as a Service (RaaS) in the hospitality context. The paper states that it is not the manufacturing that is the issue, but rather selling robots to an industry that has never had them before.

All other papers deal with robot design but have a link to the robot manufacturing domain because they use commercially available robots or components. As expected, they all involve engineering type research, with some collecting empirical data and with several having a food and beverage service focus. The qualitative analysis further shows that particular manufacturing challenges caused by tourism and hospitality servicescapes and by the specialized needs of providers in this industry are currently not discussed in the literature. There is also no research on the market share of manufacturers or the diffusion of
particular robots, no information on manufacturer agendas or strategies regarding tourism and hospitality as application areas and no research on tourism provider – manufacturer partnerships.

3.6 The travel/tourism/hospitality company
Research investigating the use of robots does not equally cover all types of tourism sectors. Instead, it heavily focuses on hotels, restaurants and airport operations (Table III). There is also currently a lack of empirical research regarding the company domain. This is not surprising because empirical studies require industry adoption, which is limited at the moment, whereas the fast-pacing robotic advances inspire researchers to conceptualize and futurize the tourism firm of the future (Lofaro, 2017).

Research in this area covers the following topics, but is not equally distributed amongst them: types of robots and their applicability and benefits for the tourism industry; use of robots in various business operations and service roles; operational and strategic decision-making in adopting robots; and the impact of robots in the tourism industry. Most of the studies are descriptive, explaining the features of robots and the pros and cons of their application in various types of operations (Ivanov et al., 2017; Mathath and Fernando, 2017; Papathanassis, 2017). Robots are found to be used in the industry very early (Graf and Weckesser, 1998 described the robot hotel housekeeper). Studies in this descriptive category provide various examples and cases on how robots can be used in various service contexts, roles and operations, e.g. back-office (e.g. to control liquid when serving bar drinks, Komoguchi et al., 2008) and front-office operations (BellBot by López et al., 2013); and robots as receptionists, bellboys, museum guides, concierges, housekeepers, waiters and bartenders, luggage-storage staff, delivery robots, butlers and room service assistance, chatbots and online customer support staff (Collins et al., 2017; Ivanov et al., 2017; Chen et al., 2010).

Basically, it is possible to integrate and use robots in all business operations. However, research describing the current use of robots in tourism firms’ operations demonstrates that robot exploitation in the tourism industry mainly focuses on the use of robots for automating and replacing repetitive, routinized service tasks that do not require high robot intellectual and socio-emotional capabilities. Research has not yet identified and described the use and impact of intelligent robots (e.g. robots empowered with artificial intelligence, machine-learning and big data) for replacing and/or enhancing and complementing the highly intellectual work and decision-making processes of top level tourism staff (e.g. marketers and financial directors).

With regard to the types of robots being used in the tourism companies, research identifies all types of robots (i.e. physical and software-based robots and industrial and service robots). However, most studies describe the use of physical service robots in the tourism industry, ignoring the great potential of artificial intelligence in tourism operations. Two studies describe the use of an industrial robot for cleaning aircrafts (Schräf and Wanner, 1993; Wanner and Herkommer, 1994). Berezina (2018) also identified the need for research to investigate the use and impact of personally owned robots in the hotel industry, but there is no empirical research looking at this either.

Despite the great business potential of robots in tourism firms’ operations, there is a lack of research investigating the industry’s current robot-adoption levels and investment intentions. There is also a scarcity of research providing a systematic and theoretically based roadmap on how tourism firms can best integrate robots into their business operations both at a strategic and operational level. There is only one study (Kuo et al., 2017) showing how hotel managers can consider environmental, demand and industry information/factors to decide whether to strategically invest in robots and achieve a
competitive advantage. By using empirical data of restaurants using robots as waiters, one study (Eksiri and Kimura, 2015) provides a useful practical guide explaining the process and the factors that restaurant operators can follow for integrating, using and evaluating the performance of robots as waiters.

There is no research examining firm performance and competitive advantage; staff levels and productivity; and the redesign and re-structuring of jobs, tasks, operations and organizations in light of robot adoption. Osawa et al. (2017) provided some preliminary speculations on the implications of robots for redesigning job tasks, but their study is very contextual and case study based (focus on a specific restaurant and type of robot activity). Finally, there is a scarcity of research examining the long-term and macro-level impacts of robots on the tourism industry in relation to its structure and operations, as well as the type of tourism firms and tourism experiences being offered. There are a few conceptual studies identifying and raising such issues, but they are too speculative, without any systematic research methodology and without evidence-based conclusions [Hay (2011) and Yeoman and Mars (2012)].

3.7 The servicescape
The servicescape domain describes the spaces and processes designed/provided or maintained/managed/augmented by tourism and hospitality organizations in which hospitality and tourism services are (co-)created and consumed and in which robots, consumers, employees and sometimes the general public encounter each other. Understanding the servicescape is essential for robot design; it is therefore not surprising that many of the papers deal with describing it in terms of its implications for robot navigation and interaction design. Pransky (2016) discusses the need to understand it from a manufacturer point of view to produce “minimum viable products,” e.g. the possibility of making robots without arms because of the omnipresence of employees in the servicescape that can load the robot. In general, the papers highlight the uniqueness and complexity of tourism and hospitality servicescapes, describing them as full of people and obstacles and therefore limiting in terms of robot accessibility. A few emphasize the need of robots to develop understandings/conceptualizations of these servicescapes rather than just being designed for them. One paper stands out in that, instead of problematizing the servicescape, it reports on robots being instrumental in overcoming existing servicescape constraints, such as in the case of beaches that do not permit the construction of restaurants (Navarro et al., 2015).

The majority of the papers deal with restaurant or hotel servicescapes, with only a few addressing museums, bars, airports, events and train stations. The portrayals of servicescapes in the papers range from already infiltrated with lots of technologies (Papathanassis, 2017) to completely void of human service providers as in the case of unmanned restaurants and hotels (Huang and Lu, 2017; Yadav et al., 2016) and finally futuristic scenarios in which distinctions between humans and robots are blurred (Yeoman and Mars, 2012). The papers further describe robots as either active or passive actors in these servicescapes (Sakamoto et al., 2009) or fully integrated/blended into the servicescapes, as in the case of robots that have the shape of bar tables (Claveau and Force, 2019).

Another theme in this domain is the need to manipulate servicescapes to accommodate robots. This can involve physical manipulation to facilitate robot tasks (Abad et al., 2017) or to generally increase robot accessibility (Ivanov and Webster, 2017). It also includes adjusting the servicescape to accommodate robots as travelers, as they are being taken on trips by their owners, e.g. in the form of adding charging stations or making space for them at restaurant tables (Ivanov, 2018). Recognizing the need for adjustments beyond the physical, a few papers specifically focus on the drawing of service blueprints to identify suitable tasks for the robots (Osawa et al., 2017) or the reengineering of service processes
The concept of robots as a service innovation (Primawati, 2018) further stresses the opportunities of robots to catalyze service innovation processes.

### 3.8 The external environment

A few studies have delved deeply into the issue of how the external environment impacts the implementation of new technologies in the hospitality industry. The meager literature takes a generally speculative approach to how the external environment will influence implementation of new technologies. In addition, the literature is generally practical, assuming that the advantages of robotic technologies will eventually lead to the embrace of such technologies into the hospitality industry, although there is also a critical and normative approach present in the research (Korstanje and Seraphin, 2018).

Pransky’s (2016) interview of a CEO of a major robotics firm discusses some of the external issues that impact the adoption of robotic technologies in the industry. An evidence-based approach is taken by Osawa et al. (2017) basing analysis upon interviews and surveys at Henn-na Hotel. The findings show that hotel operators implement robotic technologies based upon substitution of human labor with robotic labor largely because of customer needs/demands. There are other works that also focus upon the implementation of robotic technologies, mentioning the external pressures to adopt robotic technologies (Collins et al., 2017; Ivanov et al., 2017; Mathath and Fernando, 2017). Perhaps the most sophisticated of such articles is Ivanov and Webster’s (2018) analysis into how labor costs impact upon a firm’s willingness to accept replacing human labor with robotic labor, among many other considerations. Ivanov and Webster (2017b) also delve into how consumer demands will influence how hospitality industries will reorganize their physical spaces to ensure that the layout of hotels will be appropriate for customers bringing robots to hotels.

All in all, the literature that deals with the external environment and how it impacts upon the adoption of robotic technologies is in its infancy and is dwarfed by other concerns. The literature is generally speculative, assuming the great jump in robotic technologies will occur in the near future. However, as a new and small subset of the literature on robotics and hospitality, it illustrates that concerns with robotic capabilities and costs of labor will be major considerations in implementing robotic technologies.

### 3.9 Education, training and research

Education, training and research in hospitality and tourism robotics appears to be one of the youngest (together with the external environment) and less-established topics in this stream of literature. All eight papers in this category were published between 2015 and 2018. These papers were mainly conceptual/descriptive in nature and in some cases were supplemented by other research methods (e.g. engineering, survey or experiment). Existing studies have recognized the impact of robotic technologies on the hospitality and tourism industry and discussed how changes in the industry may lead to the changes in education, training and research.

Murphy et al. (2017b) recommended hospitality and tourism educators to include topics about robots in class discussions to prepare students for the changing realities of the industry where they will seek employment. The CEO of Savioke, a robotics company, mentioned in an interview that graduate students majoring in engineering and learning robot design should take business courses to learn about entrepreneurship and ways of working with businesses (Pransky, 2016). Similarly, Hsu (2018) suggested that entrepreneurship and innovation should be embedded in hospitality school curricula. It appears that the current literature is calling for a reciprocal relationship between hospitality/business and engineering disciplines, which would be beneficial for the sector from the perspective of hospitality graduates joining the industry with foundational understandings.
of robot functionality and engineering graduates being prepared to work with hospitality and tourism businesses.

In addition, Hsu (2018) suggests that further advancements in robotics may influence not only hospitality school curricula but also pedagogy used by the professors. Some of the notable changes may include elimination of lab courses from the hospitality curriculum because of the skills being taught in these courses becoming obsolete and substituted by robots. She also questions the need of knowing a foreign language because robots would be able to provide instant translations. Instead, hospitality students may want to concentrate on knowing and understanding cultures and studying machine language and communication. Last, but not least, the hospitality and tourism education may be disrupted by robot teaching assistants that would assist in monitoring online courses and answering student questions and would free up time for professors to concentrate on research activities.

Similar to university instruction, on-the-job training in the hospitality and tourism industry may also be impacted by advancements in robotics. Human employees will need to work alongside robots and should be properly prepared for such a shift. Furthermore, Ivanov (2018) predicts the future of non-human travelers, such as robots, pets or toys. If this happens, hospitality industry professionals should be offered training that would prepare them for such interactions.

4. Conclusion

4.1 Contribution

This paper contributes to the growing body of knowledge through quantitative and qualitative analyses of research publications on robotics in travel, tourism and hospitality. A total of 131 relevant research publications from Scopus, Web of Science, Academia.edu, Researchgate.net and Google Scholar were analyzed spanning from 1993 to 2019. The analysis revealed that paper topics fall within seven broad research domains. In general, the findings show that the number of publications is increasing significantly and various tourism sectors are being discussed, although robots in hotels, restaurants, bars and airports receive most of the research focus.

4.2 Theoretical implications

The literature review presented in this paper suggests that there is not only progress in tourism and hospitality-related publications in terms of an increase in numbers but also in relation to a growing diversity in topics, types of publications and research methodology. Nevertheless, the analysis also showed some important literature gaps in terms of tourism sectors and research domains that remain under-explored. For example, robot design studies are at the core of robotics research in hospitality and tourism. This stream of research has evaluated individual robot design, as well as looked into the topics of robot-to-robot and robot-to-human interaction. However, with the development of robotics and increasing adoption of robots by the hospitality and tourism industry, more complex smart environments of robots simultaneously interacting with other robots and humans will need to be studied. As robots become part of the internet of things, robots will become even more autonomous and at the same time interlinked. Considering robots as embedded in such a complex web of interactions opens up numerous doors for research.

Further, the engineering focus remains strong and, while there is evidence that more social science research is being published on the topic, there is no indication of strong and widespread inter-disciplinary research collaborations. In addition, the dominance of research from Asia is not surprising but suggests that current understandings of robots in tourism and hospitality are colored by culturally-specific perceptions of robots, service and
tourism and hospitality. This of course calls for more cross-cultural research and more recognition of the influence of culture on robot, interaction and service design and evaluations when designing and implementing research.

What emerges very clearly from the analysis is that this is not a mature field of research. Figure 1 suggests many avenues for future research within and across the various research domains identified, for example the influence of robot design characteristics on the quality of the robot-mediated interaction between customers and service staff, the ways in which employees adjust workflows and workspaces to accommodate their robotic colleagues or the impact of the external environment and robot manufacturer strategies on robot adoption by tourism and hospitality companies. Table I also indicates that some research methods are currently not applied to the topic (e.g. action research, projective techniques or ethnographic studies) and research using biometric data is scarce. In addition, there is a lot less research that considers the demand/human side, especially the impacts of robots on the tourism and hospitality experience and the attitudes, needs and hopes/fears of employees. Future research on human issues should include replication studies because as industry and customer adoption of robots increases and the novelty effect fades away, customers and employees' reactions and expectations from robot–human interactions will likely change.

The explosion of conceptual papers in the past five years could be an indicator of the difficulty of conducting empirical research in this area because of the still low diffusion of robots in the industry or the high cost of conducting laboratory experiments with robots. However, it could also be a sign of a great need to articulate why a tourism and hospitality-specific understanding of robots, robonomics and robot service (rService) is needed. It is expected that the number of conceptual and purely descriptive papers will decrease in the future as the field becomes more established and the adoption of robots increases, which will provide researchers with growing opportunities to study robots and related practices in the field. Yet, it is hoped that there will nevertheless be a continuous stream of conceptual work that will apply critical perspectives to the phenomenon and push our understandings of robots as well as of tourism and hospitality in a robot-infiltrated world. For instance, there is a great need for research related to the moral, ethical, security and privacy concerns related to the integration of robots in the practices of tourists, service employees, tourism and hospitality firms and destinations. Conceptual research that challenges our ways of exploiting robots for particular purposes is especially pressing. For example, what are the legal and moral implications of sex robots replacing or enhancing the existing sex tourism labor force and what does it mean for existing sex tourism destinations (e.g. redistribution of tourism flows, lost income for poor countries depending on sex tourism)? Thus, important concepts such as power, discrimination/equality and justice will have to be specifically defined for the context of robots.

4.3 Practical implications
A number of practical implications can be derived from the findings. First and foremost, the literature analyzed in this paper suggests a myriad of application areas for robots across various tourism and hospitality sectors. As such, this review can help interested practitioners think about potential service innovations through robots beyond the obvious room service delivery and concierge functions. Second, while publications about tourism and hospitality companies have increased drastically in the past few years, there is still a lack of research about company and staff attitudes, behaviors, reactions and impacts on companies, such as productivity, reskilling, jobs and organizational restructuring and redesigning. This is research that will require the active participation of companies and staff, their financial support and their willingness to disclose business and process strategies, performance measures and other indicators. Additionally, studies measuring and
investigating the economic impacts of robot use are needed at micro (firm), meso (industry) and macro (economy-destination) levels. The adoption of robots within companies and the resulting diffusion of robots within the industry sectors (as of any technology) heavily depends on proving their economic viability and positive influence on productivity. Robust economics research is required to measure the holistic productivity impact of robots, identify potential pitfalls and productivity paradoxes and help companies justify further investments. Third, Figure 1 identifies the servicescape as a central interaction space and suggests a need for tourism and hospitality service providers to critically think about how robots affect it and how it needs to be adjusted or re-imagined to ensure that robots and employees can augment the service experiences (co-)created within it.

Further, the lower right corner of Figure 1 draws attention to the interrelationships between tourism and hospitality companies, educational/research institutions and robot manufacturers. However, while the literature review identifies tourism and hospitality as an important application domain for robots, there is little evidence that tourism companies actively influence robot research and design, implement robot-related training and closely work together with robot manufacturers to drive the robot development agenda. This could lead to a “not invented here” syndrome that slows down adoption or could bring about actual difficulties in integrating robots that were designed with priority given to technical considerations rather than tourism and hospitality theory and practical company/consumer/employee needs. Also somewhat alarming is the lack of literature on the external environment, suggesting a potential disconnect between academic researchers, industry representatives and policy makers in this area. The dawn of robonomics and its particular impacts on tourism and hospitality (Ivanov, 2017) suggests a tremendous practical need for progress in this area. As tourism-related industries will increasingly become robotized, research is urgently required to expand our knowledge on how the external environment impacts upon the use and introduction of robots as human labor (i.e. the legal implications and changes required to consider the legal responsibilities regarding robot activities and faults) and the trade-offs with human labor (cost and benefits of robot implementation).

4.4 Limitations and future research

First, the analysis was based only on publications indexed in the two largest databases with scientific publications in the world (Scopus and Web of Science), the most popular academic search engine (Google Scholar) and the two largest archive websites (Academia.edu and Researchgate.net). It is possible that there are relevant publications not included in these databases. However, considering that these five websites are some of the most widely used by researchers globally, it is unlikely that a paper would have any significant impact on science if it does not appear in any of them. Second, only publications in English were considered in the analysis. Nevertheless, considering the supremacy of English as the de facto language of communication in science, the data set used in this paper may be considered as the one properly reflecting the scope and content of research on robotics in travel, tourism and hospitality. In any case, future research might focus on analyzing the publications in other languages as well.

References


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**Appendix**

*List of publications on robots in travel, tourism and hospitality included in the analysis (in alphabetical order)*


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Progress on smart tourism research

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Abstract

Purpose – The purpose of this paper is to conduct a systematic and quantitative review of published papers on smart tourism. More specifically, the paper aims to identify the smart tourism research life cycle, collaboration trends, main social structure, disciplinary approaches and foundations, research topics and methodological approaches.

Design/methodology/approach – Systematic quantitative review techniques were used to review smart tourism literature. Frequency analysis, network analysis, text mining techniques were performed on data obtained from 96 papers collected from three databases as follows: Web of Science, Scopus and EBSCOhost.

Findings – The smart tourism research life cycle has two turning points with an exponential increase: 2015 and 2017. The latter is mainly associated with the internationalization of collaboration. Social structure of smart tourism research was revealed. Many of the ideas and research trends are affected by one research cluster. Destination related articles are dominant in smart tourism research. Internet of things and tourist experience are less researched areas. Only a quarter of the articles was published in tourism and hospitality journals. An important gap from methodological aspect is limited number of qualitative studies with human subjects. The geographical limitation is high concentration of smart tourism studies in Korea.

Research limitations/implications – This study collected and analyzed only full papers published in peer-reviewed journals. Future research may consider including book chapters and/or conference proceedings. This study was mainly based on quantitative review techniques. Qualitative or mixed review techniques may be conducted.

Originality/value – This study is the first literature review on an increasingly popular topic of smart tourism.

Keywords Literature review, Smart tourism, Smart hospitality, Smart travel

Paper type Literature review

摘要

研究目的 - 本研究旨在从以下几方面探讨智慧旅游的沿革：(1) 出版物和研究主题；(2) 主要学科、社会结构和合作趋势；以及3）方法论和研究方式。

研究设计/方法论/方法 - 本研究对1995至2017年间发表的96篇文章进行了系统的定量评价，并采用了评价和相关回顾的方法对文献进行了分析。

研究结果 - 研究结果阐释了智能旅游研究的生命周期。自2015年以来，相关文献的出版数量迅速增长，2017年更是呈现出指数增长的趋势。2017年，相关的国际合作也大幅增加。在学科重点方面，智能旅游研究不仅仅局限于旅游，而是采用跨学科/多学科的方法。在社会结构方面，智能旅游的知识在很大程度上是由具有相似社会文化背景和制度背景的学者建构的。在研究主题方面，研究主题相关的文章占主导地位。在研究方法方面，智能旅游研究采用的主要是定量研究，其次是概念研究和混合方法研究，令人惊讶的是，定性研究则十分有限。在研究范围方面，由于研究样本主要来自韩国，研究可能存
1. Introduction

Smart became a buzzword in academia and industry (Wang et al., 2016). In recent years, a couple of remarkable events have contributed to the popularity of smartness. First, International Business Machines Corporation introduced “smarter planet initiative” in the middle of the 2008 global economic crises. This award-winning campaign suggested focusing on a new generation of technologies and intelligent systems to encourage further thinking and to create: smarter food systems; smarter power grids; and smarter water, healthcare and traffic systems. In the following year, President Obama’s inauguration speech also touched on the issues of being responsible and smart toward the planet. The US administration promised to focus on environmentally friendly green strategies and digitalization (Borger, 2009), which largely contributed to the discussion on smarter planet.

This concept of smartness has been applied to tourism, with the notion of “smart tourism” (Li et al., 2017). China National Tourism Administration began officially supporting smart tourism projects in 2011, and 2014 became the year of smart tourism in China, with many cities joining the smart tourism initiative (Zhao, 2014). As many countries and destinations actively embed smartness and innovation into their urban development and tourism plans (Bilgihan and Nejad, 2015), smart tourism research has also proliferated.

Smart tourism was initially introduced to academia by Buhalis and Amaranggana (2014, 2015) in their seminal works. Gretzel et al. (2015a), Gretzel et al. (2015b), Gretzel et al. (2015c) developed this research area further by discussing its foundations, challenges and development opportunities. Literature on the use of smart and mobile technologies (Dorcic et al., 2018; Femenia-Serra et al., 2018; Wang et al., 2014) and their impact on tourism (Dorcic et al., 2018; Kirillova and Wang, 2016; Yu et al., 2018) contributed to the conceptualization of smart tourism. In particular, the impact of smart technologies on personalized and enhanced experiences (Neuhofer et al., 2015) constituted the essence of smart tourism.

Although there is no agreed definition for what smart tourism is (or is not), the concept of smartness is generally discussed in tourism from two aspects. First, smart is associated with the development of information and communication technologies (ICT) and smart technologies. In this regard, smart technologies are seen as efficient tools for managing destinations (Ivars-Baidal et al., 2017), attractions (Wang et al., 2016), events (Silva-Pedroza et al., 2017) or hospitality businesses (Alsetoohy and Ayoun, 2018; Buhalis and Leung, 2018). The entire process of collecting, analyzing, and distributing information and the use of big data, interconnected devices, and artificial intelligence tools lies in the heart of smart management practices (Ji et al., 2016; Sun et al., 2016). Ubiquitous high-speed internet access is also a necessary condition (Almobaiden et al., 2017; Byun et al., 2017). The second aspect is related to sustainability in terms of how “smart” humans treat resources. The United Nations World Tourism Organization has specifically emphasized the adoption of smart tourism as a way of promoting and offering ethical, clean, green and high-quality services (Li et al., 2017). By combining both aspects of smartness, Gretzel et al. (2015b, p. 181) defined smart tourism as:

[….] tourism supported by integrated efforts at a destination to collect and aggregate/harness data derived from physical infrastructure, social connections, government/organizational sources and
human bodies/minds in combination with the use of advanced technologies to transform that data into on-site experiences and business value-propositions with a clear focus on efficiency, sustainability and experience enrichment.

“Smart” has been used to describe different spheres other than smart tourism, such as smart city, smart tourism destination, and smart tourism ecosystem. While these terms obviously arise from one another (Del Chiappa and Baggio, 2015), each has a specific definition and focus. Smart tourism destination can be seen as an extension or special case of smart cities, given that it focuses not only on residents but also on tourists (Gretzel et al., 2015a). Smart tourism ecosystem suggests and emphasizes the interconnections amongst and between technologies and “smart people” instead of highlighting them separately. Specifically, networks amongst and between people and technologies make smart tourism destinations successful (Boes et al., 2016). The internet of things is the key technology in this interconnectivity (Almobaideen et al., 2017). The role of tourists is also of crucial importance in this ecosystem. Tourists use various smart technologies to plan their travel (Gupta et al., 2018). It is difficult to imagine that any type of smart tourism could happen without tourists’ use and adoption of technologies, such as social media (Chung and Koo, 2015), user-generated content (Chung et al., 2015a), recommendation systems (Koo et al., 2017), smartphones or other information technologies.

In response to the rapidly increasing number of publications on smart tourism, the agenda of understanding and evaluating the progress of smart tourism research is timely and meaningful.

A number of techniques are available to review a certain research area. From a methodological perspective, review studies can be divided into qualitative and quantitative approaches. Traditionally, qualitative review studies were dominant because researchers are flexible to delve into the articles being reviewed and provide a deeper understanding of specific topics (Zupic and Cater, 2015). Recently, researchers suggested using quantitative techniques for literature review studies to increase objectivity in mapping the progress of a given research area, providing state-of-the-art trends and identifying gaps, thereby proposing future research directions (Koseoglu et al., 2016). In this regard, the latter approach was chosen for the purposes of this paper.

Benckendorff and Zehrer (2013) further divided quantitative review studies into evaluative and relational. Evaluative review studies perform frequency analysis on given units of analysis to identify state-of-the-art trends and find gaps in literature (Zupic and Cater, 2015). Relational techniques take a step beyond and identify the connections between the units being researched (Koseoglu, 2016).

Review studies also differ with respect to their focus. Quantitative review studies frequently focus on one or more bibliometric information available in the documents. Most frequently used information units are authors, author affiliations, keywords, journal titles and citations (Hall, 2010). Each of the mentioned units provides a different perspective to understand state-of-the-art trends and suggests ways to extend the given knowledge domain.

For instance, authorship and co-authorship analysis is to identify the social structure of the research area/field. The rationale is that science is an outcome of knowledge and social system (Kuhn, 1970). Knowledge that is presented as “truth” is socially constructed by those scholars who actually produce it (Astley, 1985). In this regard, sociocultural and organizational backgrounds of key scholars in the field, especially in social sciences, have a crucial influence in what we know as knowledge (Furukawa et al., 2011). By identifying the social structure of a given research area, researchers may propose ways to build and extend the knowledge domain. Therefore, adopting a relational approach, this study conducted a
network analysis to visualize the social structure of smart tourism research with a collaboration map and suggest future research directions. Another crucial unit of analysis is author-selected keywords because they represent the most reliable topical coverage of an article (Wu et al., 2012). Recently, researchers recommended adding words available in abstracts and titles to keyword analysis (Kirilenko and Stepchenkova, 2018). While evaluative keyword analysis counts most/least frequently used keywords, relational techniques focus on identifying the connections between them and thereby reveal latent topics formulated by keywords. The revealed topics and concepts are interpreted as the conceptual structure of a researched area (Koseoglu et al., 2016), which is useful to identify topic-wise gaps in literature. Using a relational technique, namely, Latent Dirichlet allocation (LDA) method, this study attempted to reveal latent topics in smart tourism research, identify central concepts for each topic category, and suggest future research directions. Literature review studies frequently analyzed published and cited journal articles that are especially valuable for interdisciplinary research areas. Journal publications represent disciplinary foci and cited journals represent disciplinary foundations of a given research area. This study used an evaluative technique to identify disciplinary focus and foundations of smart tourism and suggest disciplinary research directions. Quantitative review studies may also analyze methodological approaches and tools used in a given area and suggest new and advanced methodologies. To identify methodological gaps this study also counted, which methods have been used so far in which research settings.

By conducting a systematic and quantitative review of published journal articles on smart tourism, this study aimed to answer the following research questions:

**RQ1.** How has smart tourism research evolved in terms of publication volume and collaboration trends?

**RQ2.** What are the main disciplines, social structure, and research topics in smart tourism research?

**RQ3.** What are the dominant methods and research settings in smart tourism research?

### 2. Methodology

To conduct a systematic literature review, this study followed the guidelines suggested by Aguinis et al. (2018).

#### 2.1 Data collection

Articles published in peer-reviewed scientific journals are considered certified knowledge (Ramos-Rodriguez and Ruiz-Navarr, 2004). Three databases, namely, Web of Science, Scopus and EBSCOhost, were used in a search for relevant articles. The search was conducted in three sections as follows: abstract, title and keywords. Only full-length articles were searched; editor prefaces, conference papers, conference reports, book reviews, abstracts and internet articles were not included due to their limited contribution to scientific knowledge (Jang and Park, 2011). Because no review on this topic has been conducted, three researchers discussed and agreed on the words to be used in the search process. To collect articles related to smart tourism, the term “smart” was added to phrases that represent the hospitality and tourism domains, which were adopted from previous review studies (Law et al., 2014; Leung et al., 2013). The first round of search included the following words: “smart tourism” or “smart hospitality” or “smart restaurant” or “smart hotel” or “smart destination” or “smart travel” or “smart traveler” or “smart tourist.”
second search round was conducted to increase the sample size. The term “smart service” was searched together with the abovementioned words without the term smart (e.g. “smart service” and “tourism”). The timeframe was set to include articles published on or before 2017. Journals of all disciplines were included in the analysis. After examination of the initial search results of 138 articles, 42 articles were excluded because they did not meet the selection criteria (e.g. topic relevance, paper format and journal type). A total of 96 relevant articles were retained for further analysis.

2.2 Data treatment and analysis
Several procedures of cleaning and transforming the data were performed before analysis. The information obtained from each article (e.g. author names and affiliations) was manually entered into a spreadsheet. The same information in two different forms (e.g. due to misspellings or abbreviations) was identified and then merged. Co-author affiliations were used to categorize the articles into collaboration types (e.g. within university and international). The method section of each article was carefully examined for identifying the applied method(s) and country(ies) where the studies were conducted.

Three types of analyses were conducted as follows: frequency analysis, network analysis and LDA method. Frequency analysis was used to identify publication progress by year, collaboration trends, most published journals (disciplinary focus), most cited journals (disciplinary foundations), used methods, and countries where samples were collected (research setting). Network analysis was adopted for identifying social structure and visualization of a collaboration map. Finally, on the basis of a text mining approach, LDA was used to analyze words in the title, abstract and keywords, and the articles were categorized into research topics.

3. Findings
3.1 Publications by year
The progress of smart tourism by year is illustrated in Figure 1. The concept of smartness in travel and tourism was initiated by transportation researchers in the second half of the 1990s. Giuliano and Golob (1995) investigated automated data and surveys acquired from 41
smart traveler kiosks in Los Angeles County. The authors concluded that kiosks are more frequently used for touristic and other non-routine trips than are regular commute trips.

The development stage in the smart tourism research life cycle started in 2015, turning from one-digit publication numbers to two digits. In 2015, tourism journals had the first published paper on smart tourism. The second wave of an exponential increase occurred in 2017, when 47 articles, which is more than double that in 2016, were published. With the drawing of parallels with social media research cycle, as illustrated by Lu et al. (2018), such a dramatic increase in publication number can be assumed to likely be continued by growth, but in lower rates in succeeding years until saturation is reached.

3.2 Collaboration trends

Collaboration patterns were analyzed for an understanding of the scale of internationalization of smart tourism research. As illustrated in Table I, overall, most of the articles were published by co-authors from the same universities (N = 34). The second most preferred collaboration type was international collaboration (N = 28). Interesting changes occurred in the collaboration patterns in 2017. While within-university collaboration continued its stable growth, all other collaboration types increased substantially. Particularly, international collaboration between scholars outstood all other collaboration types in 2017 after a dramatic jump from 5 to 18 articles. This change explained the second wave in the development stage of the smart tourism research life cycle and also served as an indication of the internationalization of this research area.

The rise in international collaboration in smart tourism research can be explained by many factors that contribute to the internationalization of tourism scholarship in general, such as increased number of conferences, internet, and enhanced mobility among scholars globally (Koseoglu et al., 2018). Such an increase also occurred as a result of development in a particular research area. By publishing smart tourism papers, scholars reveal their research interests in this topic and become a target of other scholars globally who share similar research interests for future collaborative projects.

3.3 Co-author collaboration map

Social network analysis was performed to visualize a collaboration map of the smart tourism research community. The largest component of the community is illustrated in Figure 2. Each node represents one scholar, and each edge represents a direct connection or a network between two scholars. The thickness of an edge represents the number of articles the two scholars published together. The font size of the scholar name is associated with his/her degree centrality in the community, whereas the color of a node represents their betweenness-centrality. Scholars with larger font sizes have a higher degree centrality, and those with darker node colors have higher betweenness-centrality in the community.

The results showed that Namho Chung (239) has the highest betweenness-centrality in the community, followed by Chulmo Koo (171), Yoonjae Nam (138) and Changsok Yoo (78). Nodes with high betweenness-centrality can be seen as bridges in the community through

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</thead>
<tbody>
<tr>
<td>Single authorship</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Within university collaboration</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>34</td>
</tr>
<tr>
<td>National collaboration</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>International collaboration</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>18</td>
<td>28</td>
</tr>
</tbody>
</table>

Table I. Collaboration patterns in smart tourism research
which resources pass (Behara et al., 2014). In a research community, this measure represents the gatekeeping role of scholars and is one of the most important predictors of research performance in hospitality and tourism (Fan et al., 2017). Gatekeepers have the shortest access to the resources of other researchers in the community, and thereby control the flow of knowledge dissemination.

Similar results can be seen in the measure of degree centrality. Chulmo Koo (15) and Namho Chung (14) have the highest scores, followed by Ulrike Gretzel (7) and Changsok Yoo (6). This measure represents the number of direct connections a scholar has in the community. Researchers with the highest degree centrality have considerable influential power over research trends and topics because of their direct access to the ideas and research resources of many researchers. Interestingly, four of the five highest centrality measures are affiliated with Smart Tourism Research Center of Kyung Hee University, serving as an indication of the institute’s crucial influence on shaping smart tourism research trends and topics through knowledge production and dissemination.

3.4 Categorization of research topics
To categorize the research topics of articles, a text mining approach was adopted. Texts in the titles, abstracts and keywords were tokenized into words. Generic words (e.g. “tourism,” “tourist,” “smart,” “the”) were excluded. Retained words were stemmed (e.g. “manage” in “management” and “managing”). Then, LDA analysis was conducted. Table II illustrates ten most researched topic categories, word stems associated with each category, and the weight value of each stem. Weight represents the centrality of the respective word stem in the respective topic category. Each category was named on the basis of the most central word stems. Due to space limitations, the article names in each category are not present in
Instead, the number of articles in each category was added to the table to illustrate the focus of smart tourism research.

The results indicate that the highest number of articles are in the category of destination-related studies (17). Management plays a crucial role in this category. Concepts such as innovation, technology, and information are central. Although most of the articles in this category use a case study approach (Del Chiappa and Baggio, 2015; Graziano, 2014; Ji et al., 2016), others are conceptual in nature (Li et al., 2017).

Both the second and third categories have 12 articles and share a similar topic of “information.” The main difference is that articles in the second category focus on data, whereas those in the third category are mainly social media-related studies. Various settings are used for articles in information and data category but tourist attractions are a relatively dominant setting among others (Peng and Huang, 2017; Zhiyue and Mu, 2015). Interestingly, articles in the social media category focus more on theory testing (Chung and Han, 2017; Chung and Koo, 2015; Chung et al., 2015b) than other categories.

The fourth category (Development) have 11 articles, related to regional development and sustainability (Pawlikowska-Piechotka et al., 2016; Romão and Neuts, 2017). Articles aiming to develop new services and software technologies for tourists are dominant (Palumbo, 2015; Silva-Pedroza et al., 2017). Concepts such as mobile and communication technologies are central to the articles in this category. The fifth category includes studies that discuss smart cities in tourism context. Although there are various perspectives, discussions about smart travel planning systems in urban environments (Viktorsson, 2013, 2015) are relatively dominant in this category.

Technology, tourist perceptions and satisfaction are central concepts in the sixth category, which includes eight articles. Studies in this category focus mainly on the impact of various technologies on tourist perceptions (e.g. perceived usefulness, value and image)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Category</th>
<th>No. of articles</th>
<th>Associated word stems and weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Smart) Destination</td>
<td>17</td>
<td>destin (157), manag (40), inform (33), innov (32) and technolog (32)</td>
</tr>
<tr>
<td>2</td>
<td>Information and data</td>
<td>12</td>
<td>inform (72), data (56), servic (33), attract (29) and onlin (20)</td>
</tr>
<tr>
<td>3</td>
<td>Social media</td>
<td>12</td>
<td>social (92), media (70), inform (69), user (37) and theori (29)</td>
</tr>
<tr>
<td>4</td>
<td>Development</td>
<td>11</td>
<td>develop (39), technolog (34), mobil (33), commun (22) and sustain (21)</td>
</tr>
<tr>
<td>5</td>
<td>(Smart) City</td>
<td>10</td>
<td>citi (106), plan (28), mobil (20), analyt (16) and urban (15)</td>
</tr>
<tr>
<td>6</td>
<td>Technology and (tourist) perceptions</td>
<td>8</td>
<td>technolog (56), perceiv (47), satisfact (40), experienti (18) and intend (18)</td>
</tr>
<tr>
<td>7</td>
<td>Transportation</td>
<td>8</td>
<td>transport (23), user (18), system (17), adapt (14) and time (13)</td>
</tr>
<tr>
<td>8</td>
<td>Internet of Things</td>
<td>7</td>
<td>internet (40), system (39), thing (35), servic (33) and applic (25)</td>
</tr>
<tr>
<td>9</td>
<td>(Tourist) Experience</td>
<td>6</td>
<td>experi (77), valu (40), design (26), share (19) and data (15)</td>
</tr>
<tr>
<td>10</td>
<td>Mixed</td>
<td>5</td>
<td>network (25), guid (21), site (16), local (16) and access (14)</td>
</tr>
</tbody>
</table>

Note: Value in parenthesis after each word stem represents its weight in the respective category

Table II. Topic categories and word stems
and further behavioral intentions (Bogicevic et al., 2017). As word stems illustrate, tourist satisfaction is one of the central constructs in these articles. Transportation-related category also has eight articles. Compared to other categories, the centrality of identified concepts is substantially low, implying that the articles in this category have a relatively weaker linkage. Optimizing transport systems for travelers with advanced technologies (e.g. artificial intelligence) seems a dominant topic of discussions (Dailey et al., 1999; Li et al., 2016).

Categories related to internet of things and tourist experience have seven and six articles, respectively. Articles related to internet of things focus mainly on various applications of intelligent systems and services in tourism and hospitality (Feng et al., 2017; Wu, 2017). Studies about tourist experience discuss adopting and sharing tourist experiences and (co) designing tourism experiences (Bae et al., 2017; Lim et al., 2017). Apart from experience, value seems to be the most central concept in these studies. The last category is labeled as “mixed/other” because of the low linkage among the concepts and articles. The centrality of all word stems is substantially low. The stem “network” in this category refers to various concepts such as 4G networks (Byun et al., 2017) and ecosystem networks (Park et al., 2016).

### 3.5 Published and cited journals

Frequency analysis was also performed on journal titles where 96 articles were published in. Table III provides the results. Overall, Sustainability had the highest number of publications (11), followed by Technological Forecasting and Social Change (7). As journal titles suggest, the focus of the current research is on the role of smart technologies and smart tourism on sustainability practices and other social changes caused by them. Of tourism and hospitality journals, Journal of Destination Marketing and Management (JDMM) had most publications, followed by European Journal of Tourism Research and International Journal of Tourism Cities (IJTC). The titles of JDMM and IJTC suggest that tourism scholars focus mainly on the role of smart tourism on destination/city management practices.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Journal title</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>1</td>
<td>Sustainability (Switzerland)</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Technological Forecasting and Social Change</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Information and Management</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Journal of Destination Marketing and Management</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Computers in Human Behavior</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>European Journal of Tourism Research</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>International Journal of Information Management</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>International Journal of Tourism Cities</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Current Issues in Tourism</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Information Systems Frontiers</td>
<td>2</td>
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<tr>
<td>9</td>
<td>Information Technology and Tourism</td>
<td>2</td>
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<tr>
<td>9</td>
<td>Journal of Urban Technology</td>
<td>2</td>
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<tr>
<td>9</td>
<td>Revista de la Facultad de Ingenieria</td>
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<td>9</td>
<td>Technical Bulletin</td>
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<tr>
<td>9</td>
<td>Telematics and Informatics</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Tourism Management</td>
<td>2</td>
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<table>
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<tr>
<th>Journals publishing smart tourism papers</th>
<th>Journal type</th>
<th>Frequency</th>
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</thead>
<tbody>
<tr>
<td>Tourism and hospitality journals</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Non-tourism and hospitality journals</td>
<td>72</td>
<td></td>
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</tbody>
</table>
Interestingly, tourism and hospitality journals received only a quarter (24) of overall publications in smart tourism. This number suggests that smart tourism is an interdisciplinary research area rather than one solely focused on tourism or hospitality. Journal titles related to information management and ICT seem to be dominant in this research area.

Citation analysis was performed to reveal the most frequently cited journals. The book series of *Information and Communication Technologies in Tourism* was also retained in the analysis because of its high relevance to the topic. As indicated in Table IV, *Tourism Management* (260) had the highest number of citations followed by *Information and Communication Technologies in Tourism* (159), *Annals of Tourism Research* (149) and *Journal of Travel Research* (140). Despite the interdisciplinary focus of smart tourism research, its disciplinary foundations are predominantly based on tourism literature. Specifically, tourism literature on management and technology plays a crucial role in the theoretical foundations of smart tourism research. A substantial literature gap was found in hospitality journals as no hospitality journal had two or more publications on the topic.

### 3.6 Methods and research settings

The methodology sections of articles in the data set were carefully read to identify methods used in smart tourism literature. Articles were first divided into two groups with respect to their units of analysis – studies that focused on human subjects (including secondary data such as online reviews) and those that did not. Articles in each group were further categorized according to the methods used. Studies that used human subjects were more than those that did not (60 vs 36). However, the share of studies focusing on non-human subjects were substantially high considering the social science nature of tourism research. This finding is unique to smart tourism research, presumably influenced by a number of articles in information technology journals. In the category where human-subjects were not used, conceptual papers had the highest share of articles. This outcome is expected given the call from several authors (Gretzel *et al.*, 2015c; Li *et al.*, 2017) to set solid conceptual and theoretical foundations of smart tourism. The number of natural experiments and desktop studies were also relatively high. The desktop studies mainly took a case study approach to analyze reports or published materials on certain smart tourism destination(s). Conceptual papers and desktop studies are common in the tourism literature but natural experiments

<table>
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<tr>
<th>Rank</th>
<th>Journal title</th>
<th>Frequency</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Tourism Management</td>
<td>260</td>
</tr>
<tr>
<td>2</td>
<td>Information and Communication Technologies in Tourism</td>
<td>159</td>
</tr>
<tr>
<td>3</td>
<td>Annals of Tourism Research</td>
<td>149</td>
</tr>
<tr>
<td>4</td>
<td>Journal of Travel Research</td>
<td>140</td>
</tr>
<tr>
<td>5</td>
<td>MIS Quarterly: Management Information Systems</td>
<td>102</td>
</tr>
<tr>
<td>6</td>
<td>Computers in Human Behavior</td>
<td>98</td>
</tr>
<tr>
<td>7</td>
<td>Journal of Destination Marketing and Management</td>
<td>71</td>
</tr>
<tr>
<td>8</td>
<td>Information and Management</td>
<td>70</td>
</tr>
<tr>
<td>9</td>
<td>Electronic Markets</td>
<td>53</td>
</tr>
<tr>
<td>9</td>
<td>Journal of Travel and Tourism Marketing</td>
<td>53</td>
</tr>
<tr>
<td>9</td>
<td>Lecture Notes in Computer Science</td>
<td>53</td>
</tr>
</tbody>
</table>

**Note:** Information and Communication Technologies in Tourism is published annually as an edited book based on ENTER conference proceedings.
are scarcely available. Similarly, this result illustrates the interdisciplinary nature of smart tourism research. Few studies in this category used mathematical modeling and quantitative method approach (Table V).

For studies conducted on human subjects, a quantitative approach was predominant followed by mixed-method approach. Interestingly, the number of pure qualitative studies was substantially low.

Finally, countries of data collection (first or secondary) were also analyzed. As depicted in Figure 3, most studies collected data in Korea, followed by Italy and China. This finding is in line with the key scholars in this research area affiliated with Smart Tourism Research Center of Kyung Hee University, Korea. However, this presents an important fragmentation of the current state of smart tourism research. Given the illustrated geographical bias, the results of the current literature may be limited to apply to broad geographical or cultural contexts.

Governments of Italy and China also seem to encourage research on smart tourism. Spain and the USA have attracted relatively higher attention compared with France and other European countries that appear in the top 10 list. Considering the traditionally dominating

<table>
<thead>
<tr>
<th>Units of analysis</th>
<th>Method</th>
<th>Frequency</th>
</tr>
</thead>
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<tr>
<td><strong>Non-human subjects</strong></td>
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<td>14</td>
</tr>
<tr>
<td></td>
<td>Desktop study</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Mathematical study</td>
<td>3</td>
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<tr>
<td></td>
<td>Natural experiment</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Quantitative</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>36</strong></td>
</tr>
<tr>
<td><strong>Human subjects</strong></td>
<td>Design science method</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mixed</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Natural experiment</td>
<td>1</td>
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<tr>
<td></td>
<td>Qualitative</td>
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</tr>
<tr>
<td></td>
<td>Quantitative</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

Table V.
Adopted methods in smart tourism papers

![Figure 3. Countries where data were collected](image-url)
roles of the USA and the UK in terms of their contributions to tourism scholarship, the industry and/or governments of these countries can be assumed to lessen attention paid to the development of smart tourism.

4. Conclusion
Using quantitative review techniques, this study reviewed 96 published articles on smart tourism to identify state-of-the-art trends in smart tourism research. The significance of this study lies in mapping the progress of smart tourism literature, and more importantly on the identification of research gaps based on social structure, topics, disciplinary focus and foundations, methods and research settings.

First, this study visualized smart tourism research lifecycle to provide a general understanding of its progress. The first two studies on the applications of smart technologies to travel and tourism industry by transportation scholars appeared as early as 1990s. The first breakthrough in publication numbers, however, was spotted much later, that is, in 2015. This year is a turning point in the development stage of smart tourism research lifecycle. That is, the same year when the first publications in tourism journals also emerged. The second wave of growth in publication numbers was in 2017. A closer look at collaboration trends revealed that the second wave was largely caused by the internationalization of smart tourism research in 2017. The rapid growth of theoretical and empirical studies on smart tourism research crucially depends on its internationalization, indirectly fostered by universities and professional organizations’ international collaboration (Koseoglu, 2016). While the effect of internationalization on the progress of this research area is clear, an intriguing question for future research would be investigating how such collaborations are reflected on the content of respective papers. Papers co-authored by authors from various countries may be more diverse in terms of research settings and methodologies.

Second, co-authorship network analysis and collaboration map revealed the main component of the social structure of smart tourism and suggested ways to extend the research scope of smart tourism. Most key scholars are associated with Smart Tourism Research Center of Kyung Hee University. On the one hand, the finding serves as an indication of the center’s role on knowledge development and dissemination in smart tourism research. On the other hand, this is an important limitation of the current literature because many of the ideas and research trends are affected by one research cluster, which may have specific research goals, agenda, work culture and methodological preferences. This prevailing affiliation indicates an inevitable lack of diversity on the ideas and trends in smart tourism research. An institutional bias exists in the current state of smart tourism research. Smart tourism knowledge is constructed largely by a specific research team and is affected by the team members’ background, expertise and research interests. The implication is that the formulation of new research team(s) is essential to extend the current literature and diversify research trends with fresh perspectives. The formulation of new research centers in leading tourism and hospitality universities can offer crucial contributions to the development of new knowledge.

Third, this study contributed to smart tourism literature with the categorization of research topics by identifying dominant discourses and central concepts in each discourse. More importantly, topic-wise gaps were identified. The scope and variety of topics identified in this study are limited. The absence of potentially important topics (e.g. tourist motivation, tourism businesses) showed important gaps to be filled. Of those identified topics, destination related articles were dominant. The least attention
was made to tourist experience and internet of things. The current literature can be extended by focusing on various applications of internet of things and implications of smart tourism to enhance tourist experiences. Because the role of interconnected technologies and Internet of Things in the improvement of tourist experiences is essential component of smart tourism definition, more studies are required to fill these gaps.

Fourth, journals with the highest number of publications and citation numbers were also presented to identify disciplinary gaps. Interestingly, the disciplinary focus of smart tourism research is not on tourism. The findings show that smart tourism has so far developed as multidisciplinary/interdisciplinary research area. Two most productive journals were not related to tourism and hospitality. Only a quarter of the articles were published in tourism and hospitality journals. Although interdisciplinary research is usually welcomed in tourism scholarship, more studies related to the fundamentals of tourism are required in the context of smart tourism. Regarding the focus of tourism journals, more destination/city management-related studies are available in literature. In particular, the gap of published articles in hospitality journals is big. Buhalis and Leung (2018) have conceptualized the ecosystem of smart hospitality in their recent study. Coincided with their work, this study calls for more studies to focus on various aspects of smart hospitality, including its fundamental technological and systematic components.

The results of citation analysis reported that despite the interdisciplinary nature of smart tourism research, its disciplinary foundations mainly come from tourism literature, particularly from management and technology aspects. To encourage interdisciplinary collaborations, providing a theoretical and conceptual basis of smart tourism literature from non-tourism disciplines would extend the current research scope.

Fifth, the analysis of adopted methods revealed ways to extend smart tourism literature from a methodological perspective. A relatively high number of studies conducted research on non-human subjects but the number of studies with human subjects was higher. Several natural experiments are intended to design and develop technologies for smart tourism. An important gap from a methodical aspect is the limited number of qualitative studies with human subjects. Exploratory and explanatory qualitative studies are essential at this stage to solidify the conceptualization of smart tourism with empirical qualitative data.

Finally, this study identified socio-cultural gaps in smart tourism research. Studies with data collected from Korea substantially outweighed the number of studies collected from other countries. This finding suggests that the current smart tourism research is rather fragmented and limited to the Korean context. Geographical bias is evident in the current state of smart tourism research. Applicability of this knowledge to other cultures and regions can be questioned due to cultural dissimilarities or technology acceptance level. The inclusion of diverse research settings and cross-cultural studies would enrich the implications of smart tourism literature.

This study comes with a few limitations. First, it analyzed only full papers published in peer-reviewed journals. Future review studies may consider including papers published in proceedings of relevant conferences. Another limitation is the adoption of a quantitative approach only. Future review studies with qualitative and/or multiple methods may contribute to current findings and provide more in-depth insight. Despite its limitations, the quantitative approach taken in this study provided timely and valuable contributions by presenting a general picture of the progress of smart tourism research. The timeline of this research is limited. Future studies may review articles published in 2018 and onward to investigate how smart tourism research has advanced.
References


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Research progress on virtual reality (VR) and augmented reality (AR) in tourism and hospitality
A critical review of publications from 2000 to 2018
Wei Wei
Rosen College of Hospitality Management, University of Central Florida, Orlando, Florida, USA

Abstract
Purpose – This paper aims to examine the main developments of virtual reality (VR) and augmented reality (AR) research in hospitality and tourism. It also aims to pinpoint fruitful directions for tourism and hospitality research on VR and AR applications.
Design/methodology/approach – A selective literature review of full-length papers published in the period from 2000 to 2018 was conducted. A total of 60 journal papers were retrieved and thoroughly reviewed.
Findings – This paper first presents a summary of the distribution of published papers. Then, this paper synthesizes the stimuli, dimensions and consequences of VR/AR-related user behavior experience, upon which a theoretical framework is developed. Additionally, this paper provides a detailed report for the progress on the theories and research methodologies, offering a useful background concerning what remains to be achieved. Finally, this paper puts forward fruitful directions for advancing the current understanding of VR/AR and its management.
Practical implications – This research presents diverse positive outcomes of using VR/AR technologies, which encourage industry practitioners such as destination marketing organizations (DMOs) and marketing firms to incorporate recent technological developments into their strategic plans.
Originality/value – This paper represents one of the first endeavors that critically reviews research progress on VR/AR in tourism and hospitality from 2000 to 2018. Not only are information technology researchers provided with a comprehensive guide to the latest, influential VR/AR literature but also the proposals of wide-ranging directions for future research would stimulate further investigation of VR/AR.

Keywords Virtual reality, Augmented reality, Hospitality, Tourism, Technology, Review

Paper type Literature review
1. Introduction

Advances in technology have been recognized to often exert direct and influential impacts on tourism and hospitality (Guttentag, 2010). One emerging sector of information and communication technologies (ICTs) is virtual reality (VR) and augmented reality (AR). VR has been described as a computer-generated environment that represents a total immersion in the digital world (Guttentag, 2010). VR technology has unique abilities to provide perceptual simulations of real situations (Diemer et al., 2015) and allows the user to navigate through a virtual environment. A variety of VR devices/programs have been developed, such as the wearable VR head-mounted displays (e.g. wearable cardboard VR viewer) and online three-dimensional (3D) virtual tours. The most comprehensive and widely adopted definition of AR is from Danado et al. (2005, p. 1), which defines AR as:

...a technology that allows the superimposition of synthetic images over real images, providing augmented knowledge about the environment in the user’s vicinity which makes the task more pleasant and effective for the user [...].

In comparison to a fully-immersive 3D experience as provided by VR, AR technology stresses the ability to present virtual information that is superimposed on the actual world view without compromising it (Han et al., 2013). One example of AR technology is a mobile application that provides overlaid text, audio, 3D animations and avatars. Therefore, both VR and AR are not identical in their strictest sense (Burdea and Coiffet, 2003; Yung and Khoo-Lattimore, 2017). Considering that AR is perceived as a type of VR (Guttentag, 2010) and that “AR and VR are related and [...] it is quite valid to consider the two concepts together” (Milgram et al., 1995, p. 283), this review paper chose to follow the same approach of that of Yung and Khoo-Lattimore (2017) and reported the research progress in these two areas together.

VR and AR are increasingly being adopted and implemented in diverse tourism and hospitality areas such as theme parks, cruises, museums and destination marketing. The travel and tourism industry has begun to apply the virtual world as an innovative marketing medium to create the brand of tourism destinations (Huang et al., 2013a), develop interactive advertising (Scholz and Smith, 2016) and boost tourists’ attitude toward a destination (Chung et al., 2018). A variety of VR and AR applications also provide practitioners with innovative ways to revitalize their original properties to attract more visitors and to improve service experience. VR and AR, thus, likely transform the way by which one experiences a destination or an attraction, facilitating a more immersive, interactive and diversified experience (Han et al., 2018). In essence, AR/VR technology enables consumers to know and experience products and places in novel ways.

A thorough understanding of what has been done and how VR and AR have performed could assist researchers and practitioners in revealing research gaps and designing future plans. This paper aims to thematically examine the main developments of VR and AR
research in tourism and hospitality based on a comprehensive review of both conceptual and empirical papers published in different sectors of tourism and hospitality. This paper also plans to propose new directions for tourism and hospitality research on VR and AR applications. Specifically, the paper aims to address the following questions:

Q1. What are the main developments (e.g. theoretical progress, methodological progress and findings) in VR/AR research between 2000 and 2018?

Q2. What directions in research would advance the current understanding of VR/AR and its management?

2. Methodology
The literature review was conducted between January and April 2018. All VR/AR-related refereed journal publications were searched from four major online databases (as suggested by Law et al., 2014), namely, the following:

1. Sage (http://online.sagepub.com);
2. ScienceDirect (www.sciencedirect.com);
3. Emerald Management eJournals (www.emeraldinsight.com); and
4. EBSCOhost’s Hospitality and Tourism Complete (http://search.ebscohost.com).

Following Law et al.’s (2014) approach, this study used relevant keywords (i.e. virtual reality/VR, augmented reality/AR) and each of the terms “tourism” and “hospitality” in the search of the title, abstract, keywords or within the text, to present the extant state of VR/AR-related discussion in hospitality and tourism. An extensive search of the VR/AR literature was performed by applying two selection criteria (Law et al., 2014). First, only full-length articles published in refereed journals were analyzed. Research notes, book reviews, editor prefaces and conference papers were excluded following the primary approach adopted in technology-focused review papers (Ip et al., 2011; Law et al., 2014), to ensure consistency and avoid potential confusion caused by overlaps between different sources. While all journals were searched, this review paper was only interested in articles relating to VR/AR in tourism and hospitality. Second, only publications from 2000 to March 2018 were retrieved to ensure the information analyzed and presented was current.

After an extensive search of words including “virtual reality (VR),” “augmented reality (AR),” “hospitality” and “tourism” in the title, abstract, keywords or within the text, 76 journal papers published in the period 2000 to 2018 were retrieved. During this identification process, the abstract of each retrieved article was read first to initially assess whether it, indeed, has a focus on VR/AR in hospitality or tourism. Once identified, the full-length papers were read thoroughly to safeguard their appropriateness. The final decision to include an identified paper was made according to whether it has direct relevance to the topic of VR/AR in hospitality and tourism. A final sample of 60 journal papers was retained. These publications were later grouped into empirical papers (quantitative research, qualitative research or mixed-method research) and non-empirical papers (review papers and conceptual papers). Each publication was further scrutinized closely following the content analysis. Specifically, following line-by-line open-coding, the researcher began by reading each paper and highlighting, by hand, all text that provided the content related to topics of interest (e.g. theoretical framework, methodology and results). During this analytical process, sub-themes emerged and their properties were identified.
3. Findings

3.1 Distribution of published articles

Table I provides a chronological summary of identified literature on VR/AR. In total, 33 out of the 60 papers center on VR technology, while 25 discuss AR applications. The remaining 2 papers have included both VR and AR in their discussion. The empirical papers were broken down by method with first quantitative methods (n = 28), then qualitative methods (n = 17) and, finally, followed by mixed methods (n = 1). In terms of year distribution, Figure 1 was developed to more vividly illustrate the research progress of the VR/AR literature by year. As shown in Figure 1, in comparison to the 10 years between 2000 and 2010 (n = 14), the past eight years have witnessed a drastic increase of published articles on VR/AR. A total of 46 articles were published during the year of 2011-2018, with 2016 (n = 9) and 2018 (n = 9) as the peak years. Table II documents the top 13 journals that included VR/AR publications between 2000 and 2018.

3.2 Research cultural contexts and settings

In terms of the cultural context within which the extant research is conducted, this study found that the majority of the extant VR/AR research has been done in Europe (n = 24; UK, Germany, Ireland, Italy, Switzerland, Finland, Greece, Denmark and Czech Republic) and Asia (n = 13; South Korea, Taiwan, Hong Kong and Japan). In contrast, 11 studies were found to be conducted in North America (the USA) and one in Australia (Australia).

This study also revealed an overwhelming emphasis on visitor experience marketing and management in diverse tourism contexts (Table I). Specifically, the current research on VR/AR centers on a variety of tourism contexts, including tourism destinations (Hyun and O'Keefe, 2012), cultural heritage sites such as museums (Lepouras and Vassilakis, 2005) and palaces (Jung et al., 2018), shopping centers (Rauschnabel et al., 2015), meetings and events (Pearlman and Gates, 2010) and other tourism attractions such as art galleries (tom Dieck et al., 2016b) and theme parks (Jung et al., 2015).

In comparison to tourism destinations and attractions, hotels and restaurants have received relatively little attention in the current VR/AR literature with a few exceptions. In a hotel context, Lee and Oh (2007) examined the impact that VR features embedded in a hotel website exert on traveler anxiety. Kim and Hardin (2010) developed a conceptual model to illustrate the relationships between virtual social networks and the construction of interaction, as well as consumers' participation in hotels' servicescape. Guillet and Penfold (2013) focused on hotel co-branding in a Second Life world (i.e. a virtual social network service where individuals, as represented by avatars, can meet and interact with each other; Huang et al., 2012), by way of understanding how the sense of physical presence influenced consumers' brand-self connection. In a restaurant setting, this study identified one empirical research, which applied the VR technology as a research method to examine relationships between crowding, customer emotions and approach-avoidance response (Hwang et al., 2012).

Another group of research endeavored to elucidate how the adoption of VR/AR technology applications may enhance the educational experience for both educators and students within the hospitality and tourism arena. Such research can be divided into two streams. One stream introduced an existing VR system that provides virtual teaching/learning within the subject areas of hospitality, sports, leisure and tourism (Bray, 2002; Haven and Botterill, 2003). For instance, Penfold (2009) and Deale (2013) investigated how hospitality and tourism students and teachers perceive the challenges, opportunities and problems of using Second Life for learning and teaching. The other stream of research...
<table>
<thead>
<tr>
<th>No</th>
<th>Authored work (Year)</th>
<th>Journal name</th>
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<th>Technology</th>
<th>Cultural context</th>
<th>Area</th>
</tr>
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<tbody>
<tr>
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<td>Mosaker (2001)</td>
<td>Digital Creativity</td>
<td>Empirical - experiment and interviews</td>
<td>VR</td>
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<td>Tourism heritage sites</td>
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<td>Empirical - questionnaire</td>
<td>VR</td>
<td>Asia – Japan</td>
<td>Tourism marketing</td>
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<td>Lee and Oh (2007)</td>
<td>Cyber Psychology and Behavior</td>
<td>Empirical - experiment and questionnaire</td>
<td>VR</td>
<td>Asia – South Korea</td>
<td>Hotels</td>
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<td>VR</td>
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<td>Zelenskaya and Singh (2011)</td>
<td>Journal of Human Resources in Hospitality and Tourism</td>
<td>Empirical - interview</td>
<td>VR</td>
<td>Asia – Taiwan</td>
<td>Tourism - University tour system</td>
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<th>Cultural context</th>
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</thead>
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<td>17</td>
<td>Chou and ChanLin (2012)</td>
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<td>Empirical - focus group</td>
<td>AR</td>
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<td>N/A (conceptual)</td>
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<td>Huang et al. (2012)</td>
<td>Journal of Hospitality and Tourism Technology</td>
<td>Empirical - experiment and questionnaire</td>
<td>VR</td>
<td>Australia – Australia</td>
<td>Tourism destination</td>
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<td>Huang et al. (2013a)</td>
<td>Tourism Management</td>
<td>Empirical - web questionnaires</td>
<td>VR</td>
<td>Europe – Finland</td>
<td>Shopping</td>
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<td>27</td>
<td>Huang et al. (2013b)</td>
<td>Journal of Hospitality, Leisure, Sport and Tourism Education</td>
<td>Empirical - experiment and questionnaire</td>
<td>VR</td>
<td>America – USA</td>
<td>Hospitality and tourism education</td>
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<td>AR</td>
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<td>VR</td>
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<td>Tourism – family travel</td>
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<td>AR</td>
<td>Asia – South Korea</td>
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<td>Chung et al. (2015)</td>
<td><em>Computers in Human Behavior</em></td>
<td>Empirical - questionnaire</td>
<td>AR</td>
<td>Asia – South Korea</td>
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<td>Yoon et al. (2016)</td>
<td><em>Journal of Interactive Advertising</em></td>
<td>Empirical - experiment and questionnaire</td>
<td>AR</td>
<td>America – USA</td>
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<td>Rauschnabel and Ro, 2016</td>
<td><em>International Journal of Technology Marketing</em></td>
<td>Empirical - questionnaire</td>
<td>AR</td>
<td>Europe – Germany</td>
<td>Shopping center</td>
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<tr>
<td>42</td>
<td>tom Dieck et al. (2016a)</td>
<td><em>Journal of Hospitality and Tourism Technology</em></td>
<td>Empirical - interview</td>
<td>AR</td>
<td>Europe – UK</td>
<td>Museum and art gallery</td>
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<tr>
<td>43</td>
<td>Trojan (2016)</td>
<td><em>Journal of Hospitality and Tourism Technology</em></td>
<td>Conceptual</td>
<td>AR</td>
<td>N/A</td>
<td>Tourism, cultural heritage and cinema history</td>
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<td>Mesáro et al. (2016)</td>
<td><em>e-Review of Tourism Research</em></td>
<td>Conceptual</td>
<td>AR</td>
<td>Europe – Czech Republic</td>
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<tr>
<td>45</td>
<td>tom Dieck et al. (2016b)</td>
<td><em>Current Issues in Tourism</em></td>
<td>Empirical - experiment and interviews</td>
<td>AR</td>
<td>Europe – UK</td>
<td>Art gallery</td>
</tr>
<tr>
<td>47</td>
<td>Kim and Hyun (2016)</td>
<td><em>Computers in Human Behavior</em></td>
<td>Empirical - questionnaire</td>
<td>AR</td>
<td>Asia – South Korea</td>
<td>Street site</td>
</tr>
<tr>
<td>48</td>
<td>Yung and Khoo-Lattimore (2017)</td>
<td><em>Current Issues in Tourism</em></td>
<td>Conceptual – review paper</td>
<td>VR and AR</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>50</td>
<td>Jung and tom Dieck (2017)</td>
<td><em>Journal of Place Management and Development</em></td>
<td>Conceptual</td>
<td>VR and AR</td>
<td>Europe – UK</td>
<td>Cultural heritage sites - Museum</td>
</tr>
<tr>
<td>51</td>
<td>tom Dieck and Jung (2017)</td>
<td><em>Journal of Destination Marketing and Management</em></td>
<td>Empirical - focus group and interviews</td>
<td>AR</td>
<td>Europe – UK</td>
<td>Cultural heritage sites - Museum</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>No</th>
<th>Authored work (Year)</th>
<th>Journal name</th>
<th>Nature of work</th>
<th>Technology</th>
<th>Cultural context</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>Chung et al. (2018)</td>
<td>Journal of Travel Research</td>
<td>Empirical - questionnaire</td>
<td>AR</td>
<td>Asia – Korea</td>
<td>Cultural heritage sites</td>
</tr>
<tr>
<td>55</td>
<td>Marasco et al. (2018)</td>
<td>Journal of Destination Marketing and Management</td>
<td>Empirical - questionnaire</td>
<td>VR</td>
<td>Europe – Italy</td>
<td>Cultural heritage site</td>
</tr>
<tr>
<td>56</td>
<td>Jung et al. (2018)</td>
<td>International Journal of Contemporary Hospitality Management</td>
<td>Empirical - questionnaire</td>
<td>AR</td>
<td>Asia – South Korea vs Europe – Ireland</td>
<td>Cultural heritage tourism site (palace and museum)</td>
</tr>
<tr>
<td>57</td>
<td>Tussyadiah et al. (2018a)</td>
<td>Journal of Travel Research</td>
<td>Empirical - questionnaire</td>
<td>AR</td>
<td>Europe – UK</td>
<td>Art gallery</td>
</tr>
<tr>
<td>58</td>
<td>Tussyadiah et al. (2018b)</td>
<td>Tourism Management</td>
<td>Empirical - questionnaire and experiment</td>
<td>VR</td>
<td>Asia – Hong Kong and Europe – UK</td>
<td>Tourism destination</td>
</tr>
<tr>
<td>59</td>
<td>Marchiori et al. (2018)</td>
<td>Information Technology and Tourism</td>
<td>Empirical - experiment and questionnaire</td>
<td>VR</td>
<td>Europe – Switzerland</td>
<td>Tourism destination</td>
</tr>
<tr>
<td>60</td>
<td>He et al. (2018)</td>
<td>Tourism Management</td>
<td>Empirical - experiment and questionnaire</td>
<td>AR</td>
<td>America – USA</td>
<td>Museum</td>
</tr>
</tbody>
</table>
explored students’ perspectives of the potential use of virtual environments (i.e. Second Life) as an instructional medium in hospitality and tourism courses (Hsu, 2012; Huang et al., 2013b). For example, Singh and Lee (2009) interviewed students majoring in tourism and found their positive attitude toward Second Life in providing training on tourism knowledge, enhancing self-efficacy and interpersonal skills.

3.3 Theoretical framework – stimuli, dimensions and consequences
Based on a close scrutiny of the identified VR/AR literature, this study found that the prior literature has mainly adopted the perspective of the consumer, except for a few, which examined the industry professionals’ attitudes toward the opportunities, challenges and benefits related to the use of VR/AR in tourism destination marketing (Cooper and Macneil, 2005; Dueholm and Smed, 2014; Mascho and Singh, 2014), events (Pearlman and Gates, 2010) and HR recruitment (Zelenskaya and Singh, 2011). In this section, a unifying framework (Figure 2) is developed to provide both academics and practitioners with a synthesis of the key constructs and research findings associated with the application of VR/AR technologies in tourism and hospitality, with an emphasis on the user’s perspective. Adapted from a seminal review work performed by Harris and Baron (2004), this unifying framework locates the stimuli, dimensions and consequences of VR/AR-related user behavior and experience.

<table>
<thead>
<tr>
<th>Journal name</th>
<th>Number of VR/AR publications</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tourism Management</em></td>
<td>6</td>
</tr>
<tr>
<td><em>Computers in Human Behavior</em></td>
<td>4</td>
</tr>
<tr>
<td><em>Journal of Hospitality and Tourism Technology</em></td>
<td>4</td>
</tr>
<tr>
<td><em>Journal of Hospitality, Leisure, Sport and Tourism Education</em></td>
<td>4</td>
</tr>
<tr>
<td><em>International Journal of Contemporary Hospitality Management</em></td>
<td>3</td>
</tr>
<tr>
<td><em>Current Issues in Tourism</em></td>
<td>3</td>
</tr>
<tr>
<td><em>Journal of Destination Marketing and Management</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Journal of Heritage Tourism</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Journal of Marketing Management</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Journal of Travel Research</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Tourism Analysis</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Tourism Recreation Research</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Virtual Reality</em></td>
<td>2</td>
</tr>
</tbody>
</table>

Table II. Top journals based on the number of VR/AR publications between 2000 and 2018

Figure 1. Distribution of publications by year (2000-2018)
3.3.1 Stimuli of virtual reality and augmented reality-related user behavior and experience. This study first synthesized the stimuli of VR/AR-related user behavior and experience, which are defined in this paper as the factors causing/influencing VR/AR-related user behavior and experience. These factors were grouped into four themes following content analysis, namely, service environment, individual differences, interpersonal factors and feeling of presence (Table III).

Service environment relates to the conditions or the environment upon which the use of VR/AR applications is contingent. The factors that have been mainly studied so far include Wi-Fi networks that offer free internet access as data roaming/3G is quite expensive for many tourists (Kounavis et al., 2012), application system quality (Kim and Hyun, 2016; tom Dieck and Jung, 2018), web-mediated virtual information quality (Hyun and O’Keefe, 2012) and service quality (Kim and Hyun, 2016). In general, these service environment factors were found to predict VR/AR use/reuse intention (Kim and Hyun, 2016; tom Dieck and Jung, 2018) and the formation of a positive destination image (Hyun and O’Keefe, 2012).

Individual differences form another major group of stimuli of VR/AR behavior and experience. This study identified three main types of individual differences in relation to VR/AR behavior and experience, namely, technology innovativeness (Kourouthanassis et al., 2015; Rauschnabel and Ro, 2016; tom Dieck and Jung, 2018), technology readiness/optimism (Chung et al., 2015) and the Big Five personality (Rauschnabel et al., 2015). These individual differences were found to positively influence user adoption intention, word-of-mouth intention and satisfaction, and thus, should be considered as antecedents in future VR/AR research.
Different from individual differences, which represent factors at the intrapersonal level, **interpersonal factors** denote those factors concerning the involvement of others. For instance, tom Dieck and Jung (2018) included others’ recommendations in their research on mobile AR acceptance in urban heritage tourism. Their research provided empirical support that recommendations given by other users who had used the studied application positively influenced the focal user’s perceived usefulness and ease of use of a mobile AR application. Therefore, interpersonal factors should be recognized as another important stimulus influencing one’s adoption behavior and experience with VR/AR technologies, especially for research conducted in an interdependent cultural context where others’ opinions and suggestions are highly expected and appreciated.

Finally, some researchers examined whether the extent to which the users feel immersed in a VR/AR environment would lead to positive VR/AR experiences and learning outcomes. This feeling is commonly coined in literature as a **feeling of presence** (Jung et al., 2016). A case in point relates to Huang et al. (2012), who found that users’ sense of presence influenced users’ engaging and pleasant experience in Second Life.

### 3.3.2 Dimensions of virtual reality and augmented reality experiences

This study also aimed to identify the **key dimensions of VR/AR-related experience** (i.e. the aspects that users would refer to when describing/evaluating their experience of using VR/AR applications) that were studied by prior researchers. Based on the content analysis of identified VR/AR literature, this study found that the dimensions of VR/AR experience are predominantly operationalized in forms of instrumental, experiential, psychological and social aspects (Table IV).

In terms of the **instrumental aspect**, the extant research has concentrated on the utilitarian benefits and/or the risks/challenges associated with VR/AR use. The most widely studied elements include the perceived usefulness and ease of use adopted from the technology adoption model (TAM), which were often found to influence AR adoption intention (Rauschnabel and Ro, 2016; tom Dieck and Jung, 2018) and destination visit intention (Chung et al., 2015; Lepouras and Vassilakis, 2005; Leue et al., 2014); the perceived advantages/benefits, which were identified to predict users’ satisfaction with AR and, in turn, influences one’s behavioral intentions toward the actual heritage destination.
Dimensions | Topics of study                                      | Literature sources                                                                 
---          | -------------------------------------------------- |-------------------------------------------------------------------------------------
**Instrumental** | Perceived ease of use/usefulness             | Chung et al., 2015; Huang et al., 2016; Jung et al., 2018; Lepouras and Vassilakis, 2005; Leue et al., 2014; Rauschnabel and Ro, 2016; tom Dieck and Jung, 2018  
 | Perceived advantages/benefits                 | Chung et al., 2018; Leue et al., 2014                                               
 | Content quality and informativeness          | Jung et al., 2015; Lepouras and Vassilakis, 2005; Rauschnabel et al., 2017; Yaoyuneyong et al., 2016  
 | Functionality, pragmatic attributes, physical activity | Han et al., 2018; Rauschnabel et al., 2017                                         
 | Perceived responsiveness and control        | Javornik, 2016                                                                       
 | Risks/challenges related to the expected effort, the cost of use, the time commitment and potential physical risks | Kourouthanassis et al., 2015; Leue et al., 2014; Rauschnabel et al., 2017; Yaoyuneyong et al., 2016  
**Experiential** | Perceived enjoyment                             | He et al., 2018; Huang et al., 2013a; Leue et al., 2014; Rauschnabel et al., 2017; Tussyadiah et al., 2018a; Tussyadiah et al., 2018b  
 | Emotions/emotional involvement and engagement | Huang et al., 2012; Huang et al., 2013a; Huang et al., 2016; Marasco et al., 2018; Papagiannidis et al., 2013; Rauschnabel et al., 2017; Yaoyuneyong et al., 2016  
 | Esthetics/visual appeal/vividness             | Cho et al., 2002; Chung et al., 2015; Chung et al., 2018; He et al., 2018; Jung et al., 2015; Marasco et al., 2018  
 | Interactivity                                | Cho et al., 2002                                                                     
**Psychological** | Feeling of telepresence                       | Hyun and O’Keefe, 2012; Kim and Hyun, 2016                                          
 | Augmented reality presence                   | Javornik, 2016                                                                       
 | Sense of presence                           | Lepouras and Vassilakis, 2005                                                        
**Social**   | Social norms and social influence              | Jung et al., 2018; Rauschnabel and Ro, 2016; Rauschnabel et al., 2017                

(Chung et al., 2018); content quality and informativeness that affected users’ satisfaction with and intention to recommend AR applications (Jung et al., 2015); functionality and pragmatic attributes (Han et al., 2018) that influenced the mobile AR users’ experience. Some other factors related to the instrumental aspect of VR/AR include perceived responsiveness, control (Javornik, 2016) and physical activity (Rauschnabel et al., 2017). The studied risks/challenges, which were found to act as constraints to one’s VR/AR adoption behavior are mainly related to the expected effort (Kourouthanassis et al., 2015), the cost of use (Leue et al., 2014), the time commitment (Yaoyuneyong et al., 2016) and potential physical risks (Rauschnabel et al., 2017).

With regard to the experiential aspect, the perceived enjoyment (He et al., 2018; Huang et al., 2013a, 2013b, 2013c; Leue et al., 2014; Tussyadiah et al., 2018b), emotions/emotional involvement (Huang et al., 2012; Huang et al., 2013a; Marasco et al., 2018) and engagement (Papagiannidis et al., 2013) have received the most attention in the literature. Among the studied emotions, certain emotions are more salient in the context of VR/AR use, such as irritation, novelty and entertainment (Yaoyuneyong et al., 2016), nostalgia (Rauschnabel et al., 2017), competent, autonomy and sense of relatedness (Huang et al., 2016). One other experiential element identified from the existing VR/AR literature is the esthetics or visual appeal of VR/AR technology applications. For instance, Marasco et al. (2018) found that the perceived visual appeal from...
using head-mounted displays had a positive impact on emotional involvement of users and one’s intention to visit a cultural heritage site at the actual destination. Built upon prior studies (Chung et al., 2015; Jung et al., 2015), Chung et al. (2018) modeled the aesthetic experience as one key manifestation of the AR experience, which further influences AR satisfaction. Although rarely discussed, the interactivity (i.e. the degree to which users engage in modifying a VR-mediated environment) was treated as an experiential attribute of a web-based virtual tour, which was found to influence the effectiveness of tourism marketing (Cho et al., 2002).

In recognition of the importance of instrumental and experiential dimensions of VR/AR experiences, previous researchers have adopted different theoretical angles to include both dimensions in their examination. One theoretical angle is the flow experience, which suggests the inclusion of focused attention, aroused curiosity, interest and control when measuring user experiences with VR/AR (Huang et al., 2012; Javornik, 2016). Other researchers based their conceptualization on the experience economy proposed by Pine and Gilmore (1998). For example, tom Dieck et al. (2016a) examined the users’ requirements of AR wearable smart glasses, which include the content requirement (e.g. content quality and information accessibility), function requirements (e.g. navigation and instructions), experience (e.g. novelty and hedonic attributes), resistance (e.g. affordability and distraction) and comfort (e.g. comfort). Their research findings revealed that the wearable AR application empowers art gallery visitors to see connections between paintings and to personalize their learning experience, with some limitations concerning a lack of customer–customer interactions and the social acceptability. Olsson et al. (2013) developed an inventory of the characteristics of expected user experience with mobile AR services, consisting of both instrumental aspect (efficiency, increased awareness and knowledge) and experiential aspect (captivation, collectivity, connectedness, creativity, accomplishment, empowerment, inspiration, intuitiveness, liveness, playfulness, entertainment and surprise), with the latter playing a greater role.

VR/AR experiences were also measured through the users’ psychological state of mind or the feeling of presence in that environment. Examples of such manifestations include telepresence (Hyun and O’Keefe, 2012; Kim and Hyun, 2016), perceived augmented reality presence (Javornik, 2016) and sense of presence (Lepouras and Vassilakis, 2005). In comparison, relatively fewer researchers have accounted for the social aspect, dominated by social norms (Rauschnabel and Ro, 2016) and social influence (Jung et al., 2018).

3.3.3 Consequences of virtual reality and augmented reality experience. The consequences of VR/AR application adoption (i.e. the outcomes of using VR/AR applications) have been overwhelmingly tilted toward user-centered outcomes taking a consumer perspective. In Table V, the identified consequences of VR/AR user experience are synthesized and presented under 10 different themes that were categorized in this study. It is worth pointing out that the tenth theme regarding behavioral intentions has received the most scholarly attention. The studied behavioral intentions include intention to use/reuse VR/AR (Kim and Hyun, 2016; Kourouthanassis et al., 2015; Rauschnabel et al., 2017), to visit the real destination (Pantano and Servidio, 2011; Tussyadiah et al., 2018b), to revisit a destination (Chung et al., 2018) or an attraction (Chung et al., 2015), to purchase (Javornik, 2016; Papagiannidis et al., 2013), to recommend (Kim and Hardin, 2010; Marasco et al., 2018), to share information with others within the application or beyond over a much larger social network (Kounavis et al., 2012) and to pay more (He et al., 2018).

Taken together, the unifying theoretical framework illustrated in Figure 2 and the details presented in Tables III-V provide, for the first time, a means for academics and practitioners to assess systematically the stimuli, dimensions and consequences of VR/AR application use. The key research findings of the identified articles are also prepared and presented in Table VI.
<table>
<thead>
<tr>
<th>Consequences</th>
<th>Topics of study</th>
<th>Literature sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning outcomes</td>
<td>Knowledge, skills, attitudes and values, enjoyment, inspiration, creativity, activity, behavior and progression</td>
<td>tom Dieck et al., 2016b</td>
</tr>
<tr>
<td>Emotional response</td>
<td>Pleasure and enjoyment</td>
<td>Han et al., 2018; Huang et al., 2016; Papagiannidis et al., 2013</td>
</tr>
<tr>
<td></td>
<td>Dominance and arousal</td>
<td>Kourouthanassis et al., 2015</td>
</tr>
<tr>
<td></td>
<td>Anxiety</td>
<td>Lee and Oh, 2007</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Satisfaction with VR</td>
<td>Papagiannidis et al., 2013</td>
</tr>
<tr>
<td></td>
<td>Satisfaction with AR</td>
<td>Chung et al., 2018; Han et al., 2018; Jung et al., 2015</td>
</tr>
<tr>
<td></td>
<td>Satisfaction with the actual trip</td>
<td>Cho et al., 2002</td>
</tr>
<tr>
<td>Overall service/visitor experience</td>
<td>Personalized content and service tailored to consumers’ particular needs</td>
<td>Kounavis et al., 2012</td>
</tr>
<tr>
<td></td>
<td>Memory recall</td>
<td>Marchiori et al., 2018</td>
</tr>
<tr>
<td></td>
<td>Overall visitor experience</td>
<td>Tussyadiah et al., 2018a</td>
</tr>
<tr>
<td>Attitude</td>
<td>Attitude toward AR applications</td>
<td>Javornik, 2016; Leue et al., 2014; Rauschnabel et al., 2017; tom Dieck and Jung, 2018; Yaoyuneyong et al., 2016</td>
</tr>
<tr>
<td></td>
<td>Attitude toward VR applications</td>
<td>Rauschnabel and Ro, 2016; Tussyadiah et al., 2018b</td>
</tr>
<tr>
<td></td>
<td>Attitude toward the brand</td>
<td>Javornik, 2016</td>
</tr>
<tr>
<td></td>
<td>Attitude toward the destination</td>
<td>Chung et al., 2018</td>
</tr>
<tr>
<td>Values</td>
<td>Economic value, experience value, social value, epistemic value, historical and cultural value and education value</td>
<td>tom Dieck and Jung, 2017</td>
</tr>
<tr>
<td></td>
<td>Co-creation of values</td>
<td></td>
</tr>
<tr>
<td>Marketing effectiveness</td>
<td>Cost/time saving of information search, confidence in the trip</td>
<td>Cho et al., 2002</td>
</tr>
<tr>
<td></td>
<td>Overall preference, quality, memorability, Ad appeal, Ad success</td>
<td>Yaoyuneyong et al., 2016</td>
</tr>
<tr>
<td>Destination image</td>
<td>Cognitive, affective and conation image of a virtual destination</td>
<td>Hyun and O’Keefe, 2012</td>
</tr>
<tr>
<td></td>
<td>Destination image</td>
<td>Cho et al., 2002</td>
</tr>
<tr>
<td>Awareness</td>
<td>Awareness of VR devices</td>
<td>Rauschnabel et al., 2015</td>
</tr>
<tr>
<td>Behavioral intentions</td>
<td>Use/reuse VR/AR</td>
<td>Chung et al., 2015; Jung et al., 2018; Kim and Hyun, 2016; Kourouthanassis et al., 2015; Leue et al., 2014; Rauschnabel et al., 2017; Rauschnabel and Ro, 2016; tom Dieck and Jung, 2018</td>
</tr>
<tr>
<td></td>
<td>Visit/revisit a destination or an attraction</td>
<td>Chung et al., 2018; Chung et al., 2015; Huang et al., 2012; Huang et al., 2013a; Huang et al., 2016; Pantano and Servidio, 2011; Tussyadiah et al., 2018b</td>
</tr>
<tr>
<td></td>
<td>Purchase</td>
<td>Javornik, 2016; Papagiannidis et al., 2013</td>
</tr>
<tr>
<td></td>
<td>Word-of-mouth/Recommend</td>
<td>Kim and Hardin, 2010; Marasco et al., 2018</td>
</tr>
<tr>
<td></td>
<td>Sharing</td>
<td>Kounavis et al., 2012</td>
</tr>
<tr>
<td></td>
<td>Pay more</td>
<td>He et al., 2018</td>
</tr>
</tbody>
</table>

**Table V.**
Consequences of VR/AR experiences
<table>
<thead>
<tr>
<th>No</th>
<th>Authored work (year)</th>
<th>Technology</th>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mosaker (2001)</td>
<td>VR</td>
<td>This study discusses virtual reality reconstructions of historical sites. Two case studies illustrate that VR is useful for visualizing environments that do not exist anymore and that would otherwise be not available to use. The author also stressed that one cannot bring back the past itself in these reconstructions; it is through the interpretations and representation processes that a new historical VR world is being created. There is, thus, an interesting conflict between what people expect to believe (the VR historical site is real and authentic) and what they know (the historical VR world is fake).</td>
</tr>
<tr>
<td>2</td>
<td>Bray (2002)</td>
<td>VR</td>
<td>This study shares the experiences and processes of The Swiss Hotel Association developing learning programs in a totally virtual environment over the internet. Based on the experiences gained through the processes, guiding principles and directions are provided for those (i.e. administrators and tutors) involved in the educational processes to more effectively develop their own tactics in exploring ways of improving the design and functions of virtual tutoring, as well as future distance and action learning programs.</td>
</tr>
<tr>
<td>3</td>
<td>Cho et al. (2002)</td>
<td>VR</td>
<td>This conceptual paper discusses the Web-based virtual tour experience over the Internet and provides a new perspective for tourism organizations in their marketing strategies. Five propositions are developed to stress the potential of the web-based virtual tour for destination marketing to help tourists identify the experiential features of a destination before an actual visit, save costs for searching information, modify a destination’s perceived image, enhance a tourist’s confidence in a destination and increase a tourist’s satisfaction with their actual visit experience.</td>
</tr>
<tr>
<td>4</td>
<td>Haven and Botterill (2003)</td>
<td>VR</td>
<td>This paper presents an overview of the current state of the use and understanding of virtual learning environments (VLEs) within the UK higher education institutions, the key factors for the institutions to adopt particular packages (i.e. ease of use, cost, flexibility, functionality and range of features), the varying levels of staff training in relation to VLEs and the key benefits of VLEs for staff and students (i.e. accessibility, flexibility, interaction and personal reflection).</td>
</tr>
<tr>
<td>5</td>
<td>Cooper and Macneil (2005)</td>
<td>VR</td>
<td>Based on the findings from online surveys of virtual reality professionals’ attitudes and comments on its use in tourism marketing, this paper suggests that the implementation of virtual reality via the internet will become increasingly important for tourism marketing in the near future.</td>
</tr>
<tr>
<td>6</td>
<td>Lepouras and Vassilakis (2005)</td>
<td>VR</td>
<td>This study finds that 3D games technologies have the potential to offer a prominent and viable solution to the need for affordable desktop virtual reality systems in museums and edutainment institutions.</td>
</tr>
<tr>
<td>7</td>
<td>Lee and Oh (2007)</td>
<td>VR</td>
<td>This study finds that the degree of one’s anxiety about travel is significantly reduced by the use of VR functions at a hotel website (i.e. psychological relief).</td>
</tr>
</tbody>
</table>
| 8  | Berger et al. (2007)  | VR         | In this paper, the authors presents an e-tourism environment, which is enabled by means of an integrated, 3D game-like e-business application offering 3D visualization and interaction. In Table VI. A Summary of key research findings (continued)
<table>
<thead>
<tr>
<th>No (year)</th>
<th>Authored work</th>
<th>Technology</th>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Singh and Lee (2009)</td>
<td>VR</td>
<td>This study identifies positive perceptions of students toward the use of virtual environments (e.g. Second Life) as teaching tools in future tourism and hospitality courses.</td>
</tr>
<tr>
<td>10</td>
<td>Penfold (2009)</td>
<td>VR</td>
<td>This study finds that Second Life would be a very favorable teaching medium to facilitate more enjoyable and interactive learning experiences for both teachers and students (and teachers), especially if some of the technical issues related to its use can be overcome and if students and teachers are both prepared for this type of class.</td>
</tr>
<tr>
<td>11</td>
<td>Gretzel and Jamal (2009)</td>
<td>VR</td>
<td>This conceptual paper discusses an urgent need of a creative tourist class with distinct tourism experiences, which are influenced by new technologies and new virtual sites and spaces. This paper also proposes a new perspective into the new tourists and the new experiences that are shaping today’s travel and tourism.</td>
</tr>
<tr>
<td>12</td>
<td>Guttentag (2010)</td>
<td>VR</td>
<td>This review paper presents the state as well as the future of VR technologies before 2010 (e.g. tourism substitute; authenticity; motivations; and constraints).</td>
</tr>
<tr>
<td>13</td>
<td>Kim and Hardin (2010)</td>
<td>VR</td>
<td>This conceptual paper puts forward a research model, proposing the relationship between virtual world social networks and positive word-of-mouth (WOM), as realized by improved business-to-consumer interaction as well as consumer engagement in servicescape opportunities in the virtual networks.</td>
</tr>
<tr>
<td>14</td>
<td>Pearlman and Gates (2010)</td>
<td>VR</td>
<td>This research finds that virtual meetings/events provide an innovative, feasible and promising alternative for organizations to improve its efficiency and effectiveness. The authors also pinpoint that the use implementation of VR within the MICE industry is still in its infancy stage, and that its widespread adoption may take some time.</td>
</tr>
<tr>
<td>15</td>
<td>Pantano and Servidio (2011)</td>
<td>VR</td>
<td>This study finds that VR, with emphasis on pervasive Environments, improves the communication of tourism content and influence tourists’ destination choice. Such impacts are more salient for territories with a high archaeological value.</td>
</tr>
<tr>
<td>16</td>
<td>Zelenskaya and Singh (2011)</td>
<td>VR</td>
<td>This study suggests that while Second Life enables hospitality and non-hospitality firms to better connect with potential candidates, and thus, creates successful virtual career fairs, one’s unfamiliarity with the complications of the highly technological SL software may discourage most hospitality companies but attract companies that are eager to experiment new Informational Technology.</td>
</tr>
<tr>
<td>17</td>
<td>Chou and ChanLin (2012)</td>
<td>AR</td>
<td>This research finds that the smart phone AR campus touring system presents hidden information in a real environment and offers freshmen instant directions and personal navigation experience (i.e. users are able to check information anywhere and...</td>
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</table>
No | Authored work (year) | Technology | Key findings
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18 | Kounavis et al. (2012) | AR | The smart phone AR campus touring system is, thus, proven to be an effective personal mobile learning tool.
19 | Huang et al. (2012) | VR | The results support that flow experience provides an important perspective into users' experiences while navigating the 3D virtual world of Second Life. In particular, three factors are found to influence users' engaging and pleasant experience in Second Life, namely, the skills they have to tackle challenging tasks, the perception of interactivity and the extent to which users feel a sense of presence.
20 | Hyun and O'Keefe (2012) | VR | The findings of this study suggest that, travel information indirectly influences the formation of the image through telepresence. Specifically, the presence of varied Web-mediated information can exert a positive impact on telepresence and telepresence results in a positive virtual destination image.
21 | Hwang et al. (2012) | VR | Using interactive VR technology, this study finds that in a VR restaurant setting, crowding has a positive impact on arousal but a negative impact on dominance. It also stimulates approach-avoidance responses. Furthermore, the impact of crowding on affiliation depends on the desire for privacy.
22 | Hsu (2012) | VR | This study finds tourism management students' favorable attitudes toward the use of second life in providing tourism training with regards to improving knowledge, communicational and interpersonal skills, as well as learners' self-efficacy as successful future tour leaders.
23 | Papagiannidis et al. (2013) | VR | This study finds that when choosing clothes in a virtual retail store, user satisfaction is positively influenced by engagement and enjoyment. In addition, user satisfaction positively affects one's purchase intention.
24 | Huang et al. (2013a) | VR | This study provides empirical validation for the application of TAM to understanding tourists' use of 3D virtual environments. This study also highlights the importance of considering the entertainment nature of virtual worlds when examining travel intentions.
25 | Olsson et al. (2013) | AR | The results of interviews reveal that, participants expect MAR services to enhance their sense of efficiency, improve their awareness of the surroundings, empower them with novel and proactive functionalities and offer stimulating and enjoyable experiences.
26 | Guillet and Penfold (2013) | VR | Results suggest that in a virtual 3D environment, the level of physical presence positively influences consumers' brand-self connection, and their evaluation of spokes-avatar credibility.
27 | Huang et al. (2013b) | VR | This study finds that during learning in a 3D virtual world of Second Life, students' intrinsic motivation is positively influenced by their psychological needs of autonomy, relatedness and positive emotions.

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Table VI.
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<th>No</th>
<th>Authored work (year)</th>
<th>Technology</th>
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<tbody>
<tr>
<td>28</td>
<td>Deale (2013)</td>
<td>VR</td>
<td>This study provides empirical evidence for both the benefits of Second Life (e.g. offers interesting and interactive learning experience and enables students to effectively engage with each other and collaborate on group projects) and its challenges (e.g. cumbersome technical nature of SL programs and the time commitment).</td>
</tr>
<tr>
<td>29</td>
<td>Huang et al. (2013c)</td>
<td>VR</td>
<td>This conceptual paper provides an overview for the definition of virtual worlds such as Second Life. It discusses the potential of using SL in tourism marketing and tourism management to provide the opportunity of interacting with tourists and to develop informative tourism destinations with unique cultural experiences.</td>
</tr>
<tr>
<td>30</td>
<td>Leue et al. (2014)</td>
<td>AR</td>
<td>This conceptual paper proposes an AR acceptance model including five external variables (i.e. enjoyment, perceived benefits, perceived innovativeness, information quality and costs of use) that would predict users’ attitude, intention to use AR and actual use behaviors.</td>
</tr>
<tr>
<td>31</td>
<td>Mascho and Singh (2014)</td>
<td>VR</td>
<td>Based on interviews, this study finds that in comparison to traditional marketing medium, virtual worlds are perceived much less expensive and more likely offer a personal experience; thus, considerably increasing a destination’s web presence.</td>
</tr>
<tr>
<td>32</td>
<td>Whittington (2014)</td>
<td>VR</td>
<td>This paper identifies major technological and social uncertainties related to the future of family tourism and travel and points out that a future trend of family tourism and travel lies in the use of technologies to deliver virtual experiences.</td>
</tr>
<tr>
<td>33</td>
<td>Dueholm and Smed (2014)</td>
<td>AR</td>
<td>This study provides interview findings concerning heritage managers’ perception of authenticity and attitude toward AR, the incentives for them to incorporate AR, as well as the constraints (i.e. lack of financial resources, required knowledge and time) that impede their implementation of AR.</td>
</tr>
<tr>
<td>34</td>
<td>Tavakoli and Mura (2015)</td>
<td>VR</td>
<td>The findings of this study reveal that in virtual tourist spaces, people reject gender-based stereotypes toward Muslim women’s bodily representations in Iran. However, their gendered performances accept other stereotypical representations of femininity, mostly reiterated by the media in many Western countries.</td>
</tr>
<tr>
<td>35</td>
<td>Jung et al. (2015)</td>
<td>AR</td>
<td>This study finds that users’ satisfaction with and intention to recommend AR applications are influenced by the content, personalized service and system quality of such AR applications. Furthermore, personal innovativeness is found to strengthen these relationships.</td>
</tr>
<tr>
<td>36</td>
<td>Rauschnabel et al. (2015)</td>
<td>AR</td>
<td>The findings of this study suggest that open and emotionally stable consumers tend to be more aware of Google Glass and that consumers’ adoption intention of such wearables is influenced by the perceived functional benefits and social conformity of the smart glasses. In addition, the strength of these relationships depends on consumers’ individual personality (i.e. levels of openness to experience, extraversion and neuroticism).</td>
</tr>
<tr>
<td>37</td>
<td>Kourouthanassis et al. (2015)</td>
<td>AR</td>
<td>This study finds that the functional features of a mobile AR travel guide, named CorfuAR, stimulate feelings of pleasure and arousal and influence users’ adoption intention.</td>
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<tr>
<th>No</th>
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<tbody>
<tr>
<td>38</td>
<td>Chung et al. (2015)</td>
<td>AR</td>
<td>The findings show that, personal (technology readiness), stimulus (visual appeal) and situational factors (facilitating conditions) affect one’s perceived ease of use and usefulness, and further influence AR (developed as a part of a smart tourism destination) use intention and destination visit intention.</td>
</tr>
<tr>
<td>39</td>
<td>Javornik (2016)</td>
<td>AR</td>
<td>The results suggest that perceived augmentation provides a useful and viable concept to understand how consumers react to AR features. Specifically, the perceived augmentation exerts impacts on consumers’ affective responses and behavioral intentions through the flow. However, AR features are not found to increase the perceived interactivity.</td>
</tr>
<tr>
<td>40</td>
<td>Yaoyuneyong et al. (2016)</td>
<td>AR</td>
<td>Results reveal that the AR hypermedia print ad is rated very informative, novel and effective; the code hypermedia print ad brings about higher irritation; and the traditional print ad involves higher time and effort.</td>
</tr>
<tr>
<td>41</td>
<td>Rauschnabel and Ro (2016)</td>
<td>AR</td>
<td>The findings show that functional benefits, ease of use, individual difference variables, brand attitudes and social norms are important predictors of smart glass adoption.</td>
</tr>
<tr>
<td>42</td>
<td>tom Dieck et al. (2016a)</td>
<td>AR</td>
<td>This study finds that content requirement, functional requirement, experience, comfort and resistance should be carefully considered when designing/implementing wearable AR applications in museums and art galleries. Overall, wearable AR is in its infancy and in order to encourage a full adoption, technical and design issues must be overcome.</td>
</tr>
<tr>
<td>43</td>
<td>Trojan (2016)</td>
<td>AR</td>
<td>The research develops prototype of an online platform that automatically transforms geotagged point-of-interest into AR applications. It also discusses the model implementation of this online platform in Czech national tourist authority.</td>
</tr>
<tr>
<td>44</td>
<td>Mesáro et al. (2016)</td>
<td>AR</td>
<td>This conceptual paper discusses the advantage of using AR and gamification technology in tourism. The authors argue that AR applications allow tourists to see the real environment with added virtual objects; thus, making the user experience more real. Furthermore, the AR applications make it possible to visualize and tell stories about the places and their history and provide a more interactive and entertaining experience with the incorporation of gamification techniques.</td>
</tr>
<tr>
<td>45</td>
<td>tom Dieck et al. (2016b)</td>
<td>AR</td>
<td>Findings reveal that the wearable AR application empowers art gallery visitors to see connections between paintings and to customize their learning experience. Some drawbacks are also revealed, such as lack of customer-customer interactions and the social acceptability.</td>
</tr>
<tr>
<td>46</td>
<td>Huang et al. (2016)</td>
<td>VR</td>
<td>This study provides a research framework for a 3D virtual tourism site, which captures the entertainment nature of a 3D virtual world by incorporating psychological elements of self-determination theory into the technology adoption model.</td>
</tr>
<tr>
<td>47</td>
<td>Kim and Hyun (2016)</td>
<td>AR</td>
<td>The findings of this study reveal what predict the use of smartphone AR. Specifically, system quality, information quality and service quality influence telepresence and telepresence leads to AR reuse intention.</td>
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<th>Technology</th>
<th>Key findings</th>
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<tbody>
<tr>
<td>48</td>
<td>Yung and Khoo-Lattimore (2017)</td>
<td>VR and AR</td>
<td>Based on a synthesis of 46 manuscripts, this review paper shed light on five aspects: which tourism sectors and contexts are VR/AR researched; which forms of VR and AR have been researched the most; what methodologies and theories are being utilized to in VR and AR tourism research; and what are the research gaps. In general, marketing and tourism education are the most commonly studied contexts. There exist issues concerning the heterogeneity of terminology usage, a lack of theory-based VR/AR research, as well as challenges concerned with awareness of VR/AR technology, usability and time commitment.</td>
</tr>
<tr>
<td>49</td>
<td>Rauschnabel et al. (2017)</td>
<td>AR</td>
<td>The results reveal that hedonic, emotional, social benefits and social norms encourage consumers’ use of Pokemon Go, the first mobile AR game and physical risks hinder consumer reactions.</td>
</tr>
<tr>
<td>50</td>
<td>Jung and tom Dieck (2017)</td>
<td>VR and AR</td>
<td>This study finds that effective use of multiple technologies (i.e. AR, VR and 3D printing) in cultural heritage places promotes the value co-creation for both cultural heritage organizations and visitors’ pre-visit, onsite and post-visit experience.</td>
</tr>
<tr>
<td>51</td>
<td>tom Dieck and Jung (2017)</td>
<td>AR</td>
<td>The findings of this case study reveal the economic, experiential, social, epistemic, cultural and historical and educational value that AR generates for both internal and external stakeholders. AR provides an innovative way to preserve heritage, enhance the visitor experience, promote positive word-of-mouth, attract new customers and facilitate a positive learning experience.</td>
</tr>
<tr>
<td>52</td>
<td>Chung et al. (2018)</td>
<td>AR</td>
<td>The results of this study suggest that users’ perceived benefits and aesthetics of AR influence their satisfaction with AR. AR satisfaction then influences one’s behavioral intentions toward the actual heritage destination, indirectly through changing the user attitude toward the destination through AR.</td>
</tr>
<tr>
<td>53</td>
<td>Han et al. (2018)</td>
<td>AR</td>
<td>The findings reveal that in the context of urban cultural heritage tourism, the mobile AR users’ experience is influenced by product features and tourists’ perceptions and experiences. The authors further pinpoint that successful implementation of mobile AR applications within the tourism industry is still limited.</td>
</tr>
<tr>
<td>54</td>
<td>tom Dieck and Jung (2018)</td>
<td>AR</td>
<td>This study identifies seven dimensions that should be considered in AR acceptance research, including information quality, system quality, recommendations, costs of use, personal innovativeness and risk and facilitating conditions.</td>
</tr>
<tr>
<td>55</td>
<td>Marasco et al. (2018)</td>
<td>VR</td>
<td>The results reveal that the perceived visual appeal of the VR experience with wearable devices positively influences users’ visit intentions towards the cultural heritage site featured in the virtual experience. The perceived visual appeal also has a positive impact on the emotional involvement of users.</td>
</tr>
<tr>
<td>56</td>
<td>Jung et al. (2018)</td>
<td>AR</td>
<td>The findings of this study suggest the aesthetics of AR as a strong predictor of users’ perceived enjoyment. This study also confirms that high-power distance, collectivism and high uncertainty avoidance culture (e.g. South Korea) are more likely to have a stronger dependence on social influence and the hedonic features of AR.</td>
</tr>
<tr>
<td>57</td>
<td>Tussyadiah et al. (2018a)</td>
<td>AR</td>
<td>This study on wearable AR technology offers empirical evidence that technology embodiment is a multidimensional construct (i.e. (continued)</td>
</tr>
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</table>
3.4 Theoretical development in virtual reality and augmented reality literature

One of the research objectives of this review paper is to provide a detailed report for the theories, which assists in understanding VR/AR behaviors/experience as studied in prior research, to offer a useful background of theoretical progress. Therefore, following a common approach adopted by review papers (Nicholls, 2010; Yung and Khoo-Lattimore, 2017), the present review paper identified and synthesized the theories that prior VR/AR papers used to explain VR/AR-related behaviors/experiences. As delineated below, this review paper additionally categorized the identified theories/theoretical concepts and models based on how they were used (i.e. to identify antecedents, to conceptualize the process and experience or to choose outcomes), aiming to provide stronger theoretical underpinnings for future research design and conceptualization.

3.4.1 Antecedents-related theories/theoretical models. The first set of theories and theoretical models were grouped together because they mainly helped identify the antecedents to VR/AR user experience. The most widely adopted theory is the TAM, as shown in a large number of publications such as Singh and Lee (2009), Huang et al. (2013a, 2013b, 2013c), Leue et al. (2014), Chung et al. (2015), Huang et al. (2016) and Jung et al. (2018). These studies included TAM as their theoretical bedrock to examine the impacts of perceived ease of use, cost of use, usefulness, perceived benefits and facilitating conditions on consumers’ behavioral intentions and attitudes in diverse settings, ranging from destinations (Huang et al., 2013a) to specific cultural heritages (Chung et al., 2015).

Rauschnabel et al. (2015) drew on the Big Five model of human personality and discussed the association of openness, extraversion and neuroticism with consumers’ knowledge of Google Glass. Tussyadiah et al. (2018a) followed a psychometric approach to technology embodiment, where they proposed that technology embodiment should be a higher order construct underlying ownership, agency and location, and further leads to wearable AR users’ experience at an art gallery in the UK.

3.4.2 Process-related theories/theoretical models. The second set of theories and theoretical models were grouped into one theme because they all shed light on the

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<tbody>
<tr>
<td>58</td>
<td>Tussyadiah et al. (2018b)</td>
<td>VR</td>
<td>This study offers empirical support that VR can shape consumers’ attitude and behavior. Specifically, the feeling of presence in a virtual environment increases one’s enjoyment of VR experiences and liking and preference for the actual destination. Furthermore, a positive attitude change results in greater visitation intention</td>
</tr>
<tr>
<td>59</td>
<td>Marchiori et al. (2018)</td>
<td>VR</td>
<td>This study finds that the capabilities of VR technology (e.g. presenting a new viewpoint to the user and incorporating animated elements) can facilitate the formation of strong memories</td>
</tr>
<tr>
<td>60</td>
<td>He et al. (2018)</td>
<td>AR</td>
<td>This study finds that in comparison to dynamic visual cues, dynamic verbal cues result in museum visitors’ greater willingness to pay a higher price. Such impact becomes more salient when environmental augmentation creates a stronger sense of virtual presence</td>
</tr>
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</table>

Table VI.
conceptualization of the process through which VR/AR technology applications would influence consumers. For example, Jung et al. (2015) followed the process theory approach to illustrate how the features of marker-based AR applications would influence one’s intention to recommend them. In behavioral research, process theory is widely used to explain “how” something happens (Chiles, 2003). Jung et al. (2015), thus, developed a model to highlight three processes of the relationship impact on marker-based AR application functions (system quality, content quality and personalized service quality as the input), relationship-formation processes (satisfaction as a process) and relationship outcome (word-of-mouth intention as outcome). Kim and Hyun (2016) have chosen the telepresence mediation hypothesis model to test the process during which telepresence serves as a potential mediator for the relationship among AR system quality, service quality, information quality and intention to reuse AR. Chung et al. (2018) integrated balance theory, the post-acceptance model of information systems continuance and the theory of reasoned action to examine the causal process underlying users’ beliefs about AR, satisfaction with AR, as well as their attitudes and behavioral intentions toward the actual destination.

3.4.3 Subjective virtual reality and augmented reality experience-related theories. The third group of theories and theoretical models assist the conceptualization of the subjective experience with the use of VR/AR from a user’s perspective. One of such theories is the hedonic theory, used by Huang et al. (2013a) to further enrich TAM by including hedonic constructs to expand the current understanding of the experience and behavioral intentions of virtual tourists within 3D tourism sites. Huang et al. (2012) tested the applicability of flow theory (i.e. the process of optimal experience; Csikszentmihalyi, 1977) in understanding the impacts of focused attention, aroused curiosity, interest and feeling of in control during a virtual experience of Second Life on one’s travel intentions. tom Dieck and Jung (2017) followed a stakeholder approach to investigate the values of implementing AR in a museum in the UK as perceived by both internal and external stakeholders. They identified the economic, social, experiential, epistemic, cultural, historical and educational values of AR use from stakeholders’ perspectives.

3.4.4 Outcomes-related theories/theoretical models and concepts. The remaining theories and theoretical models and concepts form the fourth category, in that they all provide great insight into the conceptualization of the likely outcomes of VR/AR application use. In a chronological order, Hyun and O’Keefe (2012) drew upon the destination image concept and examined the formation of a virtual destination’s image (cognitive, affective and conation) as a result of incorporating web-mediated virtual information. Papagiannidis et al. (2013) recognized the importance of engagement; thus, they tested the impacts of simulated experience in a virtual store on user engagement. Dueholm and Smed (2014) applied the theory of authenticity and heritage and interpretation media to exploring heritage managers’ perceptions of the possibility of co-existence of authenticity and AR technology. Huang et al. (2016) adopted the self-determination theory from the human motivation literature (Deci and Ryan, 1985) to extend TAM by incorporating the psychological elements of a 3D virtual world for a better understanding of consumer experience. tom Dieck et al. (2016b) used the generic learning outcomes framework to examine how wearable AR applications could enhance a visitor’s learning experiences in forms of understanding and knowledge, skills, attitudes, enjoyment, inspiration, values, creativity, behavior, activity and progress. Jung and tom Dieck (2017) took a value co-creation perspective and developed a conceptual model of value co-creation for a cultural heritage place in the UK, which presented customer value, art gallery/museum value, co-business-to-customer value, co-customer-to-business value, co-customer-to-customer value and co-design of experience.
3.5 Development of virtual reality and augmented reality research methodologies
The examination of VR/AR literature from 2000 to 2018 revealed 12 articles, all of which are not empirical in nature. These papers are either review papers (Guttentag, 2010; Yung and Khoo-Lattimore, 2017) or conceptual papers that introduced a VR/AR concept or system (Trojan, 2016), conceptualized tourism experience mediate by VR/AR (Gretzel and Jamal, 2009) or predicted both challenges and threats to the future family travel industry under the influence of virtual reality technological advancements (Whittington, 2014).

Out of 60 articles, 46 publications are empirical by nature. Given the relatively recent introduction of VR/AR technologies to hospitality and tourism in comparison to other information technologies, in this section, this paper looked into the research design and data analysis adopted in the extant literature and the specific VR/AR technology applications that have been studied so far.

3.5.1 Research design. Among the 28 quantitative studies, questionnaires surveying people’s experiences and perceptions are identified to be a common data collection approach (Hyun and O’Keefe, 2012; Jung et al., 2018; Kourouthanassis et al., 2015). Among the 17 articles that have adopted qualitative methods, focus group discussions (Han et al., 2018; tom Dieck and Jung, 2018) and interviews (Mosaker, 2001; tom Dieck et al., 2016b) are the two approaches that have been used so far.

In addition, some researchers incorporated an experiment component in their research design. In several quantitative studies, participants were instructed to complete a questionnaire following their participation in an experiment on site (Papagiannidis et al., 2013; Lepouras and Vassilakis, 2005; Yaoyuneyong et al., 2016). In qualitative studies, researchers would ask the participants to try a VR/AR application and then discuss their experience. For instance, Han et al. (2018) instructed groups of four-five students to experience a GPS-based AR application on a street in Dublin and then participate in focus groups to discuss their perceptions of that AR application. Another study by tom Dieck et al. (2016b) was conducted at an art gallery in the UK, where the researchers used two groups: an experimental Google Glass group who tried a wearable AR application developed through Google Glass during their visit to the gallery and a control group who was not provided any technological tool throughout their visit. Afterward, participants from both groups were invited to participate in a semi-structured interview concerning their learning outcomes.

3.5.2 Virtual reality and augmented reality technological innovations. With regard to the use of VR/AR technological innovations in prior research, the present study found that, in general, there are three approaches, namely, developing new tools/devices, adopting the existing ones or directing participants to imagine a hypothetical VR/AR-mediated scenario.

Using the existing VR/AR technological applications is the most commonly adopted method. These applications include mobile/smartphone-based apps (Chung et al., 2015; Javornik, 2016; Rauschnabel et al., 2017), augmented smart glasses (Rauschnabel et al., 2016; tom Dieck et al., 2016a), wearable Google Glass/cardboard VR viewer (Rauschnabel et al., 2015; tom Dieck et al., 2016b), wearable VR head-mounted displays (Marasco et al., 2018), onsite GPS-based AR application (Han et al., 2018), online 3D virtual tour provided by tourism websites (Hyun and O’Keefe, 2012), computer graphical reconstruction of historical towns (Mosaker, 2001), AR print ad (Yaoyuneyong et al., 2016) and Second Life programs for tourism destinations (Mascho and Singh, 2014) and for hospitality and tourism education (Deale, 2013; Hsu, 2012; Penfold, 2009).

Some researchers chose to develop a VR/AR application and test it in their studies. For instance, Chou and ChanLin (2012) used a smartphone campus virtual tour that was developed to provide hidden information in a real environment. Hwang et al. (2012)
developed a VR simulation in a restaurant setting to examine the effect of crowding on customer emotions. Huang et al. (2013a, 2013b, 2013c) designed a virtual tourism destination in Kenya – a Basecamp Maasai Mara – in Second Life, in collaboration with scholars from various disciplines. Tussyadiah et al. (2018a) used a Museum Zoom Google Glass application (i.e. Glassware), which was designed to improve the visitor experience in an art gallery in the UK. tom Dieck and Jung (2018) used a smartphone-based AR application at Dublin’s Heritage Trail, which was developed as part of their project. In a recent publication, He et al. (2018) designed an experimental study where they experimentally manipulated the information type and virtual presence of an AR display of Vincent van Gogh’s painting in a video scenario describing a museum experience.

Other researchers used “imaginary” AR apps to explore expected user experience, requirements and values related to such technological applications. One example is Olsson et al. (2013). Olsson et al. (2013) first provided their participants with a brief conceptual introduction to mobile augmented reality (MAR), accompanied by some demonstrations of digitalized content, which were augmented over a real-life view. Participants were then invited to interviews and were instructed to brainstorm, how MAR services can be used in shopping centers. The ways to use MAR services were not only supposed to address their own needs and help with activities that they would normally engage in in that context but also which were beyond the limitations of present-day technology. tom Dieck and Jung’s (2017) research on a small museum in the UK revealed the perceptions of museum stakeholders related to the values of AR. To achieve this goal, tom Dieck and Jung (2017) prepared an explanation along with a short video demonstrating AR in a museum context. In other words, the results of their study reflect the perceptions of these stakeholders on an imaginary AR application.

3.5.3 Data analysis methods. In terms of data analysis methods, based on the extensive review of prior VR/AR research, this study put together a list of analysis methods frequently used in empirical studies. In quantitative research, structural equation modeling (Huang et al., 2013a; Hyun and O’Keefe, 2012; Kim and Hyun, 2016; Marasco et al., 2018; Rauschnabel et al., 2015) and partial least squares regressions (Jung et al., 2018; Papagiannidis et al., 2013) were found to be the most popular statistical analysis methods. A few other researchers have adopted latent moderating estimation (Rauschnabel et al., 2015), linear regression analysis (Singh and Lee, 2009), regression and Booststrapping (Javornik, 2016), hierarchical ordinary-least squares regression and process model (Rauschnabel et al., 2016) and ANOVA (He et al., 2018). In qualitative research, four analysis methods were identified, namely, thematic analysis (Han et al., 2018; tom Dieck and Jung, 2018), content analysis (Panto and Servidio, 2011), inductive line-by-line open coding (Mascho and Singh, 2014; Tavakoli and Mura, 2015) and affinity diagram technique (tom Dieck et al., 2016a).

4. Discussions and conclusions

4.1 Conclusions

This paper examines the main developments of VR and AR research in hospitality and tourism in the period from 2000 to March 2018. A total of 60 full-length journal papers were retrieved and thoroughly reviewed. In addition to a summary of the distribution of published papers, this paper synthesizes the stimuli, dimensions and consequences of VR/AR-related user behavior and experience, upon which a theoretical framework is developed. This paper also provides a detailed report for the progress on the theories and research methodologies. The information provided in this review paper generates great insight for
both academic scholars and industry practitioners to better understand the progress and future directions of VR/AR technology in the tourism and hospitality industry.

4.2 Theoretical implications

Theoretically, this paper represents one of the first attempts to critically review the research progress on both VR and AR in tourism and hospitality over the past two decades. In comparison to the review paper of Guttentag (2010), which focused on only VR literature before 2010, and that of Yung and Khoo-Lattimore (2017), which reviewed VR/AR literature published between 1995 and 2016, the present study analyzed the published VR/AR articles in tourism and hospitality between 2000 and 2018 (Tables I and II). The strategic inclusion of both VR and AR literature during 2000 and 2018 is aimed to present the current state of VR/AR-related progress in the tourism and hospitality industry and to offer a useful foundation for future studies. It is worth pointing out that the selection of databases had a high influence on the review process. While this review paper followed the approach recommended in Law et al. (2014) by retrieving articles from four major online databases (i.e. Sage Journals, ScienceDirect, EBSCOhost’s Hospitality and Tourism Complete and Emerald Management ejournals), future research may consider other databases such as Scopus when the access is possible and convenient.

The present study also expands the knowledge base concerning the theoretical progress of VR/AR research in hospitality and tourism research. Yung and Khoo-Lattimore (2017) discussed the theories being used to study VR/AR in tourism research. The present study not only identified the theories being drawn upon to study VR/AR in tourism and hospitality research but also included theoretical models/concepts, and further categorized them based on how they were used (i.e. to identify antecedents, to conceptualize the process and experience or to choose outcomes). This is to provide stronger theoretical underpinnings for future research design and conceptualization. This paper also developed a unifying theoretical framework (Figure 2), revealing that a number of VR/AR-related topics, such as marketing, destination management, customer experience, e-service and co-creation, are worthy of further research endeavors in the field of VR/AR. Further, the analysis results of the methodological progress among VR/AR literature presented the prevalent research designs, data collection techniques and data analysis methods. In comparison to Yung and Khoo-Lattimore’s (2017) review paper, which briefly discussed the nature of the identified VR/AR articles (i.e. conceptual, quantitative and qualitative) in their section of methodological progress, the rich information offered by the present paper offers valuable and concrete examples/recommendations for the development of research methodology for future research.

Additionally, not only are tourism and hospitality information technology researchers provided with a comprehensive, thematic guide to the latest, influential VR/AR literature but also the proposals of wide-ranging directions for future research on VR/AR stimulate further investigation of many new topics of VR/AR. For instance, while VR/AR technology applications have begun to be applied to hotels, resorts, restaurants, events and cruises, research in these settings lag behind. This study further called for multidisciplinary research projects to provide predictions and guidance of future technology advancements.

4.3 Practical implications

This study also generates some implications for industry practitioners. First, this study reveals that tourism and hospitality industries use the up-to-date VR/AR technology applications in different functional units and for different purposes, which encourages new and constant innovations for maintaining a firm’s competitive advantages. Second, while
the pace of VR/AR adoption quickens, smaller organizations tend to fear making large investments in these technologies due to their perceived high risk of failure, especially without a reliable proof of the concept (tom Dieck and Jung, 2017). This study identified from extant literature empirical evidence for the opportunities to influence customer awareness, attitude, experience, learning, emotions, as well as the visit and word-of-mouth intentions through the adoption of VR/AR technologies. Such information should encourage Destination Marketing Organizations and marketing firms, especially small firms, to incorporate VR/AR considerations into their strategic and operational plans and aid them in deciding what outcomes they aim to achieve by way of using recent technological developments.

Finally, this study suggests that the benefits of VR/AR application adoption go beyond the intrapersonal level (i.e. the focal user) and extend to the interpersonal level (i.e. a social network). This is because VR/AR can significantly benefit tourism sites, destinations and tourist professionals by way of enabling information to be organized and transmitted in a large social network among users. Eventually, industry practitioners can use such information to profile tourists’ desires and expectations and personalize their visits, generating a much more memorable experience.

4.4 Suggestions for future research

4.4.1 Need for a cross-cultural approach to virtual reality and augmented reality experience.

The review performed in this study revealed that more than half of the empirical VR/AR research published between 2000 and 2018 represents European contributions (i.e. the UK, Germany, Ireland, Italy, Switzerland, Finland, Greece and Czech Republic). Considering what has already been established in the cross-cultural literature, it is presumable that the users’ attitude toward and experience with VR/AR applications might differ in different cultural contexts. For example, individuals’ sensitivity to time and space varies vastly between cultures (Nicholls, 2010). Such cultural differences may cause variations in the importance users attach to various virtual environments or augmented platforms as mediated by VR/AR. There exist significant values for replicable studies in, for instance, Asian contexts. Europe represents only 21.7 per cent of the world’s population and is predicted to be a mere 7 per cent by 2050 (worldometers.com), whereas Asia becomes increasingly dominant in the world’s demographic balance with over 55 per cent world share.

To close such a research gap, two directions are proposed. On the one hand, future research is recommended to look into other world regions such as China and Japan and explore how Western versus Eastern cultures may influence customers’ subjective experience with VR/AR in tourism and hospitality settings. Such research endeavors will provide valuable suggestions on how tourism and hospitality industry practitioners can effectively engage in these encounters and leverage the advantages of VR/AR to create added-values for customers. On the other hand, this study proposes a direction for future research to undertake inter-cultural investigations at service settings where a range of customer cultures meet, such as airports, theme parks and international resorts (Nicholls, 2010). These settings are likely subjective to potential clashes of attitudes, behaviors, expectations and values. However, despite the applications of VR/AR technologies to theme parks, museums, tourism destinations and other contexts where various cultural backgrounds often co-exist, cultures have been rarely adopted as a central theme in VR/AR studies, especially in the tourism and hospitality industry. One exception identified in the present study is a research by Tussyadiah et al. (2018b). Tussyadiah and her colleagues designed two studies as part of their research: one was in Hong Kong and the other in the
UK. This research presented positive outcomes of the sense of VR presence. However, systematic cultural comparisons were not performed. There remains a wealth of technology-related complexity to unlock, calling for a systematic investigation of VR/AR applications in cross-cultural consumption contexts.

4.4.2 Need for more research in events and hospitality settings. Guttentag’s (2010) review of the previous literature identified six major topics, namely, planning and management, marketing, education/training, accessibility, entertainment and heritage preservation. Yung and Khoo-Lattimore’s (2017) review of VR/AR literature focused on the tourism sectors where VR/AR was mostly researched. They found that the most common context was marketing, followed by education and tourism experience, while very few emerged from Food and Beverage (F&B) and meetings, incentives, conventions and events (MICE) sectors. The finding of the current study is more akin to that of Yung and Khoo-Lattimore (2017), but provided greater details and directions for future research. Specifically, this study pinpoints that the VR/AR literature over the past two decades is dominated by investigations of visitor experience management and marketing in cultural heritage tourism sites such as museums and palaces, tourism destinations, shopping centers and other tourism attractions such as art galleries and theme parks. This finding has revealed an emphasis that the extant VR/AR literature has placed on tourism settings; thus, calling for more studies in hospitality settings such as hotels, restaurants and resorts and events settings where VR/AR technologies have begun to be increasingly implemented for marketing and consumer experience enhancement purpose. For example, it will be interesting to explore how the use of VR technologies in event planning and management may influence the prospective client’s booking intention and satisfaction or how the incorporation of AR in a restaurant setting may help consumers make healthier and better food choices. In addition, this study found that the extant literature has prioritized a consumer perspective. As a critical element in service encounters, the perceptions, attitudes and behavioral intention of service providers should also be explored in order to facilitate a more positive, personalized and effective VR/AR-mediated consumer experience.

4.4.3 Need for prediction of future technology advancements. In comparison to other information technology applications such as Skype or smartphones, the introduction of VR/AR technologies to tourism and hospitality appears relatively recent. The access to ready-made VR/AR applications plays a critical role in the successful design and implementation of empirical studies. Based on the review of identified VR/AR literature between 2000 and 2018, this study revealed that the majority has applied existing VR/AR tools such as mobile/SMARTphone-based apps (Kourouthanassis et al., 2015), augmented smart glasses (Rauschnabel et al., 2016), wearable Google Glass/cardboard VR viewer (tom Dieck et al., 2016b), wearable VR head-mounted displays (Marasco et al., 2018), onsite GPS-based AR application (Han et al., 2018), online 3D virtual tour at tourism website (Hyun and O’Keefe, 2012), computer graphical reconstruction of historical towns (Mosaker, 2001), AR print ad (Yaoyuneyong et al., 2016) and Second Life programs (Penfold, 2009). Some other researchers are more forward-thinking as they either aimed to develop new VR/AR technologies by eliciting users’ expected requirements (Olsson et al., 2013) or tested newly designed VR/AR technologies for specific tourism destinations and attractions (Tussyadiah et al., 2018a). Given the fast development of technology advancements, research to predict future VR/AR technology advancements is in dire need to provide more proactive guidance that would lead both scholars and practitioners rather than reactive suggestions in response to technology development. This approach, however, poses some challenges as it would require multidisciplinary collaborations with researchers in the fields of engineering,
computer science and psychology, as well as strategic consultations with industry practitioners.

References


Further reading

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Abstract

Purpose – Virtual reality (VR) and augmented reality (AR) are two technological breakthroughs that stimulate reality perception. Both have been applied in tourism contexts to improve tourists’ experience. This paper aims to frame both AR and VR developments during the past 15 years from a scientific perspective.

Design/methodology/approach – This study adopts a text mining and topic modelling approach to analyse a total of 1,049 articles for VR and 406 for AR. The papers were selected from Scopus, with the title, abstract and keywords being extracted for the analysis. Formulated research hypotheses based on relevant publications are then evaluated to assess the current state of the broader scope of the large sets of literature.

Findings – Most of research using AR is based on mobile technology. Yet, wearable devices still show few publications, a gap that is expected to close in the near future. There is a lack of research adopting Big Data/machine learning approaches based on secondary data.

Originality/value – As both AR and VR technologies are becoming more mature, more applications to tourism emerge. Scholars need to keep pace and fill in the research gaps on both domains to move research forward.

Keywords Virtual reality, Augmented reality, Literature analysis, Tourism

Paper type Literature review
1. Introduction

Virtual reality (VR) and augmented reality (AR) are two technological breakthroughs that stimulate reality perception. VR simulates real scenarios whereas AR focuses in enhancing physically based reality perception through computer-generated sensory outputs (Gavish et al., 2015). Both appeared in the 1960s when pioneer researchers adopted 3D graphics environments. However, VR has paved a long way owing to computer technology fast paced evolution since then, being currently adopted in a wide range of industries with effective results (Berg and Vance, 2017). On the opposite side, AR was still considered an emerging technology ten years ago and only recently has been greatly stimulated due to the major advances in mobile equipment, including smartphones, tablets and wearable devices (Van Krevelen and Poelman, 2010).

Both VR and AR have been applied in several distinct tourism contexts to improve tourists’ experience. Therefore, researchers have studied both of them in tourism context during recent years (Paulo et al., 2018). The impact of VR has been analysed by Bruno et al. (2010) in a digital archaeological exhibition context, by Huang et al. (2016) who explored VR as a tool for leveraging tourism marketing, and by Pantano and Servidio (2011) for promoting tourism destinations. Examples of AR research include improving visitors’ experience through smart glasses in museums (Tom Dieck et al., 2016), and marker-based AR applications in theme parks (Jung et al., 2015).

This study offers an overall scientific perspective of AR and VR evolution in tourism in the post-2000 era, enabling to understand the main trends and research gaps for both vibrant technologies. Research hypotheses grounded on existing literature are raised and validated within the broader scope of the large body of knowledge published on AR/VR in tourism. By unveiling the current state-of-the-art in the scientific literature, the contribution of this paper lies also in providing thought-provoking future directions on the application of these technologies to tourism.

2. Literature review and research hypotheses

According to Hobson and Williams (1995, p. 128), “VR is the computer-generated medium that gives people the feeling that they are being transported from a physical world to a world of imagination”. VR technologies provide environments where consumers can interact with simulations of real-world. These involve the use of various technologies to create environments where people can experience and interact with event simulations or build fictional scenarios. Guttentag (2010) provides an interesting review of VR uses within tourism and raises relevant questions and challenges regarding the use of VR technology to enhance and substitute tourism experiences. One may clearly perceive that VR’s applications and implications for the tourism sector are vast and significant and can provide added value to this sector.

Tussyadiah et al. (2018) conducted two studies to analyse how the sense of presence during a virtual walkthrough of a tourism destination influences their attitude toward a future visit. The aforementioned studies were conducted with 202 participants from Hong Kong (using VR street view of Tokyo, Japan, viewed with Google Cardboard or VR video of Porto, Portugal, viewed with Samsung Gear VR) and 724 from the UK (using 360-degree VR videos of Lake District National Park, UK, viewed with Samsung Gear VR). They concluded that the feeling of being in the virtual environment increases enjoyment of VR experiences, the heightened feeling of being
there results in stronger liking and preference for the destination, and positive attitude change leads to a higher level of visitation intention. Hyun et al. (2009) explained the typology of virtual experience in mobile context based on two dimensions: vividness and interactivity. Virtual experience is classified in different categories (from verbal-based to animated interactive experience), and based on those categorises mobile applications are identified.

Instead of creating a non-real environment as in VR, AR enhances the reality by amplifying it through information technologies. Audio guides are among the first AR tools, providing interactive descriptions through numbered menus in cultural heritage sites and in museums (Bederson, 1995), with research showing evidence of the benefits of these audio devices to tourist satisfaction. The connectivity and visualization technologies have led to pocket PCs (Bellotti et al., 2002), which are upgraded versions of audio guides, with additional information available through screens, making these more appealing to tourists by a visual environment and context information using geographical information systems (Vlahakis et al., 2002).

Yet, the new millennium brought a technological breakthrough that would bring to each human’s hands a device able to connect anywhere and at any time: smartphones. Seizing to improve tourist’s experience, tourism managers incorporated these devices into their strategies by developing mobile AR applications. These applications in tourism include not only museums (Lee et al., 2015) and cultural sites (Haugstvedt and Krogstie, 2012) but also points of interest geotagged by a national tourist office (Trojan, 2016), or even a revolutionary game such as Pokémon Go which influenced users to travel while looking for the game experience (Aluri, 2017).

More recently, experiences with emerging technologies are taking place in tourism contexts. Some examples include specifically developed AR wearable technologies such as smart glasses, with tom Dieck et al. (2016) acknowledging that this is a still unchartered domain requiring additional attention in the future. Another interesting and innovative research project is the one by Rodrigues et al. (2018), where the authors propose an AR framework devoted to developing an enhanced AR system for exploring the five human senses.

As technologies keep evolving, the tourism industry tends to adopt them to improve user experience. The large quantities of online hotel reviews which result in Big Data sources are a great example (Moro et al., 2019). Likewise, both VR and AR have been experiencing advances at the rate of emergent technologies which enable new tourism applications. Currently, VR applications look more mature, with AR witnessing an exponential increase in applications owing to mobile devices and wearable technologies. As such, we hypothesize that:

**H1.** VR research has been fruitful since 2000.

**H2.** AR research has exponentially increased in the past seven years.

Table I summarizes eight distinct studies, three of them focussed on VR, and the remaining on AR. All these studies adopted a primary data-based research, consisting in interviews or responses to questionnaires, which most likely limited the number of individuals to around 200 at most. Additionally, three of them used structural equation modelling (SEM), while two adopted linear regression to analyse the data. In a world flooded in Big Data, Table I suggests a scarcity of research based on secondary data. Thus, we postulate that:

**H3.** There is a large trend of research on AR/VR based on primary data.

The AR studies highlighted in Table I are all related to the use of AR to support visitors by improving their experiences in their visits. Yet, while in the past years, mobile applications have been extensively studied, the most recent years are likely to result in a new wave of research based on wearable technologies. Therefore, we hypothesize that:
There is a recent exponential growth of studies based on wearable devices for AR in tourism.

Mobile applications have been dominating the landscape of AR in tourism for the past 10 years (since the advent of smartphones).

Since the early 2000s, VR has been seen as a promising tool in disseminating cultural heritage throughout the world, considering this technology is available at the distance of a click (Addison, 2000). More recent studies corroborate such relevance, suggesting this trend remains up-to-date (Tussyadiah et al., 2018). Thus, we posit that:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Context</th>
<th>Data</th>
<th>Method of analysis</th>
<th>Major findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>VR Pantano and Corvello (2014)</td>
<td>Virtual tour for an archaeological site in Italy</td>
<td>100 interviews</td>
<td>Technology-Acceptance Model; SEM</td>
<td>Both perceived usefulness and enjoyment have an impact on behavioural intention</td>
</tr>
<tr>
<td>VR Lee and Oh (2007)</td>
<td>VR features in a hotel website</td>
<td>51 responses</td>
<td>Linear regression</td>
<td>There is a relation between travel anxiety and psychological relief caused by using VR</td>
</tr>
<tr>
<td>VR Disztinger et al. (2017)</td>
<td>VR for Travel Planning</td>
<td>148 responses</td>
<td>Linear regression</td>
<td>Immersion, interest, enjoyment and usefulness impact intention to use VR</td>
</tr>
<tr>
<td>AR Kourouthanassis et al. (2015)</td>
<td>Mobile travel guide for Corfu, Greece</td>
<td>105 responses</td>
<td>PAD emotional state model; Partial least squares (PLS) SEM</td>
<td>The AR implemented application evokes feelings of pleasure, which influence behavioural intention</td>
</tr>
<tr>
<td>AR Han et al. (2013)</td>
<td>Mobile application for urban heritage in Dublin</td>
<td>26 interviews</td>
<td>Thematic analysis technique to analyse the transcripts</td>
<td>AR is being implemented in a meaningful way in the tourism industry</td>
</tr>
<tr>
<td>AR Tussyadiah et al. (2018)</td>
<td>Wearable devices for AR in an art gallery in UK</td>
<td>211 responses</td>
<td>Co-variance-based SEM</td>
<td>AR embodiment encompasses ownership, location and agency</td>
</tr>
<tr>
<td>AR Cranmer et al. (2018)</td>
<td>Revenue model for AR implementation in a Museum, in UK</td>
<td>50 semi-structured interviews of museum stakeholders</td>
<td>Content analysis of interviews</td>
<td>AR implementation can contribute to increased profits</td>
</tr>
<tr>
<td>AR Neuburger and Egger (2017)</td>
<td>Museum experience in Salzburg, Austria</td>
<td>176 responses</td>
<td>Independent t-test</td>
<td>AR can be used in the curation process, by facilitating and enhancing the presentation of exhibits in a museum</td>
</tr>
</tbody>
</table>

Table I. VR/AR studies applied to tourism
H6. VR has been researched as a tool to help promote culture and heritage. According to Disztinger et al. (2017), the immersion effect influences tourists’ intention to use VR as a travel planning tool. Thus, VR’s efficiency can promote destinations by offering an inexpensive view of the location to be visited in the near future. The place-attachment created by VR was shown to be a powerful tool in valuing the places mimicked by VR (Tussyadiah et al., 2018). Both studies suggest that:

H7. The usefulness of VR applications for tourists to plan their next visits has been one of the main trends of research in tourism.

Recently, several literature analysis studies emerged to assess the body of knowledge of technology applied to tourism. Yet, most of them address themes related to Web-based services, social media or mobile services (Ukpabi and Karjaluoto, 2017; Confente, 2015). Also, with a few exceptions (Moro and Rita, 2018), most of those studies adopt a manual content analysis procedure, limiting the scope to a few tens of articles. Yung and Khoo-Lattimore (2018) analysed 46 articles and found that marketing and education were two dominant trends, although they found gaps related to awareness of the technology, usability and time commitment. The same authors also highlighted a lack of theory-based research. Despite such lack of theory, two theoretical models were recently published for both AR (tom Dieck and Jung, 2018) and VR (Huang et al., 2016). The former is specifically focussed on AR acceptance in tourism, by instantiating the constructs from the well-known technology acceptance model (TAM) by Davis et al. (1989) to the tourism case. Relevant subjects identified by their model include “navigation”, specific to AR, and “multi-language”, specific to the tourism context. Both lead us to hypothesize that:

H8. Given the relevance of language and navigation capabilities to devices supporting AR in tourism, there are important topics of research focussed on both.

The VR model for tourism proposed by Huang et al. (2016) is also based on TAM, and it was validated in virtual tourism in Second Life. Their results suggest that perceived usefulness is associated with visually appealing elements related to the naturalistic environment and cultural authenticity. Based on their findings, we posit that:

H9. Research on VR in tourism includes trends related to cultural and environmental elements presented in VR applications.

Although the raised hypotheses are grounded on existing literature, there is lack of a holistic vision of VR/AR research in tourism, despite its importance, justifying the relevance of the present study.

3. Methods and results

Several databases index scientific articles and provide an easy-to-access mean of retrieving relevant literature on a given subject. In this study, Scopus was adopted, which is one of the most widely used and disseminated database worldwide (Cortez et al., 2018). Scopus indexes titles, abstracts and keywords of articles. Two distinct queries (one for VR, and the other for AR, respectively), were executed:

(1) TITLE-ABS-KEY(“virtual reality” AND (tourism OR hospitality OR tourist OR travel OR leisure)) AND SRCTYPE(j OR p OR k) AND PUBYEAR > 1999; and

(2) TITLE-ABS-KEY(“augmented reality” AND (tourism OR hospitality OR tourist OR travel OR leisure)) AND SRCTYPE(j OR p OR k) AND PUBYEAR > 1999.
The result is a total of 1,049 for VR and 406 for AR, including journal articles (parameter “j”), conference proceedings (parameter “p”) and book chapters (parameter “k”) published from 2000 up to the present. Figure 1 shows the articles’ distribution through the analysed years for both technologies. As the articles were collected on the 1 June 2018, this year only accounts for articles in the January-May period, justifying the lower number found on Figure 1. It becomes clear that VR has been applied in tourism for a while (at least since 2000), with researchers acknowledging its importance. Conversely, AR’s relevance to tourism has only been largely studied after 2010, with the 2010-2014 period observing a significant increase. However, while both research in AR and VR have been steadily increasing through the years, VR still seems to take most time from scholars (see 2017 and 2018 numbers).

Tables II and III show the source names that contribute the most (i.e. with more articles) for VR and AR, respectively. Specific tourism and hospitality sources appear shaded in grey. This enables to highlight that most AR and VR research has not been published in tourism sources. In fact, most of the sources are technological-related. This finding potentiates future calls by tourism outlets for further research on both technologies. Additionally, it is interesting to note that conferences are major contributors of both VR and AR (the five most relevant for both cases). Notably, the “Lecture Notes in Computer Science”, a Springer series that publishes conference proceedings in several relevant information technology conferences is the first contributor, with 72 VR articles and 38 AR articles.

The results of both queries were archived under two data sets (one for each technology), including all words used in the title, abstract and keywords. Then, a text mining and topic modelling approach (Moro et al., 2017; Nave et al., 2018) was adopted to summarize the main results under both technologies, VR and AR. Such approach has been previously used to analyse tourism and hospitality literature from a branding and social media perspective (Moro and Rita, 2018) and to summarize the body of knowledge of Annals of Tourism Research literature (Moro et al., 2017). Nevertheless, it has not been applied to cover VR/AR literature in tourism. Also, by including articles from several sources (i.e. not restricting to tourism and hospitality literature) and by including also conference articles and book chapters, a larger body of knowledge related to the studied themes is considered, when compared to both Moro and Rita (2018) and Moro et al. (2017) studies. Additionally, such automated approach offers an objective and broader
perspective on VR/AR by covering a larger number of sources when compared to traditional systematic literature reviews.

The latent Dirichlet allocation (LDA) algorithm was chosen for gathering the topics. This algorithm provides a simple yet effective solution and has been extensively used under a large variety of contexts (Amado et al., 2018, for a literature review on Big Data in marketing; Canito et al., 2018, for news on Big Data; Calheiros et al., 2017, for sentiment

<table>
<thead>
<tr>
<th>VR sources</th>
<th>No. of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture notes in computer science</td>
<td>72</td>
</tr>
<tr>
<td>Proceedings – IEEE virtual reality</td>
<td>23</td>
</tr>
<tr>
<td>ACM international conference proceeding series</td>
<td>19</td>
</tr>
<tr>
<td>Proceedings of SPIE – the international society for optical engineering</td>
<td>18</td>
</tr>
<tr>
<td>Proceedings of the ACM symposium on virtual reality software and technology, VRST</td>
<td>13</td>
</tr>
<tr>
<td>Conference on human factors in computing systems – proceedings</td>
<td>11</td>
</tr>
<tr>
<td>IEEE transactions on visualization and computer graphics</td>
<td>11</td>
</tr>
<tr>
<td>Cyberpsychology and behaviour</td>
<td>9</td>
</tr>
<tr>
<td>International archives of the photogrammetry, remote sensing and spatial information sciences – ISPRS archives</td>
<td>8</td>
</tr>
<tr>
<td>PLoS ONE</td>
<td>8</td>
</tr>
<tr>
<td>Applied mechanics and materials</td>
<td>8</td>
</tr>
<tr>
<td>Advanced materials research</td>
<td>7</td>
</tr>
<tr>
<td>Virtual reality</td>
<td>7</td>
</tr>
<tr>
<td><strong>Tourism management</strong></td>
<td></td>
</tr>
<tr>
<td>Communications in computer and information science</td>
<td>6</td>
</tr>
<tr>
<td>Computers in human behaviour</td>
<td>6</td>
</tr>
<tr>
<td>Xitong Fangzhen Xuebao/Journal of system simulation</td>
<td>6</td>
</tr>
<tr>
<td>ACM transactions on applied perception</td>
<td>6</td>
</tr>
</tbody>
</table>

Table II. Sources for VR articles

<table>
<thead>
<tr>
<th>AR sources</th>
<th>No. of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture notes in computer science</td>
<td>38</td>
</tr>
<tr>
<td>ACM international conference proceeding series</td>
<td>13</td>
</tr>
<tr>
<td>International archives of the photogrammetry, remote sensing and spatial information sciences – ISPRS archives</td>
<td>8</td>
</tr>
<tr>
<td>Procedia computer science</td>
<td>8</td>
</tr>
<tr>
<td>Lecture notes in electrical engineering</td>
<td>6</td>
</tr>
<tr>
<td>Conference on human factors in computing systems – proceedings</td>
<td>5</td>
</tr>
<tr>
<td>Journal of telecommunication, electronic and computer engineering</td>
<td>5</td>
</tr>
<tr>
<td><strong>Current issues in tourism</strong></td>
<td></td>
</tr>
<tr>
<td>AIP conference proceedings</td>
<td>4</td>
</tr>
<tr>
<td>Lecture notes in geoinformation and cartography</td>
<td>4</td>
</tr>
<tr>
<td><em>Journal of heritage tourism</em></td>
<td>3</td>
</tr>
<tr>
<td>Multimedia tools and applications</td>
<td>3</td>
</tr>
<tr>
<td>Advances in intelligent systems and computing</td>
<td>3</td>
</tr>
<tr>
<td>Proceedings of the ACM Symposium on virtual reality software and technology, VRST</td>
<td>3</td>
</tr>
<tr>
<td>Communications in computer and information science</td>
<td>3</td>
</tr>
<tr>
<td><em>Journal of hospitality and tourism technology</em></td>
<td>3</td>
</tr>
<tr>
<td>Applied mechanics and materials</td>
<td>3</td>
</tr>
<tr>
<td>Advanced materials research</td>
<td>3</td>
</tr>
<tr>
<td>CEUR workshop proceedings</td>
<td>3</td>
</tr>
<tr>
<td>Proceedings of SPIE – the international society for optical engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Table III. Sources for AR articles

577
analysis of an eco-hotel). The results are displayed in tables summarizing the discovered topics similarly to Moro et al. (2017). For the experiments, the R statistical tool was adopted, namely both the “tm” and “topicmodels” packages, which implement the text mining and topic modelling functions.

Figures 2 and 3 exhibit the word clouds for AR and VR, respectively, drawn on all the terms from the studied articles. Although each word cloud displays every single word, thus providing the full picture on the emphasis that specialized hospitality and tourism literature has been giving to each of the terms in the 2000-2018 analysed period, their corresponding word frequency (Tables IV and V) uses a skimming approach by showing the top 20 words. The top ten topics found for AR and VR are shown in Tables VI and VII, respectively. These are presented in a descending order by the number of articles, including the four terms which best identify each topic as well as the beta distribution value (the smaller its value the stronger its relation to the topic). Articles were also grouped in three-time periods of six years (2000-2005; 2006-2011; 2012-2018; the latter includes also the first five months of 2018) each to facilitate the perception of evolution from a time perspective.

4. Discussion and conclusions

4.1 Conclusions

Both in AR and VR all the topics show a big jump in the last period. Yet, the incremental rate of VR research shows a steady increase for the three studied periods, with research even in
the early 2000s showing fruitful results, with eight of the ten topics gathering more than ten publications each for the 2000-2005 period. Therefore, $H1$ is supported, showing a high maturity level right from 2000. The incremental increase observed may derive from a larger number of researchers pressured to publish their work (Grimes et al., 2018), as well as from incremental advances on VR technologies. Notwithstanding, in AR the number of articles published more recently, i.e. from 2012 onwards, account for a massive 80 per cent of all published since 2000, when compared to nearly 50 per cent of VR. Thus, $H2$ is clearly confirmed. Further advances on wearable technologies may account in the near future for additional growth of this trend, since “wearable” was not found to be a frequent word in Table IV, paling in a green font in Figure 2, when compared to “mobile”.

Both Tables VI and VII show the lack of a combined occurrence of words such as “machine” and “learning” or “big” and “data” in a single topic. This suggests that researchers on both VR/AR are still adopting primary data-based research, which restricts data to a few hundred (Table I). Such result confirms $H3$, which points to a research gap in adopting data-driven approaches such as data mining and machine learning based on secondary data which may directly be collected from mobile devices or even from social media, if the goal is to assess users’ opinions. This shows a clear avenue for relevant future research, which needs to keep pace with well-established research in tourism topics such as customer engagement and satisfaction, where researchers have already paved the way (Moro et al., 2018).
AR using wearable technology still shows little evidence of clearly emerging as a dominant trend. Topic 8 in Table VI is the only one mentioning it, in a total of 25 articles. This corroborates tom Dieck et al. (2016)'s perceptions that this is still a topic requiring further development. Nevertheless, topic 8 also shows the exponential growth of “wearable” studies as it was hypothesized, confirming $H_4$. Mobile is the word that occurs more often by far.

<table>
<thead>
<tr>
<th>Word</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile</td>
<td>581</td>
</tr>
<tr>
<td>Heritage</td>
<td>283</td>
</tr>
<tr>
<td>Cultural</td>
<td>269</td>
</tr>
<tr>
<td>Experience</td>
<td>228</td>
</tr>
<tr>
<td>Design</td>
<td>227</td>
</tr>
<tr>
<td>Data</td>
<td>218</td>
</tr>
<tr>
<td>Technologies</td>
<td>165</td>
</tr>
<tr>
<td>Digital</td>
<td>154</td>
</tr>
<tr>
<td>Development</td>
<td>149</td>
</tr>
<tr>
<td>Travel</td>
<td>134</td>
</tr>
<tr>
<td>Model</td>
<td>130</td>
</tr>
<tr>
<td>Time</td>
<td>129</td>
</tr>
<tr>
<td>Interaction</td>
<td>129</td>
</tr>
<tr>
<td>Learning</td>
<td>123</td>
</tr>
<tr>
<td>Devices</td>
<td>119</td>
</tr>
<tr>
<td>Navigation</td>
<td>115</td>
</tr>
<tr>
<td>Real</td>
<td>115</td>
</tr>
<tr>
<td>Environment</td>
<td>113</td>
</tr>
<tr>
<td>Services</td>
<td>109</td>
</tr>
<tr>
<td>Smart</td>
<td>106</td>
</tr>
</tbody>
</table>

Table IV. Word frequency for AR

<table>
<thead>
<tr>
<th>Word</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel</td>
<td>966</td>
</tr>
<tr>
<td>Environment</td>
<td>664</td>
</tr>
<tr>
<td>Design</td>
<td>459</td>
</tr>
<tr>
<td>Data</td>
<td>445</td>
</tr>
<tr>
<td>Time</td>
<td>413</td>
</tr>
<tr>
<td>Model</td>
<td>395</td>
</tr>
<tr>
<td>World</td>
<td>365</td>
</tr>
<tr>
<td>Experience</td>
<td>343</td>
</tr>
<tr>
<td>Development</td>
<td>341</td>
</tr>
<tr>
<td>Navigation</td>
<td>326</td>
</tr>
<tr>
<td>Mobile</td>
<td>323</td>
</tr>
<tr>
<td>Real</td>
<td>322</td>
</tr>
<tr>
<td>Heritage</td>
<td>295</td>
</tr>
<tr>
<td>Digital</td>
<td>292</td>
</tr>
<tr>
<td>Learning</td>
<td>288</td>
</tr>
<tr>
<td>Interaction</td>
<td>270</td>
</tr>
<tr>
<td>Space</td>
<td>267</td>
</tr>
<tr>
<td>Simulation</td>
<td>263</td>
</tr>
<tr>
<td>Techniques</td>
<td>261</td>
</tr>
<tr>
<td>Social</td>
<td>261</td>
</tr>
</tbody>
</table>

Table V. Word frequency for VR
| #  | No. of articles | Word 1 | β   | Word 2 | β   | Word 3 | β   | Word 4 | β 2000-2005 | 2006-2011 | 2012-2018 |
|----|----------------|--------|-----|--------|-----|--------|-----|--------|------|-----------|-----------|-----------|
| 1  | 65             | heritage | 2.50 | cultural | 2.68 | sites | 3.66 | learning | 3.76 | 1 | 7 | 57 |
| 2  | 56             | mobile | 2.41 | smart | 3.86 | city | 3.89 | game | 3.92 | 1 | 12 | 43 |
| 3  | 53             | navigation | 3.32 | camera | 3.63 | location | 3.97 | image | 4.00 | 5 | 11 | 37 |
| 4  | 49             | mobile | 2.96 | objects | 3.55 | services | 3.68 | devices | 4.23 | 3 | 13 | 33 |
| 5  | 44             | interaction | 3.37 | space | 3.64 | design | 3.83 | environment | 4.02 | 0 | 8 | 36 |
| 6  | 43             | mobile | 3.30 | app | 3.59 | experience | 3.98 | design | 3.99 | 1 | 3 | 39 |
| 7  | 37             | social | 3.51 | physical | 3.80 | people | 4.02 | model | 4.02 | 0 | 4 | 33 |
| 8  | 25             | experience | 2.69 | wearable | 3.19 | computing | 3.60 | context | 3.93 | 1 | 4 | 20 |
| 9  | 22             | design | 3.60 | algorithm | 3.83 | control | 4.08 | data | 4.16 | 0 | 2 | 20 |
| 10 | 12             | data | 2.63 | model | 3.88 | web | 3.90 | spatial | 4.07 | 2 | 0 | 10 |

Table VI. Topics for AR
when considering AR research (Table IV). The unveiled topics from Table VI give a more detailed expression to this number. Mobile is the dominant word in three out of the ten topics (second, fourth and sixth topics), showing these are topics highly related to mobile devices/applications. Additionally, the three topics’ articles are almost entirely from the two latter periods (i.e. 2006-2018), confirming H5.

The summarized body of knowledge unveiled from the topics identified in Table VII shows VR research is in a more mature state than AR. Besides the relatively large number of articles published in the first analysed period (2000-2005), there is a significantly larger variety of words, with most topics emphasizing the most relevant words as being related to the tourist experience (e.g. “heritage”, “travel”, “walking”, “leisure” and “cultural”), when compared to AR where technological-related words such as “mobile”, “camera”, “app”, “data”, “physical”, “wearable” and “computing” prevail. The second topic, encompassing 138 articles, confirms H6, while the profusion of words such as “travel”, “walking”, “simulation” and “navigation” seems to partially grant support to H7. Yet, the lack of a single topic mentioning plan/planning clarifies that travel planning is not a main stream of research, thus rejecting H7. Most likely VR has been researched to mimic real navigation in tourism scenarios (topic #6), but not accounting for real travel planning.

Table VI shows that “navigation” emerges as the most relevant word in the third topic, encompassing 53 articles. Navigation appears associated with camera (needed to support navigation), location and image. Nevertheless, language does not appear in any of the topics, suggesting that the recent model proposed by tom Dieck and Jung (2018) and validated by Han et al. (2018) is still an open avenue for further research. Thus, although H8 is only supported for “navigation”, the very recent above cited studies suggest that a future literature analysis is likely to uncover more research on language.

Culture is present in VR in tourism, especially associated to heritage and sites, providing evidence on VR’s relevance to promote cultural dissemination. Moreover, the environment appears as the fourth most relevant word in the fifth topic, mostly associated with interaction, space and design. Additionally, nature is not appearing in any topic. Such result only partially corroborates H9 (in what is related to culture), as there is not enough evidence of a relevant trend on naturalistic environments.

4.2 Theoretical implications
This literature analysis framed both AR and VR current state-of-the-art literature. The undertaken approach, guided by grounded hypotheses on a subset of relevant tourism literature, helped to confirm or refute localized trends suggested by specific studies, contributing to a broader understanding of the overall body of knowledge. Although VR is in a more mature state when compared to AR, the number of publications has been steadily increasing since 2000. Additionally, there is a consistent lack of research based on Big Data and machine learning approaches to benefit from secondary data to unearth VR/AR user experiences. Such finding uncovers an interesting avenue for future research.

4.3 Practical implications
The lack of a theory-based research identified from the 46 articles analysed by Yung and Khoo-Lattimore (2018) is only partially supported by our findings based on a much larger set of literature, considering most of the hypotheses drawn from the literature were supported. Thus, the automated approach has shown to be useful by offering a broader perspective that sometimes does not agree with focussed systematic quantitative literature reviews.
<table>
<thead>
<tr>
<th>#</th>
<th>No. of articles</th>
<th>Word 1</th>
<th>$\beta$</th>
<th>Word 2</th>
<th>$\beta$</th>
<th>Word 3</th>
<th>$\beta$</th>
<th>Word 4</th>
<th>$\beta$</th>
<th>2000-2005</th>
<th>2006-2011</th>
<th>2012-2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>156</td>
<td>game</td>
<td>3.62</td>
<td>social</td>
<td>3.79</td>
<td>online</td>
<td>3.89</td>
<td>community</td>
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<td>7</td>
<td>59</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>132</td>
<td>heritage</td>
<td>3.18</td>
<td>cultural</td>
<td>3.36</td>
<td>project</td>
<td>4.18</td>
<td>development</td>
<td>4.29</td>
<td>14</td>
<td>47</td>
<td>71</td>
</tr>
<tr>
<td>4</td>
<td>128</td>
<td>mobile</td>
<td>3.17</td>
<td>environment</td>
<td>3.97</td>
<td>visualization</td>
<td>4.28</td>
<td>scene</td>
<td>4.41</td>
<td>17</td>
<td>67</td>
<td>44</td>
</tr>
<tr>
<td>5</td>
<td>108</td>
<td>design</td>
<td>3.07</td>
<td>space</td>
<td>3.85</td>
<td>digital</td>
<td>4.11</td>
<td>interaction</td>
<td>4.13</td>
<td>13</td>
<td>41</td>
<td>54</td>
</tr>
<tr>
<td>6</td>
<td>98</td>
<td>travel</td>
<td>2.97</td>
<td>simulation</td>
<td>3.85</td>
<td>traffic</td>
<td>3.90</td>
<td>vehicle</td>
<td>3.91</td>
<td>21</td>
<td>31</td>
<td>46</td>
</tr>
<tr>
<td>7</td>
<td>98</td>
<td>performance</td>
<td>3.66</td>
<td>walking</td>
<td>3.72</td>
<td>distance</td>
<td>3.78</td>
<td>travel</td>
<td>3.83</td>
<td>15</td>
<td>39</td>
<td>44</td>
</tr>
<tr>
<td>8</td>
<td>88</td>
<td>leisure</td>
<td>4.09</td>
<td>health</td>
<td>4.13</td>
<td>patients</td>
<td>4.22</td>
<td>experience</td>
<td>4.33</td>
<td>20</td>
<td>16</td>
<td>52</td>
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<tr>
<td>9</td>
<td>79</td>
<td>data</td>
<td>3.33</td>
<td>city</td>
<td>3.65</td>
<td>urban</td>
<td>3.94</td>
<td>model</td>
<td>3.98</td>
<td>18</td>
<td>30</td>
<td>31</td>
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<tr>
<td>10</td>
<td>30</td>
<td>learning</td>
<td>3.12</td>
<td>software</td>
<td>3.89</td>
<td>network</td>
<td>3.94</td>
<td>computer</td>
<td>4.02</td>
<td>6</td>
<td>11</td>
<td>13</td>
</tr>
</tbody>
</table>
Continued research is in demand to take advantage of the most advanced text mining techniques to address issues that still pose a limitation to such approaches (e.g. word disambiguation). Nevertheless, AR and VR are still emergent technologies that require further research to assess ongoing adoption under several tourism contexts such as hotels, museums, restaurants and tours.

References


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Progress in wireless technologies in hospitality and tourism

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Universidad Nacional de Educación a Distancia – Facultad de C.C. Económicas y Empresariales, Madrid, Spain

Abstract

Purpose – This paper aims to critically review the progression of wireless technologies in tourism and hospitality since 2000. Wireless technologies are a set of information and communications technologies (ICTs) involving radio transmission (such as mobile or satellite technologies) that are extensively used in tourism and hospitality, but which have not yet been studied comprehensively.

Design/methodology/approach – This study is a mixed methods review combining a quantitative and qualitative approach and including a systematic review of the academic literature since 2000.

Findings – Contrary to the prevailing focus of study on mobile technologies, the authors open the field to other technologies (such as Zigbee or Bluetooth), and in a particular highlight, the large role played by satellite technology in tourism and how this is reflected in the literature. In literature reviews linking tourism and ICTs, the authors find that excluding some journals may leave out notable aspects for any systematic analysis. Moreover, the study highlights the importance of wireless technologies in a sensor-based convergence between the physical and digital worlds.

Originality/value – The contribution is mainly twofold: first, the authors develop the literature on tourism with a better understanding of the role played by these technologies in supporting tourism and hospitality, by updating sources and research work; second, the authors take a holistic, all-embracing approach, providing a truly comprehensive view of the literature on tourism and ICTs, in which wireless technologies have always been approached with fragmented or limited scope, lacking a view in the round.

Keywords Mobile, Tourism, IoT, Hospitality, Satellite, Wireless technologies

Paper type Research paper

论无线科技在酒店和旅游业中的发展进程

目的

研究目的 – 本论文批判性评论了自2000年起无线科技在酒店和旅游业中的发展过程。无线科技是一组有关无线电传输的信息通信技术（ICTs）（如移动技术或卫星技术），这种技术在酒店旅游业中使用频繁，但是却没有得到全面的研究。

研究设计/方法/途径 – 本论文采用混合方法，评论了自2000年来发表的定量和定性研究的文章。

研究结果 – 比起大部分移动技术研究的文章，本论文延展了研究领域到其他技术（如Zigbee或蓝牙），特别强调了卫星技术在旅游业的重要作用，以及文献中所研究的重点。在连接旅游业和ICTs的文献中，我们发现一些期刊漏掉了很多系统分析的重要方面。此外，我们的研究还强调了无线科技在感应器为基础的物联网世界的重要性。

研究原创性/价值 – 研究结果的贡献大致有两点：首先，我们更新了数据和研究作品，展示了旅游业文献，深入理解了这些科技是如何支撑旅游和酒店业的发展。第二，我们采用了整体全面的研究方法，提供旅游和ICTs有关的文献体系，而之前的文献往往对无线科技的研究是片面的或者不成体系。

关键词：无线科技、旅游业、酒店业、IoT、移动、卫星

1. Introduction

This paper is a review of the progression of wireless technologies in tourism and hospitality since 2000. Wireless technologies are a set of information and communications technologies (ICTs)
involving radio transmission (such as by mobile or satellite), extensively used for communications, equipment networking and interoperability between organizations and functions (Buhalis and Law, 2008). Although they are gaining prominence in the world of tourism, their use in the field has not yet been studied comprehensively.

Regarding the development of ICTs, researchers have paid most attention to exploring tourist behaviour (Zhao et al., 2018). Connectivity has become a crucial technological issue for tourists (Tanti and Buhalis, 2017). Yet, linking up the ecosystem of connectivity is a challenging task as there is no standard among practitioners, and the stages of ICT development and implementation across the EU member states vary (Buhalis and Leung, 2018). Further, to mobile communications, wireless technologies are some of the newest means of guaranteeing the required seamless connectivity: short-range wireless communications technologies such as radio frequency identification (RFID) and near-field communication (NFC) (Kim and Kim, 2017) promote ubiquitous connectivity and real-time synchronization so as to create new travel experiences. In addition, the use of beacons located on top of traditional physical signage turns signs into digital visitor guides when connected to tourists’ devices via Bluetooth. Tourists are now hyperconnected and multichannel. They are connected via their mobile devices and also via a host of sensors, wearables and apparatus based on wireless technologies at all stages of their journeys (Xiang et al., 2015). So, it is worth exploring this range of technologies configuring the hyperconnected tourist, including but not confined to smartphones.

This study provides answers to some basic research questions: How has research on tourism and hospitality evolved in recent years when dealing with these technologies? How does the literature reflect the new trends, topics and phenomena that have appeared in digital tourism as a result of wireless solutions? Our paper provides scholars and practitioners with a view of the main recent changes in tourism research linked to these technologies, analysing strategic drivers in the trends.

This approach is, moreover, justified by the need to take as comprehensive a view as possible, for as Kim et al. (2018, p. 56) state in their “review of reviews” of the academic literature on tourism, “future research endeavours could address the gap created by the uneven distribution of subjects covered by review studies in our disciplines”.

2. Brief literature review
The literature deals mostly with mobile technologies, which have undergone huge growth in recent years and attract more interest than wireless technologies in general. The mobile field has been closely analysed and has recently been the subject of specific literature reviews. Reviews have been conducted by Kim and Law (2015), Liang et al. (2017) and more recently, Law et al. (2018), who include only papers published in hospitality and tourism journals in 2016-2017, and therefore, lack a holistic or panoramic view; and in methodological terms they mix different technologies under the “mobile” umbrella in a piecemeal way. In all events, given a large number of papers analysing this technology, the overview in these reviews is a good picture of research and findings linking mobile technologies and tourism. However, there are cases in which the novelties in these technologies are better reflected in non-tourism journals.

There is a growing interest in satellite technologies (Wu and Chen, 2016), and in recent years we have witnessed the development and deployment of the Internet of Things (IoT) as applied to tourism (Kaur and Kaur, 2016), short-range wireless communication technologies, such as RFID and NFC (Kim and Kim, 2017) promote ubiquitous connectivity and real-time synchronisation for the creation of new user experiences. In addition, the use of beacons located on top of traditional physical signage turns signs into digital visitor guides when connected to tourists’ devices via Bluetooth or WiFi.
Interest in WiFi is diffuse, as this is a generic technology geared to connectivity regardless of the type of data transmitted and so is less specifically applicable, as occurs with sensor-based or more short-range technologies. The literature focusses chiefly on discussing its role in connectivity in tourism-related facilities such as airports (Nghiem-Phu and Suter, 2018), buses (Bagloee et al., 2017), car parks or coffee shops (Sanusi and Palen, 2008), trains (Carteni et al., 2017) and museums and cultural heritage environments (Borrero et al., 2015). As well as, given their wide availability, economic models such as social login have also recently been studied (Tanti and Buhalis, 2017).

Television is a clear example of studies being more focussed on the content transmitted than on the technology as an enabler. Thus, studies on the influence in tourism of images, series or films and the message they convey are numerous: soap operas from Korea (Oh, 2014), television shows in Ukraine (Salahodjaev, 2016), India (Tessitore et al., 2014) or UK series (Iwashita, 2008; O’Connor et al., 2008), medical and cosmetic tourism (Lazar and Deneuve, 2013), artistic tourism (Lim and Bendle, 2012) or religious travel (Terzidou et al., 2018) are the most widely studied examples. We found even meta-analysis and a degree of theoretical development emerging from about 2008.

3. Methodology
This study’s main aim is to explore the inroads made in the literature by wireless technologies in tourism and hospitality in the period 2000-2018. Our study is a mixed methods review (Kim et al., 2018) combining a quantitative and qualitative research approach and including a systematic literature review.

In pursuing our study objectives, we followed the recommendations of Aguinis et al. (2018) for methodological improvement of study transparency and the steps, decisions and value judgements made. The process followed is summarized in Table I.

In methodological terms, we use a systematic approach to cover all “wireless” technologies: we review the radio spectrum from very low frequencies (VLF 3-30 kHz) to super-high frequencies (SHF 3-30 GHz) so as to provide a broad picture of all wireless technologies and their applications in tourism (ITU-R, 2015). Thus, our paper includes all the implications for hospitality and tourism of broadcast techniques, RFID and wearables, beacons, radio, NFC, television, Bluetooth, microwaves, Zigbee (as well as other technologies involved in the IoT and the “smart” phenomenon), along with mobile and satellite communications, as set out in Table II.

We used the Web of Science (WoS) core collection database as our sole information source, in June 2018. The following parameters were taken into account: a timescale from 2000 to 2018; all types of journal; all research fields, countries and regions; tourism, hospitality, marketing, economics, business, management, psychology, sociology, technology, etc.; only full-length papers in English were considered and other publications such as book chapters, research notes

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Determine the goal and scope of review</td>
</tr>
<tr>
<td>Step 2</td>
<td>Determine the selection procedure for the inclusion of journals</td>
</tr>
<tr>
<td>Step 3</td>
<td>Calibrate source selection process through an inter-coder agreement</td>
</tr>
<tr>
<td>Step 4</td>
<td>Select sources using the process identified in Step 3</td>
</tr>
<tr>
<td>Step 5</td>
<td>Calibrate content extraction process through an inter-coder agreement</td>
</tr>
<tr>
<td>Step 6</td>
<td>Extract relevant content using multiple coders</td>
</tr>
</tbody>
</table>

**Table I.** Process for identifying journals, papers and content to include in a literature review study

**Source:** Adapted from Aguinis et al. (2018)
and conference papers were excluded from the analysis; subject search for each of the technologies referred to in Table II together with the term “tourism*”; and the process was repeated with the term “hospitality*”. The search yielded 974 papers in total.

After compiling our first sample we did a manual search in each of the 974 studies so as to identify those directly linked to our subject. By reading the article title, keywords and
abstract and in some cases the whole paper, we made the first selection and categorised the studies with the following indicators: “related”, “unrelated”, “maybe” and “duplicate”. The decision to include a paper as “related” was based primarily on direct relevance to the topic of wireless technologies in tourism and hospitality. Those classified under “maybe” were revisited by the three study authors so as to rule them in or out of the final list of “related” papers and to avoid missing any significant information. The product of this second selection phase was 124 journals and 220 papers “related” to the subject of study.

Once the research team had read and analyzed the 220 studies, these were classified by the following criteria:

- code assigned to the paper (1-220);
- type of technology (beacons, Bluetooth, microwaves, mobile, NFC, radio, RFID, satellite, television, WiFi or Zigbee);
- title of the paper;
- DOI of the paper;
- authors of the paper;
- research topics (adapted from Kim et al., 2018): business management (BM), business operations (BO); consumer behaviour (CB); CSR, the environment and sustainability (CS); distribution (DS); education (ED); economics and finance (EF); human resources (HR); marketing communication (MC); marketing strategy (MS); Study of specific regions: countries, cities (RG); theories (TH); and types of tourism: cultural, rural (TP);
- type of study analysis: quantitative or qualitative;
- journal title;
- field of journal: tourism/hospitality or other;
- publication date;
- publication year;
- journal volume;
- issue number;
- special issue: yes/no;
- start page;
- end page;
- total number of paper citations; and
- average yearly citations.

In this third phase, after reading the 220 papers selected as “related”, we excluded 35 papers, which seemed not to be truly related to the field, as most of these dealt with research areas directly linked to questions of technology with little or nothing to do with applications in tourism and hospitality, such as in archaeology, medicine or geography; or because tourism was just one application of the technology among others and with no particular significance or salience. The final paper selection process yielded 185 articles from 118 journals.

Figure 1 shows the trend over time (2000-2018) in the number of publications considered. We see a growing interest for the subject of tourism and wireless technologies as from 2012.
to 2013, when the number of publications on these technologies rose very sharply. The year 2018 is also likely to end with such a rising trend.

Table III shows the first 25 journals (organized by percentage of related papers) used in the final selected sample that have published papers on wireless technology linked to tourism and hospitality, including tourism and hospitality journals and journals in other fields. *Tourism Management, Journal of Hospitality and Tourism Technology and Information Technology and Tourism* are the three journals that have shown more interest in research linked to our subject.

<table>
<thead>
<tr>
<th>Journal</th>
<th>Area</th>
<th>No of papers</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tourism Management</em></td>
<td>T/H</td>
<td>14</td>
<td>7.6</td>
</tr>
<tr>
<td><em>Journal of Hospitality and Tourism Technology</em></td>
<td>T/H</td>
<td>9</td>
<td>4.9</td>
</tr>
<tr>
<td><em>Information Technology and Tourism</em></td>
<td>T/H</td>
<td>6</td>
<td>3.2</td>
</tr>
<tr>
<td><em>Current Issues in Tourism</em></td>
<td>T/H</td>
<td>5</td>
<td>2.7</td>
</tr>
<tr>
<td><em>International Journal of Contemporary Hospitality Management</em></td>
<td>T/H</td>
<td>5</td>
<td>2.7</td>
</tr>
<tr>
<td><em>Journal of Travel and Tourism Marketing</em></td>
<td>T/H</td>
<td>5</td>
<td>2.7</td>
</tr>
<tr>
<td><em>Sustainability</em></td>
<td>Other</td>
<td>5</td>
<td>2.7</td>
</tr>
<tr>
<td><em>Journal of Sustainable Tourism</em></td>
<td>T/H</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td><em>Journal of Travel Research</em></td>
<td>T/H</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td><em>Annals of Tourism Research</em></td>
<td>T/H</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td><em>International Journal of Tourism Research</em></td>
<td>T/H</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td><em>Personal and Ubiquitous Computing</em></td>
<td>Other</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td><em>Environmental Monitoring and Assessment</em></td>
<td>Other</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>International Journal of Hospitality and Tourism Administration</em></td>
<td>T/H</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>International Journal of Hospitality Management</em></td>
<td>T/H</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>International Journal of Information Management</em></td>
<td>Other</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>International Journal of Mobile Communications</em></td>
<td>Other</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Journal of Hospitality and Tourism Management</em></td>
<td>T/H</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Journal of Tourism and Cultural Change</em></td>
<td>T/H</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Journal of Urban Technology</em></td>
<td>Other</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Multimedia Tools and Applications</em></td>
<td>Other</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Pervasive and Mobile Computing</em></td>
<td>Other</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Sistemas and Telematica</em></td>
<td>Other</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Telematics and Informatics</em></td>
<td>Other</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Tourism Geographies</em></td>
<td>T/H</td>
<td>2</td>
<td>1.1</td>
</tr>
</tbody>
</table>

**Table III.**
Top 25 journals in the sample

**Notes:** T/H = Tourism or Hospitality; Other: other fields
Of the selected journals, 77 per cent are not devoted to the field of tourism and hospitality; thus, showing the importance of considering journals outside our field in ascertaining trends in applied wireless technologies in tourism.

Regarding the impact by number of citations of our study sample, those linked to theoretical studies (TH), the study of specific regions (countries, cities, etc.) (RG), consumer behaviour (CB), distribution (DS) and marketing strategies (MS) are, in that order, those which have had most impact in the academic sphere (Figure 2).

4. Empirical analysis

4.1 Overview and trends in wireless technologies in tourism

Below, we set out the main findings of our analysis with the selected papers, allowing us to give an overview of studies on tourism linked to wireless technologies and the trends in them over time.

In Table IV, we distribute the various empirical studies by category and year. We find a large extent of theorising on the use of wireless technologies in tourism especially as of 2015, when the number of studies looking at such theories rose sharply, up to a total of 37 over the years. It is also worth noting specific analyses on particular regions, countries and cities, whose numbers shot up as of 2010, as well as studies on marketing and consumer behaviour. Finally, there are also many on the topic of business management. Accordingly, we see a certain trend towards theorising as the academic corpus grows, allowing researchers to better define the theories formulated. In line with our review, research on tourism using wireless technologies can be divided into two categories. First, is a generation of studies focussed on methodological dimensions and specific case studies. Second, are papers making use of that background to build a more comprehensive theoretical picture.
and also to study previously unexplored aspects of tourism. In relation to new technological advances, these theoretical studies revisit fundamental questions of technology in tourism and consumer behaviour, and also look at the multiple interactions of various technologies with an integrative approach (Buhalis and Leung, 2018, in their study of smart hospitality, interconnectivity and interoperability towards an ecosystem).

Figure 3 shows the trend in papers published with quantitative or qualitative approaches since 2013, with a sharp rise in quantitative studies. Thus, beyond exploratory or descriptive work, we find statistical analyses or quantitative studies backing up their conclusions with numerical data. This is a significant development and shows the maturity of tourism-related studies on wireless technologies, with a shift towards in-depth analysis of more concrete aspects.

Figure 4 shows a breakdown of papers analyzed by technology. We separate beacon applications from Bluetooth and WiFi, as these devices may function with both technologies. We thought, it is appropriate to highlight their specific emergence in the sphere of wireless technologies as applied to tourism. By contrast, we find no research linking tourism and microwave devices, whereas there are many studies given over to mobile technologies. Also,
notable is the emergence of satellite technology as the second-ranking area of study. This is a novelty, as satellite applications are normally studied less widely than other technologies in tourism. Figure 4 shows details of technologies and of whether they were studied in journals on tourism or in other fields: it is well worth noting the abundance of satellite-related papers not appearing in tourism journals, in which little attention is given to satellite technology, whereas this has been a focus of interest for journals in other fields. This is a significant finding. The role being played increasingly by satellite applications as tools in tourism should be better covered and recognized by journals in the sector.

A similar divergence is observed when classifying papers by study type: tourist consumer behaviour is more widely studied in journals outside the tourism sector. This leads us to reflect on the scope of literature reviews often based only on tourism journals and which may be leaving out of the analysis a range of tourism-related papers published in journals of other kinds. Examining the bias resulting from this exclusion may be a possible future line of research.

We also found that a large number of papers look at technology as an enabler or facilitator while others are chiefly concerned with the contents and data with which technologies are used. The clearest case is television, where among the pre-selected papers there were many studies on the influence on tourism of imagery, series or films and of the message they convey. Those in which the content in itself took precedence over the technology were ruled out of our analysis.

5. Discussion and conclusions

5.1 Conclusions

Despite the dominance of the mobile field, other wireless technologies are gaining attention from researchers. The most widely analysed and recurrent technology in the literature is mobile telephony, as it is unsurprising given that mobiles have established themselves as the most popular devices for accessing the internet, with 52 per cent of users worldwide, as opposed to 43 per cent using laptops or desktops (We are social and Hootsuite, 2018). This high degree of penetration across the world population is probably the reason for the greater volume of research related to mobile technology. Other wireless technologies are gradually increasing their presence in the literature: in the papers analysed, comprehensive technological solutions are proposed for smart cities and new uses for exhibitions and events, e-payments and systematic platforms, envisaged with practical applications. The role that satellite applications are playing in the field of tourism emerges not directly from tourism journals, but rather from publications in other fields, normally technological ones.

The tourism industry’s rapid evolution in the past 18 years because of technological development, pressure among competitors and new habits in consumer behaviour is not
sufficiently reflected in the academic literature in the field. In fact, the tourism industry is ahead of academic research as regards the adoption of technological advances. The use of data in tourism research still faces some important challenges such as quality of data, cost of data and privacy concerns (Li et al., 2018), aspects that are still not sufficiently reflected in the academic literature.

Contrary to the prevailing focus of studies on mobile technologies, with abundant research on smartphones and apps, we have opened the field to other technologies (such as Zigbee or Bluetooth), and in particular, we have highlighted the large role played by satellite technology in tourism and how this appears in the literature. As mentioned, interest in the field has been reflected chiefly in non-tourism journals. This involves drawing attention to a research gap and is, therefore, a genuine contribution by this study. Moreover, by focussing on satellite technologies, we have identified their widest and most significant uses in the tourism sphere. Given that, to date, no literature review has looked at the relationship between tourism and satellite technology so closely, our study is an original contribution.

5.2 Theoretical implications

Wireless technologies are not only socially produced but also act as agents influencing users by reconstituting social ties and redrawing social boundaries. Technology forms part of the social capital that is embedded in a network of actors acting collectively and can modify that network’s structure and operation (Bystrowska et al., 2017).

Thus, we see that journals in the technological and ICT spheres reflect these technical changes more quickly, including their impact in the field of tourism because of their cross-cutting approach, whereas tourism journals take longer to pick up on such aspects. There is also a delay in their emergence in tourism literature reviews, where the emphasis is placed on contributions from the sectoral literature. Where the aim is to detect trends, providing a view in the round, observing developments and mapping future progression, there is a risk of missing key aspects driven by technological change. On excluding research in non-tourism journals, it is easy to leave out aspects of vital importance to tourism. In line with Navío-Marco et al. (2018), we are, therefore, critical of approaches which, to narrow the scope of work for researchers, omit vital aspects in their findings. We advocate more holistic and all-encompassing methods.

In this paper, we have offered a holistic overview of the linkage in research papers between tourism and hospitality and wireless technologies, avoiding the fragmentary approach taken to date to such technologies (using the radio spectrum to facilitate communications) and which are not confined to mere mobile communications, and which, moreover, cannot be included in the mobile category in a piecemeal way. We have sought to take an orderly approach so as to analyse them in a structured way, and at the same time, we have conducted a more comprehensive overview. This approach is also justified by the need to provide as wide a view as possible, as, with Kim et al. (2018), we believe that future research endeavours could address the gap created in the academic literature of tourism by the uneven distribution of subjects covered by review studies in our disciplines.

5.3 Practical implications

These new trends and implications open new avenues of research, especially in the areas where we have found ourselves lacking in research to refer to: satellites, beacons, WiFi, Zigbee or Bluetooth as applied to tourism are still uncharted territories where the academic literature of tourism is concerned. Wireless technologies make possible a major change: a convergence between the physical and digital worlds supported by sensors gathering data originating from mutual interactions between tourists and the environment. Also strangely,
despite the impact they have had on consumer behaviour and in the tourism industry itself, we believe they have still not been thoroughly researched.

The results of our research have interesting implications for management given that these technologies substantially increase the connections between tourists; and between tourists and their environment, and allow information and data to be obtained about them, increasing bidirectionality between supply and demand. Today, all the data that can be accessed through the technologies discussed in this study allow us to improve business intelligence, to better understand consumer behaviour and to improve organizational processes.

5.4 Limitations and future research
Our study has various limitations owing precisely to its copious bibliography and the choice not to exclude non-tourism journals, with the aim of not passing over any notable aspects linked to the technologies under study. The number of references dealt with made it difficult to refine our analysis, but it allowed us to detect some of the shortcomings resulting from excluding non-tourism journals at the outset. Moreover, we focussed only on English-language papers, neglecting those in other languages, as well as book chapters and conference proceedings. Future studies might seek to integrate these, notwithstanding the volume of literature involved. New research initiatives should look into how these new technologies will enter the public mind in terms of technology take-up and how companies may incorporate them into their operations.

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Further reading

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A bibliometric analysis of knowledge development in smart tourism research

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Abstract
Purpose – The purpose of this paper is to examine the production of smart tourism knowledge, thereby revealing the development of the concept through collaborative networks.

Design/methodology/approach – A bibliometric analysis, which enables visual mapping and observation of the domain, was conducted using journal articles retrieved during the period of 2000 to 2018.

Findings – The understanding of smart tourism is shaped and enhanced through collaborative network of researchers. As the domain develops, its reach expands across different networks as well as core themes.

Research limitations/implications – Data for the study was generated from English-written journal articles that were produced from a database search of specific keywords associated with smart tourism.

Practical implications – Findings can prove useful to academic researchers and industry practitioners to aid their understanding of smart tourism research development, identify the underlying context and aid in coherent development of the concept.

Originality/value – The paper is one of the first articles to provide a greater understanding of smart tourism as a research topic by examining its evolution in an academic context through bibliometric analysis.

Keywords Tourism, Review, Publications, Bibliometric analysis, Smart tourism

1. Introduction
Technology is intertwined with various aspects of life, enabling communication and collaborations among people. This development was as a result of the need for data-driven
destination management decisions as well as the creation of enhanced tourist experiences, which can be delivered through smart tourism. Smart tourism bears importance for researchers and industry professionals because of its ability to provide meaningful, timely data and interconnectivity among tourism stakeholders (Gretzel et al., 2015a; Boes et al., 2016; United Nations World Tourism Organisation, 2018). Subsequently, smart tourism as a research topic is developing in the academic community with collaborations among scholars resulting in academic contributions that can aid in understanding this phenomenon (Celdran-Bernabeu et al., 2018).

Understanding the creation of knowledge and academic discussions in various fields is important for academic fields to become recognised and mature (Echtner and Jamal, 1997). This has been evident in other fields within the social sciences. For example, a few decades ago in public relations research, knowledge was limited because of little discourse and research on particular aspects of the field. However, with more recent engaging academic discussions, such as conversations surrounding the function of spreading news via digital networks as well as subsequent contributions to knowledge, the field has grown towards becoming more established (Pasadeos et al., 1999; Pasadeos et al., 2010).

In addition to supplying knowledge that is relevant to both business and practice, tourism academics are required to maintain standards through high-quality and impactful research (Echtner and Jamal, 1997; Racherla and Hu, 2010; Tung and McKercher, 2017; Koseoglu et al., 2018). Authors generate studies with theoretical and practical implications by positioning discussions within those happening in the domain, which can lead to the maturity of the field. This can be facilitated by understanding knowledge development, of which this paper aims to do within the smart tourism domain.

To grow towards a more mature academic field, knowledge formation in the smart tourism domain has to be understood. This can be based on understanding the sources of knowledge, association of researchers and subsequent invisible colleges (De Solla Price and Beaver, 1966). Invisible colleges in this context are understood as associations of researchers that are not institutional but are based on personal knowledge networks or collaborations not fostered by institutions directly but formed from research groups out of common interests and common goals. Authors in these associations quote and collaborate with each other multiple times (Morehouse and Saffer, 2018).

Bibliometric studies have been used frequently to identify invisible colleges (Racherla and Hu, 2010), particularly by visualising bibliographic and bibliometric data. By applying social network analysis, there is a deeper understanding of knowledge development through collaborative networks (Benckendorff and Zehrer, 2013), specifically in the tourism domain (Koseoglu et al., 2016).

This study utilises data derived from the database, Web of Science (WoS) Core Collection, as a comprehensive database for interdisciplinary, international social science publications. There was a need to add Scopus database as well in order to increase reliability of findings. The analysis and visualisation process is done with the aid of Gephi, an open-source software for exploration of social networks (Bastian et al., 2009). While similar studies have been conducted within already existing collaborative networks in the e-tourism domain (Pourfakhimi and Ying, 2015) and based on smart tourism research emerging from China (Qui et al., 2016), this serves as one of the first studies to examine the knowledge domain of smart tourism based on English-written publications.

2. Literature review
2.1 Understanding smart tourism
The disruptive force of technology has impacted everyday life and subsequently various aspects of tourism research (Buhalis and Law, 2008; Sigala, 2018). This mirrors similar
occurrences in other areas of social sciences, such as public relations (Pasadeos et al., 2010) and sports management (Quatman and Chelladurai, 2008). These fields of study have been informed by business practice as well as the subsequent analysis of these events within academia. In this case, the emergence of new technologies has given rise to the concept of smart environments (Albino et al., 2015) and, also, the concept of smart tourism. As a topic, smart tourism has experienced increased attention in academia, being a growing interdisciplinary topic with knowledge being generated from fields such as sustainability and archaeology (Almobaideen et al., 2016; MDPI, 2017).

The notion of smart tourism being applied to the destination context is derived primarily from the concept of the smart city (Del Chiappa and Baggio, 2015). A smart tourism destination follows the requirements of a smart city. For instance, being equipped with advanced technologies for creating personalised tourist experiences and giving opportunities for the creation of interconnected tourist experiences (Chang and Caneday, 2011; Barile et al., 2014; Gregori et al., 2014). It encompasses interdependent actors such as government, locals, infrastructure, businesses and tourists (Gretzel et al., 2015a). Smart tourism should, therefore, not only be understood as the mere existence of advanced technologies for tourists but as an interdependency of diverse actors.

At first, smart tourism research aimed to describe the integration of technology and various technological components that interact with humans for producing enhanced tourist experiences (for example: Camacho et al., 2001; Fodor and Werthner, 2004). Further on, while still in the early stages of smartness being mentioned in tourism research, this term was associated with an ethically or environmentally “right” tourism choice or the “right” destination management strategy (Maia et al., 1998; Gossling, et al., 2008). Later on, smartness was more associated with technological advancements and interconnectedness of the human and the technological element (Albino et al., 2015).

Amidst knowledge development, the concept still remains as one that is not sufficiently defined and understood (Gretzel et al., 2015b). Various contributions have been made in the field of tourism towards defining smart tourism. Some studies frame smartness as the intertwining of technology with offline activities and infrastructure with online portals (Li et al., 2017; Ho and See-To, 2018). On the other hand, some authors propose it as the ubiquity and availability of digital data based on the interactions of stakeholders such as suppliers and government agencies (Gretzel et al., 2015a; Boes et al., 2016; Li et al., 2017). Smart tourism has been comprehensively conceptualised as “tourism supported by integrated efforts at a destination to collect and aggregate/harness data derived from physical infrastructure, social connections, government/organisational sources and human bodies/minds in combination with the use of advanced technologies to transform that data into on-site experiences and business value- propositions with a clear focus on efficiency, sustainability and experience enrichment” (Gretzel et al., 2015b, p. 181).

Smart tourism research is continuously developing, but there is need for further progress. For a field to advance intellectually, more theoretical and conceptual work within sub-fields of tourism research is needed (Racherla et al., 2008; Dredge and Jamal, 2015; Koseoglu et al., 2018). There is a lack of thorough understanding of the concept, formulation of diverse perspectives and theoretical underpinning in the research area (Dredge and Jamal, 2015; Gretzel et al., 2015b). Further criticisms of the smart tourism domain include the need for evaluating the risks and constraints of its development, undirected data collection as well as the use of various research methods (Gretzel et al., 2015a, 2015b).
2.2 Invisible colleges in academic research
Research development depends on the production of publications; thus, studies are built upon each other (Morehouse and Saffer, 2018). Therefore, criticisms regarding the lack of conceptualisation of the smart tourism domain may be attributed to the lack of knowledge. As assessment of knowledge development in other social sciences fields has shown, only through understanding the forces and networks that shape discussions can knowledge be formed and an academic field mature (Pasadeos et al., 1999; Pasadeos et al., 2010). Hence, it is important to know the academic relationships between scholars to discover the underlying invisible colleges that determine the direction of research in an academic field (De Solla Price and Beave, 1966; Quatman and Chelladurai, 2008).

The ideological conglomerations of academics collaborating and publishing actively have been coined as invisible colleges (De Solla Price and Beaver, 1966, Morehouse and Saffer, 2018). To identify the influential academics in their field as well as under-researched areas, metrics are needed to quantify academic research outputs (Ellegaard and Wallin, 2015; Garcia-Lillo et al., 2018). The results are also useful for connecting scholars to highly networked, experienced academics who can guide them in the academic world (Benckendorff and Zehrer, 2016; Koseoglu et al., 2018). At the same time, knowledge development is not only linked to individual authors but also to networks such as peer groups or interest groups.

Network analysis can provide information as to the reasons for the success of research interests and research trends based on interests of peer groups (Hirsch, 2005; Ellegaard and Wallin, 2015; Garcia-Lillo et al., 2018). Therefore, it is important to not only know the academic but also invisible relationships between scholars to discover the underlying invisible colleges that determine the direction of research in an academic field (De Solla Price and Beaver, 1966; Quatman and Chelladurai, 2008). These ties of invisible networks have been examined in previous tourism studies (Pourfakhimi and Ying, 2015; Koseoglu et al., 2016; Qui et al., 2016; Koseoglu et al., 2018) and also in part in smart tourism research as evident in Pourfakhimi and Ying (2015).

2.3 Bibliometric analysis in academic research
Bibliometric analysis can be conducted in various ways. One of the approaches is to analyse bibliographic data with quantitative network analysis for identifying and examining the structure of research through visual representations (Dzikowski, 2018). By using metric measurements, bibliometric analysis is seen as a suitable means of analysing quantifiable data objectively for quality and ascertaining the importance of researchers and topics in various subjects (Bouyssou and Marchant, 2011; Albert-Morant and Ribeiro–Soriano, 2016).

Basic metric measurements to quantify pure bibliographic data, for example, the h-index (Hirsch, 2005), is a type of metric most commonly referred to by journals and aiming to quantify research and publication outputs for researchers (Hirsch, 2005). However, specifically, in tourism studies, indices can be problematic because of the specialisation of the research field (Hirsch, 2005; Hall, 2011) and the need to frequent publications to keep up with the indexing requirements, which can cause research to deteriorate in quality and scope over time (Dredge and Jamal, 2015).

2.4 Social network analysis
Social network analysis is a method of analysis that can assess bibliographic output quantifiably in metric form and number of publications, leading to results which can unearth the relational ties of researchers (Morehouse and Saffer, 2018) forming a network of expertise. According to Otte and Rousseau (2002), social network analysis can be used as a
tool to understand and visualise social structures. This includes the social structure of an international community of researchers. The analysis provides information on literature, journals and, most importantly, authors, which is deemed important by researchers (Pasadeos et al., 1999).

2.5 Bibliometric analysis in tourism studies and social network analysis

Bibliometric studies, in tourism research as well as smart tourism, can be found as early as 2008 (Buhalis and Law, 2008). Network analysis in tourism is an examination of the different connections, conversations and collaborations among members. Hence, its aim is to clarify which authors and which topics are participating in the creation of knowledge in the domain (Racherla et al., 2008) by reviewing previous research in an effort to gain an overview of research patterns that might drive future research. With bibliometric analysis methods such as co-authorship and co-citation, one can detect the hidden intellectual associations and flows of research (Racherla et al., 2008; Benckendorff and Zehrer, 2016; Koseoglu et al., 2016) as well as detect growing networks amongst scholars globally (Benckendorff and Zehrer, 2013; Koseoglu et al., 2016).

Qui’s et al. (2016) study examining social networks and collaborations within smart tourism research amongst Chinese scholars has undertaken a social network and bibliometric analysis. Pourfakhimi and Ying (2015) are amongst the first authors to assess knowledge, shaping forces and collaborations of the particular domain of e-tourism. Pourfakhimi and Ying (2015) examine the connections amongst members of the ENTER Conference by IFITT (International Federation for IT and Travel in Tourism). However, studies that are developed within an established network of researchers might not reflect invisible colleges satisfactorily, as Kretschmer (1994) found that dynamics of co-authorship differed for invisible colleges and institutionalised networks. In invisible colleges, academics with a comparable amount of publications publish more frequently together, whereas for institutionalised communities, authors with unevenly yoked publication numbers publish together.

By discovering what lies beneath networks of smart tourism research, one can support the academic development of smart tourism research. Therefore, the following research questions have been formulated for this study:

*RQ1.* What are the invisible associations that can be discovered by utilising bibliometric analysis?

*RQ2.* What are the prominent scholar networks driving the conversations in smart tourism?

*RQ3.* What are the keywords shaping the conversation on smart tourism?

3. Methodology

3.1 Data collection

A systematic review process derived by Aguinis et al. (2018) was applied to ensure methodological transparency of this bibliometric analysis focused on smart tourism. Aguinis et al. (2018) formulated six steps, which are illustrated in Figure 1.

The first step was to decide on the aim of the review. The goal is to examine knowledge development in smart tourism research using bibliometric analysis. The study aims to answer the main research questions from Section 2.
Qui et al. (2016) reviewed smart tourism literature specifically within the Chinese academic research community, drawing upon Chinese academic journal databases. However, as the article by Qui et al. (2016) examines Chinese articles only, one might note that in Chinese academic literature, smart tourism has been conceptualised differently (Li et al., 2017). Other authors have remarked on the probability of publication language. Research articles that are written in English have a higher probability of being cited than non-English articles, as they attract a wider audience and, therefore, English-written articles are more likely to have a higher impact in the academic community (Di Bitetti and Ferreras, 2017). There is also evidence of smart tourism initiatives beyond China, as it exists in other countries globally such as South Korea (Ivars-Baidal et al., 2017) and also European destinations such as Spain and the Netherlands (Boes et al., 2016). Hence, there is need to examine the concept’s general development within a wider geographical context.

The second step of the review process was to select a database to develop a data set for the bibliometric analysis. Web of Science (WoS) Core Collection database was chosen, as it is regarded as a major database used by tourism academics (De La Hoz-Correa et al., 2018) evidently in previous tourism reviews (Benckendorff, 2008; De La Hoz-Correa et al., 2018; Garrigos-Simon et al., 2018). The database provides access to many sub-databases, thereby incorporating a wide representation of published articles (Garrigos-Simon et al., 2018). However, the representation of work in WoS specifically to tourism and hospitality is not as broad as Scopus (Benckendorff and Zehrer, 2013). Therefore, the Scopus database increases reliability and ensures the comprehensiveness of the dataset. Both databases are also compatible with bibliometric softwares, which is necessary to execute the analysis (Benckendorff, 2008).

After choosing the primary databases, the third step involved selecting English-written smart tourism articles. Initially, query words affiliated with smart were used to generate the data set. “Smart tourism” was chosen, as it had been used by similar studies such as Qui et al. (2016). “Smart tourist destination” was also included as a query word, as this is sometimes used interchangeably with smart tourism (Romao et al., 2017). As the notion of a smart destination derives from the concept of a smart city (Del Chiappa and Baggio, 2015) and smart destinations are forms of smart cities (Gretzel et al., 2015a), this study includes “smart city” as a keyword. Upon further review, smartness only started becoming a graspable concept in the 1990s. Studies describe the concept with different terminology surrounding aspects of E-, „, connectedness, intelligence and creativity (Albino et al., 2015). Hence, there is need to include the variations of smart that have been noted prior.

Consequently, the keywords, “m-tourism” and “e-tourism” were also incorporated in this study. Gretzel et al. (2015b) warns that e-tourism is different from smart tourism. E-tourism is based on information delivered before and after trip while smart tourism merges both the

Figure 1. Overview of the systematic process for identifying journals, articles and content

Note: Adapted from Aguinis et al. (2018, p. 7)
physical and virtual world to deliver an experience using advanced technologies. E-tourism is information and communication technologies (ICTs) in tourism (Buhalis and Law, 2008; Navio-Marco et al., 2018). ICTs are the electronic components that enable organisations to carry out their functions according to their objectives (Buhalis, 2003). Boes et al. (2016) note that ICTs are one of the five core components of smartness. There are others existing such as leadership, innovation, social capital and human capital. Although Gretzel et al. (2015b) states that there is a difference between e-tourism and smart tourism, e-tourism has played a role in the development of smart tourism because of its ICT component. Therefore, smart tourism is seen as an extension of previous tourism and technology concepts such as “e-tourism” (Qui et al., 2016); hence, the term is included in this study. The online search and collection of articles from Web of Science containing these keywords was conducted during November 2018.

The fourth, fifth and sixth step involved finalising the articles to be used. The fourth step was specifically selecting the documents. A short evaluation of the articles from WoS database found that the conversation on e-tourism emerged after 2000 with articles such as Camacho et al. (2001) and Buhalis and Licata (2002). Therefore, the period of 2000 to 2018 was chosen to generate the data set for analysis. Within the results of the general database search of studies on smart tourism, it was found that conference proceedings and journal articles were dominant. From a total of 1195 results, book chapters, editorial notes and conference proceedings were removed. Unlike conference proceedings, there was ease of access to the abstracts and full manuscripts of the journal articles in order to perform a thorough review. Furthermore, conference proceedings are sometimes not subject to a thorough peer-review process that is comparable to journal articles and may be seen as less credible and pertinent (McKercher, 2018).

At Stage 4, duplicates were also found and removed as both databases, WoS and Scopus, produced the same journal articles. Duplicates were found by reviewing the titles and authors of the documents. The articles retrieved from the overall search were further manually inspected by two reviewers to ensure relevance and applicability to this study. The documents were reviewed using the title, author and abstracts. Coder 1 examined the articles during the period of 2000-2009, while Coder 2 examined articles from 2010 to 2018.

The fifth and sixth step involved ensuring intercoder agreement and finalising the approved list of articles for review. Intercoder reliability is necessary for reproducibility of findings (Finn et al., 2000; Krippendorff, 2013), and thus, ten articles were given to each coder to ensure full agreement was attained. There was full agreement between both coders, which did not warrant the need for calculating the Cohen’s Kappa. The final list was further agreed upon collaboratively, resulting in a total of 247 journal articles.

3.2 Bibliometric analysis
Of the three types of bibliometric procedures namely review, evaluative and relational studies, relational has been deemed the least applied in tourism. Relational studies using social network analysis are able to enhance the understanding of connections within scholarly networks by unveiling patterns (Koseoglu et al., 2016). Authors such as Hu and Racherla (2008) as well as Benckendorff and Zehrer (2013) have used the relational method to conduct co-authorship analysis and co-citation analysis. Due to of the benefits of conducting bibliometric studies via relational review and the lack of these types of studies in the tourism domain, Koseoglu et al. (2016) propose that this is an area to develop future research. This study, therefore, fills this gap by undertaking a relational bibliometric review from the perspective of smart tourism.
Specifically, three bibliometric relational methods are used to undertake the study: co-authorship analysis, co-citation analysis and co-occurrence of keywords. Co-authorship analysis illustrates the research collaborations within the domain by producing a visualisation of the networks of authors based on institutions and countries (Moed et al., 2004). This study identifies knowledge networks, which can provide insights needed for research questions 1 and 2. Co-citation analysis identifies the rate in which the same documents are repeatedly cited together by other sources (Benckendorff and Zehrer, 2013). A co-occurrence of keywords analysis is also done to examine the relationship and frequency of keywords within the domain based on authors (Zhu et al., 2015). This technique highlights current research themes in the development of smart tourism research, which is needed to address research question three.

Visual representation of bibliometric analysis of bibliographic data provides a better understanding of the entire data set and helps to identify key elements of the data set in its representation of items: authors, journals and keywords – as nodes and connections between these respectively, as edges (Van Eck and Waltman, 2010). The main elements are nodes that represent the network actors in this study, specifically the authors and keywords. Edges represent the relationships among the nodes which include co-citations and co-authored work. The edges, in graphic representation lines between the different items, are assigned different statistical weights within the overall data set. The different weights are represented by connectors of varying thickness; the thickness of the connecting line increases or decreases based on the frequency by which the edges connect to each other (Racherla and Hu, 2010).

The network metrics play a key role in revealing the level of significance of key elements of a network and leading from a bibliographic data set to a bibliometric data set that can be evaluated and interpreted objectively. At the node level (authors, articles, keywords), these metrics are betweenness centrality, closeness centrality and degree measures (Timur and Getz, 2008; Baggio et al., 2010). Betweenness centrality describes the proximity of a specific node to the other nodes in terms of frequency of paths that go through this particular node to reach a specific other node on the shortest path. Centrality refers to the number of connections a node has within its network. Degree measures the non-directional links that nodes have. Moreover, modularity measures describe the network in terms of fragmentation on how dense the individual sub-clusters are. High modularity means that the network is highly sub-segmented (Morehouse and Saffer, 2018). These measures can be described as being high or low (Table I).

3.2.1 Tools for bibliometric analysis. There are a variety of software programmes that can be used to process bibliometric data for visualisation such as CiteSpace (Chen, 2006), Visualisation of Similarities (VOS) Viewer (Van Eck and Waltman, 2010) and Gephi software (Bastian et al., 2009). CiteSpace allows researchers to visualise co-citation networks and trends in the research domain (Chen, 2006) as evident in Qui et al. (2016). VOS Viewer has the capability to graphically represent bibliometric data using techniques such as co-citation and co-occurrence of keywords and allows users of the software to increase and decrease the zoom settings while examining the bibliometric maps, as well as transforming and exporting the data into different formats such as re-usable Pajek files (Van Eck and Waltman, 2010). Other graphic data visualisation tools also utilise similar data set structures such as Pajek files and CSV-files in specific formatting. However, in comparison to a software like Gephi, VOS Viewer is limited in its network analysis functions and toolboxes (Fahimnia et al., 2015). This can limit the provision of network metrics necessary for an in-depth analysis of findings.

Gephi was chosen to analyse the dataset in this study, primarily because of its ability to provide the necessary network analysis metrics. The software features a modality tool that
measures the density of links for clustering of data (Fahimnia et al., 2015). Like other tools used for bibliometric analysis, it is also an interactive software that can illustrate the connections between nodes in a network (Cheng et al., 2018) to perform and graphically represent co-author analysis, co-citation analysis and co-occurrence of keywords (Fahimnia et al., 2015). Gephi has been used to conduct bibliometric analysis in tourism such as Avila-Robinson and Wakabayashi (2018), Cheng et al. (2018) and Ward and Pelaez-Verdet (2018); however, it is yet to be applied in smart tourism research. The software is also freely accessible.

4. Findings
The study provides results that can provide a holistic perspective of smart tourism knowledge development. The systematic review process yielded a total of 247 journal articles that were published during the 18-year period as seen in the breakdown in Figure 2. There has been continuous development in the research domain, signifying an increase in

<table>
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<th>Measure</th>
<th>Explanation</th>
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| Betweenness centrality| **High**: Highly impactful, connected node, serving as connection point to multiple other nodes  
**Low**: Node is not impactful to the network, is not a connector to multiple other nodes |
| Closeness centrality  | **High**: Shortest distance from any point in the network to any other given node in the network. Information can thus be passed most efficiently from any given point A to any given point B  
**Low**: Information flow is not rapid through this point, as it is not central Therefore, information passing through this node will have to detour longer to get from any given point A to any given point B |
| Degree                | **High**: Connects to betweenness centrality, amount of edges that are connected to any point in the network. High degree means high amount of adjacent edges  
**Low**: Low amount of adjacent edges – less well connected in the network |
| Modularity            | **Low**: Low overall connections of the network, highly connected sub-segments within  
**High**: Low amount of adjacent edges – less well connected in the network  
**Low**: Less sub-clustering, higher amount of overall connectivity |

Figure 2. Number of journal articles per year from 2000 to 2018
research interest in the topic area as journal articles are continuously being published annually. However, there has been an inconsistency in the annual growth rate of smart tourism research. There was a steady increase in the growth of publications from 2009 to 2011 with 2011 being the highest rate of growth at a record of 67 per cent. However, after this, there was a decrease based on a −12 per cent growth in publications in 2012. Publications from 2001 to 2012 significantly concentrated on e-tourism. The first evidence of the words “smart tourism” was not until 2013, a claim also supported by Celdran-Bernabeu et al. (2018). The first article that directly mentioned smart tourism was Wang et al. (2013) article on China as a smart tourism destination.

First, this study examines the knowledge network in its entirety and then specifically the most dominant clusters that contribute to the conversation of smart tourism. Furthermore, the study examines the leading journals that concentrate on the topic as well as perform a co-word analysis to identify the common themes in smart tourism.

4.1 Knowledge networks in smart tourism research

To ascertain the knowledge networks in smart tourism, a co-author analysis was performed that revealed the measurements in Table II.

Upon reviewing the co-author network consisting of 637 nodes and 1165 edges in Figure 3, it becomes evident that the network diameter, which describes the longest path between two nodes, lies at nine nodes. The nodes connect only via nine other researchers. This describes a very loose network, which is confirmed by the network modularity of 0.945. This network modularity indicates that the network is highly separated into internally closely tied sub-clusters.

With an edge density of 0.008, this indicates that the network is not very well-connected; instead, there are only few nodes that connect to a wider range of other nodes (Otte and Rousseau, 2002; Botta and del Genio, 2016).

4.1.1 Smart tourism sub-clusters. The results provide a highly fragmented view of the co-author network. The high modularity indicates several densely connected sub-clusters; however, the clusters most central to the Gephi output can be grouped into four prominent clusters (Figure 4).

Being a significantly bigger node within the network, the dominant author in the first sub-cluster is identified as Rob Law who is surrounded by other authors who co-author with him or with his previous co-authors. This specific author node provides characteristics of a comparatively high closeness centrality of 0.407767, a fairly high betweenness centrality of 4,465.616667, a low clustering coefficient of 0.059113 and a high eigencentrality value 0.232856. In Figure 4, betweenness centrality was chosen to demonstrate the influential position of specific nodes. Therefore, the high betweenness centrality of the author node of Rob Law is significantly larger than others. Hence, data that Rob Law does co-author

<table>
<thead>
<tr>
<th>Network structure and metrics</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nodes</td>
<td>637</td>
</tr>
<tr>
<td>Edges</td>
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</tr>
<tr>
<td>Centrality</td>
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</tr>
<tr>
<td>Modularity</td>
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</tr>
<tr>
<td>Density</td>
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</tr>
<tr>
<td>Network diameter</td>
<td>9</td>
</tr>
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Table II. Network metrics for co-occurrence network
multiple times with the same authors based on a lower clustering coefficient and frequency of publications with other select authors in the network with a high eigencentrality value.

A further examination of the data set reveals that Law has been collaborating with at least one other author from the early years of e-tourism research as evident in Li and Law (2007) study where it was found that a text-based approach can assist in alleviating English/Chinese barriers experienced with using hotel websites. Much of Law’s studies since 2007 are based on e-tourism with a concentration on websites and mobile applications; articles include Law et al. (2009), Qui et al. (2016) and Zhone et al. (2013).

Within the second sub-cluster, Lorenzo Cantoni seems to be the most connected author in terms of co-authorship. This sub-cluster has a comparatively high closeness centrality of 0.366279, a high betweenness centrality of 1.582.029365, a fairly high clustering coefficient of 0.470588 and a high eigencentrality value of 0.665434, which characterise this author node. This cluster is also connected to sub-cluster 1 that is dominated by Rob Law because of its connection via Elsa Estevez’s collaborative work on digitisation of governance in tourism. This study was co-authored with Kalbaska, Janowski and Cantoni in 2007. Nonetheless, just as the cluster dominated by Law, the cluster dominated by Cantoni is centred on e-tourism but with attention on e-learning and digitisation at a government and destination level (Marchiori and Cantoni, 2018; Stoklosa et al., 2018).

Although Cantoni’s work is predominantly based on information systems in tourism, he has been involved in other collaborations with authors such as Werthner and Gretzel who

Figure 3.
Overview of co-authorship network after Yifan Hu Test

Notes: This is the application of the Yifan Hu test on 637 nodes and 1,165 edges of co-authorship network with distinct sub-clusters in the centre.
are instrumental in setting the theoretical foundations of smart tourism as evident in Gretzel (2011). These studies are specifically Lamsfus et al. (2013) in Cantoni and Xiang (2013) and Werthner et al. (2015). Cantoni serves as a connecting co-author to the third sub-cluster dominated by co-authorships of Hannes Werthner (with a closeness centrality – 0.324742, betweenness centrality – 279.819048, clustering coefficient – 0.666667 and eigencentrality – 0.635773), Ulrike Gretzel (with a fairly high betweenness centrality of 300.885714 because of the influential connection position to the two clusters that she inhabits), Chulmoo Koo and Namho Chung (showing a high betweenness centrality of 762.879365 because of the position of the key connector between two networks of connections). Namho Chung has been linked with most segments, which signifies Chung’s involvement in multiple collaborative networks. This connection is because of the joint effort on the article focusing on the relationship between tourists’ readiness and usefulness of smart technologies (Chung et al., 2017). Generally, research within this cluster concentrates on tourists’ attitude and behavioural intentions of different types of smart tourism experiences (Chung et al., 2017; Koo et al., 2017; Lee et al., 2018).

The knowledge network in smart tourism includes a fourth sub-cluster that comprises 15 author nodes. Unlike the other clusters, the articles that emerge from this one are from 2015 to 2018. Attention has been placed on different types of technologies for enhancing tourist experiences such as augmented reality (example: Chung et al., 2017), near-field communication (example: Han et al., 2016) and social networks (example: Chung et al., 2017).

The previously highlighted sub-clusters in smart tourism research are the largest and most central clusters found in the data set. Although the data set encompasses articles from

Notes: This displays the central cluster of the co-authorship network. Node size is dependent on node’s betweenness centrality (minimum size 2, maximum size 30) and thickness/edge weight is dependent on frequency of connections between authors. Data shown only at a degree of minimum four authorships. Sub-clusters are separated by colour.

Figure 4. Central sub-clusters in co-authorship network.
the Web of Science and Scopus databases, findings reveal similar articles as those found in Pourfakhimi and Ying’s (2015) bibliometric study on the development of e-tourism research; for example: Buhalis and Law (2008) as well as Law et al. (2009). In the case of Pourfakhimi and Ying (2015), only the ENTER Conference proceedings were used as the dataset. This overlap proves that the invisible college within smart tourism research is almost, if not the same as the authors from ENTER, which represent an already established knowledge exchange association. This finding is opposed to Kretschmer’s (1994) finding that the dynamics of invisible colleges and already established ones differ.

4.1.2 Influencers within the clusters. Opposed to the co-author network, the co-citation networks in Figures 5 and 6 have a low network diameter. Every node is connected via a maximum of three nodes; therefore, the distance which lies between different co-cited sources is a maximum of three researchers. There is also a smaller modularity of 0.2 than the co-author network. This indicates a higher interconnectedness of sub-clusters and a less dense connection within the individual sub-clusters. The edge density is 0.467, which signifies that almost half of the nodes are connected to each other in the overall network. The main cluster with the most citations received was that of the cluster of IFITT

![Diagram](image_url)

**Figure 5.** Overview over co-citation network after application of proportional Yifan Hu test

**Notes:** This is the application of the Proportional Yifan Hu test with betweenness centrality measures and frequency measure applied. Author nodes with highest betweenness centrality are depicted 10 times larger than author with smallest betweenness centrality. Edges with highest frequency are assigned larger weight depicted in the thickness as well as darker colour gradient. Only authors with a minimum of 30 co-citations have been shown, which equates to 90.91 per cent of nodes and 95.46 per cent of edges being displayed. Total network is made up of 121 nodes and 3.391 edges.
affiliated researchers. One can, therefore, assume that while some sources and authors are cited more often alongside each other, citations occur within their own realms of research peers but also reach out towards other research communities to cite other researcher's findings together with predominantly cited sources. This section, therefore, aids to answer the research questions as to which scholars are influential and crucial to the smart tourism research area.

Specifically, within the co-citation network presented in Figure 6, the weight – depicted by thickness of the connecting edge – is greatest between Ulrike Gretzel and Dimitrios Buhalis – both having extremely high scores on betweenness centrality 0.99115 (Gretzel) and 1 (Buhalis) respectively as well as the same clustering coefficient of 0.96. This indicates a connection to almost every node and that they are cited alongside each other in most sources. It can be inferred that these authors have been the most co-cited within smart tourism research. In contrast to the previous co-authoring clusters, Ulrike Gretzel's work on the conceptualisation of smart tourism is impacting the co-citation network as a base for further academic discussions. On the other hand, within the authorship network depiction, Dimitrios Buhalis appeared less central within the authoring network and co-authorships of smart tourism research authors but rather within the e-tourism field. However, this may be due to the emergence of smart tourism research from the e-tourism and technology field, within the co-citation network, Buhalis appears more central and with higher betweenness centrality, thereby signifying more influence. Although, Gretzel and Buhalis emerge from two separate clusters that concentrate on varying themes, the results confirm that there is an intertwined relationship between e-tourism and the conceptual roots of smart tourism research based on the connections in Figure 6.

Gretzel, with authorship on smart tourism conceptualisation, and Buhalis with publications on e-tourism and travel technology results in a very high frequency of general co-citations in combinations with a multitude of publications and further combinations of co-citations arising. Special attention should be paid here to the fact that these central
groupings – citing and use of the publications of the same researchers over time – all emerge from the cluster comprising of authors associated with the ENTER Conference/IFITT. This finding poses similarity with the study by Pourfakhimi and Ying (2015).

4.2 Keywords in smart tourism research

Based on the clusters and focus of various studies found in co-author and co-citation analyses, distinct themes begin to emerge. Nonetheless, to provide a more in-depth understanding of the keywords and themes that may contribute to smart tourism knowledge development, a co-occurrence of keywords is undertaken.

4.2.1 Frequently used keywords. Keywords are essential for ascertaining the knowledge structure of the subject area beyond the theme of the journal publications. Specifically, they reflect the core themes of an article. In this study, keywords refer to those highlighted by the authors of various articles from the data set. The process of keyword co-occurrence is a matching of keywords and a frequency count of keywords that occur together.

The co-occurrence network has a network diameter of six nodes, which indicates that keywords occur within six nodes distance from each other on a maximum. The modularity of this network is 0.463, indicating that nodes are well-connected within their own sub-clusters, but also on a wider scale, it is skewed towards a well-connected overall network of keyword co-occurrences. This signifies that many terms co-occur together frequently. Edge density is fairly low at 0.014 (Table III). Therefore, fewer nodes are connected to the overall network but via various edges, and hence, there is a higher network diameter. Gephi provides a visual representation of the results in Figure 7.

Overall network consists of 1,292 nodes and 11,670 edges. Only nodes displayed with 70 keywords mentioned leads to a visibility of 2.86 per cent of nodes and 3.63 per cent of edges. Nodes with greatest impact on overall network (i.e. highest betweenness centrality) are depicted as larger nodes (10 times larger than smallest/least impactful keyword). Edges also vary in thickness and colour gradient (red), which indicates the frequency in which keywords were co-cited (Figure 8).

There are 1,292 author keywords. These keywords include “smart city” and “cities”. These are often cited together and linked to conversations involving sustainability, big data and innovation. Then, there are the keywords, information technology and the internet, that are linked to e-tourism and social media. It is prudent to note that although smart tourism is seen as a concept emerging from the smart city, it was mostly cited as a keyword with the term information technology, rather than the term smart city. Therefore, the technological component plays a vital role in understanding and examining smart tourism research as well as social media. While social media has a connection with the smart tourism, concept, big data is a far-removed, non-central topic for the smart tourism research field.

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<td>Network diametre</td>
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Table III. Network Structure and Metrics
Note: This illustrates a network with keywords “smart tourism” and “internet” removed.
To perform the analysis of keyword co-occurrence, only keywords that appeared at least three times were included. Smart tourism has the highest closeness centrality score of 0.914286, the highest betweenness centrality of 92.912316 as well as the highest eigencentrality of 1. Upon examination of the results from Gephi, the top keywords are mostly related to technology, which is potentially because of the inclusion of e-tourism keywords. For instance, the keyword social media ranks constantly ninth with a closeness centrality in the network of 0.752941, a betweenness centrality score of 36.881113 and an eigencentrality of 0.80669.

5. Discussion

Smart tourism has been examined under various aspects and by different researchers; however, it is still a relatively recent research field. To further develop knowledge of this topic, future research must have an in-depth understanding of the conceptual and theoretical underpinnings. To facilitate this process, this study provides a relational view of the smart tourism domain in an effort to capture the underlying assumptions driving the development of knowledge.

5.1 Knowledge networks

Results reveal that there are many authors within the smart tourism domain; however, a significant number of them are not connected. The sub-clusters were linked to each other via a minimum of two authors. It also became evident that while an author can be prominent in the co-authorship network, it might not be prominent in the co-citation network, as the initial publication was co-authored by influential authors whose other works are being cited more often. This can be seen in the case of Kalbaska et al. (2017) co-authoring with Janowski, Estevez and Cantoni which is very central in the co-authorship analysis; however, within the co-citation analysis, this work has not been cited along with other works. An explanation could be that government involvement in smart tourism planning seems as of now less of a research concern. At the same time, authors that do not co-author frequently with other authors but issue publications that conceptualise smart tourism, have a higher score within the co-citation network than within the co-authorship network. This becomes evident in the case of Marianne Sigala (Sigala, 2018).

This study found that within authorship sub-clusters, there are dominant authors. Rob Law is identified as one author around which author nodes cluster, as well as authors such as Lorenzo Cantoni, Ulrike Gretzel, Hannes Werthner, Chulmo Koo and Namho Chung. This study concludes that potential invisible colleges in smart tourism are overlaid by already established associations such as IFITT.

5.2 Citation networks

Within the co-citation network, it becomes clear that few authors have a substantially higher influence on the research community than others and are dominantly cited within the smart tourism domain. Several authors dominant in the co-authorship network — potentially because of their already established popularity as a co-author, supervisor or senior researcher — also dominate the co-citation network. However, it also becomes evident, in some cases such as Marianne Sigala, that by authoring publications alone, the impact of the author on the co-citation network might be enhanced. Nevertheless, also, these authors along with many of the prominent authors already found in the co-authorship network seem to be mostly connected through the organisation IFITT, indicating an ideological room in which smart tourism research is developed and the origin of the connections between researchers.
5.3 Emerging themes
While some of the themes already became evident by observing the individual prominent researcher's research interests, keywords and groupings emerged that smart tourism research is focused on. For instance, the cluster that had Rob Law as the most influential author focused on e-tourism, while other sub-clusters concentrated on the foundations of smart tourism such as clusters co-authoring with Ulrike Gretzel.

The actual keywords differed in naming particular terms such as smart city, smart tourism, social media and information technology. Despite smart tourism destinations being considered as a type of smart city, results reveal that smart tourism was not closely associated with the terms, smart city or e-tourism. Instead, smart tourism was directly linked to information technology and social media. Therefore, there is still significant focus on the ICT component of smart (Boes et al., 2016). Although the specific ICT component cannot be ascertained through this relational analysis, it is important to note that the specific advanced technologies that drive smart, such as big data (Gretzel et al., 2015a), are also not closely tied keywords to smart tourism.

Sometimes, smart tourism may have been used as a central keyword and at the heart of different academic studies such as the case of when destination planning was evaluated. In other cases, articles discussed technologies in clusters on smart cities and artificial intelligence. Themes, which had more social aspects such as governance, emerged only marginally, and aspects such as acceptance and usability of smartness suppliers, did not emerge.

6. Conclusion
This study contributes a reflective piece on knowledge development in smart tourism, which can facilitate a deeper understanding of the discussions in the domain. It reveals the development of smart tourism research through collaborations and which topics might be unearthed through collaborations of researchers. The analysis also explores the existence of invisible colleges and knowledge networks in the smart tourism domain through graphical representations of the research evolution. The invisible colleges that are driving the conversations in smart tourism are similar to that of already established associations.

The paper contributes findings to the body of bibliometric studies that exist in tourism. By responding to the call by Celdran-Bernabeu et al. (2018) for future studies that map articles on smart tourism, it also extends previous literature reviews on smart tourism by providing new insights to aid further generation of knowledge in the research area. It explores smart tourism knowledge development from an English-language publication perspective, thereby increasing the dataset and extending the findings of Qui’s et al. (2016) bibliometric study. This study supports the stance held by Qui et al. (2016) to acknowledge e-tourism in the data set, as it is the platform upon which discussions have developed on smart tourism. Smart tourism research is influenced by e-tourism studies based on the associations within knowledge networks. However, it must be highlighted that from the keyword analysis, there was no close association between the keywords: e-tourism and smart tourism. This calls for further investigation to uncover the reason for this inconsistency.

Furthermore, smart tourism extends beyond e-tourism thereby issuing the need for research into other aspects. Most articles utilise this ICT perspective to examine smart tourism, specifically in tandem with tourist experiences; however, there are other components that can be explored. According to Boes et al. (2016), the key components on smart include human and social capital as well as leadership, which are understudied areas.
in the domain. Furthermore, a focus on other stakeholders in smart tourism such as destination management organisations and governments can enhance further understanding of smart tourism from a holistic perspective.

From the analysis, it was evident that a few scholars emerged as the lead authors in the domain, which is primarily because of their theoretical contributions. For instance, Gretzel’s et al. (2015a) provided theoretical foundations for smart tourism. The popularity of this article speaks to the fact that future researchers are interested in understanding the philosophy surrounding smart tourism to advance knowledge. Early career researchers can collaborate with the authors from the identified knowledge networks to aid productivity within the domain as well as the authors' professional development. While the domain is still growing, this study suggests that future studies cater to the demand of prospective researchers for a conceptual understanding. Authors who seek to do so, position themselves within current discussions central to the development of smart tourism as a concept.

This review provides a further understanding of the development of research in smart tourism; nonetheless, it has various limitations. Journal articles were evaluated for this study, which limits the variety of academic papers that were included in the data collection stage. This was due to the accessibility of the articles, which was a necessity for thorough analysis. Future studies can incorporate conference proceedings and book chapters to diversify the data set as well as enrich the results. Moreover, other academic databases exist and a consolidated data set from various databases might be able to provide a more thorough image. The proposed studies can expand on the current findings which can in turn contribute to progress within the domain.

References


Further reading


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From sci-fi to sci-fact: the state of robotics and AI in the hospitality industry

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Chaplin School of Hospitality and Tourism Management, Florida International University, Miami, Florida, USA, and
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Department of Electrical and Computer Engineering, School of Computing and Information Sciences, Florida International University, Miami, Florida, USA

Abstract

Purpose – This paper aims to review the extant hospitality and tourism literature on the state of robotics and artificial intelligence (AI) in the service industry. The aim was to highlight the current areas of research on this emerging topic and identify areas for future application and study.

Design/methodology/approach – A list of hospitality and tourism journals was used to identify articles related to AI and robotics using the terms AI, robots, robotics, hospitality and tourism, and several combinations thereof. Additional sources were identified through the literature reviews from the identified works.

Findings – The findings revealed several studies on the current state of robotics and AI in hospitality and tourism. Additional research examines and discusses implications for internal and external customer service, legal and ethical issues and theory.

Originality/value – This paper provides a compilation of the current studies that examine the impact of robotics and AI in hospitality and tourism. It offers scholars an overview of the current knowledge in the field on this rapidly emerging and evolving topic.

Keywords Robotics, Literature review, Artificial intelligence (AI), Hospitality technology

Paper type Literature review
Introduction

As early as 1988, hospitality scholars have been postulating how the development of artificial intelligence (AI) and expert systems, such as robots, might impact “small, routine, everyday tasks like departmental budget analysis, shift scheduling, credit verification, and room assignment” (Farsad, 1988, p. 491). In 1989, scholars proposed more robotics and automation be added to the back of house foodservice for personnel to be redistributed to the front of the house for more guest interaction (Sarabahksh et al., 1989). In 1993, Frank Borsenik postulated in his *Hospitality technology in the 21st century* that hotels and rooms would be booked using “a video telephone,” (p. 263), guest rooms would be “cleaned by a semi-robotic system” (p. 264), that modern eateries would use “receivers located at each table” that the guests would use to enter in their food order (p. 265), and that “the basic purpose of the management staff is to cater to guest needs and to develop technological systems to satisfy high-frequency needs” (p. 267).

In an age where robots are no longer science fiction, but rather a reality, the benefits and consequences of employing robots in the workplace are being debated by myriad business people across work sectors (Agah et al., 2016; Ferreira et al., 2017). The hospitality industry is no exception to this debate. Several hospitality and tourism companies, both large (Disney, Carnival Cruises, Mandarin Oriental, etc.) and small (Henn-na Hotel, Café X, Zaxby’s, etc.) have begun to embrace and use AI and robotics. Owing to the nature of the hospitality industry, some hospitality professionals and guests will argue that the essence of hospitality is personal contact – by people, not machines. Kuo et al., 2016 and others propose that machines have the capacity to perform the same services without days off, sick days, complaints and various other human resource issues (Wirtz et al., 2018). This article reviews the extant literature, both academic and trade, to understand how the state of the art of robotics and AI are currently being used and studied in the hospitality and tourism industry.

Methodology

In November 2018, a systematic review of articles related to the topics of robotics and AI in the hospitality and tourism industry was conducted. Because there is no singular source of hospitality and tourism journals from which to draw, the authors used the list of tourism, leisure and hospitality journals provided by Scimago Journal and Country Rank combined with the list of hospitality and tourism journals suggested in Arendt et al. (2007). Redundant titles were removed and the comprehensive list is provided in alphabetical order (Appendix). The terms AI, robots and robotics were used to identify relevant articles from each hospitality and/or tourism journal. Additionally, references that were cited in the published articles were examined and included when topically relevant (Leung et al., 2013).

Included in the final article set are titles from peer-reviewed conference proceedings and books, in addition to peer-reviewed full-length articles. However, the authors excluded abstracts, editor prefaces, book reviews and internet columns from the primary content of the literature review as they have been shown to offer limited contributions to knowledge development (Jang and Park, 2011; Leung et al., 2013).

The authors determined an appropriate cutoff date for identifying relevant articles. While the installation of the first digital programmable robot took place in 1961 in a manufacturing plant (Robot Hall of Fame, 2003) and the first consumer robot, the Roomba, was released in 2001 (Grossman, 2002), robotics has undergone a very slow and steady trajectory that culminated in the Urban Grand Challenge of 2007, when people took notice of robotic progress in the driverless space. This challenge demonstrated that the “state of the art in robotics has reached the point where the most sophisticated autonomous vehicles can
now drive comfortably and safely on a city course while surrounded by traffic and other obstacles” (Markoff, 2007).

Big Tech investment in robotics technology, such as that of Google creating Waymo, has triggered an unprecedented growth in both industrial and consumer applications of robotics. For example, since 2007, the overall average growth of industrial robotics has been 15 per cent, with an estimated three million industrial robots expected in service by the year 2020 (Gemma et al., 2017). Furthermore, there is a 20-25 per cent projected growth in service robots forecast for 2018-2020 (Hagele and Litzenberger, 2017). Thus, for the purposes of this study, articles from 2007 forward were considered.

In addition to a cutoff date of 2007, the literature search was similarly bound by a specific use for AI and robotics in the industry. While some extant literature focuses on AI in terms of predictive ability for forecasting tourism and occupancy, this literature review sought to identify articles that featured AI and robotics as customer service devices. Therefore, it was the socio-technical service system, which requires the confluence of the front of house employees, customers and technology, that was of interest.

Accordingly, the authors identified which articles were appropriate by reading the abstracts of each of the articles that yielded matches from the search terms. Once the abstracts demonstrated topical relevance, the full articles were read for content and to verify appropriateness. To be included in the manuscript, articles had to be directly related to both technology (robotics and/or AI) and the industry (hospitality and/or tourism) and be peer reviewed. Both qualitative and quantitative studies were included in the review of the literature. A total of 21 articles were published on AI and robotics across the listed hospitality journals after 2007, and of those only 12 were deemed topically relevant.

Qualitative content analysis was used to examine the articles as the purpose of this qualitative research method is “to provide knowledge and understanding of the phenomenon under study” (Downe-Wamboldt, 1992, p. 314). This type of analysis is often used in literature reviews (Leung et al., 2013). Because qualitative content analysis seeks to identify and highlight the contextual meaning of the text, the researchers used their understanding of the topics of AI and robotics to induce or discover the themes that were grounded in the literature and then systematically coded and identified those themes through the literature review process (Hsieh and Shannon, 2005). The three researchers reviewed the articles and created themes independently, which were then cross-compared and agreed upon to ensure interrater reliability (Leung et al., 2013). The themes were then compared, consolidated and agreed upon. From the content analysis, seven themes emerged from the literature, which are shown in Figure 1. They increase in size by the frequency with which they occurred in the literature.

Due to the multifaceted nature of some of the research, some of the articles discuss more than one theme and, accordingly, appear in more than one section (Table I). In addition to highlighting extant literature on the topic of robotics and AI in the hospitality service industry, this review also details the contributions these works provide and offers areas for future theoretical and practical use.

Current state of the art
To grasp the gravitas of the impending robotics and AI boom, it is first crucial to understand the meanings of these terms. Robotics, generally speaking, is the science of creating and building machines that are capable of performing tasks that are traditionally performed by humans. These robots are directed by computers and may carry out simple or complex tasks. While consensus has yet to be achieved regarding the definition of a robot, it is typically seen as a mechanism that senses the surrounding environment, processes what it senses and then executes a function based on what was processed (Robotics, 2013). There
are many mechanical devices used to assist persons in the workplace, but robots are a higher level of sophisticated technology. A clear example is a robotic bartender, which can take orders, prepare and serve drinks.

In the context of hospitality, a robot is a “relatively autonomous physical device capable of motion and performing a service” (Murphy et al., 2017, p. 106). Moreover, a hospitality robot may be viewed as a “social” or “service” robot. A service robot is one that is able to interact with and engage humans in a social setting (Dautenhahn, 1999; Tung and Law, 2017) and is defined as “system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization’s customers” (Wirtz et al., 2018). These service robots are built to provide information or assist in the hospitality industry, and their integration into a practical environment has sparked a great deal of interest on the part of researchers (Tung and Law, 2017; Wirtz et al., 2018; Zalama et al., 2014).
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<tr>
<th>Theme</th>
<th>Findings</th>
<th>Authors</th>
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<tbody>
<tr>
<td></td>
<td>Robotics for hospitality</td>
<td>Dautenhahn (1999); Murphy et al. (2017); Tung and Law (2017) and Zalama et al. (2014)</td>
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<tr>
<td></td>
<td>Robotics and AI performing hotel service functions</td>
<td>Castrodale (2016); Crook (2014); Hilton (2016); Ivanov et al. (2017); Markoff (2014); Nelid (2015), Nippon News (2018), Niculescu et al. (2014); Rajesh (2015) and Tussyadiah and Park (2018)</td>
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<td></td>
<td>Robotic beverage service</td>
<td>Golden (2014)</td>
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<td>Robotic deliveries and guest interactions</td>
<td>Miller (2018)</td>
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<td>Current and potential use of robotics and AI in hospitality, food service and tourism</td>
<td>Ivanov et al. (2017)</td>
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<td></td>
<td>Demand prediction for food service</td>
<td>Noone and Coulter (2012)</td>
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<td></td>
<td>Hotel guest preference and frequency prediction</td>
<td>Bowen and Whalen (2017) and Noone and Coulter (2012)</td>
</tr>
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<td>Necessary training for new technology</td>
<td>Ivanov and Webster (2017a), Kuo et al. (2016) and Warech (2018)</td>
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<td>Chatbots</td>
<td>Ivanov and Webster (2017a) and Kuo et al. (2016)</td>
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<td>Guest satisfaction with robotic hotels in China</td>
<td>Zhong and Verma (2018)</td>
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<td>Benefits and Value Propositions</td>
<td>Robotics and AI use for menial tasks</td>
<td>Farsad (1988)</td>
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<td></td>
<td>Back of the house foodservice preparation</td>
<td>Sarabahksh et al. (1989)</td>
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<tr>
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<td>Hotel services automation</td>
<td>Borsenik (1993)</td>
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<td>General workplace automation</td>
<td>Agah et al. (2016) and Ferreira et al. (2017)</td>
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<td></td>
<td>24/7 service, multiple guests simultaneously</td>
<td>Ivanov and Webster (2017a) and Kuo et al. (2016)</td>
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<td></td>
<td>Fewer errors, no fatigue</td>
<td>Kuo et al. (2016)</td>
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<td>Speed of service, efficiencies</td>
<td>Noone and Coulter (2012)</td>
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<td>Robotics for dangerous and hazardous conditions</td>
<td>Ivanov and Webster (2017a)</td>
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<td>Guest attraction to the novelty of robotics and AI</td>
<td>Ivanov and Webster (2017a), Kuo et al. (2017), Haidegger et al. (2013) and Kuo et al. (2017)</td>
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<td></td>
<td>Entertainment and fun of robotic and AI experience</td>
<td>Saber Chtourou and Souiden (2010)</td>
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<td>Communication, customer service and engagement with guests through AI</td>
<td>Kressmann (2017)</td>
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<td></td>
<td>Productivity increase</td>
<td>Gorle and Clive (2013)</td>
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<td>Personalized service through robotics and AI</td>
<td>Agah et al. (2016); Chung and Cakmak (2018); Haidegger et al. (2013); Lee and Sabanovic (2014); Nørskov (2016) and Royakkers and van Est (2016)</td>
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<td></td>
<td>Increased customer expectation that service robots offer value-added services</td>
<td>Kuo et al., 2017 and Zalama et al., 2014 (continued)</td>
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<td>Financial efficiency of robotics and AI</td>
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<td>Osawa et al., 2017</td>
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<tr>
<td>Efficiencies in labor costs</td>
<td></td>
<td>Gursoy, 2017</td>
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<tr>
<td>Projections for human replacement by robotics</td>
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<td>World Economic Forum, 2017</td>
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<tr>
<td>Competitive advantages in guest experiences through robotics and AI</td>
<td></td>
<td>Deliotte (2018), Kuo et al., 2017 and Noone and Coulter, 2012</td>
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<td>HR may be streamlined through resume scanning (recruitment), and assist with employee assignment, management and retention</td>
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<td>Dickson and Nusair, 2010</td>
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<td>Robotics and AI with an understanding of situational surroundings and empathetic abilities</td>
<td></td>
<td>Jasonos and McCormick, 2017</td>
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<tr>
<td>Guest service interactions by robotics and AI</td>
<td></td>
<td>Kim et al., 2015 and Lam and Shankar, 2014</td>
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<td>Guest expectations when using robotics and AI technology</td>
<td></td>
<td>Murphy et al., 2017; Tussyadiah and Park, 2018 and Zhong and Verma, 2018</td>
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<td>Robotic service (rService) paradigm that examines the Human-Robot Interactions</td>
<td></td>
<td>Pan, et al., 2015 and van Doorn et al., 2017</td>
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<tr>
<td>eService paradigm which explores the effect of services rendered via electronic networks (computers or phones) on customers</td>
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<td>Fassnacht and Koese, 2006; Parasuraman et al., 2005 and Rust and Kannan, 2003</td>
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<tr>
<td>rTourism paradigm</td>
<td></td>
<td>Papathanasis, 2017</td>
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<tr>
<td>Analysis of financial and service benefits of robotics and AI</td>
<td></td>
<td>Ivanov and Webster, 2017 and Kuo et al. (2016)</td>
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<td>Guests are concerned about safety aspects of robotics and AI service</td>
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<td>Tussyadiah and Park, 2018</td>
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<td>Positive results of guest-robotics interactive technology in hotels</td>
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<td>Chung and Cakmak, 2018 and Sinarta and Buhalis, 2018</td>
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<tr>
<td>Guest acceptance of robotics and AI</td>
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<td>Noone and Coulter, 2012</td>
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<td>The adoption of service robots alters the service experience as the interaction becomes a Human-Robot Interaction (HRI) instead of a solely human interaction, but emphasize the importance of guest satisfaction, regardless of the type of interaction</td>
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<td>Bartneck Kanda et al., 2009; Bartneck et al., 2009; Chung and Cakmak, 2018; Lee and Sabanovic, 2014; Sinarta and Buhalis, 2018; Tung and Au, 2018; Tussyadiah and Park, 2018 and Zhong and Verma, 2018</td>
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<td>Personal attention by humans is essential for hospitality services</td>
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<td>Kuo et al. (2016)</td>
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<td>Guest-Robot service interaction is important</td>
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<td>Bartneck Kanda et al., 2009; Bartneck et al., 2009 and Tussyadiah and Park, 2018</td>
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<td>Marketing to attract guests using robotics technology</td>
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<td>Bitner et al., 2002; Kuo et al., 2017</td>
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<td>Enhanced guest experience by using robotics and AI</td>
<td></td>
<td>Grünroos and Ravald, 2011 and Gursoy, 2017</td>
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<td>Measuring robotics and AI effectiveness</td>
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<th>Theme</th>
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<td>Legal and Ethical Implications</td>
<td>Robotics and artificial intelligence (AI) will create new types of beings and prompt ethical and legal concerns: (digital and material inequalities, guest interactions with service and sexbots) Privacy and security of information being recorded Robotics may eliminate low skill and low wage-earning positions Liability insurance for robotics and AI Laws must adapt to human interactions with robotics and AI Business human resource requirements and liabilities are reduced through the use of robotics and AI; less concern about protective labor laws Robot as its own legal entity or is it linked to its owner-operator by master-servant legal principles; product liability law application Protection of personal information secured by, or contained in, robotics or AI Ethical and moral issues of robotics and AI Uncanny Valley – guest perceptions when robotics are not sufficiently human-like; satisfaction if they are more human-like Human–Robot interactions are similar to Human-Human interactions TAM USUS Framework (usability, social acceptance, user experience and societal impact) Five dimensions for evaluating HRI (embodiment, emotion, human-oriented perception, the feeling of security and co-experience) Future of AI and robotics AI which would craft its own opinions of situations and these opinions would influence its decisions, and “self-awareness” AI, which implies an understanding of situational surroundings and empathetic abilities Prediction of increased demand for service robots</td>
<td>Bowen and Whalen, 2017 and Cronin et al., 2000 Morgan and Pritchard, 2018 and Pritchard, 2018 Wirtz et al., 2018 Huang and Rust, 2018; Frey and Osborne, 2017 and Wirtz et al., 2018 Ivanov and Webster, 2017a Balkin, 2015; Burri and Wildhaber, 2016; Calo, 2015; Pagallo, 2013; Hubbard, 2014 and Introna, 2010 Ivanov and Webster, 2017a Bayern, 2015; Calo, 2011; Burri and Wildhaber, 2016 and Ivanov and Webster, 2017c Calo, 2010 and EUGDPR, 2018 Cheok et al., 2017 and Morgan and Pritchard, 2018 Rodriguez-Lizundia et al., 2015; Murphy et al., 2017 and Lee and Sabanovic, 2014 Rodriguez-Lizundia et al., 2015 Davis, 1989 and Wirtz et al., 2018 Weiss et al., 2009 Tung and Au, 2018 Jasonos and McCormick, 2017 Gorle and Clive, 2013; Zalama et al., 2014</td>
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Table I.
The term AI was first coined in 1956 by the American computer scientist, John McCarthy (Jasonos and McCormick, 2017; Russell and Norvig, 2010). AI has been defined as the field of study that formalizes and mechanizes computed intelligent thought. This mechanized intelligence is achieved through the intersection of knowledge representation (the development of a language that represents knowledge) and knowledge manipulation (the limiting of search space to a reasonable amount and natural language processing) on the part of the programmers. Once there is a demonstrable capability of learning and subsequently changing behavior over time, and synergy or the whole being greater than the sum of its parts, the machine is said to be intelligent or rational (Artificial Intelligence, 2013; Russell and Norvig, 2010).

The AI that exists today is categorized as “weak AI” or a system designed to execute a particular task. Systems such as Apple’s Siri, Amazon’s Alexa, IBM’s Deep Blue and Google’s AlphaGO, are all representative of this type of weak AI. Deep Blue, for example, is known as a “reactive machine” because it is able to make predictions, but cannot use past experiences to inform future decisions (Jasonos and McCormick, 2017).

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<tr>
<th>Theme</th>
<th>Findings</th>
<th>Authors</th>
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<tbody>
<tr>
<td>Decrease in human workforce needs resulting from service robots</td>
<td>Gorle and Clive, 2013 and Ivanov and Webster, 2017a</td>
<td></td>
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<td>Resistance to change</td>
<td>Ivanov and Webster, 2017a, Anckar and Walden, 2001 and Cobos et al., 2016</td>
<td></td>
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<tr>
<td>Cultural differences in acceptance of robotics and AI technology</td>
<td>Brown et al., 1998; Kanoh, 2017; Kuo et al., 2017 and Lee and Sabanovic, 2014</td>
<td></td>
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<tr>
<td>A shift in organizational structure management training may be required to incorporate robotics and AI</td>
<td>Cobos et al., 2016</td>
<td></td>
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<tr>
<td>Structural changes to accommodate new technology</td>
<td>Akaoka, 2015; Lee and Sabanovic, 2014 and Ivanov and Webster, 2017b</td>
<td></td>
</tr>
<tr>
<td>Likelihood of robotics and AI adoption in hospitality</td>
<td>Mizuta, 2014; Pagliarini and Lund, 2017, Crews, 2016 and Ivanov, 2017</td>
<td></td>
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<tr>
<td>Taiwan is culturally prepared for robotics and AI, and is supported by government funding</td>
<td>Kuo et al., 2017 and Chen, 2011</td>
<td></td>
</tr>
<tr>
<td>Financial and strategic considerations for the incorporation of robotics and AI in hospitality businesses</td>
<td>Barrett et al., 2015; Melian-Gonzalez and Bulchand-Gidumal, 2016; Kuo et al., 2017 and Ivanov et al., 2017</td>
<td></td>
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<tr>
<td>Robotics and AI can complement, not replace human labor</td>
<td>Noone and Coulter, 2012 and Cesta et al., 2018</td>
<td></td>
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<tr>
<td>Robotics and AI as job creators</td>
<td>Smith and Anderson, 2014</td>
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<td>Hospitality educators should teach students to use the best technology and to optimize human-robotic actions and interactions</td>
<td>Smith and Anderson, 2014</td>
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<tr>
<td>Future studies on robotics operations</td>
<td>Hu et al., 2012 and Floreano and Wood, 2015</td>
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<tr>
<td>Future studies on human-robotic interactions</td>
<td>Ivaldi et al., 2016; Gursoy, 2017; Murphy et al., 2017; Tung and Law, 2017 and Zalama et al., 2014</td>
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<td>Planning strategic marketing with robotics and AI in mind</td>
<td>Floreano and Wood, 2015</td>
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While these systems are becoming increasingly more adept at executing specific tasks, there has been a call by researchers to focus more on “human-level AI (HLAI).” The goal is for future machines to be able to think, learn and create. This requires the application of the myriad tenets of AI, including philosophy (rationalism, induction, logical positivism and confirmation theory); mathematics (algorithms, incompleteness theorem, tractability and probability); economics (decision theory, game theory, decision processes and satisficing); neuroscience (neurons, brain mapping and singularity); psychology (behaviorism and cognitive science); computer engineering (programmability and Turing test); linguistics (natural language processing and knowledge representation); and control theory and cybernetics (Russell and Norvig, 2010). Although current systems include robotic vehicles, speech recognition, autonomous planning and scheduling, game playing, spam fighting, logistics planning, robotics and machine translation (Russell and Norvig, 2010), artificial general intelligence (Goertzel and Pennachin, 2007), in which learning and acting in any environment is achieved is the penultimate goal (Russell and Norvig, 2010).

The number of real-world applications of robotics and AI in hospitality and tourism is growing rapidly across the globe. Examples include the hotel Henn-na, a hotel completely staffed by robots including front desk agents, porters, in-room assistants, vacuum cleaners and a robotic arm operating the luggage storage room (Rajesh, 2015; Wirtz et al., 2018); Mario: a robot that has been greeting guests in 19 different languages at the buffet at a Marriott in Ghent, Belgium since 2015 (Nelid, 2015); Pepper: a receptionist robot at all Hamazushi conveyor belt restaurants in Japan (Nippon News, 2018); Botlr: a robotic butler employed by Starwood’s Aloft Hotel (Crook, 2014; Markoff, 2014); the Bionic Bar: robotic arms that act as bartenders on Royal Caribbean’s Quantum of the Seas (Golden, 2014); NAO: a small, multi-lingual robot that currently answers questions at Tokyo airport, and for check-in at hotels (Castrodale, 2016; Tussyadiah and Park, 2018); Singapore’s automated responsive assistant aka SARA, a robotic virtual agent that provides information and assistance to tourists (Niculescu et al., 2014); Connie: a robotic concierge implemented by Hilton that answers guests’ questions and learns based on each guest interaction to improve future responses (Hilton, 2016; Ivanov et al., 2017).

One major player in the hospitality service robot game is the company Savioke. Savioke created Relay, an autonomous, moving, 3-foot tall, delivery robot that transports items in a locked bin to guest rooms from the front desk and elsewhere. The robot has a touchscreen display that faces guests and it traverses hallways, doorways and elevators and avoids fixed objects and moving impediments, such as guests. As of January 2018, approximately, 70 Relay robots have been deployed worldwide (Miller, 2018). According to Savioke, the robots are slated to be able to identify where in the hotel there are Wi-Fi dead zones (the most common guest complaint) and will also interact with guests by the end of 2018 (Miller, 2018).

Recent studies list the current and potential uses of robots (Ivanov et al., 2017) and the current service dimensions of robots (Wirtz et al., 2018) in hospitality and tourism companies. The current uses for robots in hotels at the time of the study include front desk agent, concierge, delivery, vacuum cleaning, porters and room assistants. The potential for growth included housekeeping robots that do laundry, room cleaning, dishwashing, helping customers with their order, etc. The current applications of robots in restaurants include robot chefs, servers, bartenders and baristas (Ivanov et al., 2017). The current dimensions of service capabilities of robots at the time of this study include service training and learning capabilities and customizable customer experience services (Wirtz et al., 2018). Additional potential capabilities include cost-saving robot delivered services and automation of mundane jobs.

Because service marketers are concerned with the impact these new technologies have on customers (Kim et al., 2015; Lam and Shankar, 2014), service robot scholars have created a
robotic service or rService paradigm that help to examine the human–robot Interaction (HRI)(Pan, et al., 2015; van Doorn et al., 2017). This research was modeled after the eService paradigm, which explores the effect of services rendered via electronic networks (computers or phones) on customers (Fassnacht and Koese, 2006; Parasuraman et al, 2005; Rust and Kannan, 2003, p. 38). R-Tourism is another extension of this paradigm (Papathanasis, 2017).

According to Papathanasis (2017), R-Tourism may be broken into three typologies, namely, industrial robots, tele-presence devices and robotic guides and assistants. The primary driver of industrial robots is productivity; application examples include robotic bartenders, chefs and entertainers. The primary driver of tele-presence devices is accessibility; application examples include unmanned aerial vehicles, robot avatars and 3D holographic projections. The primary driver of robotic guides and assistants is service augmentation; the application example is the robotic assistance device (NAO, Pepper) (Papathanasis, 2017).

Benefits and value propositions
Hospitality scholars have only begun to discover the myriad benefits of using AI and robotics in the industry, as the implementation and use of such technologies is still burgeoning. Several researchers have identified benefits, both financial and otherwise, that may result from the use of these machines (Ivanov et al., 2017; Kuo et al., 2016). Kuo et al. (2016) used a SMART SWOT survey to understand the perspectives of hotel practitioners. Findings revealed five sets of perspectives and 60 key-item issues.

The first financial benefit identified would be saving in labor costs as robots and chatbots are able to provide service 24/7 to more than one customer at a time, which humans cannot (Ivanov and Webster, 2017a; Kuo et al., 2016). Additionally, robots do not fatigue or get bored, the way that humans do, so errors in message delivery are eliminated, which may be a long-term benefit for the company (Kuo et al., 2016). Because the technology may be used as a supplement to manpower, the result would enable more orders to be filled or rooms to be booked and more money to be generated. It would also allow for the streamlining of services in a restaurant setting as the number of inputs in the sequence of service would be reduced. Using AI assistance, a human serving guests can better personalize their service by being prompted about the guest’s history of preferences and by identifying guests by name through facial recognition technology.

Noone and Coulter (2012) report that Zaxby’s use of robots in its roughly 200 quick service restaurants has reduced product hold times by 65 per cent, product waste by 80 per cent and reduced employee training time. Additionally, the restaurants have increased their speed of service. Zaxby’s restaurant guest prediction system tracks customer arrivals, starts the cooking process as customers arrive and then gives employees specific directions to expedite cooking and service. The use of the robotics and AI in this setting facilitates consistently accurate decisions about production because the information is gathered real-time-based of the state of the restaurant. Additionally, the decisions made are delivered in real-time to the human staff members, which enables commands to be executed based on information that is merely seconds old. In the case of Zaxby’s, wait times, food freshness and guest satisfaction have all improved due to this streamlined predictive system. An effective AI and robotics system for food production and service has been shown to increase efficiency, reduce expenses, eliminate waste and improve the guest experience, ultimately, positively impacting the business revenue (Noone and Coulter, 2012).

Researchers maintain this is just the tip of the iceberg of possible savings for quick service restaurants that adopt robotics (Noone and Coulter, 2012). Other identified opportunities for the financial benefit include training and management for staff, customer demand prediction, process control, food quality control, corporate objective quantification and decision control and complex production rule application (Noone and Coulter, 2012).
The novelty of these technologies may also add positively to sales as people may be more inclined to patronize a hotel or restaurant if there is a robot due to curiosity. If there are unsafe or unsanitary conditions, the use of a robot would be beneficial over paying for a human (and for the requisite special attire and equipment) to handle the situation (Ivanov and Webster, 2017a). Robots are also valuable for security functions because of capabilities of detection sensors for dangerous products (chemicals and explosives) and the capability to securely detain or disarm dangerous persons or products with less risk than a human intervenor.

There are also several benefits that are not financially calculable. First, the novelty of the robots and AI may enhance the perceived service quality (Ivanov and Webster, 2017a; Kuo et al., 2017; Kuo et al., 2016). The media awareness generated by implementing the use of robotics and positive word-of-mouth was also touted as a short-term strategic benefit (Ivanov and Webster, 2017a; Kuo et al., 2016). It has been suggested that value may be created for the consumer by adding an element of entertainment and fun to the experience (Saber Chtourou and Souiden, 2010). Additionally, the use of AI and robotics would be a time saver for employees, which would enable them to use their skills for more creative, revenue-generating endeavors (Ivanov and Webster, 2017a). Finally, researchers have suggested that hospitality educators implement trainings, courses and lessons about robotics and robot services, as current and future workplaces will need skilled workers who know to understand this emerging area in the hospitality industry (Kuo et al. (2016); Warech, 2018).

Internal and external customer service

Hospitality researchers have determined that customer demand prediction, where customer preference and frequency of various types of hospitality establishments will be calculable, is a future possibility with the use of AI, robotics and big data (Bowen and Whalen, 2017; Noone and Coulter, 2012). Hotels.com predicts “the emergence of a new travel design science, which is a combination of using Big Data, AI and predicting travelers’ dreams” (2016).

The research on how robotics and AI are and will continue impacting employers and employees is polarized. Demand for service robots is projected to increase in various areas across the globe (Gorle and Clive, 2013). This may help hotels and restaurants deal with issues of seasonal employees and supplement labor in times of shortage. Additionally, scholars have identified AI as a useful tool to assist in improving and streamlining the human resources process; thus, making recruitment and personnel assignment, management and retention easier and more cost-effective (Dickson and Nusair, 2010).

The concern is that service robots will replace and displace service workers, causing unemployment to occur (Gorle and Clive, 2013; Ivanov and Webster, 2017a; Wirtz et al., 2018). Some researchers have proposed that there is cause for concern for those whose jobs require repetition of a task, as this may be executed by a robot and lead to the elimination of entire positions (Ivanov and Webster, 2017a; Wirtz et al., 2018). However, research has also demonstrated that when robots are employed in the workplace, productivity increases and service robots, specifically, have the potential to create new business as the importance of the use of these robots is more readily understood (Gorle and Clive, 2013). Regardless of one’s feelings toward robots, it is evident that hospitality workers will need to be well-versed in the technological advances that will serve and sustain internal and external customers, on top of being experts in their respective fields (Warech, 2018).

The implementation of service robots will inherently meet resistance from employees as their adoption would necessitate modifications to the established processes within the organization (Ivanov and Webster, 2017a). This resistance to change is a powerful social factor that scholars warn should not be overlooked (Anckar and Walden, 2001; Cobos et al., 2016). Scholars warn of failure due to sabotage on the part of the internal customers if they
do not buy in to the technology in addition to backlash on the part of human employees who believe their jobs are in jeopardy from the technology that may be more efficient (Ivanov and Webster, 2017a). Beyond the fear of job loss, standard operating procedures and training manuals would all need to be altered and staff trainings would need to take place to demonstrate the uses of the robots and the new protocols, thus creating change and removing employees from their comfort zones (Ivanov and Webster, 2017a). Hospitality managers will need to demonstrate to employees how their jobs will be improved and made more enjoyable by technology assistance.

Previous literature has demonstrated that there are some work cultures that may be more inclined to accept the technological change (Japanese, Taiwanese cultures), whereas other cultures (American) may be more resistant to robot usage (Brown et al., 1998; Kanoh, 2017; Kuo et al., 2017). However, recent literature has revealed that while traditionally Japanese culture has placed greater value in their employee, there may be a shift in value towards profits in the current business climate (Akaoka, 2015).

In addition to operational changes, there may also need to be physical changes made to the property to accommodate the new technology, which will be part of the new workforce. For example, Ivanov and Webster (2017b) list several structural areas that may serve as impediments to the successful implementation and use of robots. These include, but are not limited to:

- external accessibility to the property (which the owner may or may not be able to alter, but may impede the robots’ abilities to function outside of the property);
- internal accessibility of the property (which needs to facilitate the successful movement of the robot and may be altered by the owner);
- downloadable digital maps of the premises (to accommodate future guests’ robots successful navigation of the property and to allow for hotel robots to successfully navigate the property);
- pool area accessibility (to allow for poolside robot service without risking them falling into the pool);
- safety and security (which encompasses both the physical layout of the hotel to facilitate the safe operation of the robot and the ability of the robot to recognize both wanted personnel and guests and detect threats and intruders to the establishment);
- power issues (which includes making sure there is sufficient ability to power robots for the facilities and for guests in times when the power is and is not working);
- rentals and repairs (which may increase revenue by allowing guests to rent robots while on premises and facilitating repairs for mechanical issues with robots); and
- liability insurance for robots (Ivanov and Webster, 2017a; Ivanov and Webster, 2017b).

**Customer satisfaction, training and service recovery**

Many of the emerging robot studies focus on customer service, as this is a major tenet of success in hospitality. Researchers have maintained that a key means to create a unique experience is by using service robots (Agah et al., 2016; Chung and Cakmak, 2018; Haidegger et al., 2013; Lee and Sabanovic, 2014; Norskov, 2016; Royakkers and van Est, 2016). Coupled with the increase in customer expectation that service robots offer value-added services (Kuo et al., 2017; Zalama et al., 2014) it is becoming vital to understand how
customers respond to this new intelligence, as the technology will not succeed if the customer is not surprised and delighted by it.

The appeal of robot service is that it has been shown to be more cost effective due to the mechanical efficiency of robots (Osawa et al., 2017). Additionally, previous studies have demonstrated that the development of service robots is something that may be practically implemented and sustained as there has been an increase in demand for this type of service (Zalama et al., 2014). These studies have underscored how the adoption of service robots alters the service experience as the interaction becomes a HRI instead of a solely human interaction, but emphasize the importance of guest satisfaction, regardless of the type of interaction (Bartneck Kanda et al., 2009; Bartneck et al., 2009; Tung and Au, 2018; Tussyadiah and Park, 2018). The execution of proper marketing to successfully attract customers using robotics technology as a draw is also emphasized (Bitner et al., 2002; Kuo et al., 2017) as this may result in attracting technology enthusiasts and families with children because of the novelty and entertainment of the devices (Haidegger et al., 2013; Kuo et al., 2017). Accordingly, understanding how satisfaction is affected by the HRI and what characteristics are required of robots has been a topic of interest (Tussyadiah and Park, 2018; Zhong and Verma, 2018). Some robots have an appearance that is friendly to children to encourage interaction.

According to Pinillos et al. (2016), there are two main criteria that robots must have in tourism marketing:

1. robots must offer good service at an affordable price; and
2. robots must perform the tasks with minimal failure.

However, there is other research that suggests that the hospitality consumer expects more than robots offering good, failure-free service to feel comfortable with this emerging technology (Murphy et al., 2017; Tussyadiah and Park, 2018; Zhong and Verma, 2018).

One study found several marketing and user-acceptance implications regarding robot adoption (Murphy et al., 2017). Murphy et al. (2017) found that responsibility and trust, in addition to loyalty to the robot, were afforded when the robot was sufficiently human-like. However, they warned against a robot with an image that falls in the “Uncanny Valley” wherein the robot is viewed as eerily similar to man, but not similar enough. A robot that falls in this Uncanny Valley classification will likely never be adopted (Murphy et al., 2017).

A recent exploratory study gauged the satisfaction of 94 guests from 6 different hotels, which represented the use of roughly 188 robot rooms in China (Zhong and Verma, 2018). Findings revealed high guest satisfaction levels with a stay that they expected to be engaging, cost-effective, interesting, convenient and customized. Notable concerns included safety and privacy, because of the cameras in the robots (Zhong and Verma, 2018).

Another set of recent studies (one online and one laboratory experiment using biosensors) similarly found safety concerns to be of import to customers (Tussyadiah and Park, 2018). These studies were conducted by having individuals watch videos of robots serving customers, so the HRI was not experienced first-hand because of the limited availability of hotel robots. The studies sought to understand customer responses to NAO, a check-in robot; and Relay, a room delivery robot. The first study sought to understand hotel customers’ intention to adopt service robots by examining dimensions of anthropomorphism, perceived intelligence and perceived security (Tussyadiah and Park, 2018). For the check-in robot, NAO, customers were more concerned with anthropomorphism and security. For the room delivery robot, Relay, customers emphasized the importance of perceived intelligence and service operations. In the second study, which used galvanic skin responses, the notable results included security, emphasis on human-like
characteristics and facial expressions, and functionality without failure (the ability of the robot to deliver goods, find its way around the property and offer appropriate suggestions for questions asked) (Tussyadiah and Park, 2018).

A different exploratory study examining customers’ perceptions of Relay suggest there are mixed feelings regarding its use for real-time customer feedback gathering (Chung and Cakmak, 2018). The study methods were in-depth interviews of five hotel administrators from five different hotels that employed the use of Relay. The positive results reported included that collection of real-time issues would be beneficial for the staff for problems to be solved prior to check-out, and guests might be more forthcoming with issues as there would not be a fear of insulting another human. The respondent also intimated that a robot might serve as a good intermediary between the human staff and the customer (Chung and Cakmak, 2018). This finding is consistent with another exploratory study that sought to understand how technology may positively impact a company with real-time service response (Sinarta and Buhalis, 2018). This research demonstrated that real-time service facilitates co-creation abilities and fosters engagement (Sinarta and Buhalis, 2018).

Chung and Cakmak (2018) determined, based on their interviews, that robots may be able to quickly disseminate positive reviews and identify customer dissatisfaction while the customer is still on premises. They suggest that future robot design should incorporate the features that encourage customers to offer feedback in a terse and entertaining manner. They also recommend that the robots alter questions based on type or nationality of the customer. This suggestion is in keeping with research that suggests culture may influence user acceptance of robots (Lee and Sabanovic, 2014).

A major challenge, as one preliminary study of three different cultures demonstrated, is that customers’ perceptions and preferences toward robot design and functions vary from culture to culture. The study was conducted across three geographic areas (South Korea, \( N = 73 \); Turkey, \( N = 46 \); USA, \( N = 99 \)). The findings revealed variability across general attitudes toward robots, preferences of robot form, interactivity, intelligence and sociality (Lee and Sabanovic, 2014). Correlations between these variables and media exposure and religious beliefs were also explored, resulting in a conclusion that acceptance of robots is tied to cultural norms and social dynamics (Lee and Sabanovic, 2014). Lee and Sabanovic (2014) also found that robots with human-like appearances were more apt to create an engaging and fun experience and were most readily adopted by Asian cultures.

Researchers have posited that the advances in AI and robotics will inherently lead to future adoption of the technologies (Mizuta, 2014; Pagliarini and Lund, 2017) resulting in a time where AI and robots will be the producers of many of the hospitality goods and services currently provided by humans (Crews, 2016; Ivanov, 2017).

**Legal and ethical implications**

There are myriad legal and ethical implications that the implementation and use of robots and AI present. The advancing technology of robotics requires new laws to be applied (Burri and Wildhaber, 2016; Calo, 2015; Pagallo, 2013), although many legal principles still apply even to the increasing complexity of robotics and AI (Balkin, 2015; Hubbard, 2014). Some scholars view the use of robots as a legal benefit to the company (Ivanov and Webster, 2017a). The legal benefits of using AI and robots include alleviating the legal burdens associated with hiring, care and firing of human employees. The potential issues that arise from employment, labor and termination contracts of regular (and particularly seasonal) employees becomes moot with robots, as the machines do not have legal rights or limitations as to the number of hours, days, etc., that they can work. This substantially reduces the legal
issues hospitality companies ordinarily face with unions, legal authorities, immigration, injuries, etc., (Ivanov and Webster, 2017a).

However, there are also liability issues that arise with the new technology. Will the robot be established as a legal entity with responsibility for its actions, with its owner, operator and manufacturer contractually protected by releases and hold harmless agreements? The answer is still evolving, as the AI robot has some independence of operation apart from its masters (Bayern, 2015). Liability for injury caused by an AI directed robot is confusing if there are multiple programming authors. Cases show that liability may be limited by contracts, but the law of products liability may allow liability to be maintained against the manufacturer and/or programmer for physical injuries to persons, particularly if the robot is considered a dangerous instrumentality. It is expected that legislation will be required to allocate responsibility among the manufacturer, programmer, operator and the robot itself (Calo, 2011).

The protection of personal information included in the robotic and AI memory is another vulnerability for which the robot and its operators may have liability (Calo, 2010). Consumer protection laws govern liabilities for certain dangerous products, so robots and related emerging technologies should be regulated, though these regulations are not currently in place (Burri and Wildhaber, 2016). As robots have cameras and digital memories, there will also be issues about intrusion into personal privacy during their operation. Protection of personal information and personal privacy are paramount issues in the hospitality business, as is evident from the European Global Data Protection Regulation (EUGDPR) (2018), which went into effect May 25, 2018, and requires all businesses in the European Union to have specified safety measures in place to protect user data. How these policies and practices will impact large and small hospitality organizations that use AI and robotics warrants future study.

The hospitality industry also faces ethical and moral issues with regards to robots and AI. From the digital and material inequalities, robots afford, to the ways in which guests interact with and treat the robots, to the implications of sex-bots in hotels, ethical and moral implications abound (Morgan and Pritchard, 2018; Pritchard, 2018). As early as 2010, researchers were proposing the issues of working alongside robots and the ethical responsibilities that we, as humans, have when working alongside all things (Introna, 2010). The challenge faced is that culturally, physically, emotionally and mindfully, there are few commonalities shared, and bridging the gap and remaining hospitable in the face of these differences (among humans, animals and robots) is the ethical dilemma. Some researchers have even maintained that social robots will need to be treated in the same manner as human customers in the future because they will be able to perform all of the activities that a human can regarding purchasing goods and services (Ivanov and Webster, 2017c).

**Robotics and artificial intelligence theory**

In addition to the *plethora* of marketing (customer service, satisfaction and loyalty), financial resource-advantage theory (Hunt, 2012), organizational behavior (employee retention and employee satisfaction) and various other applicable areas from which hospitality theories derive, there has emerged several noteworthy theories concerning the acceptance and use of robotics and AI in hospitality literature. Because of the verisimilitude of many robots to humans, one of the essential features of a robot is its degree of human likeness or the Uncanny Valley (Broadbent, 2017; Belk, 2016; Mori *et al.*, 2012; Murphy *et al.*, 2017). The Uncanny Valley represents the degree to which another being or object, in this case, a robot, resembles a human being and the emotional response that is elicited in humans because of this likeness. Therefore, the more a robot resembles a human, the more likely humans are to feel comfortable with the robot. However, this relationship is not linear; hence, the valley.
There is a point at which the resemblance is close, but unnatural (or uncanny), eliciting feelings of unease. As the needle moves closer to human resemblance from the uncanny valley, user acceptance again strengthens.

Hospitality research has begun to explore the uncanny valley. One study demonstrated that HRI greatly resembled human to human interaction (Rodriguez-Lizundia et al., 2015). Rodriguez-Lizundia et al. (2015) found that there was greater customer engagement with robots that had anthropomorphic qualities than there was with robots that did not have human-like characteristics or bodies. They also found that eye-contact engendered even greater levels of engagement between the human and the robot and fostered curiosity and exploration of functionality. The current advances in robotics technology, particularly as integrated with AI capabilities, are producing remarkably human-looking and human-acting robots, even adopting personality traits of the persons from who they are learning. The dilemma may shift from the uncanny valley of working with semi-human robots to the ethical implications of robots that look, act and make decisions like humans. Futurists are in conflict on the risks that this may entail for human to robot interactions.

Service scholars have also taken the technology acceptance model (TAM) (Davis, 1989), which identifies the customers perception of the technology’s ease of use and its usefulness as influences on attitudes toward using and ultimate determinants of the actual system use. Recent scholars have proposed a service robot acceptance model (sRAM), which incorporates the features of the TAM model and adds subjective social norms and social-emotional elements (perceived humanness, perceived social interactivity and perceived social presence) with relational elements (trust and rapport), which all impact customer acceptance of robots and ultimately dictate the actual use of robots (Wirtz et al., 2018).

Finally, service scholars have identified the USUS evaluation framework in which a human-centric perspective is used to evaluate the robot-human interaction. This framework highlights the usability, social acceptance, user experience and societal impact of the robots and may be used in a hospitality context to evaluate customers’ perceptions of service robots (Weiss et al., 2009). Tung and Au (2018) conducted a thematic analysis of user responses to flesh out the five dimensions for evaluating the user experience of the HRI. They identified embodiment, emotion, human-oriented perception, feeling of security and co-experience as the five pivotal attributes that comprise the evaluation of the human-robot interaction (Tung and Au, 2018).

**Future of artificial intelligence and robotics**

The high cost of labor in the hospitality industry has scholars anticipating the adoption of technology to help with these expenses (Gursoy, 2017). The World Economic Forum has lofty projections for the infusion of robotics and AI into the hospitality industry (2017). The prediction for the state of the industry by 2025 is that one out of every 11 jobs in the hospitality and tourism workforce will be replaced by intelligent automation, and that this technology will alter the description of some jobs and completely eliminate the need for others (Huang and Rust, 2018; Frey and Osborne, 2017; Wirtz et al., 2018). Additionally, within the next five years, technologies including robotics and AI are expected to impact the skill set needed to succeed as a human worker in the hospitality industry—a shift toward social skills, cognitive abilities and systems-related skills are postulated. Future financial projections include $780,000 added due to displaced hotel and airline jobs, particularly on the front-line; $305bn in value-added because of streamlined and increased productivity and capacity usage; $100bn in value migration of new players in the hospitality arena; and $700bn in value-addition to society because of the time and financial savings passed on to others.
customers and savings elicited by security and other reductions (World Economic Forum, 2017).

Academic research studies have already begun to identify potential competitive advantages gained through new developments in the customer experience afforded by properly implementing robotics and AI in the hospitality scape (Kuo et al., 2017; Noone and Coulter, 2012). The challenge will be to move from a human-generated experience toward a customer-centric model that relies heavily upon IT solutions to customize the travel and tourism experience (Deloitte, 2018). Some scholars argue that robots will become a commodity (much like ATM’s at a bank), but that gaining a competitive advantage from robots is unlikely in the near future (Wirtz et al., 2018). Understanding whether or not and how hospitality and tourism customers will accept and engage with robots and AI is vital for their adoption and success (Noone and Coulter, 2012). For AI and robotics to successfully take hold, a shift in organizational structure management training may be required (Cobos et al., 2016). While there is still a great deal of room for exploration, several scholarly pioneers have begun to examine scenarios in which robotics and AI might gain a foothold and become a mainstay.

Kuo et al. (2017) found that the Taiwan hospitality industry may be ripe for the implementation of robotics and AI due to the importance the industry places on these advancements in conjunction with the availability of government funding (Chen, 2011). In keeping with other previous findings (Barrett et al., 2015; Melian-Gonzalez and Bulchand-Gidumal, 2016), these authors maintain that the success of implementation is contingent upon the hotels’ strategic position in the given market and may include expansion into new markets. The researchers conclude that the use of service robots should be expected to increase in the near future due to the lucrative and cost-reducing nature of the revenue model (Kuo et al., 2017).

Noone and Coulter (2012) have recommendations for implementing robotics and AI in the quick service environment. They maintain there are two pivotal issues with which practitioners must be concerned concerning robotics use and the quick service restaurant environment. The first is that practitioners should look beyond simply replacing the labor force with technology (robot chefs and self-service kiosks) and envision ways in which the robots and AI may supplement the manpower in the establishment to make the service better. The second area of consideration is the financial investment needed to implement and use these technologies, as the profit margins on many quick service establishments are already very small (Noone and Coulter, 2012).

Scholars recommend that robotics and AI be used in the future to buttress against the temporal variance that inherently results from humans, in addition to adapting task plans to be dynamic to facilitate the human worker and robot worker interaction (Cesta et al., 2018). While there will naturally be job elimination due to the use of AI and robotics in the hospitality industry, researchers assert that the transition to a more streamlined operation has historically created more jobs than it has eliminated, as new types of jobs playing on uniquely human capabilities will be required (Smith and Anderson, 2014). Additionally, Smith and Anderson (2014) write that the elimination of mundane tasks will help to cultivate a future workspace that is more engaging, meaningful and interesting. Robotics and AI may help industry practitioners deliver an enhanced customer experience by using the technology to assist with the complexities of the operations (Gursoy, 2017). Grönroos and Ravald (2011) maintain that customers co-create their experiences with robots and this self-service format will be inspired by curiosity and result in fun and enjoyment. From a human resources perspective, workers should be relieved from mundane work and shifted to more creative and satisfying jobs.

Scholars warn, however, that this next iteration of technology will likely impact white-collar positions and lower paying service industry jobs, where previous technological
advances have affected blue collar jobs. They also suggest that the hospitality educational environment adapt quickly to better equip the future hospitality workforce with the tools necessary to succeed in this technologically robust environment (Smith and Anderson, 2014). Hospitality educators must teach students to play well with robots.

**Future research**

While the research on AI and robotics in hospitality is certainly gaining traction, there are still myriad avenues of study begging to be explored and explained. Gursoy (2017) asserted that a significant research stream will continue to focus on robotics and AI adoption and customer acceptance of those technologies. Other researchers (Tung and Au, 2018; Tung and Law, 2017; Wirtz et al., 2018; Zalama et al., 2014) expand on the importance of future research exploring the human-robot interaction, with an emphasis being placed on human-centered experiences and the techniques required to combat the inevitable technological issues that will arise. For example, researchers could examine the environmental perception, psychological knowledge representations, and visual and voice recognition issues that will result from the implementation of robots (Zalama et al., 2014).

Murphy et al. (2017) recommend investigating engagement between a human customer and hospitality robots, as this is critical for understanding the human-robot interaction and will impact customer service. Ivaldi et al. (2016) propose examining attitudes and personality traits as indicators of user comfort and acceptance. Because there is an uncanny valley into which robots may fall, the physical ways in which customers best engage with robots needs to be understood. Ways to facilitate human robot interaction and engagement warrant further study (Murphy et al., 2017).

Researchers also recommend exploring technology management as a stream of research. The application of the popular service quality measure SERVQUAL has been suggested to be applied to robot service quality with one lens exploring the robot as an employee and one lens exploring the robot as a self-service apparatus (Bowen and Whalen, 2017). Understanding how robots impact the customer through the service quality they provide has implications for driving marketing outcomes (Cronin et al., 2000).

In addition to the service components, the financial impact of implementation merits the attention of future research (Ivanov et al., 2017). Ivanov et al. (2017) highlight several key focal areas for hospitality businesses that wish to adopt and implement this technology. Future research topics include: the financial impact of adoption and automation; the physical and emotional readiness of companies to substitute machines for human workers; the perceptions of key stakeholders including customers, employees and managers of the technology; the impact on service quality of AI and robot usage; the impact the technology has on the business’ competitive advantage; and the ethical implications of robot usage (Ivanov et al., 2017).

Because the combination of cloud robotics and robotic navigation enable a robot to plot a course around the property (Hu et al., 2012), future research could identify the unique features of robotic path planning that may enhance or facilitate the guest experience (Floreano and Wood, 2015). Contextual examples include backpacking, hiking and climbing, which are all reliant upon mapping (Floreano and Wood, 2015). All of the aforementioned future research streams help formulate the foundation for strategic marketing that hospitality and tourism entities may use to gain a competitive advantage and capture new customer segments (Bitner et al., 2002; Scherer et al., 2015).
Conclusion
What is evident above all else, is that robotics and AI are no longer relegated to the realm of science fiction. They are already permeating hospitality and tourism organizations and the evidence points largely to their continued and growing presence in this industry. In the future, managers will need to have sufficient technological skills to understand robotics and AI applications to maximize the potential benefits and efficiencies of such systems. This is not an insurmountable task, but failure to stay aware and capable of managing technology will result in falling behind better-prepared competitors.

One key takeaway is that a human plus technology is the winning formula. Persons must be trained to work with and around their robotic support staff, to use their Artificial Intelligence and to continuously improve guest experiences through enhancement of AI and robotic devices. These are the things we know. What we do not know is what technology and algorithms of the future will bring. Learning and adaptation must be perpetual.

The good news is that the hospitality and tourism skills of today’s industry leaders are still of utmost importance. The skills valued today are those of excellent personal service – this will not change. Today’s managers should interact with the producers of technology to result in humanized robotics and AI systems, which are friendly and create an enjoyable experience. Tourism professionals are best positioned to assist with creating the enhanced experiences available in AI and robotic service devices. People skills are still extremely important for a successful system. Hospitality experts must interact with the technology producers to create robots and AI with excellent people skills. Therefore, hospitality and tourism human professionals will remain valuable and essential parts of the hospitality and tourism industry of the future.

References


Further reading


Appendix

- Tourism, Leisure and Hospitality Journals Considered in this Study (listed alphabetically)
  - Acta Turistica
  - Advances in Culture, Tourism and Hospitality Research
  - Advances in Hospitality and Leisure
  - African Journal of Hospitality, Tourism and Leisure
  - Anatolia: An International Journal of Tourism and Hospitality Research
  - Annals of Applied Sport Science
  - Annals of Leisure Research
  - Annals of Tourism Research
  - Applied Geography
  - ASEAN Journal on Hospitality and Tourism
  - Asia Pacific Journal of Tourism Research
  - Bridging Tourism Theory and Practice
  - China Tourism Research
  - Cities
  - Cornell Hospitality Quarterly
  - Cuadernos de Turismo
  - Current Issues in Tourism
  - DETUROPE
  - e-Review of Tourism Research
  - European Journal of Futures Research
  - European Journal of Tourism Research
  - European Sport Management Quarterly
  - Event Management
  - FIU Hospitality Review
  - Geographica Pannonica
• Hospitality and Society
• Hotel Management
• Information Technology and Tourism
• Information Technology in Hospitality
• International Conference on Virtual Rehabilitation, ICVR
• International Journal of Contemporary Hospitality Management
• International Journal of Culture, Tourism, and Hospitality Research
• International Journal of Event and Festival Management
• International Journal of Heritage Studies
• International Journal of Hospitality and Tourism Administration
• International Journal of Hospitality Management
• International Journal of Religious Tourism and Pilgrimage
• International Journal of Retail and Distribution Management
• International Journal of Services, Economics and Management
• International Journal of Sport Policy
• International Journal of Tourism Anthropology
• International Journal of Tourism Cities
• International Journal of Tourism Policy
• International Journal of Tourism Research
• International Travel Law Journal
• Journal of China Tourism Research
• Journal of Convention and Event Tourism
• Journal of Ecotourism
• Journal of Foodservice
• Journal of Foodservice Business Research
• Journal of Heritage Tourism
• Journal of Hospitality and Marketing Management
• Journal of Hospitality and Tourism Education
• Journal of Hospitality and Tourism Management
• Journal of Hospitality and Tourism Research
• Journal of Hospitality and Tourism Technology
• Journal of Hospitality Financial Management
• Journal of Hospitality Marketing and Management
• Journal of Hospitality, Leisure, Sports and Tourism Education
• Journal of Hospitality, Tourism, Leisure Science
• Journal of Human Resources in Hospitality and Tourism
• Journal of Leisure Research
• Journal of Outdoor Recreation and Tourism
• Journal of Place Management and Development
• Journal of Policy Research in Tourism, Leisure and Events
• Journal of Quality Assurance in Hospitality and Tourism
• Journal of Service Management
• Journal of Sport and Tourism
• Journal of Sustainable Tourism
• Journal of Teaching in Travel and Tourism
• Journal of Tourism and Cultural Change
• Journal of Tourism History
• Journal of Travel and Tourism Marketing
• Journal of Travel and Tourism Research
• Journal of Travel Research
• Journal of Vacation Marketing
• Leisure Sciences
• Leisure Studies
• Leisure/Loisir
Progress on technology use in tourism

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Abstract
Purpose – With the rapid development and implementation of cutting-edge information technologies in tourism and hospitality, it is necessary to update the progress of technology use in the past 18 years and set up research agenda for future research. By adopting information systems (IS) as a reference discipline, this paper aims to create a literature review of technology and tourism papers around the theme of use.

Design/methodology/approach – Following the systematic literature review process of Aguinis et al. (2018), 314 papers were downloaded to determine how they applied the concept of technology use.

Findings – Three themes about technology use emerged: types of processing, organisational use and users. Among various types of technology processing, interactive and online are largely addressed in the tourism and hospitality literature. The organisational use theme explores how the competitive and strategic use of technology provides management support for organisations. There was a large amount of research focussed on direct users, such as individual characteristics, user attitudes and user behaviour. The theories of technology acceptance model and unified theory of acceptance and use of technology have been widely applied in these studies.

Originality/value – This paper provides a review of key issues which has been discussed in tourism research in relation to technology use. By applying the scheme developed in the IS discipline, this study provides new insights into the development of technology in tourism. In addition, it also gives us the opportunity to suggest a research agenda by identifying research gaps and future research collaboration opportunities between these two fields.

Keywords Tourism, Technology use, Information systems, Users, Organizational, Processing

Paper type Literature review

摘要

研究目的 - 随着尖端科技在旅游和酒店业中的快速发展和应用, 我们有必要审视过去18年中科技使用的进展, 并且为未来研究确立方向。采用信息系统（IS）作为参考标杆，本论文旨在建立围绕科技使用和旅游业的文献综述体系。

研究设计/方法/途径 - 本论文采用系统文献综述法（Aguinis et al, 2018），共314篇文章被审阅, 以确立科技使用概念如何被研究应用。

研究结果 - 三种有关科技使用的主题被确立：处理类型、组织使用、用户。在各种科技处理类型中，互动性和线上的方式在大多数旅游酒店文献中被研究。组织使用主题开拓了科技的有利和策略的使用如何为组织提供管理支持，文献有很大一部分集中在研究在直接用户身上，比如用户个人特点、用户态度、用户行为。TAM和UTAUT理论在这些研究文献上被广泛使用。
1. Introduction
Information technology (IT) use is one of the most explored areas in tourism technology since the 1980s (Buhalis and Law, 2008). With the rapid development and implementation of cutting-edge information technologies in tourism and hospitality, it is necessary to update the progress of technology use in tourism in the past 15 years, and set up research agenda for future research. In the past 18 years, there have been other review articles in a similar vein carried out (Buhalis and Law, 2008; Law et al., 2009; Leung et al., 2013; Navío-Marco et al., 2018). While some reviews focus on the specific use of mobile technology and social media in the tourism industry (Liang et al., 2017; Leung et al., 2013) others provide a more generic overview of the advancement of eTourism in this timeframe (Buhalis and Law, 2008; Navío-Marco et al., 2018). In contrast to these review papers, our paper specifically focusses on the technology use in tourism. Technology use has been recently touted as among the most central constructs in the information system (IS) discipline (Straub and del Guidice, 2012). Subsequently, we believe a similar approach can be taken from a tourism technology perspective. Adopting IS as a reference discipline (Baskerville and Myers, 2002) enables a rigorous and comprehensive understanding of the progress on tourism technology use. Therefore, in this article, we aim to create a literature review of technology and tourism around the theme of use. The next section introduces the systematic literature review process followed in this research. The subsequent sections outline the key findings of the literature review process. Finally, the conclusion summarises the key research gaps and suggests opportunities for future research.

2. Methodology
We followed the systematic literature review process of Aguinis et al. (2018) as detailed below.

2.1 Step 1: determine goal and scope of review
The aim of this literature review focuses on the technology use, which has been recently touted as among the most central constructs in the IS discipline (Straub and del Guidice, 2012). We apply this in the context of tourism research.

2.2 Step 2: determine procedure to select journals considered for inclusion
We downloaded papers from the following journals: Journal of Travel Research (JTR), Tourism Management (TM), Annals of Tourism Research (ATR) and Journal of Sustainable Tourism (JST). These tourism journals were selected based on their high rankings (4-star Academic Journal Guide 2018) within the Association of Business School’s (ABS) journal rankings. We also selected two key specialised technology and tourism journals, the Journal of Hospitality and Tourism Technology (JHTT) and Information Technology and Tourism (ITT). We also reviewed six review papers in this domain.

We downloaded papers based on a keyword search of “technology” within the title, abstract, or keywords for each journal using Scopus. We acknowledge that this keyword search may not retrieve all relevant papers, but it is the most widely used keyword and is
often part of other terms such as “Information and Communication Technology”. Using this keyword also provided a more manageable sample. We downloaded papers from the years 2000 to October 2018 from Scopus (to ensure the most current research was included). The total number of papers downloaded for each journal is illustrated in Table I.

2.3 Step 3: calibrate source selection process through inter-coder agreement
Downloaded articles were then imported into NVivo for analysis. We ran a keyword query of the papers using the “use” keyword list from Barki et al. (1993) and use terminology from Burton-Jones et al. (2017). Based on the keywords discovered by the query, we then manually checked to see if the keyword was used in the correct context. If the context was incorrect, then the paper was disregarded. The authors discussed the keywords and the context to ensure that we were in agreement for a paper to be included or disregarded. The list of keywords used, and the number of codes matched to them, can be found in the Appendix.

2.4 Step 4: select sources using process identified in step three
Each author took a sub-section of the keyword list and reviewed all papers within that section across all years and all journals:

- Author 1: Organisational Use of IS
- Author 2: Type of Support, Type of Processing
- Author 3: Users

Note: our keyword query did not find any papers from the sub-section type of IS access.

2.5 Step 5: calibrate content extraction process through inter-coder agreement
All authors read samples of the other authors’ codes and discussed and compared notes from the selected articles, and to ensure that we addressed the evidence of our codes within the correct context.

2.6 Step 6: extract relevant content using multiple coders
Each author read the full text of each paper coded within his or her sub-section and made notes about how to ensure the code was being used correctly. Based on themes emerging from the coding process, each author re-structured and grouped their codes to ensure papers with a similar context and code were considered together. For example, we found that some papers within the “Type of Support” category were better suited in the “Organisational Use” or “Users” category, based on the focus of each paper. All authors then reviewed the coding

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<tr>
<th>Journal</th>
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Table I. Number of papers downloaded
structure and agreed on the recommendations made by each author. All authors agreed on the common themes found in the paper and used this to structure the literature review.

3. Type of processing
IS can facilitate information processing, which includes data collection, processes for data analysis, knowledge transfer, and information display for organisations and consumers. In our sample, we found tourism papers predominantly explored this from an interactive, online and real-time processing perspective.

3.1 Interactive
Interaction, among other factors, is an important issue for tourism, for example, e-commerce hotel bookings (Bilgihan et al., 2014), and social media marketing efforts (Tatar and Eren-Erdoğan, 2016). In an early study of the use of the internet in travel agents, Buhalis and Licata (2002) argued that tourism intermediaries must reengineer their business processes to remain competitive. Many of the studies examined interactivity from a tourism marketing perspective. Özturan and Roney (2004) examined the Internet use of travel agencies in Turkey, and found that their websites did not have the interactive features required for Internet marketing. Young Chung et al. (2011) explored the use of interactive thematic maps on tourist perceptions, using a network analysis. They found that interactive maps can play an important role in tourists’ planning behaviour, and for online tourism marketing. Online interactive processing of information as used by marketers can also apply to other technologies such as virtual worlds used for building destination images (Huang et al., 2013), or to knowledge-based network participation in destination and event marketing (Breukel and Go, 2009). Interactive reservations received through direct channels and online travel agencies cause tourism service providers to interface with new intermediaries (Digiorgio, 2016), whereas smart tourism destinations improve the co-creation of tourism experiences and encourage greater interaction with tourists, and sharing of experiences (Buonincontri and Micera, 2016).

Other uses of interactivity were studied by image research and mobile devices. From the differences and commonalities between images of destinations, Govers et al. (2007) presented an interactive measurement approach for image research. From a study of mobile device use in private clubs, Morosan and DeFranco (2014) linked club members’ demographic and behavioural characteristics to their use of mobile devices in clubs. There were a number of differences between the types of clubs, as well as the origins of the participants. More recent studies of interactivity have focussed on interactive decision-making tasks to find a destination to travel as a group (Delic et al., 2018) and the impact of digital technology on public governance processes for destination management (Kalbaska et al., 2017).

3.2 Online
Online was by far the most common type of processing in our sample and from a very wide range of topics. We were able to categorise our sample into further, but related, categories:

- **Information sharing** – in the earliest research, electronic word of mouth (eWoM) was considered as a cost-effective means for tourism and hospitality marketing, but ethical issues must be considered to engage with eWoM technologies (Litvin et al., 2008). However, it is useful for targeting new customers and planning effective marketing strategies (Rong et al., 2012). User-generated content (UGC) has increasingly been considered a credible form of eWoM (Stepchenkova and Zhan,
and the sharing of videos has become more popular as a means to mediate tourist experiences (Tussyadiah and Fesenmaier, 2009). Photos are also a popular means of information sharing. People who post photos online tend to have higher incomes, are better educated, and from younger generations (Lo et al., 2011). Other forms of UGC include blogs, which can be used to help build a destination image (Tseng et al., 2015). Online information sharing can also be considered to model behavioural intentions to follow online travel advice from online communities (Lee and Hyun, 2015). These sources of information online can be further categorised in terms of specialisation, endorsement and other users’ star ratings (Choi et al., 2018). Two other examples of information sharing in tourism focussed on interoperability solutions for online tourism distribution (Reino et al., 2016) and the effect of management response in engaging customers (Li et al., 2017).

- **Information gathering** – initial research of technology use in tourism focussed around the apprehension toward Internet use (Susskind et al., 2003) for gathering information for tourism purposes, i.e. trip planning. In 2005, an analysis was completed to understand how information search for travel information behaviours evolved (Beldona, 2005). Earlier research also focussed on the accessibility of information online for disabled tourists (Shi, 2006) and how to identify the challenges and potential solutions for online marketing of travel destinations (Xiang et al., 2008). Another stream of research focussed on the representation of information online and the understanding of travellers’ information needs as expressed through search engine queries (Xiang et al., 2009) and the effects that online information search had on tourists’ destination image development (Li et al., 2009), destination image formation (Llodrà-Riera et al., 2015) and how tourists’ search for information through alternative channels for more authentic and profound experiences (Xiang et al., 2015). More specific types of information are also sought, for example, for the promotion of sustainable tourism for visiting world heritage sites (Garbelli et al., 2017) and for exchanges between hosts and guests in the sharing economy, for example, couchsurfing (Germann Molz, 2013). While all of these studies focussed on the tourist or manager perspective, one study focussed on the gathering of information by using advanced IT for fire detection systems for protecting cultural heritage tourism resources (Joo et al., 2009).

- **Websites** – an important tool related to information sharing and information gathering is the website. We found examples of tourism research from our sample which specifically discussed issues relating to the influence of website characteristics for planning a trip, (Kaplanidou and Vogt, 2006), how the design of a hotel website influences appeal and likelihood to purchase (Bender Stringam and Gerdes, 2010) and how tourism websites influence consumer innovativeness for information search, purchasing and communication (Couture et al., 2015).

### 3.3 Real time

Real time processing is another, although less researched area of technology use in tourism, but is an important issue, especially regarding the use of mobile travel services (Bouwman et al., 2011). From the perspective of creative tourism, Ihamäki (2012) explored the use of geocaching in adventure tourist destinations, and provided broader implications for adventure tourism. Joo et al. (2009) examined a real time fire detection system for protecting cultural heritage resources. Daigle and Zimmerman (2004) described visitor characteristics using real time bus information, to address
transportation problems. Zheng et al. (2017) focussed on the prediction of a tourists’ next location using GPS. Their research contributes towards tourist attraction administration and real time crowd control. Recognising the importance of this area, Hardy et al. (2017) developed a methodological approach for tracking tourists’ movements through smartphones and global positioning systems.

4. Organisational use
Recently, a paper manifesto arising out of a JITT conference identified pivotal research topics in eTourism (Werthner et al., 2015), in this paper the authors paid special attention to the increasing strategic use of IT in Tourism. For this reason, in this paper, we also include organisational use of IT as one of our key topic areas. From our analysis of the organisational use of IS, we found research relating to support, competitive IS and strategic IS. Organisations, regardless of the industry they operate in, their location or size, depend on the strategic use of IS to become and remain competitive. In particular, technology affects competitive advantage as it determines the relative cost position or differentiation of organisations (Buhalis, 1998; Arvidsson et al., 2014).

4.1 Corporate or management support
The number of papers which focussed on corporate support or management support for ICT was sparse, and from a wide range of technologies and domains. Technology adoption that entails the commitment of substantial resources is typically viewed as a strategic decision by top management (Cheng and Lok, 2015). In their study, the authors found that the recognition of the ability of IT to generate revenue and reduce costs was vital before management support could be sought for any investment in new IT (Cheng and Lok, 2015). In a comparative study, Reino et al. (2011) found there were differences in inter-firm technology adoption in rural and urban accommodation establishments in Scotland. They use their study to theoretically explain different levels of adoption between the two settings. Additionally, from a corporate level of support, travel intermediaries can use ICT to maintain a competitive advantage, obtain information capabilities and focus on their critical success factors to enhance travel supply chains through inter-organisational collaboration (Lin, 2016). In the food service industries, managers use multiple ICT innovations, and differing rates of diffusion stages than was previously thought. IT adoption and implementation in this industry also related to significantly sufficient capital (Fareed Ismail et al., 2013). Tourism managers may use Internet-based marketing decision support systems. The use of these systems is highly dependent on a manager’s perceived ease of use, perceived usefulness, their experience in using similar systems, their attitude to ICT in general, and the complexity of the task and time pressures in the work environment (Woeber and Gretzel, 2000).

4.2 Competitive information system
There is a dual focus in the competitive use of IS, that of the enhancing the guest experience and of improving the revenue of tourism organisations through the more innovative use of technology.

In the first instance, Bilgihan and Wang (2016) interviewed vice presidents, CTO/CIOs of hotels, CEOs of hospitality technology vendors and academics who focus on hospitality technology research. They found that IT-induced competitive advantage is possible when hotels choose to integrate all the possible technologies in the organisation with a harmony that creates synergy. Similarly, another study announces a paradigm shift away from away from management-facing technology to the new customer-facing technology, where the
customer’s expectation of technology is at the forefront (Coussement and Teague, 2013). Another study examined the use of interactive mobile technologies in enhancing the experiential value of guests (Zhu and Morosan, 2014). Tajeddini and Trueman (2014) provided a slightly different view, they investigated the role that national culture can play in using innovative technologies to retain competitive advantages.

The uptake of e-commerce has been well accepted as a means of gaining competitive advantage in the tourism industry (Kim et al., 2009; Tsai et al., 2005). In terms of new technologies enhancing competitiveness from a management perspective, Buhalis and Licata (2002) discussed how traditional eMediaries must reengineer their business processes to survive and remain competitive by embracing the 3 new ePlatforms - the Internet, interactive digital television and mobile devices. Similarly, Hönken et al. (2015) discuss a novel way to utilise business intelligence to increase the competitiveness of a Swedish mountain destination. Okumus (2013) discussed how organisations can facilitate knowledge management (KM) and thus gain a competitive edge through IT tools. To achieve this, hospitality organisations not only need to create a supportive organisational culture and structure, but also train and motivate their team members to manage knowledge through IT applications. Another study investigated how social networks can become the primary tool for promoting tourist destinations and reaching a wider range of potential visitors to create competitive advantage in the market (Di Pietro et al., 2012).

A study based in Taiwan found different types of travel operations have different evaluation considerations for an application service provider (ASP) adoption. Travel intermediaries can devote to their core competencies, and acquire information support services through an ASP. On the other hand, ASPs can use differentiation strategies and allocate limited resources by focussing on these critical success factors to enhance inter-organisational collaboration in the travel supply chain (Lin, 2016). Further studies focus rather more on more explanatory factors that relate to improving competitiveness, for example, why do tourist organisations adopt e-Marketing (El-Gohary, 2012), why are internet based marketing decision support systems successful (Woeber and Gretzel, 2000). Interestingly, the majority of these studies rely on the Technology Acceptance Model (TAM) (Davis, 1989) to provide theoretical support for their studies.

4.3 Strategic information system

The continuing development and widespread adoption of IT have deeply influenced the tourism and hospitality industry, especially on a strategic level (Kim et al., 2008; Garces et al., 2004).

Cabiddu et al. (2013) examined how IT enables value co-creation and strategic advantage in tourism and why some players appear to appropriate the value co-created in the partnership more successfully compared to others. Similarly, Buonincontri and Micera (2016) discuss how involving tourists as active co-creators of their own experiences has given rise to a new kind of destination, a smart tourist destination, where technologies are so embedded in all tourist experiences that leads to the increased competitiveness of the destination. The importance of maintaining a successful network of actors is important for this to occur, Breukel and Go (2009) suggested that modern ICT may offer support to establishing hospitality networks that shape a physical and virtual environment for the delivery of services to developing client demands. Some studies indicate the importance of using technologies in a strategic manner especially in terms of social media and online presence. For example, Leung et al. (2017) and Wozniak et al. (2017) examined the importance of strategic social media message strategies while Baggio et al. (2011) focussed on general online web presence strategies. Also important are other IT solutions such as the
adoption of interoperability solutions for online tourism distribution (Reino et al., 2016), the vast number of applications that near field communication technologies have for the tourism industry (Egger, 2013), the use of intelligent context-aware recommender system that takes into account temporal and social context in tour guide applications (Meehan et al., 2016) or the strategic use of Customer Relationship Management systems in tourism as a whole (Vogt, 2011; Mohammed et al., 2017).

The use of ICT to promote sustainable tourism has garnered some attention from scholars too (Ali and Frew, 2014a, 2014b; Garbelli et al., 2017; Isacsson and Gretzel, 2011; Ali and Frew, 2014a, 2014b). Ali and Frew (2014a, 2014b) talked about the ability of ICTs to provide novel ways of approaching marketing, energy monitoring, waste management, and communication for destinations, while Garbelli et al. (2017) suggested how ICTs could be used in order for a destination to offer a proper and complete online communication, to educate travellers about the several implications of being a WHS and about a sustainable and responsible behaviour in case they choose to visit it. Finally, Isacsson and Gretzel (2011) discuss how Facebook can be used to engage students in learning about sustainable tourism. On the other hand, we only found a few studies that looked at the use of ICTs for strategic purposes in destination marketing (Buhalis, 2000; Ali and Frew, 2014a, 2014b; Gon et al., 2016; Dickinger and Lalicic, 2016).

Another thread in this area of research was exploring what kinds of firms are more likely to embrace different types of technology for strategic purposes. Spencer et al. (2012) explored the factors influencing the decision to engage in technology adoption in small owner-managed travel firms. El-Gohary (2012) indicated that environmental pressures significantly affect the perceived benefits and barriers of e-commerce adoption, in addition to having an indirect effect on adoption behaviour in tourism SME’s in developing countries. Siguaw et al. (2000) concluded that luxury and upscale hotels adopted more IT than economy and budget hotels. Eugenia Ruiz-Molina et al. (2013) explored the use of ICTs in established and emerging tourist areas. They found that the reasons for making use of ICT may differ: while hotels located in established tourist destinations may use technology to differentiate themselves from the competition in the local market, hotels in emerging destinations may try to attract Western tourists who are looking for something different. Finally, Hsu et al. (2016) explored how established inbound tour operators are increasingly forced to embrace technology-enabled innovations to keep up with their increasingly digital savvy tourists.

Studies also found that the use of IT does not occur in a uniform manner; instead, there are different stages of adoption within organisations. For example, Yuan et al. (2006) found that advancements in IT in American convention and visitor bureaus did not spread uniformly across four information activity dimensions and appear to occur in five recursive and sequential stages, namely: substitution, enlargement, gestation, reconfiguration, and setback. Fareed Ismail et al. (2013) investigated how three organisational factors – affiliation, sufficient capital and company age – related to 323 Malaysian foodservice companies’ diffusion of six IT applications. Their study highlights multiple diffusion stages for multiple technological innovations in organisations.

5. Users
ISs are used by users at all levels of an organisation and can provide various types of support. There was a large amount of research focussed on users and sub-categories such as individual characteristics, user attitudes, user support and end-user attitudes and behaviour.
5.1 Individual characteristics
Studies find that individuals’ backgrounds, demographic profiles and intentions largely determine the various patterns of technology use. Comparing the differences between travellers from Australia, China and the US in terms of technology readiness (TR) and customer satisfaction with travel technologies, Wang et al. (2016) found out the relationships between perceived quality and satisfaction of technology-enabled services, overall satisfaction, and further behaviour were stronger among travellers with high TR and varied across countries. San Martin and Herrero (2012) found that the higher level of innovativeness of users, the more likely they purchase rural tourism products. Darley et al. (2017) investigated senior caravan travellers’ characteristics and behaviours for SNS use in Australia.

Segmentations are proposed to develop a more strategic targeting plan in various contexts. Four user categories of mobile travel services were identified by Eriksson (2014) to provide insights for travel service providers. Lalicic and Weismayer (2016) categorised three types of tourists in terms of their emotional engagement with their mobile phones. Yuan et al. (2003) classified American convention and visitor bureaus into five adopter groups, and two paths of technology use. Morosan and DeFranco (2014) used actual mobile devices data to offer a systematic operationalisation to distinguish private club members’ behavioural and demographic characteristics in different types of clubs as well as different regions in the USA. Using cluster analysis, Lo et al. (2011) classified five cohorts of users in terms of different travel motivations, demographic profiles and the choice of online platforms to share travel photos. This finding provides implications for destination promotions.

5.2 User expectations
User expectations of technologies have been widely explored in various contexts. In the context of e-learning in the tourism and hospitality course, students’ expectations from Egypt are influenced by interpersonal, external and instructor these three social factors (Abbas, 2016). Some studies provide implications for organisations to meet users’ expectations. By gaining emotional insights of passenger’s airport experiences, Straker and Wrigley (2016) suggested airports can generate suitable digital channel engagement content to meet passengers’ expectations. On a conceptual level, Coussement and Teague (2013) addressed the paradigm shift from management-facing technology to the new customer-facing technology in the hospitality industry. This helps the industry better manage customers’ expectations by developing suitable mobile technologies.

Providers are required to integrate desirable features when developing new technologies to meet users’ expectations. In the tourism and hospitality context, user requirements focus on conditions and criteria to develop new applications. Content requirement, functional requirement, comfort, experience and resistance are significant user requirement for developing the wearable AR museum application (tom Dieck et al., 2016). Given the heavy reliance of location-based recommendation in tour guide application, Meehan et al. (2016)’s study found that environmental, temporal and social these three contextual conditions at a significantly higher level of influence in mobile recommender systems.

5.3 User support
In terms of research into ICT from a perspective of user support, studies investigated the supportive role of interactive mobile technologies in hotel guests’ facilitation of transactions. The adoption of these technologies can mediate the experiences of guests in hotel service settings, with importance placed on cognitive absorption, playfulness, and security (Zhu and
Morosan, 2014). Virtual worlds, such as Second Life, can provide visual 3D representations of destinations, and have also been used in the travel and tourism industry for marketing tourism destinations and business management. The experience and behavioural intentions of tourists’ to use virtual worlds is related to positive emotions, enjoyment, emotional involvement and flow experience. Social media sites also allow for visual representations of destinations through UGC such as the sharing of images. UGC has become a new and credible form of word of mouth, as tourists share their images and travel experiences with their social networks. The types of images uploaded by destination marketing organisations, when compared with those uploaded by users, can provide a useful means for tourists’ destination image (Stepchenkova and Zhan, 2013). Ribeiro et al. (2018) explored the potential of mobile technologies can provide supports for disabled tourists to engage in tourist activities.

5.4 End-user attitudes and behaviours
When looking at consumers, most studies focus on direct users and end-users given the increasing user confidence and the improvement from providers. Influential factors of consumers’ intentions and satisfaction were largely explored in the context of online reservation systems (Kim et al., 2006; San Martin and Herrero, 2012; Gregorash, 2016), firm-hosted online travel communities (Casaló et al., 2010), implementation of eVisa (Çakar et al., 2018), and registered traveller biometric system in air travel (Morosan, 2013). Other research has explored the factors affecting intentions for online purchasing generally (Amaro and Duarte, 2015), and more specifically the intentions of purchasing flights from low-cost carrier websites (Escobar-Rodriguez and Carvajal-Trujillo, 2014). Oppositely, Huertas (2018) and Dinhopl and Gretzel (2016) look at how the use of new technology (videos) influence and construct tourists’ travel behaviour and experiences. Related to consumer behaviour, the idea of trust has been emphasised (Agag and El-Masry, 2017; Kim et al., 2017) when perceiving new technologies. Content providers, such as tourism boards, are considered the able information providers, however, UGC appears to be the most trustworthy, although not necessarily the most informative (Dickinger, 2011).

TAM has been widely adopted to discuss users’ attitudes and behavioural intention. It has been utilised as a theoretical construct to understand factors that influencing users’ attitudes and intentions of technology use, such as the interrelationship of travellers’ attitudes towards travel mobile applications with utilitarian and hedonic motivations, and self-identity (Young Im and Hancer, 2014), gender differences in terms of technology acceptance in the high-power conditions (Zhang et al., 2014), factors that influence tourists’ acceptance of mobile electronic tourist guides. TAM also used as a useful model to explain why many customers not using mobile applications from the hospitality firms (Kwon et al., 2013).

Some studies extend and modify TAM with other variables and/or theories to investigate users’ attitudes and behavioural intentions in their contexts. Balouchi et al. (2017) examined influences of TAM and variables of perceived enjoyment, perceived source credibility and perceived risk in the behavioural intention in accepting consumer-generated contents in the context of Iran. Park et al. (2014) looked at how franchise support, which is not included in the original TAM, affects attitudes towards franchise intranet usage in quick-service restaurants. Straker and Wrigley (2016) developed the TAM by proposing to include emotional drivers as influences in the use of digital channels in their study of passengers’ airport experience. Therefore, TAM has been widely extended with contextual factors to understand tourists’ acceptance of social media for the choice of destination (Di Pietro et al.,
biometric systems (Morosan, 2012), consumer-generated media usage for travel planning (Ayeh et al., 2013) and airline BC2 e-Commerce websites (Kim et al., 2009).

In some studies, TAM is combined with other theory(ies) to develop the theoretical framework. Huang et al. (2015) used TAM and readiness model as the research structure to investigate the user’s intention golfers towards golf GPS. By examining the applicability of the TAM and Hedonic Theory, (Huang et al., 2013) developed a research framework to identify the factors that affect tourists’ experience and behavioural intentions within a 3D tourism destination. From a generational perspective, (Sos et al., 2016) synthesised a theoretical model of technology use within meetings by investigating how attendees’ experiences and the basis of the generational cohort theory influence the TAM. Integrated TAM with the theory of reasoned action, the theory of planned behaviour, and the innovation diffusion theory, Amaro and Duarte (2015) proposed and test a model of consumers’ intentions to purchase travel online. Casaló et al. (2010) provided a framework that integrates TAM with the Theory of Planned Behaviour and Social Identity Theory to explain the intention to participate in firm-hosted online travel communities.

The unified theory of acceptance and use of technology (UTAUT) is another widely used theory in tourism technology research. UTAUT was developed by Venkatesh et al. (2003) to predict user adoption of an IT. Venkatesh et al. (2003) found that performance expectancy, effort expectancy, social influence and facilitating conditions are the main factors determining user adoption. Escobar-Rodríguez and Carvajal-Trujillo (2014) applied an extended UTAUT model to examine key determinants of purchasing flights from low-cost carrier websites. San Martín and Herrero (2012) established a theoretical model that includes psychological factors that influence tourists’ online purchase intention in rural tourism. Based on the UTAUT-2 framework, Gupta et al. (2018) found that performance expectancy, social influence, price saving, perceived risk, perceived trust and prior usage habits are significant predictors that affect tourists’ intention of using travel apps.

Some studies synthesise new framework or theory to understand tourist behaviours of technology use. Wang et al. (2014) proposed a new framework to understand the holistic understanding of smartphone use for travel that integrates the mechanism shaping the adoption, use and impact of smartphones. Zhang et al. (2015) proposed a conceptual model that suggest brand equity, sense of community and monetary incentive are three main motivations for customer engagement in online co-innovation communities. In Dinhopfl and Gretzel (2016)’s conceptual study, the theory of tourist videography was proposed to establish a foundation of various social practices in relation to tourists’ video taking on holiday. Synthesising previous research, Okumus and Bilgihan (2014) developed a conceptual model to test users’ intention of using mobile applications as a tool to promote healthy eating in the restaurant.

6. Discussion and conclusion
6.1 Concluding thoughts
In this paper, we adopt Barki et al.’s (1993) keyword classification scheme to provide a rigorous and comprehensive understanding of the progress on technology use in tourism. Around the theme of use, we found that research has been widely conducted in both organisational and individual levels with focuses in certain areas. In tourism and hospitality organisations, innovative technologies are used by managers as a strategic tool to maintain a competitive advantage, develop marketing strategies or support their decision-makings. In addition, the recent development of technology such as the interactive feature of the IT, virtual world and wearable AR applications also enable tourism and hospitality providers to design a wide range of experiences. One key goal of adopting new technologies is to achieve
high levels of user satisfaction. A large amount of research focuses on the consumers, ranging from their expectation, attitudes and behaviours towards various forms of technologies in different tourism and hospitality settings. Among these, eWoM and mobile technologies have been largely explored (Munar and Jacobsen, 2014; Young Im and Han, 2014), given the increasing confidence of consumers as well as the development of ICT and e-platforms. Our findings are illustrated in Figure 1. The figure is organised by major keyword themes. Bolded keywords above the line were found in our analysis, while un-bolded items below the line were missing from the literature. Based on the focus of the papers, we reclassified [User Support] and [Corporate or Management] research into different categories. Additionally, we found no research from the “Type of Access” category.

6.2 Theoretical implications
In terms of theories, IS theories such as UTAUT, TAM, hedonic theory and innovation diffusions theory are widely adopted or extended in various tourism and hospitality context to understand technology use. In addition to IS theories, these articles also widely adopt concepts from other fields and disciplines such as cognitive absorption, postcolonial theory and theory of tourist motivation, the theory of affordances and the theory of planned behaviour. Furthermore, there are several conceptual papers developing new frameworks and/or theories to understand technology use.

Future research can broaden the choice of IS theories. Two particular theories that could be borrowed from the IS field is that of adaptive structuration theory (DeSanctis and Poole, 1994) and task-technology fit theory (Goodhue and Thompson, 1995). The basic reasoning of adaptive structuration theory is that of how IS work. System designers embed their own intentions (spirit) into the functioning of the systems, but that users “adapt” these to their own needs (appropriations) and thus use the system in unintended ways (Straub, 2012). These kinds of workarounds result in new ways to use systems which designers respond to in subsequent redesigns. From a tourism IT design point of view, this could be an interesting theory to apply in terms of how technology evolves over time according to use. On the other hand, the task-technology fit theory asserts that users, depending on the relevant tasks at hand, make conscious choices of best-fitting technologies before they use systems (Straub, 2012). Again, this could be applied to the tourism field in terms of how and why users choose IS for their specific purposes.

Studies of technology use can be further explored by exploring various critical turns of theories, such as mobilities turns, performance turn, late modernity and queer theory to contribute to critical tourism and hospitality studies. Issues such as the critics of ubiquitous connectivity during the holiday, ICT roles in the social inclusion in the holiday space and ethical concerns the robotic use in the hospitality sector are worthy of further investigation.
6.3 Practical implications
Our paper has delineated the research in this area into three main categories: type of processing, organisational use, and users. This is a useful way of categorising the main uses of technology in tourism. That is, managers for example, can and should deal with future IT-related issues by integrating the innovative uses of IT into their strategic business plans. One way to do this is to simultaneously be aware of changing IT technology that could benefit the bottom line of tourist organisations, and being aware of changing tourist perceptions, expectations and increasing digital savviness. The way data is collected, stored and analysed is also important to consider due to changes in data protection laws in Europe for example, and future research could explore more ways to make this interactive, online, and to provide information processing in real-time.

6.4 Limitations and future research
This literature review article focuses on four high impact tourism journals and two specialised tourism and technology journals. Although the selection criteria ensure the quality and impact of reviewed papers, some relevant research published in other journals or proceedings could be potentially excluded. Future research can review a wider scope of journals and books to achieve a comprehensive understanding. This article applied Barki et al.’s (1993) keyword classification scheme of IS use. In Figure 1, we illustrate that tourism and technology studies only focus on certain use themes, and there are a wide range of themes in IS use which are under-researched. Tourism and IS academics can look for potential topics to research in these areas.

References


Technology use in tourism


## Appendix

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Table AI. Keywords used, and the number of papers coded
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Reviewing the progress of information and communication technology in the restaurant industry

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Abstract

Purpose – The purpose of this study is to identify the progress of research of information and communication technologies (ICT) in the restaurant industry. More specifically, this paper reviews the main academic contributions from the area of hospitality and tourism over the past 18 years by addressing the adoption and implementation of ICT in restaurant activities.

Design/methodology/approach – This study analyses 68 full-length ICT research articles that were published in the period 2000-2018 in 29 journals (with Science Journal Citation Reports or Scimago Journal Rankings impact) and eight subject areas.

Findings – The review reveals a number of significant findings. It highlights the scarcity of contributions within academic research related to the area of hospitality and tourism focused on addressing the issue of ICT in restaurants. Moreover, and predictably, several dimensions clearly emerge from the consumer and supply perspectives as being the most prominent. On the one hand, the adoption of ICT has changed the behaviour of consumers in at least three dimensions: information search and evaluation of alternatives purchase decision and post-purchase behaviour. On the other hand, ICT has revolutionised the core business areas of restaurants by dramatically transforming the following areas: operational and strategic management, marketing and Web design, customer services, security, food and nutrition and human resources.

Originality/value – Given the fact that ICT in the restaurant industry remains a largely unexplored subject, this paper can offer a useful tool for researchers who pursue advances in this field, by providing an overview that outlines the main aspects that need further research.

Keywords Information technology, Communication technology, Restaurants, Review

Paper type Literature review

1. Introduction

In the recent decades, a growing body of scientific knowledge regarding the emergence and adoption of information and communication technologies (ICT) in the hospitality and tourism industry has been consolidated (Buhalis, 2004; Buhalis and O’ Connor, 2005; Buhalis
and Law, 2008; Ip et al., 2011; Law et al., 2014, 2013, 2009; Leung and Law, 2007; Litvin et al., 2008; Werthner and Klein, 1999). However, the existing academic research has largely focused on the hotel industry (Bilghihan et al., 2011; Cobanoglu et al., 2013; Ham et al., 2005; Morosan and Bowen, 2018), and to a lesser extent on intermediation activities (Buhalis and Licata, 2002; Buhalis and Zogue, 2007; Ruiz-Molina et al., 2010). The restaurant industry remains an under-represented area in terms of research papers (Ansel and Dyer, 1999; DiPietro, 2017; Johns and Pine, 2002). To fill this gap, a systematic analysis of the research existing on this subject is essential as a first step. The main aim of this study is, therefore, the identification both of the progress of academic research on ICT in the restaurant industry and of its main impacts, which will allow the scarcity of existing research on the development and implementation of ICT in the restaurant sector to be addressed.

This paper is organised as follows. Section 2 describes the methodology used to carry out the reviewing process. Sections 3 and 4 examine the content of the publications selected in this paper from the consumer and supplier perspectives, respectively. Finally, Section 5 reaches conclusions by briefly foregrounding several of the implications for practitioners in this study, including a discussion regarding the limitations of this review and the principal lines for future research that stem from the paper.

2. Methodology
To increase the methodological transparency, this paper follows the six steps implemented by Aguinis et al. (2018). In the first place, the present paper conducts a systematic review based on a number of selection criteria. Contributions necessarily belong to the period from 2000 to ensure that the review is as current as possible, without forgoing the inclusion of a sufficiently long period. This criterion has allowed us to capture the progress made in research on ICT in the restaurant industry in the past two decades. Moreover, in spite of the unquestionable relevance of other publications, such as research notes, conference proceedings and book reviews, we have exclusively selected full-length papers. This decision is consistent with the approach used in outstanding works of existing review of the impacts of ICT in the hospitality industry and tourism (Leung and Law, 2007; Law et al., 2009; or Law et al., 2013).

In the second step, the review searches and gathers the publications from two of the principal online databases on academic research: Web of Science and Scopus. The journals finally considered do not exclusively belong to the area of hospitality and tourism (Johns and Pine, 2002) since otherwise the number of articles selected to carry out this revision work would have been exceedingly small and barely representative. All the journals selected are ranked in the list of journals indexed in the Web of Science Journal Citation Reports (JCR) and/or in Scimago Journal Rankings (SJR) by Scopus. The combination of the above criteria significantly increases search capabilities, thereby allowing more contributions to be gathered for review.

In Steps 3 and 4, the method used is that of content analysis, based on several terms related to the addressed topic, such as “ICT”, “information technology”, “communication technology”, “eWOM”, “restaurant”, “gastronomy” and “food service”. These keywords are used as query terms within “article title, abstract and keywords” in two selected databases and the list of journals indexed in JCR and/or SJR. Both researchers of this study then read the title, abstract and keywords of each of the publications encountered, and, where doubts regarding the relevance of the paper arose, the paper was read in its entirety. Owing to this search and selection procedure, the present paper finally reviews 68 out of 99 potentially relevant articles (Figure 1). It is noted that research on this topic has substantially increased, particularly over the past decade.
The papers are drawn from 29 journals. The top positions are for the *Journal of Foodservice Business Research International* and the *Journal of Hospitality Management*. The publications fall into eight subject areas, based on the subject areas of the journals (Table I). Unsurprisingly, "Hospitality and Tourism" provides the largest number and the second category is "Food Science".

Finally, in Steps 5 and 6, the authors read the complete text of each of the 68 selected articles to calibrate the content extraction process, whereby the articles are classified in accordance with two possible approaches for the study of the impacts of ICT in the restaurant industry, in line with outstanding preliminary reviews on ICT in hospitality and tourism (Law et al., 2014, 2009); consumers and restaurant suppliers. As a result, the review process reveals several dimensions or subcategories from consumers’ and suppliers’ perspectives. All reviewed papers were assigned either to the perspective of demand or to that of supply, and, within each of these categories, to the most consistent dimension to the subject under study. It should be pointed out that three of the reviewed items fall outside this classification (DiPietro, 2017; Muller, 2010; O’Connor and Murphy, 2004), since they offer an overview of the subject under study. Table II summarises the ICT-related publications in each category and dimension. The following two sections analyse the content of the published papers in each category.

3. Information and communication technologies-related studies from the consumers’ perspective

In agreement with previous studies (Johns and Pine, 2002), although it can still be asserted that research related to consumer behaviour for the specific case of the restaurant industry is under-represented, this shortage is on track to be solved given the enormous efforts by scholars over the past century. Consequently, the range of existing research related to the impact of ICT on different stages of restaurant consumption is sufficiently wide.

Inspired by the systematisation proposed by previous studies addressing the impact of ICT on the consumer for the hospitality and tourism industry (Ip et al., 2011; Law et al., 2009, 2014), and from the exhaustive review of selected articles, three dimensions have clearly emerged: information search and evaluation of the alternatives, purchase decision and post-purchase stage.

3.1 Information search and evaluation of the alternatives

The majority of reviewed ICT papers from the consumer perspective focus on the first stage of restaurant consumption. Nowadays, ICT as a means of information search and evaluation...
### Table I.
Distribution of ICT-related papers by journals and subject categories

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<th>Journal title</th>
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<th>Area</th>
<th>n (%)</th>
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<tr>
<td>1  Business Process Management Journal</td>
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</tr>
<tr>
<td>2  Journal of Retailing and Consumer Services</td>
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<td>Business</td>
<td></td>
</tr>
<tr>
<td>3  Service Science</td>
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<td>3</td>
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<tr>
<td>4  Computational Statistics and Data Analysis</td>
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<td>Computer Science</td>
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</tr>
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<td>5  Computers in Human Behavior</td>
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</tr>
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<td>6  Journal of Intelligent Information Systems</td>
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</tr>
<tr>
<td>7  Expert Systems with Applications</td>
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<td>Computer Science</td>
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<tr>
<td>8  Futures</td>
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<tr>
<td>9  Journal of Agribusiness in Developing and Emerging Economies</td>
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<tr>
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### Table II.
Summary of ICT-related research papers in the restaurant industry

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<td>Consumers’ perspective</td>
<td>Information search and evaluation alternatives</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Purchase decision</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Post-purchase stage</td>
<td>9</td>
<td>13</td>
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<td></td>
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<td>Operational and strategic management</td>
<td>14</td>
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</tr>
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of the existing alternatives wields unquestionable power. In this respect, the early study of Litvin et al. (2005) is noteworthy, since it brings into question the influence of the Internet on tourist restaurant selection.

An ever-increasing body of the restaurant literature examines electronic word-of-mouth (eWOM) from various standpoints. Thus, the differences between language used by diners and restaurateurs has aroused a growing interest among scholars (Xiang et al., 2007; Zhang et al., 2010), as well as the factors that determine positive eWOM (Jeong and Jang, 2011) or negative eWOM (Boo and Kim, 2013). The outstanding work of Yang (2017) explores the predictors to eWOM intention (experience factor, knowledge-sharing factors and technology-acceptance factors) through an integrative framework, testing the proposed model with consumers from Hong Kong and Macao using a well-known restaurant review website, Openrice.com. Findings reveal that perceived usefulness constitutes a key factor in explaining the intention to spread online comments, not only through a direct link but also by moderating the effect of other determinants. Parikh et al. (2014) also insist on the usefulness of user-generated content (UGC), and focus on examining Yelp.com, the largest consumer-generated restaurant-review website, specifically the factors that explain “why” and “when” diners use and contribute to this platform.

Meanwhile, other areas of interest appear strongly in academic research on the pre-purchase stage of dining out. Wang (2011) evaluates the influence of gastronomy blogs on restaurant clients and identifies key predictors to explain the reader’s intention to try food

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<td>Food and nutrition</td>
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<td>Human resources and training</td>
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and beverages in local restaurants, from among the various factors that characterise
gastronomic blogs (inspiring taste desire, forming taste awareness and facilitating
interpersonal interaction). On the other hand, Zhai et al. (2015) postulated the utility of social
media data on restaurants. By combining the use of a consumer review website (CRW) and a
geographical information system, this research aims to map the popularity of restaurants in
a spatial area. Based on Diaoping.com, one of the most famous CRWs in China, a popularity
index was built and mapped. Finally, Ha et al. (2016) apply the concept of “herd behaviour”
in the choice of restaurant, that is, the influence of others’ opinions/choices on potential
restaurant customers. By testing the proposed model in a famous convention and visitor
bureau located in Fargo (North Dakota), the authors found that diners make decisions
strongly based on the crowdedness and review rating of a restaurant, whereby the visual
aspect of “herd behaviour” (crowdedness) was considered a more relevant aspect than
writing aspects (review rating).

3.2 Purchase decision
Concerning this stage, the review shows a subject of more innovative research, still to be
explored in depth, and mostly focused on the acceptance of technology by consumers
(biometric systems, mobile payment (MP), etc.). Morosan (2011) examines the consumers’
adoptions of biometric systems for payment in restaurants. Particularly, this study extends
the original technology acceptance mode by including the perceived security of biometric
systems and their perceived innovativeness towards information technology. Using data
collected on students enrolled in a MBA program at a private university in the southwest of
USA, the empirical analysis reveals that the consumers are ready to use biometric systems.
Given that most preliminary studies on biometric systems are staff-oriented, the
contribution of this paper to theory and its managerial implications are undeniable, showing
the convenience of advancing in this line of research.

More recently, the empirical work of Ozturk et al. (2017) investigates the acceptance of
MP technology based on “the valence model”, adapting this model to better explain the
impact of diners’ perceptions, both positive (utilitarian value and convenience) and negative
(perceived risk and privacy concern) regarding their intention to use MP technology. By
means of an online survey distributed among members at a large university located in the
southeast of the USA, the authors determine that utilitarian value, convenience, private
concern and compatibility constitute the best predictor of MP technology acceptance.
Furthermore, the work of Kapoor and Vij (2018) evaluates how mobile application attributes
of online food aggregators (OFA) influence the purchase decision of diners and lead to their
conversion, which is defined as effective purchase. The authors propose a theoretical model,
highlighting visual, informational, navigational and collaboration design as the main
attributes to consider. From data collected through a survey among mobile shoppers
conducted in India, the study proves that OFA attributes have a significant effect on
conversion, particularly the collaboration design, this attribute referred to “alliances
between the online food aggregator and other e-commerce players to provide discounts or
cash back” (Kapoor and Vij, 2018, p. 348).

Related to the increasing use of mobile, a number of papers insist on evaluating the
incursion of diverse and numerous smartphone applications, either related to their adoption
by the restaurant consumers (Okumus and Bilgihan, 2014), or by focusing on the growing
acceptance of applications of greater specialisation, such as diet applications and their roles
in the on-site decision process (Okumus et al., 2016, 2018). The breakthrough of diet
applications could be related to the emergence of a new field of academic research on the
process of creating an e-healthy menu in a restaurant: this issue remains incipient, but has huge potential.

3.3 Post-purchase behaviour
As a final point in the post-purchase stage, research conducted on self-service technology (SST) is especially highlighted for its impacts on consumer behaviour in restaurants. Kincaid and Baloglu (2005) are pioneers in evaluating the use of SST in the casual-dining restaurant industry and its direct marketing opportunities. Ruiz-Molina et al. (2014) conclude that SST provides widely recognised ICT solutions for the improvement of operational efficiency and the image of restaurant, regardless of their characteristics. Ahn and Seo (2018) examine the influence of consumers’ psychological responses to the quality of SST, and provide strategies to improve this service in the restaurant industry. Finally, it is worth mentioning the work of Hanks et al. (2016), who assess the negative incidence of SST on donation behaviour in corporate social responsibility programs. Nevertheless, and as pointed out by DiPietro (2017), further research concerning SST in the restaurant industry is required.

In other respects, given the relevance of evaluating the customer perceptions of innovativeness to gain insight, Kim et al. (2018) build a scale to measure customer perceptions of restaurant innovativeness (CPRI), through a multidimensional approach to capture the full complexity of innovativeness from a customer-centric perspective (innovativeness of the menus, technology-related service innovativeness, innovativeness of the experience and promotional innovativeness). Additionally, Beldona et al. (2014) evaluate customer perceptions to establish the relative efficacy of an e-tablet menu over the traditional paper-based menu. The authors prove that the use of technology significantly improves the service experience, particularly in respect to the ordering experience.

Lastly, several studies focus on the factors explaining the willingness of diners to return to a restaurant. Thus, Cobanoglu et al. (2012) stress the importance of providing internet amenities, from an empirical study on the impact of wireless services on the frequency of customers returning to a restaurant. More specifically, these authors demonstrate that the “Wi-fi availability” increases the frequency of the visit, unlike other factors such as “perceived risks of using Wi-fi” or “cost of Wi-fi access”, which exert a negative effect.

4. Information and communication technologies-related studies from the suppliers’ perspective
The impact of ICT in the tourism industry from the perspective of supply has frequently been addressed by prior research in this field, and it is even feasible to find a number of studies exclusively focused on the supply side (Ip et al., 2011). In fact, among the existing review papers on ICT in the hospitality and tourism industry, the highest percentage of selected items fall within the perspective of supply (Law et al., 2009, 2014). This paper does not constitute an exception, since, of the total number of articles examined, 57 per cent correspond to the supply perspective (Table II).

The comparison of previous studies reveals that no consensus exists in terms of resulting subcategories or dimensions, but a number of these subcategories do systematically appear (Buhalıs and Law, 2008; Law et al., 2009; Ip et al., 2011; Law et al., 2014): strategic management, marketing, Web design and analysis, guest services and security. Furthermore, human resources and training, and guest services appear as two crucial supplementary areas in which the development and implementation of ICT have yet to fully realise their vast potential for research, which makes its inclusion extremely suitable.
Nevertheless, impacts of ICT in hospitality and tourism have been traditionally examined in the context of the hotel industry (Ham et al., 2008; Ruiz-Molina et al., 2014), with the resulting dimensions (Ip et al., 2011). In the present review, the analysis of the selected articles has highlighted the need to adapt the various existing subcategories within the supply perspective to include the particular case of the restaurant industry. Thus, the resulting classification differs slightly from those set out in preliminary research referring to the broader context of the hospitality and tourism industry as a whole. Accordingly, seven dimensions have been revealed as the main streams from the supply perspective: operational and strategic management, marketing, Web design and analysis, customer services, security, food and nutrition, and human resources and training.

4.1 Operational and strategic management
Research into this matter constitutes a recurrent dimension that has been investigated throughout the reporting period of 2000-2018, and hence concentrates the largest number of the selected contributions within the supply approach (36 per cent), and addresses various ever-changing issues.

Liu et al. (2001) evaluate how data mining can be a powerful tool for the improvement of forecast performance, and apply the study to the operation of fast-food restaurant franchises in Chicago. Based on the Box–Jenkins model, the authors develop an automatic model for time series, and apply this technique to sales and transaction data collected through a point-of-sale (POS) system. The findings prove the effectiveness of data mining as a meaningful tool for the support of the restaurant industry both at store level (restaurants reduce operating expenses and increase food quality by means of improving operational management) and at corporate level (by easing strategic planning). Green and Weaver (2008) subsequently conduct a qualitative paper inquiring on the existing link between information technologies and sales forecasting. Their research displays a number of possible technologies for the estimation of the restaurant sales and evaluation of the levels of satisfaction shown by the interviewed managers with regard to these technologies. Ultimately, Cavusoglu (2019), from an exhaustive review of the technologies applied to date, explores the relevance of front-of-house and back-of-house technologies and their application to operational management in the restaurant industry.

Sigala (2003) examines the relationship between investment in ICT and productivity in the context of a four-star hotel restaurant in the UK. The author reviews the academic literature related to the “IT productivity paradox” concept, and provides a measure of the productivity gains of ICT investment through data envelopment analysis, thereby highlighting the exploitation of ICT possibilities in redesigning and restructuring operations. Subsequently, this author deals with a more specific topic, the application of radio frequency identification (RFID) technologies to supply chain management. This study evaluates and discusses the adoption of RFID and its resulting benefits in integrating and informationising the foodservice supply chain (Sigala, 2007).

Moreover, a number of researchers consider that both the implementation of ICT and the impacts resulting therefrom vary substantially depending on the type of restaurant. Consequently, they have focused on the analysis of the differences according to various criteria. Oronsky and Chathoth (2007) examine the differences in the factors that motivate the adoption of information technologies between chain restaurants and independent restaurants in the context of full-service restaurants in the Bay of San Francisco. The results show that chain restaurants are more oriented towards IT, being also convenient to distinguish between the store level and the corporate level, consistent with the work of Liu et al. (2001). Similarly, Huber et al. (2010) deduce that the best practices in ICT depend on
the type of restaurant. More recently, and applied to the case of Germany, Zeller and Drescher (2017) investigate whether the top 100 restaurant companies differ from smaller restaurants in their professionalisation concerning their procurement management, concluding that the accurate use of ICT can allow small restaurants to adopt the best practices.

Within this dimension, it is also worth highlighting the research of Kimes, who focuses on investigating several aspects pertaining to revenue management. This scholar demonstrates that technology used in conjunction with revenue management techniques can achieve greater profitability, and claims its usefulness for the restaurant industry in the USA (Kimes, 2008). On the other hand, Ojiako et al. (2009) assimilate the adoption of IT as organisational capabilities that provide operational and strategic control for the company. This research focuses on YUM!, one of the major restaurant brands among the fast-food companies operating in China, Taiwan and Thailand. And lastly, Douglas (2007) investigated the effectiveness of Chip and PIN smart-card systems at the POS to combat credit-card fraud.

4.2 Marketing and Web design
Moving on to the marketing and Web design dimensions, among the most recent studies it is possible to differentiate between those who, from the early work on eMarketing in the restaurant industry (Kasavana, 2001), investigate the progress made in the development and implementation of social network sites and websites (Daries-Ramon et al., 2017; DiPietro et al., 2012; Park et al., 2016), to research into aspects of a more specific nature, such as the case of Bedard and Kuhn (2015), whereby the influence of Nutricare recipe on restaurant purchases is analysed. Within this second group, it is also noted the contribution of Kim et al. (2012), who evaluate the usefulness of DINEWEBQUAL as an effective tool to measure customer perception of the restaurant website quality.

Overall, in spite of the rising interest in the effect of social networks in the restaurant industry from the management perspective, this line of research is still in its early stages (Park et al., 2016).

4.3 Customer services
Regarding customer services, Mozeik et al. (2009) analyse the customer acceptance of restaurant e-services across two types of computing devices, conventional and mobile handhelds, for the particular case of restaurant industry in Delaware region (the USA). The research claims the need for restaurateurs to be fully prepared for the mobile Internet experience, to facilitate its use. Tan and Chang (2010) continue to research into wireless technologies and conduct a series of tests in two Chinese restaurants to develop an e-restaurant system for customer-centric service.

In contrast, Sigala (2012) adopts a qualitative case study to investigate the role of consumers’ contributions in social networks for new service development. This author studies a particular online community, www.mystarbucksidea.com, a project carried out by the firm with the purpose of linking customers and potential customers with its brand, products and services (Sigala, 2012; Zhang et al., 2015). Further exploring this issue of online brand communities, Zhang et al. (2015) investigate the motivations for clients to become involved in online co-innovation communities. The co-innovation process, as a development of co-creation, allows the clients and the company to collaborate closely to create values that contribute specifically to the innovation of products and services.
4.4 Up-and-coming dimensions: security, food and nutrition and human resources and training

More recently, several dimensions have emerged as areas of growing attention to both researchers and practitioners. Thus, in spite of the relevance of security in the restaurant industry (Khalilzadeh et al., 2017) since it is an activity subject to many food safety standards, inspections and regulations (Jin and Lee, 2014), the number of studies related to ICT remains insufficient, and hence there is ample scope for future research. Another interesting topic of discussion within the security dimension in the restaurant industry is that which refers to the evaluation of the security of restaurant networks, and more precisely “to analyse the security practices of electronic information, network threats and prevention techniques” (Cobanoglu, 2007, p. 33).

An increasing characteristic of current societies is their concern regarding nutrition and eating habits. Relating to the restaurant industry, this topic has multiple consequences. On the one hand, certain ICT-related papers on health behaviour can be found, such as those on the use of menu labels in restaurants (Jeong and Ham, 2018), the analysis of food-related conversations on social networks (Blackburn et al., 2018), and the overview of future food-recommendation technologies (Tran et al., 2018). On the other hand, various explorative studies have been developed in different fields. Thus, Kera and Sulaiman (2014) explore the possibilities of the FridgeMatch application as an educational experiment to evaluate future forms of food commensality, while Aguilera (2017) describes gastronomic engineering, highlighting the technological capabilities of food engineers to improve the innovation process, especially regarding haute cuisine.

Restaurants are labour-intensive businesses, and hence the significance of human resources and training in this industry. Nevertheless, this significance fails to trigger research into ICT. Esteemed exceptions include studies by Kim (2008) and Ham et al. (2008). The work of Kim and Hancer (2010) is also worth noting, whereby the effectiveness of the resources of knowledge management (KM) in the restaurant industry is tested, from the perspective of employees, and the determinants of KM resources are found to be ICT, incentives and the culture of knowledge exchange.

5. Conclusions, implications and limitations

Academic research on the emergence and implementation of ICT in the hospitality and tourism industry has been consolidated in recent decades. Nevertheless, the restaurant industry remains underrepresented in terms of contributions made, especially in comparison with the hotel industry. To overcome this gap, a systematic analysis of the research existing on this subject is essential as a first step. Thus, the purpose of the present paper is to identify the progress of academic research on ICT in the restaurant industry, while shedding light on which aspects need further attention.

From the reviewing process, it is possible to underline several conclusions. To begin with, in spite of the unquestionably profound revolution that has been taking place in the restaurant industry because of ICT (Ansel and Dyer, 1999; O‘Connor and Murphy, 2004; DiPietro, 2017), it has revealed that a relative paucity of research persists, in keeping with prior studies (Ham et al., 2008; Ruiz-Molina et al., 2014). In this respect, although research on this topic has substantially increased, particularly over the past decade, it is necessary to continue moving forward, since ICT is still not considered to play a major role in restaurants (Cobanoglu, 2007) and there is a lack of any formal ICT structure within these companies (Cavusoglu, 2019).

Moreover, it has become clear that the compilation and revision studies should not be limited exclusively to journals in the “Hospitality and Tourism” area, since there is crucial research from other areas, particularly from that of “Food Science”. The reason mostly lies in the marked interdisciplinary nature of tourism activities, a particularly evident feature in
the case of the restaurant industry. In the near future, we can expect the consolidation of research on ICT in restaurants from new perspectives of knowledge, such as the science of health care, geography and even sustainability, thereby expanding the academic research on this issue, and contributing towards building a specific epistemological body.

Respecting the approach used, the research conducted to date has been greater in the case of the supply side than the demand side, and therefore a greater effort regarding consumer perspective must be made. In consonance with the review work carried out in the broader context of the hospitality and tourism industry, a number of dimensions have been differentiated both from the demand and supply perspectives, which facilitates an analysis compared with previous research. However, it has been necessary to adapt this systematisation for the restaurant industry, which highlights the convenience of investigating into greater depth into this aspect, that is, regarding which is the most appropriate criterion to be used in the classification of the contributions made in ICT in the restaurant industry.

The review process has revealed various implications of interest to scholars and, to a lesser extent because of the nature of the study, to practitioners. Given the markedly empirical character of most of the studies reviewed, it would be highly suitable to replicate these studies in other geographical contexts and/or in different restaurant segments. In addition, it would be pertinent, if not necessary, to strength the theoretical framework concerning the various aspects involved in the adoption of ICT by restaurateurs.

A number of valuable inferences can be derived from the comprehensive assessment of prevailing research from the consumer viewpoint. In spite of an increasing awareness in the past two decades among scholars and practitioners of the matter of eWOM, further work is needed on the factors that determine eWOM behaviour. Moreover, research concerning the impacts of ICT on purchase decision-making and the post-purchase stage is relatively recent and still has remarkable potential. Clearly, specific and innovative research topics have been emerging strongly in the past decade (gastronomy blogs, smart applications, big data, biometric systems, MP systems, etc.), and are likely to claim a greater role in the near future.

Pertaining to the supply standpoint, in spite of the fact that it is crucial to continue going into greater depth in aspects related to the dimensions that have traditionally been studied by the academic community (e-POS systems, menu engineering software, e-purchasing, table management systems, etc.), a few dimensions emerge as crucial areas for future research, such as security, food and nutrition and human resources and training. Overall, those restaurateurs who lack proper knowledge of ICT applicable to their businesses should adopt a more proactive attitude in recognising the capacity of technology as a source of competitive advantage and as a crucial factor in achieving better business performance. Furthermore, a greater investment in the creation of a specific ICT structure in restaurants should be recommended as an imperative measure, both for the policymakers and for the restaurateurs themselves. This investment would also positively contribute to another key aspect: the innovation developed within the restaurants.

Finally, with reference to the limitations of this review, the exclusive use of only two databases (WOS and Scopus), and the inclusion of only full-length articles published in journals indexed in JCR or SJR, must be emphasised. Although the adoption of these restrictions, following the recommendations of Aguinis et al. (2018), conforms the objective of maximising the methodological transparency of this review, it is clear that relaxation of these criteria would significantly expand the number of publications included in this review. A future extension of this paper should take into account other sources of information that have been omitted, such as research notes, conference proceedings, book reviews, editor prefaces and specialised reports, to assess their contribution to this line of research. Similarly, it might be appropriate to include supplementary online databases recurrently
used in these types of studies, for instance, those of Science Direct, Sage Journal and Emerald Insight.

References


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A critique of the progress of eTourism technology acceptance research: time for a hike?

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Abstract
Purpose – The purpose of this study is to evaluate eTourism technology acceptance literature to illustrate current gaps in the field and suggest two alternative perspectives that could be adopted.

Design/methodology/approach – A review of academic literature in the field of eTourism technology acceptance was undertaken combining a systematic keyword-based search and snowballing techniques leading to the identification of relevant academic journal articles published since the year 2000.

Findings – While the field of eTourism technology acceptance research has grown substantially over the past few decades, this study highlights that the majority of this research seems to have been conducted within a narrow theoretical scope. The study suggests that this has led to contemporary theoretical and philosophical advancements in understanding the psychological, sociological and neuroscientific aspects of consumer behaviour not yet being mirrored in the eTourism technology acceptance research.

Research limitations/implications – This study invites researchers to adapt alternative theoretical perspectives to create a more in-depth understanding of aspects of technology acceptance behaviour that have yet to be understood. Two distinct alternative perspectives, NeuroIS and interpretivism, are suggested.

Practical implications – This study assists researchers in developing alternative research agendas and diversifying the theoretical foundations of eTourism technology acceptance research.

Originality/value – eTourism technology acceptance research risks being left behind if it does not begin to think beyond current theoretical conceptions of consumer behaviour research. This study contributes to the wider literature by highlighting how eTourism literature is falling behind and by suggesting two innovative alternatives that allow eTourism research an exciting way forward.

Keywords Technology acceptance, eTourism, TAM, NeuroIS, Neurotourism, Interpretivism

Paper type Literature review
1. Introduction

At the dawn of the current century, when consumer behaviour studies were in the early stages of departure from the age of cognitivism, Zaltman (2000) encouraged consumer behaviour researchers to “take a hike” to other academic fields, broaden their horizons and embrace the progress in understanding human behaviour from alternative psychological, physiological, sociological and philosophical perspectives. This paper argues that perhaps it is time for eTourism researchers to take this “hike” to alternative academic fields of studying human behaviour.

Technology acceptance is among the most well-studied topics in the eTourism field (Pourfakhimi and Ying, 2015; Ukpabi and Karjaluoto, 2017; Usoro et al., 2010). Contemporary eTourism technology acceptance research is largely developed based on classical models of consumer behaviour, such as the Technology Acceptance Model (TAM) (Davis, 1985), the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975) or the Theory of Planned Behaviour (TPB) (Ajzen, 1985). Continued progress in the fields of social psychology, neuroscience and sociology has, however, revolutionised our understanding of human decision-making (Zaltman, 2000). This progress has led to the integration of alternative perspectives in a wide range of contemporary marketing and consumer psychology research (Hubert, 2010; Hudson and Ozanne, 1988; Thaler, 2000). Unfortunately, the persistent over-reliance by eTourism technology acceptance researchers on the earlier models means this field still inherits the limitations of the underlying grand cognitive theories (Pourfakhimi et al., 2018; Ukpabi and Karjaluoto, 2017). As a result, across the majority of eTourism technology acceptance research, users are still perceived as (more or less) well-informed and rational decision-makers – economic humans (homo economicus) – where their decision to use a technology is a rational response to a limited number of normative, evaluative and behavioural factors. In addition, taking unsystematic and ad hoc approaches to expand classic models without due attention to their theoretical foundations has undermined the generalisability, meaningfulness and explanatory power of the academic findings of such studies (Bagozzi, 2007). In many instances, the rapid expansion of research in this field seems to suffer from a widespread issue in the attitude-behaviour research, which Rise et al. (2010, p. 1088) have labelled as the additional-variables paradigm. This is characterised by researchers’ attempts to increase the predictive power of classic models through adding often arbitrary and synonymous, yet statistically significant, variables to classic models. This has occurred often without justifying the parsimony, validity and generalisability of the new models or questioning the role of these newly added variables in forming the investigated behaviour (Bagozzi, 2007). As a result, similar to technology acceptance research in general, eTourism technology acceptance research is at risk of transforming into an overly confused, overwhelmed, fragmented and theoretically shallow but voluminous field of research (Bagozzi, 2007, p. 245; Benbasat and Barki, 2007).
Going back to Zaltman’s (2000) call to take a hike, this paper presents a critique of the most frequently used theoretical models in the eTourism technology acceptance research and discusses their limitations to highlight the most critical gaps in contemporary eTourism research. Following a review of 74 academic journal articles published in the eTourism field, this paper suggests two fundamentally distinctive alternative pathways: a modernist consumer neuroscience and a post-modern interpretive paradigm. These alternative perspectives are based on a more humanistic and dynamic conceptualisation of humankind as social decision-makers. The paper concludes by arguing that eTourism researchers need to take such fundamental alternative approaches to go beyond the rigid boundaries of classic cognitivism and co-create more meaningful insights into understanding the dynamic and context-dependent nature of the adoption of new technologies in the eTourism field.

2. Research method
A review of academic literature in the field of eTourism technology acceptance was undertaken combining a systematic keyword-based search and snowballing techniques. These methods have previously been used and suggested for sourcing relevant work for a meta-analysis of literature (Greenhalgh and Peacock, 2005; Khan et al., 2003). A number of recent systematic reviews in tourism (see for instance, Khoo-Lattimore et al., 2017; Baum et al., 2016) highlight the multitude of databases that can be used to conduct reviews of academic literature. For this research, EBSCO and Google Scholar were used in favour of other databases. This is in part because of easy accessibility and useability and in part because of the voluminous, fragmented and diverse literature in the field of eTourism. Also, this paper does neither intend to seek nor claim to review a fully representative body of literature in this field or illustrate the diversity of existing research work. As such, these databases provided sufficient searchable resources to illustrate evidence of a gap in the eTourism technology acceptance literature. The time scale of the search was also limited to the years 2000-2018. This was for two reasons. First, as Buhalıs and Law (2008, p. 609) state, “since the year 2000 we have been witnessing the truly transformational effect of the communication technologies”. Second, this time period captures the most recent thinking in this area and allows insight into the development of knowledge over a period of time (Baum et al., 2016).

A list of relevant keywords was identified, refined and expanded through the initial stages of literature identification. Using the keywords and databases, a number of peer-reviewed, empirical, full-length, original English-language eTourism technology acceptance articles were identified. Subsequent rounds of snowballing and citation tracking were used to source additional publications matching the criteria, initially identifying 135 articles. These 135 articles were screened to ensure that the major dependent variable investigated in all selected literature was exclusively related to the adoption of a certain technology. Following the identification of these articles, a second round of screening occurred and studies that were concentrated on only a limited aspect of tourist technology acceptance behaviour (e.g. risk) without considering other factors were removed from the analysis. After the screening stages, 74 articles remained for analysis (Table II). The final 74 full-text articles were reviewed by the researchers to identify and shortlist the theoretical models and determinants of technology acceptance used in each of these studies to investigate the scope of adoption of classic cognitive models across eTourism technology adoption research.

The selected beliefs, affective responses as well as personal and non-situational determinants of technology adoption that recur in multiple studies were identified and organised. The constructs were defined and categorised into five categories: evaluative and...
functional beliefs, normative (social) beliefs, behavioural control beliefs, evaluative and affective beliefs and personal traits or characteristics (Table I).

The first four categories consist of various beliefs and emotive responses towards either the technology or self. The authors have integrated all the synonymous terms referring to the same or highly similar constructs into single groups. The most recurring groups of constructs are categorised and listed in Table III. Each row in Table III represents a group of highly synonymous constructs identified after the above process of integration and highlights a number of key studies that exemplify the constructs.

### 3. Findings

The 74 studies identified through the review process were published in 32 academic journals in the fields of tourism and hospitality, information and communication technology (ICT), business (including marketing and management) and transportation, suggesting a broad range of audiences and researchers’ backgrounds in this field. The top three journals with the highest number of selected articles were: *Tourism Management* (n = 13), *International Journal of Hospitality Management* (n = 10) and the *Journal of Hospitality and Tourism Research* (n = 6). Of the selected articles, 51 were published between 2010 and 2018, while only two of the selected papers were published before 2005. Table II presents an overview of the articles and illustrates the investigated technologies, principal theoretical methods and significant determinant relationships reported in each of the selected studies.

As can be seen in Table II, Fishbein-school models (TRA and TPB), TAM and TAM extensions are the dominant models, directly used in more than two third of the studies selected. It is clear that these classic models continue to have a significant impact on the state of research in eTourism. Table III present a summary of the most recurringly identified determinants of behavioural intention to adopt technologies in these studies. As it can be seen in this table, among the groups of constructs used in the studies reviewed in this research, perceived usefulness and other functional beliefs, such as perceived risk and perceived value, are among the most widely accepted technology-related evaluative beliefs used. Symbolic constructs, such as social influence and word of mouth, are among the most widely accepted normative beliefs. The most widely referred to behavioural control beliefs include notions such as perceived ease of use, self-efficacy and facilitating conditions.

### 4. Discussion

TAM has gained a paradigm-like status in technology adoption research (Bagozzi, 2007, p. 244). This has resulted in multiple conceptual shortcomings (Bagozzi, 2007; Benbasat and Barki, 2007). Some of the most critical consequences are the accumulation of a voluminous

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Evaluative functional beliefs</td>
<td>Attributed-oriented, analytical beliefs cognitively associating the technology with a functional attribute (Fishbein and Ajzen, 1975)</td>
</tr>
<tr>
<td>Normative beliefs</td>
<td>Socially constructed beliefs about the perceived social norms and expectations of the social environment (Fishbein and Ajzen, 1975)</td>
</tr>
<tr>
<td>Behavioural control beliefs</td>
<td>Beliefs about the factors that may facilitate or hinder use of a technology (Ajzen, 2002b, p. 107)</td>
</tr>
<tr>
<td>Evaluative affective beliefs</td>
<td>Affective, emotive and hedonic responses towards using a technology (Slovic et al., 2002)</td>
</tr>
<tr>
<td>Personal traits and characteristics</td>
<td>Generalised patterns of an individual’s responses to the environment as well as persistent qualities in one’s behaviour (Kassarjian, 1971, p. 409)</td>
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<tr>
<td>No.</td>
<td>Study</td>
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</tbody>
</table>
| 1   | Wöber and Gretzel (2000)    | Use of tourism marketing decision support systems                                   | TAM                                                 | Intention to use technology | Experience → Ease of use (0.63)  
|     |                              |                                                                                     |                                                     |                                                                           | Experience → Attitude (0.48)  
|     |                              |                                                                                     |                                                     |                                                                           | Task relevance → Usefulness (0.27)  
|     |                              |                                                                                     |                                                     |                                                                           | Ease of use → Usefulness (0.14)  
|     |                              |                                                                                     |                                                     |                                                                           | Ease of use → Intention to use (0.98)  
|     |                              |                                                                                     |                                                     |                                                                           | Perceived usefulness → Intention to use (0.70)  
|     |                              |                                                                                     |                                                     |                                                                           | Information completeness → Intention to use (0.42)*, **  
|     |                              |                                                                                     |                                                     |                                                                           | Ease of use → Intention to use (0.26)  
|     |                              |                                                                                     |                                                     |                                                                           | Colour combination → Intention to use (0.13)  |
| 2   | Jeong et al. (2003)         | Use of hotel website                                                               | Intention to use hotel websites in different hotel segments ($R^2$ varies per segment between 0.39 and 0.64) | Intention to use technology | Information quality → Intention to use (0.320)  
|     |                              |                                                                                     |                                                     |                                                                           | Sensitivity content → Intention to use (0.273)  
|     |                              |                                                                                     |                                                     |                                                                           | Time required → Intention to use (0.170)  
|     |                              |                                                                                     |                                                     |                                                                           | Machine interactivity → Enjoyment (0.33)  
|     |                              |                                                                                     |                                                     |                                                                           | Ability → Enjoyment (0.14)  
|     |                              |                                                                                     |                                                     |                                                                           | Integrity → Enjoyment (0.25)  
|     |                              |                                                                                     |                                                     |                                                                           | Enjoyment → Transaction intention (0.26)  
|     |                              |                                                                                     |                                                     |                                                                           | Task fit, career fit and organisation fit → Perceived usefulness (0.57, -0.16, 0.37)  
|     |                              |                                                                                     |                                                     |                                                                           | Task fit, career fit and organisation fit → Perceived ease of use (0.12, 0.16, 0.02)  
|     |                              |                                                                                     |                                                     |                                                                           | Career-fit → Intention to use (0.07)  
|     |                              |                                                                                     |                                                     |                                                                           | Perceived usefulness → Intention to use (0.21)  
|     |                              |                                                                                     |                                                     |                                                                           | Perceived ease of use → Intention to use (0.14)  |
| 3   | Wong and Law (2005)         | Use of hotel website for purchase                                                   | Intention to use hotel websites for purchase ($R^2 = 0.231$) | Intention to use technology | Information quality → Intention to use (0.320)  
|     |                              |                                                                                     |                                                     |                                                                           | Sensitivity content → Intention to use (0.273)  
|     |                              |                                                                                     |                                                     |                                                                           | Time required → Intention to use (0.170)  
| 4   | Wu and Chang (2005)         | Make a transaction using online travel communities                                  | Intention to make a transaction with the website     | Intention to use technology | Information quality → Intention to use (0.320)  
|     |                              |                                                                                     |                                                     |                                                                           | Sensitivity content → Intention to use (0.273)  
|     |                              |                                                                                     |                                                     |                                                                           | Time required → Intention to use (0.170)  
| 5   | Lee et al. (2006)           | Use of computerised reservation systems                                            | TAM, TTF (Task-Technology Fit)                      | Intention to use technology | Information quality → Intention to use (0.320)  
|     |                              |                                                                                     |                                                     |                                                                           | Sensitivity content → Intention to use (0.273)  
|     |                              |                                                                                     |                                                     |                                                                           | Time required → Intention to use (0.170)  

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<tr>
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<th>Reported structural paths / Significant relationships (Standardised regression coefficient: $\gamma/\beta$)</th>
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<tbody>
<tr>
<td>6</td>
<td>Chen (2007)</td>
<td>Use of flight e-tickets</td>
<td>DTPB</td>
<td>Intention to use</td>
<td>Compatibility $\rightarrow$ Attitude (0.50)</td>
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<td></td>
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<td>($R^2 = 0.32$)</td>
<td>Relative advantages $\rightarrow$ Attitude (0.16)</td>
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<td>Complexity $\rightarrow$ Attitude (0.14)</td>
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<td>Peer influence $\rightarrow$ Social support (0.46)</td>
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<td>External influence $\rightarrow$ Social support (0.41)</td>
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<td>Perceived capability $\rightarrow$ Perceived confidence (0.84)</td>
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<td>Attitude $\rightarrow$ Intention to use (0.47)</td>
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<td>Social support $\rightarrow$ Intention to use (0.14)</td>
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<td>Perceived confidence $\rightarrow$ Intention to use (0.19)</td>
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<td>7</td>
<td>Järveläinen (2007)</td>
<td>Use of online cruise channels for booking</td>
<td>TAM</td>
<td>Intention to use</td>
<td>Previous booking online $\rightarrow$ Intention to use (0.206)</td>
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<td>($R^2 = 0.396$)</td>
<td>Conversation preference $\rightarrow$ Intention to use ($-0.207$)</td>
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<td>Social environment $\rightarrow$ Intention to use (0.102)</td>
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<td>Prior online experience $\rightarrow$ Intention to use (0.157)</td>
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<td>Perceived usefulness $\rightarrow$ Intention to use (0.254)</td>
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<td>8</td>
<td>Kamarulzaman (2007)</td>
<td>Use of online travel websites for purchase</td>
<td>TAM</td>
<td>Intention to use</td>
<td>Involvement $\rightarrow$ Trust (0.246)</td>
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<td>Trust $\rightarrow$ Perceived Risk ($-0.429$)</td>
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<td>Involvement $\rightarrow$ Perceived Risk ($-0.170$)</td>
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<td>Perceived Risk $\rightarrow$ Perceived usefulness ($-0.183$)</td>
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<td>Perceived ease of use $\rightarrow$ Trust (0.343)</td>
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<td>Perceived ease of use $\rightarrow$ Perceived usefulness (0.635)</td>
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<td>Involvement $\rightarrow$ Intention to use (0.139)</td>
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<td>Innovativeness $\rightarrow$ Intention to use (0.378)</td>
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<td>Perceived usefulness $\rightarrow$ Intention to use (0.403)</td>
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<td>Perceived IT beliefs $\rightarrow$ Task-technology fit (0.415)</td>
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<td>Perceived IT beliefs $\rightarrow$ Attitude (0.352)</td>
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<td>Task-technology fit $\rightarrow$ Attitude ($-0.232$)</td>
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<td></td>
<td>Self-efficacy $\rightarrow$ Attitude (0.230)</td>
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<tr>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>Lee et al. (2007)</td>
<td>Use of online websites for searching information and purchase</td>
<td>TRA</td>
<td>Intention to use for search ($R^2 = 0.52$) Intention to use for purchase ($R^2 = 0.58$)</td>
<td>Self-efficacy → Intention to use (0.40) Attitude → Intention to use (0.36) Subjective norm → Intention to use (0.21) Attitude → Intention to use (search), moderated by personal innovativeness (0.55) Attitude → Intention to use (purchase) (0.30) Subjective norm → Intention to use (purchase) (0.36)</td>
</tr>
<tr>
<td>11</td>
<td>Luque-Martinez et al. (2007)</td>
<td>Use of travel websites as a source of information</td>
<td>TAM</td>
<td>Intention to use as information source</td>
<td>Ease of use → Attitude (0.34) Ease of use → Usefulness (0.68) Usefulness → Attitude (0.32) Ease of use → Satisfaction (0.34) Usefulness → Satisfaction (0.20) Attitude → Satisfaction (0.20) Usefulness → Intention to use (0.40) Satisfaction → Intention to use (0.43) Ease of use → Willingness to use (0.476) Information/ Content → Willingness to use (0.367) Responsiveness → Willingness to use (0.310) Fulfillment → Willingness to use (0.201) Security/ Privacy → Willingness to use (0.197)</td>
</tr>
<tr>
<td>12</td>
<td>Park et al. (2007)</td>
<td>Willingness to use online travel agencies</td>
<td>TAM</td>
<td>Willingness to use  ($R^2 = 0.58$)</td>
<td>Ease of use → Willingness to use (0.476) Information/ Content → Willingness to use (0.367) Responsiveness → Willingness to use (0.310) Fulfillment → Willingness to use (0.201) Security/ Privacy → Willingness to use (0.197)</td>
</tr>
<tr>
<td>13</td>
<td>Bai et al. (2008)</td>
<td>Online purchase from travel websites</td>
<td>Intention to use</td>
<td></td>
<td>Functionality ← Usability (0.34) Useability → Satisfaction (0.60) Functionality → Satisfaction (0.14) Satisfaction → Intention to use (0.46)</td>
</tr>
<tr>
<td>14</td>
<td>Kim et al. (2008)</td>
<td>Use of mobile Technologies</td>
<td>TAM</td>
<td>Intention to use</td>
<td>Technology experience → Perceived usefulness (0.39) Technology experience → Perceived ease of use (0.44) Travel experience → Perceived usefulness (0.80) Travel experience → Perceived ease of use (0.46) Perceived usefulness → Attitude (0.067)</td>
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<tr>
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</tr>
</thead>
</table>
| 15  | Kim et al. (2008) | Use of hotel front office systems | TAM | Actual use ($R^2 = 0.46$) | Perceived ease of use → Attitude ($0.32$)  
Attitude → Intention to use ($0.88$)  
Information quality → Perceived usefulness ($0.32$)  
System quality → Perceived usefulness ($0.19$)  
System quality → Perceived ease of use ($0.18$)  
Service quality → Perceived ease of use ($0.24$)  
Perceived usefulness → Attitude ($0.26$)  
Perceived ease of use → Attitude ($0.29$)  
Perceived value → Attitude ($0.47$)  
Perceived usefulness → Actual use ($0.15$)  
Attitude → Actual use ($0.40$)  
Perceived ease of use → Perceived usefulness ($0.83$)  
Perceived ease of use → Perceived playfulness ($0.81$)  
Perceived usefulness → Attitude ($0.53$)  
Perceived ease of use → Attitude ($0.34$)  
Perceived playfulness → Attitude ($0.14$)  
Perceived playfulness → Intention to use ($0.58$)  
Attitude → Intention to use ($0.43$) |
| 16  | Morosan and Jeong (2008) | Online purchase from hotel websites | TAM | Intention to use ($R^2 = 0.46$) | Perceived usefulness → Affective intention ($3.3$)  
Perceived ease of use → Affective intention ($-3.667$)  
Affective intention → Behavioural intention ($-0.677$)  
Ease of use → Usefulness ($0.76$)  
Usefulness → Actual use ($0.38$)  
Ease of use → Attitude ($0.34$)  
Usefulness → Attitude ($0.33$)  
Usefulness → Future use ($0.48$)  
Actual use → Future use ($0.35$)  
Attitude → Future use ($0.12$) |
| 17  | Ryan and Rao (2008) | Use of internet for travel planning and purchase | TAM | Behavioural intention to internet for travel planning and purchase future use ($R^2 = 0.58$) |  |
| 18  | Castañeda et al. (2009) | Internet | TAM |  |  |

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</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Huh et al. (2009)</td>
<td>Information systems</td>
<td>Comparison of: TAM, TPB, DTPB</td>
<td>Intention to use ($R^2_{TAM} = 0.611$, $R^2_{TPB} = 0.597$, $R^2_{DTPB} = 0.639$)</td>
<td>Perceived usefulness $\rightarrow$ Attitude ($0.396**$) Compatibility $\rightarrow$ Attitude ($0.382$) Peer influence $\rightarrow$ Subjective norm ($0.171$) Superior influence $\rightarrow$ Subjective norm ($0.283$) Subjective norm $\rightarrow$ Intention to use ($0.128$) Self-efficacy $\rightarrow$ Perceived behavioural control ($0.345$) Technical support $\rightarrow$ Perceived behavioural control ($0.398$) Perceived behavioural control $\rightarrow$ Intention to use ($0.371$) Perceived ease of use $\rightarrow$ Perceived usefulness ($0.53$) Perceived ease of use $\rightarrow$ Attitude ($0.39$) Perceived usefulness $\rightarrow$ Attitude ($0.15$) eTrust $\rightarrow$ Attitude ($0.32$) Subjective norm $\rightarrow$ Perceived usefulness ($0.19$) Perceived usefulness $\rightarrow$ Intention to use ($0.25$) Subjective norm $\rightarrow$ Intention to use ($0.31$) Attitude $\rightarrow$ Intention to use ($0.42$) eTrust $\rightarrow$ Intention to use ($0.38$) Previous ICT usage $\rightarrow$ Effort expectancy ($0.46$) Previous ICT usage $\rightarrow$ Performance expectancy ($0.36$) Trip experience $\rightarrow$ Effort expectancy ($0.57$) Trip experience $\rightarrow$ Performance expectancy ($0.78$) Effort expectancy $\rightarrow$ Behavioural intention ($0.36$) Performance expectancy $\rightarrow$ Behavioural intention ($0.59$)</td>
</tr>
<tr>
<td>20</td>
<td>Kim et al. (2009)</td>
<td>Airline websites</td>
<td>TAM/TRA</td>
<td>Intention to reuse ($R^2 = 0.53$)</td>
<td>Perceived ease of use $\rightarrow$ Perceived usefulness ($0.53$) Perceived ease of use $\rightarrow$ Attitude ($0.39$) Perceived usefulness $\rightarrow$ Attitude ($0.15$) eTrust $\rightarrow$ Attitude ($0.32$) Subjective norm $\rightarrow$ Perceived usefulness ($0.19$) Perceived usefulness $\rightarrow$ Intention to use ($0.25$) Subjective norm $\rightarrow$ Intention to use ($0.31$) Attitude $\rightarrow$ Intention to use ($0.42$) eTrust $\rightarrow$ Intention to use ($0.38$) Previous ICT usage $\rightarrow$ Effort expectancy ($0.46$) Previous ICT usage $\rightarrow$ Performance expectancy ($0.36$) Trip experience $\rightarrow$ Effort expectancy ($0.57$) Trip experience $\rightarrow$ Performance expectancy ($0.78$) Effort expectancy $\rightarrow$ Behavioural intention ($0.36$) Performance expectancy $\rightarrow$ Behavioural intention ($0.59$)</td>
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<td>21</td>
<td>Oh et al. (2009)</td>
<td>Mobile technologies</td>
<td>TAM</td>
<td>Behavioural intention</td>
<td>Previous ICT usage $\rightarrow$ Effort expectancy ($0.46$) Previous ICT usage $\rightarrow$ Performance expectancy ($0.36$) Trip experience $\rightarrow$ Effort expectancy ($0.57$) Trip experience $\rightarrow$ Performance expectancy ($0.78$) Effort expectancy $\rightarrow$ Behavioural intention ($0.36$) Performance expectancy $\rightarrow$ Behavioural intention ($0.59$)</td>
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</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Okazaki and Hirose (2009)</td>
<td>Mobile internet</td>
<td></td>
<td>Habitual usage</td>
<td>Satisfaction from traditional media $\rightarrow$ Attitude towards traditional media (0.97)</td>
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<td>Satisfaction from mobile internet $\rightarrow$ Attitude towards mobile internet (0.99)</td>
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<td>Satisfaction from PC internet $\rightarrow$ Attitude towards PC internet (1.0)</td>
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<td>Satisfaction from PC internet $\rightarrow$ Attitude towards mobile internet ($-1.71$)</td>
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<td>Attitude towards PC internet $\rightarrow$ Attitude towards mobile internet (1.72)</td>
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<td>Satisfaction from PC internet $\rightarrow$ Habitual usage (2.55)</td>
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<td>Satisfaction from traditional media $\rightarrow$ Habitual usage (0.40)</td>
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<td>Attitude towards traditional media $\rightarrow$ Habitual usage ($-0.38$)</td>
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<td>Attitude towards PC internet $\rightarrow$ Habitual usage ($-2.63$)</td>
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<td>Attitude towards mobile internet $\rightarrow$ Habitual usage (0.83)</td>
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<tr>
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<th>Investigated technology adoption behaviour</th>
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<th>Reported structural paths / Significant relationships (Standardised regression coefficient: $\gamma/\beta$)</th>
</tr>
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</table>
| 23  | Varol and Tarcan (2009)      | Hotel information systems                   | TAM 2                                              | Intention to use ($R^2 = 0.76$) | Organisational innovativeness → Personal innovativeness (0.15 and 0.38)  
Personal innovativeness → Perceived ease of use (0.63)  
Perceived ease of use → Perceived usefulness (0.83)  
Perceived usefulness → Intention to use (0.16)  
Perceived ease of use → Intention to use (0.73)  
Perceived ease of use → Perceived usefulness (0.557)  
Perceived ease of use → Attitude (0.379)  
Perceived usefulness → Attitude (0.164)  
Identification → Attitude (0.609)  
Identification → Subjective norm (0.498)  
Identification → Intention to participate (0.175)  
Perceived usefulness → Intention to participate (0.290)  
Attitude → Intention to participate (0.350)  
Subjective norm → Intention to participate (−0.087)  
Perceived behavioural control → Intention to participate (0.471)  
Technology experience → Perception of technology (0.74)  
Technology experience → Perceived value (0.82)  
Perception of technology → Perceived value (0.23)  
Perception of technology → Satisfaction (0.76)  
Perceived value → Satisfaction (0.05)  
Perceived value → Intention to use (0.81)  
Satisfaction → Intention to use (0.1) |
| 24  | Casaló et al. (2010)         | Firm-hosted online travel communities       | TAM/TPB                                            | Intention to participate in online communities ($R^2 = 0.593$) | |
| 25  | Lee and Mills (2010)         | Mobile tourism technologies                 | American customer satisfaction model               | Intention to use | Technology experience → Perception of technology (0.74)  
Technology experience → Perceived value (0.82)  
Perception of technology → Perceived value (0.23)  
Perception of technology → Satisfaction (0.76)  
Perceived value → Satisfaction (0.05)  
Perceived value → Intention to use (0.81)  
Satisfaction → Intention to use (0.1) |
<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| 26  | Lin (2010)     | Travel websites                            | TAM                                                 | Intention to use          | Functionality needs services $\rightarrow$ Perceived ease of use (0.41)  
|     |                |                                             |                                                     |                           | Information quality $\rightarrow$ Perceived usefulness (0.30)  
|     |                |                                             |                                                     |                           | Information quality $\rightarrow$ Perceived ease of use (0.41)  
|     |                |                                             |                                                     |                           | Relevance of information content $\rightarrow$ Perceived usefulness (0.36)  
|     |                |                                             |                                                     |                           | Relevance of information content $\rightarrow$ Perceived ease of use (0.46)  
|     |                |                                             |                                                     |                           | Perceived ease of use $\rightarrow$ Perceived usefulness (0.52)  
|     |                |                                             |                                                     |                           | Perceived ease of use $\rightarrow$ Behavioural intention (0.37)  
|     |                |                                             |                                                     |                           | Perceived usefulness $\rightarrow$ Behavioural intention (0.5)  
|     |                |                                             |                                                     |                           | Task characteristics $\rightarrow$ TTF (0.44)  
|     |                |                                             |                                                     |                           | Technology characteristics $\rightarrow$ TTF (0.56)  
|     |                |                                             |                                                     |                           | Experiential characteristics $\rightarrow$ TTF (-0.01)  
|     |                |                                             |                                                     |                           | TTF $\rightarrow$ Perceived ease of use (0.98)  
|     |                |                                             |                                                     |                           | TTF $\rightarrow$ Perceived usefulness (0.98)  
|     |                |                                             |                                                     |                           | Perceived usefulness $\rightarrow$ Intention to use (0.78)  
|     |                |                                             |                                                     |                           | Perceived ease of use $\rightarrow$ Intention to use (0.22)  
|     |                |                                             |                                                     |                           | Perceived usefulness $\rightarrow$ Intention to use (0.372)  
|     |                |                                             |                                                     |                           | Perceived ease of use $\rightarrow$ Intention to use (0.285)  
|     |                |                                             |                                                     |                           | TTF $\rightarrow$ Intention to use (0.398)  
|     |                |                                             |                                                     |                           | Perceived trust $\rightarrow$ Intention to use (0.227)  
|     |                |                                             |                                                     |                           | Perceived ease of use $\rightarrow$ Intention to use (0.217)  
|     |                |                                             |                                                     |                           | Perceived usefulness $\rightarrow$ Intention to use (0.530)  
|     |                |                                             |                                                     |                           | Perceived usefulness $\rightarrow$ Actual use (0.527)  
|     |                |                                             |                                                     |                           | Intention to use $\rightarrow$ Actual use (0.624)  |
| 27  | Schrier et al. (2010) | Self-service guest empowerment hotel technologies | TAM, TTF | Intention to use | |
| 28  | Usoro et al. (2010) | Tourism websites | Comparison of TAM and combined TAM/ TTF | Intention to use ($R^2_{TAM} = 0.296$, $R^2_{TAM/TTF} = 0.320$, Actual use $R^2_{TAM} = 0.448, R^2_{TAM/TTF} = 0.442$) | |

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<th>Reported structural paths / Significant relationships (Standardised regression coefficient: $\gamma/\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>Wang and Wang (2010)</td>
<td>Mobile hotel reservation</td>
<td>Intention to use ($R^2 = 0.379$)</td>
<td>Information quality $\rightarrow$ Perceived value ($0.311$)</td>
<td>System quality $\rightarrow$ Perceived value ($0.356$) Technological effort $\rightarrow$ Perceived value ($-0.089$) Perceived fee $\rightarrow$ Perceived value ($-0.080$) Perceived value $\rightarrow$ Intention to use ($0.645$)</td>
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<tr>
<td>30</td>
<td>Ku (2011)</td>
<td>Backpacker forums</td>
<td>Intention to use</td>
<td>Flow experience orientation $\rightarrow$ Intention to use Perceived enjoyment $\rightarrow$ Intention to use Perceived usefulness $\rightarrow$ Intention to use Perceived behavioural control $\rightarrow$ Actual participation Intention to use $\rightarrow$ Actual participation Personalisation $\rightarrow$ Perceived usefulness Privacy assurance $\rightarrow$ Perceived usefulness Personalisation $\rightarrow$ Privacy concern Perceived usefulness $\rightarrow$ Willingness to share unidentifiable and identifiable information ($0.30, 0.33$) Privacy concern $\rightarrow$ Willingness to share unidentifiable and identifiable information ($-0.44, -0.41$) Perceived usefulness $\rightarrow$ Intention to use ($0.37$) Privacy concern $\rightarrow$ Intention to use ($-0.37$)</td>
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<td>31</td>
<td>Lee and Cranage (2011)</td>
<td>Travel websites</td>
<td>Willingness to share personal information, Intention to use</td>
<td>[continued]</td>
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<td>32</td>
<td>Para-Lopez et al. (2011)</td>
<td>Social media</td>
<td>Intention to use</td>
<td>TAM/TRA</td>
<td>Benefits (functional benefits, psychological and hedonic benefits, social benefits) → Intention to use $\beta = 0.44$</td>
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<td>Incentives (Altruism, access, environment, predisposition, trust) → Intention to use $\beta = 0.38$</td>
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<td>Usefulness → Intention $\beta = 0.76$</td>
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<td>Knowledge → Intention $\beta = 0.18$</td>
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<td>Attitude → Intention $\beta = 0.63$</td>
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<td>Performance expectancy → Intention $\beta = 0.19$</td>
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<td>Effort expectancy → Intention $\beta = 0.21$</td>
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<td>Social influence → Intention $\beta = 0.19$</td>
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<td>Facilitating conditions → Intention $\beta = 0.18$</td>
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<td>Intention to use → Use behaviour $\beta = 0.56$</td>
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<tr>
<td>33</td>
<td>Peres et al. (2011)</td>
<td>Mobile electronic tourism guides</td>
<td>Intention to use</td>
<td>TAM/TRA</td>
<td>Usefulness $\beta = 0.71$</td>
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<td>Attitude $\beta = 0.18$</td>
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<td>Knowledge $\beta = 0.16$</td>
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<td>Intention $\beta = 0.19$</td>
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<td>34</td>
<td>Wu et al. (2011)</td>
<td>Tourism websites</td>
<td>Intention to use</td>
<td>UTAUT</td>
<td>Performance expectancy $\beta = 0.63$</td>
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<td>Intention to use $\beta = 0.56$</td>
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<td>Use behaviour $\beta = 0.56$</td>
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<tr>
<td>35</td>
<td>Al-hawari and Moutaiket (2012)</td>
<td>Flight online reservation systems</td>
<td>Use behaviour</td>
<td>SERVPERF</td>
<td>Employee based service $\beta = 0.72$</td>
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<td>Trust $\beta = 0.58$</td>
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<td>Image $\beta = 0.28$</td>
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<td>Online continual usage $\beta = 0.57$</td>
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Table II.
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<tr>
<th>No.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Herrero and San Martin (2012)</td>
<td>Rural tourism accommodation websites</td>
<td>TAM</td>
<td>Intention to use (search $R^2 = 0.40$) Intention to use (purchase; $R^2 = 0.36$)</td>
<td>Accommodation information $\rightarrow$ Perceived usefulness (0.27) Destination information $\rightarrow$ Perceived usefulness (0.11) Interactivity of the website $\rightarrow$ Perceived ease of use (0.35) Navigability of the website $\rightarrow$ Perceived ease of use (0.26) Perceived ease of use $\rightarrow$ Perceived usefulness (0.54) Perceived ease of use $\rightarrow$ Intention to use for search (0.30) Perceived ease of use $\rightarrow$ Intention to use for purchase (0.19) Perceived usefulness $\rightarrow$ Intention to use for search (0.42) Perceived usefulness $\rightarrow$ Intention to use for purchase (0.47)</td>
</tr>
<tr>
<td>37</td>
<td>Jungsun Kim et al. (2012)</td>
<td>Hospitality self-service technologies</td>
<td>Likelihood of use</td>
<td>Role clarity $\rightarrow$ Likelihood of use (0.112) Extrinsic motivations $\rightarrow$ Likelihood of use (0.357) Intrinsic motivations $\rightarrow$ Likelihood of use (0.123) Need for interaction $\rightarrow$ Likelihood of use (0.120) Transaction security $\rightarrow$ Trust (0.338) Navigation functionality $\rightarrow$ Trust (0.421) Cost effectiveness $\rightarrow$ Trust (0.158) Ability $\rightarrow$ Trust (0.537) Integrity $\rightarrow$ Trust (0.426) Benevolence $\rightarrow$ Trust (0.314) Trust $\rightarrow$ Intention to reuse (0.481)</td>
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<tr>
<td>38</td>
<td>Kim et al. (2012)</td>
<td>Online purchase of tourism products</td>
<td>Intention to reuse ($R^2 = 0.232$)</td>
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</table>
| 39  | Morosan (2012)            | Hotel biometric systems                     | TAM                                                | Intention to use ($R^2 = 0.79$) | Personal innovativeness → Perceived ease of use (0.29)  
Perceived ease of use → Perceived usefulness (0.69)  
Perceived ease of use → Attitude (0.23)  
Perceived usefulness → Attitude (0.72)  
Attitude → Intention to use (0.89) |
| 40  | Muñoz-Leiva et al. (2012) | Web 2.0 travel websites (Blogs, Facebook, TripAdvisor) | TAM                                                | Intention to use             | Ease of use → Usefulness (0.36) ****  
Ease of use → Trust (0.49)  
Ease of use → Attitude (0.19)  
Usefulness → Attitude (0.57)  
Attitude → Intention to use (0.36)  
Trust → Intention to use (0.33)  
Performance expectancy → Intention to use (0.41)  
Effort expectancy → Intention to use (0.10)  
Innovativeness → Intention to use (0.18)  
Innovativeness x Performance expectancy → Intention to use (0.11) |
| 41  | San Martín and Herrero (2012) | Rural tourism accommodation websites         | UTAUT                                              | Intention to use ($R^2 = 0.40$) | Performance expectancy → Intention to use (0.17)  
Effort expectancy → Intention to use (0.10)  
Innovativeness → Intention to use (0.18)  
Innovativeness x Performance expectancy → Intention to use (0.11)  
Quality of website design → Attitude (0.6)  
Quality of website design → Satisfaction (0.64)  
Quality of website design → Trust (0.752)  
Quality of website design → Intention to use (0.227)  
Attitude → Intention to use (0.467)  
Satisfaction → Intention to use (0.270)  
Trust → Intention to use (0.73) |
| 42  | Wen (2012)                 | Travel websites                             |                                                    | Intention to use ($R^2 = 0.726$) | Homophily → Trustworthiness (0.455)  
Homophily → Attitude (0.138)  
Homophily → Expertise (0.473)  
Trustworthiness → Attitude (0.422)  
Expertise → Attitude (0.218)  
Trustworthiness → Intention to use (0.126)  
Attitude → Intention to use (0.649) |
| 43  | Ayeh et al. (2013a)        | User-generated content                      |                                                    | Intention to use ($R^2 = 0.578$) | Continuation |

(continued)
<table>
<thead>
<tr>
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</tr>
</thead>
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| 44  | Ayeh et al. (2013b)                       | User-generated content                     | TAM                                               | Intention to use \((R^2 = 0.647)\) | Perceived ease of use → Usefulness \((0.574)\)  
Perceived ease of use → Attitude \((0.665)\)  
Perceived enjoyment → Perceived ease of use \((0.792)\)  
Perceived enjoyment → Attitude \((0.259)\)  
Perceived similarity → Trustworthiness \((0.593)\)  
Trustworthiness → Attitude \((0.334)\)  
Trustworthiness → Usefulness \((0.189)\)  
Perceived enjoyment → Intention \((0.258)\)  
Perceived similarity → Intention \((0.167)\)  
Perceived ease of use → Intention \((0.131)\)  
Perceived similarity → Intention \((0.167)\)  
Usefulness → Intention \((0.117)\)  
Attitude → Intention \((0.292)\)  
Performance expectancy → Intention \((0.141)\)  
Facilitating conditions → Intention \((0.087)\)  
Facilitating conditions → Use behaviour \((0.102)\)  
Price-saving orientation → Intention \((0.310)\)  
Habit → Intention \((0.462)\)  
Habit → Use behaviour \((0.328)\)  
Intention → Use behaviour \((0.392)\)  
Perceived ease of use → Enjoyment \((0.280)\)  
Perceived ease of use → Positive emotions \((0.222)\)  
Perceived ease of use → Emotional involvement \((0.233)\)  
Perceived ease of use → Flow \((0.299)\)  
Perceived usefulness → Enjoyment \((0.593)\)  
Perceived usefulness → Positive emotions \((0.522)\)  
Perceived usefulness → Emotional involvement \((0.553)\)  
Perceived usefulness → Flow \((0.653)\) |
| 45  | Escobar-Rodriguez and Carvajal-Trujillo (2013) | Online flight tickets                     | UTAUT2                                            | Intention to use \((R^2 = 0.82)\)  
Use behaviour \((R^2 = 0.579)\) | Performance expectancy → Intention \((0.141)\)  
Facilitating conditions → Intention \((0.087)\)  
Facilitating conditions → Use behaviour \((0.102)\)  
Price-saving orientation → Intention \((0.310)\)  
Habit → Intention \((0.462)\)  
Habit → Use behaviour \((0.328)\)  
Intention → Use behaviour \((0.392)\)  
Perceived ease of use → Enjoyment \((0.280)\)  
Perceived ease of use → Positive emotions \((0.222)\)  
Perceived ease of use → Emotional involvement \((0.233)\)  
Perceived ease of use → Flow \((0.299)\)  
Perceived usefulness → Enjoyment \((0.593)\)  
Perceived usefulness → Positive emotions \((0.522)\)  
Perceived usefulness → Emotional involvement \((0.553)\)  
Perceived usefulness → Flow \((0.653)\) |
| 46  | Huang et al. (2013)                        | 3D Virtual Worlds                          | TAM                                               | Intention to use \((R^2 = 0.761)\) | Perceived ease of use → Enjoyment \((0.280)\)  
Perceived ease of use → Positive emotions \((0.222)\)  
Perceived ease of use → Emotional involvement \((0.233)\)  
Perceived ease of use → Flow \((0.299)\)  
Perceived usefulness → Enjoyment \((0.593)\)  
Perceived usefulness → Positive emotions \((0.522)\)  
Perceived usefulness → Emotional involvement \((0.553)\)  
Perceived usefulness → Flow \((0.653)\) |

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</table>
| 47  | Lai (2013)                 | Mobile travel guide app                     | UTAUT                                              | Intention to use             | Perceived ease of use $\rightarrow$ Intention (0.129)  
Emotional involvement $\rightarrow$ Intention (0.183)  
Flow $\rightarrow$ Intention (0.561)  
Perceived usefulness $\rightarrow$ Intention (0.209)  
Informativeness $\rightarrow$ Perceived ease of use (0.50)  
Informativeness $\rightarrow$ Effort Expectancy (0.32)  
Entertainment $\rightarrow$ Perceived ease of use (0.29)  
Entertainment $\rightarrow$ Effort Expectancy (0.55)  
Entertainment $\rightarrow$ Informativeness (0.66)  
Social influence $\leftrightarrow$ Informativeness (0.66)  
Social influence $\leftrightarrow$ Entertainment (0.70)  
Facilitating conditions $\leftrightarrow$ Informativeness (0.66)  
Facilitating conditions $\leftrightarrow$ Entertainment (0.67)  
Facilitating conditions $\leftrightarrow$ Social influence (0.72)  
Perceived ease of use $\rightarrow$ Intention to use (0.23)  
Informativeness $\rightarrow$ Intention to use (0.33)  
Effort Expectancy $\rightarrow$ Intention to use (0.16)  
Social influence $\rightarrow$ Intention to use (0.14)  
Facilitating conditions $\rightarrow$ Intention to use (0.17)  
Perceived ease of use $\rightarrow$ Trust (0.62)  
Perceived ease of use $\rightarrow$ Perceived usefulness (0.59)  
Trust $\rightarrow$ Perceived risk (−0.48)  
Perceived ease of use $\rightarrow$ Attitude (0.06)  
Perceived usefulness $\rightarrow$ Attitude (0.76)  
Trust $\rightarrow$ Attitude (0.48)  
Perceived Risk $\rightarrow$ Attitude (−0.34)  
Attitude $\rightarrow$ Intention to use (0.53) |
<p>| 48  | Nunkoo and Ramkissoon (2013)| Online purchase of travel products          | TAM                                                | Intention to use             | (continued)                                                                                                                     |</p>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>Wen (2013)</td>
<td>Online purchase of travel products</td>
<td>Intention to use ((R^2 = 0.709))</td>
<td>Perception of convenience (\rightarrow) Experience ((0.347))</td>
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<td>Perception of merchandise options (\rightarrow) Experience ((0.081))</td>
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<td>Perception of value (\rightarrow) Experience ((0.314))</td>
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<td>Perception of convenience (\rightarrow) Intention ((0.339))</td>
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<td>Perception of merchandise options (\rightarrow) Intention ((0.076))</td>
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<td>Altruism (\rightarrow) Intention ((0.20))</td>
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<td>Satisfaction x Perceived usefulness (\rightarrow) Intention ((0.22))</td>
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<td>50</td>
<td>Yang (2013)</td>
<td>Use of eWOM tools to share experience</td>
<td>TAM</td>
<td>Intention to use ((R^2 = 0.44))</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Escobar-Rodríguez and Carvajal-Trujillo (2014)</td>
<td>Use of low cost carrier websites for online purchase of flight tickets</td>
<td>UTAUT, UTAUT 2</td>
<td>Intention to use ((R^2 = 0.603))</td>
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<td>Use behaviour ((R^2 = 0.6))</td>
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<td>Performance expectancy (\rightarrow) Intention to use ((0.099))</td>
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<td>Effort expectancy (\rightarrow) Intention to use ((0.085))</td>
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<td>Social influence (\rightarrow) Intention to use ((0.043))</td>
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<td>Facilitating conditions (\rightarrow) Intention to use ((0.146))</td>
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<td>Hedonic motivation (\rightarrow) Intention to use ((0.047))</td>
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<td>Price-saving orientation (\rightarrow) Intention to use ((0.206))</td>
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<td>Habit (\rightarrow) Intention to use ((0.249))</td>
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<td>Innovativeness (\rightarrow) Intention to use ((0.061))</td>
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<td>Trust (\rightarrow) Intention to use ((0.273))</td>
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<td>Facilitating conditions (\rightarrow) Use behaviour ((0.105))</td>
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<td></td>
<td>Habit (\rightarrow) Use behaviour ((0.372))</td>
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<td></td>
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<td></td>
<td></td>
<td>Intention to use (\rightarrow) Use behaviour ((0.421))</td>
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<tr>
<th>No.</th>
<th>Study</th>
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<th>Dependant variable ($R^2$)</th>
<th>Reported structural paths / Significant relationships (Standardised regression coefficient: $\gamma/\beta$)</th>
</tr>
</thead>
</table>
| 52  | Gao and Bai (2014) | Use of online travel agencies for purchase | Intention to use ($R^2 = 0.59$) | Satisfaction ($R^2 = 0.31$) | Informativeness $\rightarrow$ Flow (0.55)  
Effectiveness $\rightarrow$ Flow (0.68)  
Entertainment $\rightarrow$ Flow (0.53)  
Flow $\rightarrow$ Satisfaction (0.52)  
Flow $\rightarrow$ Intention to use (0.69) |
| 53  | Liu and Zhang (2014) | Comparison of use of online travel agencies and hotel websites for purchase | Intention to use for search, Intention to use for purchase | Product factors (Review, price, variety) $\rightarrow$ Search intentions  
Channel factors (Website quality, payment, customer relationships) $\rightarrow$ Search intentions  
Product factors (Review, price, variety) $\rightarrow$ Purchase intentions  
Channel factors (Website quality, payment, customer relationships) $\rightarrow$ purchase intentions |
| 54  | No and Kim (2014) | Use of smartphones for travel information | UTAUT, e-Satisfaction model | Intention to use smartphones ($R^2 = 0.309$) | Website interface $\rightarrow$ Perceived quality (0.714)  
Perceived quality $\rightarrow$ Perceived value (0.446)  
Website interface $\rightarrow$ Online experience (0.216)  
Perceived quality $\rightarrow$ Online experience (−0.079)  
Perceived value $\rightarrow$ Online experience (0.685)  
Online experience $\rightarrow$ Satisfaction (0.641)  
Satisfaction $\rightarrow$ Intention to use (0.077)  
Usefulness $\rightarrow$ Intention to use (0.409)  
Ease of use $\rightarrow$ Intention to use (0.094)  
Social influence $\rightarrow$ Intention to use (0.127) |
<table>
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<tr>
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</tr>
</thead>
</table>
| 55  | Amaro and Duarte (2015)      | Use of online travel platforms for purchase                                                                   | TRA, TBP, TAM                                        | Intention to use ($R^2 = 0.67$)                                      | Perceived relative advantage $\rightarrow$ Trust ($0.29$)  
Trust $\rightarrow$ Perceived risk ($-0.72$)  
Perceived behavioural control $\rightarrow$ Complexity ($-0.64$)  
Trust $\rightarrow$ Attitude ($0.11$)  
Perceived relative advantage $\rightarrow$ Attitude ($0.26$)  
Complexity $\rightarrow$ Attitude ($-0.05$)  
Compatibility $\rightarrow$ Attitude ($0.47$)  
Compatibility $\rightarrow$ Intention to use ($0.20$)  
Trust $\rightarrow$ Intention to use ($-0.06$)  
Perceived risk $\rightarrow$ Intention to use ($-0.12$)  
Perceived behavioural control $\rightarrow$ Intention to use ($0.10$)  
Attitude $\rightarrow$ Intention to use ($0.55$)  
Expertise $\rightarrow$ Attitude ($0.166$)  
Ease of use $\rightarrow$ Attitude ($0.416$)  
Ease of use $\rightarrow$ Usefulness ($0.461$)  
Trustworthiness $\rightarrow$ Attitude ($0.257$)  
Trustworthiness $\rightarrow$ Usefulness ($0.248$)  
Usefulness $\rightarrow$ Attitude ($0.120$)  
Usefulness $\rightarrow$ Intention to use ($0.266$)  
Attitude $\rightarrow$ Intention to use ($0.538$) |
| 56  | Ayeh (2015)                  | Use of user generated content for travel planning                                                              | TAM                                                 | Intention to use ($R^2 = 0.623$)                                    | Internet privacy concerns $\rightarrow$ Perceived security ($-0.075$)  
Familiarity with the website $\rightarrow$ Perceived security ($0.089$)  
Disposition to third party certification $\rightarrow$ Perceived security ($-0.055$)  
Understanding of seals $\rightarrow$ Perceived security ($0.096$)  
Privacy/ security policy $\rightarrow$ Perceived security ($-0.245$) |
<p>| 57  | Bonsón Ponte et al. (2015)   | Use of travel websites for online purchase                                                                  | Intention to use ($R^2 = 0.677$)                          |                                                                         | (continued)                                                                                                   |</p>
<table>
<thead>
<tr>
<th>No.</th>
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</tr>
</thead>
</table>
| 58  | Chung and Koo (2015) | Use of social media for travel information search | Value-based adoption model | Intention to use ($R^2 = 0.315$) | Website investment $\rightarrow$ Perceived security (0.303)  
Vendor reputation $\rightarrow$ Perceived security (0.225)  
Assurance seal $\rightarrow$ Perceived security (0.213)  
Information quality $\rightarrow$ Trust (0.598)  
Perceived security $\rightarrow$ Trust (0.319)  
Trust $\rightarrow$ Perceived value (0.810)  
Perceived value $\rightarrow$ Intention to use (0.561)  
Trust $\rightarrow$ Intention to use (0.299) |
| 59  | Ku and Chen (2015) | Using tourism websites | End-user satisfaction | Intention for continued use ($R^2 = 0.37$) | Website design quality $\rightarrow$ Satisfaction (0.49)  
Web service quality $\rightarrow$ Satisfaction (0.31)  
Website design quality x interactivity $\rightarrow$ Satisfaction (0.57)  
Web service quality x interactivity $\rightarrow$ Satisfaction (0.78)  
Satisfaction $\rightarrow$ Intention for continued usage (0.67) |
| 60  | Kucukusta et al. (2015) | Using tourism online booking services | TAM | Intention to book online ($R^2 = 0.40$) | Usefulness $\rightarrow$ Intention to use (0.394)  
Ease of use $\rightarrow$ Intention to use (0.223) |

(continued)
<table>
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<tr>
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</tr>
</thead>
</table>
| 61  | Lu et al. (2015) | Use of rural tourism travel apps | TAM, IDT (Innovation Diffusion Theory), SCT (Social Cognitive Theory) | Intention to use ($R^2 = 0.53$) | Self-efficacy → Performance outcome (0.56)  
Self-efficacy → Personal outcome (0.62)  
Advantage → Intention to use (0.10)  
Compatibility → Intention to use (0.40)  
Complexity → Intention to use (0.36)  
Performance outcome → Intention to use (0.43)  
Personal outcome → Intention to use (0.15)  
Marketing activities → Perceived benefits (0.422)  
Marketing activities → Perceived risks (0.357)  
Marketing activities → Confusion by over-choice (0.186)  
Perceived benefits → Perceived risks (0.215)  
Perceived benefits → Price issues (0.314)  
Perceived benefits → Quality issues (0.280)  
Perceived risks → Price issues (0.327)  
Perceived risks → Quality issues (0.206)  
Confusion by over-choice → Price issues (0.185)  
Confusion by over-choice → Quality issues (0.231)  
Price issues → Quality issues (0.219)  
Price issues → Trust (0.385)  
Quality issues → Trust (0.408)  
Trust → Intention to use (0.411)  
Usefulness → Intention to use (0.134)  
Perceived ease of use → Intention to use (−0.017)  
Perceived enjoyment (pleasure, escape, directed behaviour) → Intention to use (0.10, 0.081, 0.153)  
Attitude → Intention to use (0.042)  
Compatibility → Intention to use (0.234)  
Perceived behavioural control → Intention to use (0.118)  
Subjective norm → Intention to use (0.256) |
| 62  | Pappas (2015) | Online purchase of tourism products |  | Intention to use ($R^2 = 0.521$) |  |
| 63  | Sahli and Legohérel (2015) | Online booking of tourism products | Tourism Web Acceptance Model (T-WAM) | Intention to use ($R^2 = 0.506$) |  |

(continued)
<table>
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<tr>
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</tr>
</thead>
</table>
| 64  | Wang *et al.* (2015) | Using hotel websites for online booking | Intention to use ($R^2 = 0.705$) | | Perceived benefits $\rightarrow$ Intention to use (0.106)  
Trust $\rightarrow$ Intention to use (0.085)  
Product risk $\rightarrow$ Intention to use (0.139)  
Social risk $\rightarrow$ Intention to use (0.043)  
Website quality $\rightarrow$ eTrust (0.577)  
eTrust $\rightarrow$ Intentions to use (0.369)  
Website quality $\rightarrow$ Intentions to use (0.190)  
Performance expectancy $\rightarrow$ Intention to use (0.356)  
Effort expectancy $\rightarrow$ Intention to use (0.152)  
Social influence $\rightarrow$ Intention to use (0.184)  
Facilitating conditions $\rightarrow$ Intention to use (0.122)  
Facilitating conditions $\rightarrow$ Use behaviour (0.137)  
Habit $\rightarrow$ Intention to use (0.134)  
Habit $\rightarrow$ Use behaviour (0.221)  
Hedonic motivation $\rightarrow$ Intention (0.362)  
Price-value $\rightarrow$ Intention to use (0.179)  
Intention to use $\rightarrow$ Use behaviour (0.284)  
Trust $\rightarrow$ Perceived risk (−0.74)  
Communicability $\rightarrow$ Perceived risk (−0.04)  
Perceived risk $\rightarrow$ Attitude (−0.22)  
Trust $\rightarrow$ Attitude (0.42)  
Perceived risk $\rightarrow$ Intention to use (−0.12)  
Attitude $\rightarrow$ Intention to use (0.07)  
Perceived behavioural control $\rightarrow$ Intention to use (0.11) |
| 65  | Ali *et al.* (2016) | Tourism computer supported classrooms | Intention to use ($R^2 = 0.707$)  
Usage ($R^2 = 0.737$) | | |
<p>| 66  | Amaro and Duarte (2016) | Online purchase of travel | Intention to use ($R^2 = 0.66$) | | |</p>
<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>67</td>
<td>Chang <em>et al.</em> (2016)</td>
<td>Using medical tourism app</td>
<td>TPB, TAM</td>
<td>Intention to use ($R^2 = 0.571$)</td>
<td>App involvement $\rightarrow$ Attitude (0.213) Perceived ease of use $\rightarrow$ Attitude (0.457) Perceived usefulness $\rightarrow$ Attitude (0.477) Mobile self-efficacy $\rightarrow$ Perceived behavioural control (0.334) Attitude $\rightarrow$ Intention to use (0.424) Social influence $\rightarrow$ Intention to use (0.411) Perceived behavioural control $\rightarrow$ Intention to use (0.159)</td>
</tr>
<tr>
<td>68</td>
<td>Kim (2016)</td>
<td>Using hotel tablet apps</td>
<td>TAM</td>
<td>Intention to use ($R^2 = 0.976$)</td>
<td>Perceived usefulness $\rightarrow$ Intention to use (0.532) Subjective norm $\rightarrow$ Intention to use (0.187) Perceived credibility $\rightarrow$ Intention to use (0.409) Risk $\rightarrow$ Security ($-0.75$) Social influence $\rightarrow$ Security (0.21) Security $\rightarrow$ Trust (0.54) Risk $\rightarrow$ Trust ($-0.16$) Trust $\rightarrow$ Effort expectancy (0.32) Facilitating conditions $\rightarrow$ Effort expectancy (0.59) Self-efficacy $\rightarrow$ Effort expectancy ($-0.09$) Risk $\rightarrow$ Utilitarian performance expectancy ($-0.25$) Trust $\rightarrow$ Utilitarian performance expectancy (0.26) Social influence $\rightarrow$ Utilitarian performance expectancy (0.26) Effort expectancy $\rightarrow$ Utilitarian performance expectancy (0.31) Trust $\rightarrow$ Hedonic performance expectancy (0.24) Social influence $\rightarrow$ Hedonic performance expectancy (0.09) Effort expectancy $\rightarrow$ Hedonic performance (continued)</td>
</tr>
<tr>
<td>69</td>
<td>Khalilzadeh <em>et al.</em> (2017)</td>
<td>NFC based mobile payment in restaurants</td>
<td>UTAUT</td>
<td>Intention to use ($R^2 = 0.87$)</td>
<td>(continued)</td>
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<td>Reported structural paths / Significant relationships (Standardised regression coefficient: $\gamma/\beta$)</td>
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</table>
| 70  | Fong et al. (2017)         | Using mobile apps for hotel booking         | UTAUT                                            | Intention to use ($R^2 = 0.532$) | Hedonic performance expectancy $\rightarrow$ Attitude (0.48)  
Security $\rightarrow$ Intention to use (0.15)  
Utilitarian performance expectancy $\rightarrow$ Attitude (0.24)  
Hedonic performance expectancy $\rightarrow$ Attitude (0.24)  
Internal control $\rightarrow$ effort expectancy $\rightarrow$ Intention to use (0.074)  
Chance control $\rightarrow$ effort expectancy $\rightarrow$ Intention to use (−0.030)  
Control by powerful others $\rightarrow$ facilitating conditions $\rightarrow$ Intention to use (−0.061)  
Chance control $\rightarrow$ perceived risk $\rightarrow$ Intention to use (−0.027)  
Performance expectancy $\rightarrow$ Intention to use (0.172)  
Effort expectancy $\rightarrow$ Intention to use (0.190)  
Social influence $\rightarrow$ Intention to use (0.123)  
Facilitating conditions $\rightarrow$ Intention to use (0.307)  
Perceived risk $\rightarrow$ Intention to use (−0.100)  
Performance expectancy $\rightarrow$ Intention to use (0.171)  
Facilitating conditions $\rightarrow$ Intention to use (0.249)  
Hedonic motivation $\rightarrow$ Intention to use (0.131)  
Habit $\rightarrow$ Intention to use (0.415)  
Habit $\rightarrow$ Use behaviour (0.301)  
Intention to use $\rightarrow$ Use behaviour (0.357) |
| 71  | Gupta and Dogra (2017)      | Use of travel mapping apps                 | UTAUT 2                                           | Intention to use ($R^2 = 0.599$) | Hedonic performance expectancy $\rightarrow$ Attitude (0.48)  
Security $\rightarrow$ Intention to use (0.15)  
Utilitarian performance expectancy $\rightarrow$ Attitude (0.24)  
Hedonic performance expectancy $\rightarrow$ Attitude (0.24)  
Internal control $\rightarrow$ effort expectancy $\rightarrow$ Intention to use (0.074)  
Chance control $\rightarrow$ effort expectancy $\rightarrow$ Intention to use (−0.030)  
Control by powerful others $\rightarrow$ facilitating conditions $\rightarrow$ Intention to use (−0.061)  
Chance control $\rightarrow$ perceived risk $\rightarrow$ Intention to use (−0.027)  
Performance expectancy $\rightarrow$ Intention to use (0.172)  
Effort expectancy $\rightarrow$ Intention to use (0.190)  
Social influence $\rightarrow$ Intention to use (0.123)  
Facilitating conditions $\rightarrow$ Intention to use (0.307)  
Perceived risk $\rightarrow$ Intention to use (−0.100)  
Performance expectancy $\rightarrow$ Intention to use (0.171)  
Facilitating conditions $\rightarrow$ Intention to use (0.249)  
Hedonic motivation $\rightarrow$ Intention to use (0.131)  
Habit $\rightarrow$ Intention to use (0.415)  
Habit $\rightarrow$ Use behaviour (0.301)  
Intention to use $\rightarrow$ Use behaviour (0.357) |

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<tr>
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<th>Dependant variable ($R^2$)</th>
<th>Reported structural paths / Significant relationships (Standardised regression coefficient: $\gamma/\beta$)</th>
</tr>
</thead>
</table>
| 72  | Herrero *et al.* (2017) | Using tourism social network sites for sharing user generated content                                       | UTAUT 2                                           | Intention to use ($R^2 = 0.77$) | Effort expectancy → Performance expectancy (0.64)  
Effort expectancy → Habit (0.22)  
Effort expectancy → Hedonic motivation (0.67)  
Hedonic motivation → Habit (0.22)  
Performance expectancy → Intention to use (0.49)  
Hedonic motivation → Intention to use (0.28)  
Habit → Intention to use (0.22)  
eWOM argument quality → Perceived usefulness (0.37)  
eWOM credibility → Perceived usefulness (0.50)  
Perceived ease of use → Perceived usefulness (0.34)  
Perceived ease of use → Information adoption (0.52)  
Perceived usefulness → Information adoption (0.42)  
Information adoption → Intention to use (0.89) |
| 73  | Chong *et al.* (2018)   | Using electronic word of mouth (eWOM) in making travel decisions                                             | TAM                                               | Intention to use ($R^2 = 0.78$) | (continued)                                                                                           |
| No. | Study               | Investigated technology adoption behaviour | Fundamental technology adoption theoretical models | Dependant variable ($R^2$) | Reported structural paths / Significant relationships (Standardised regression coefficient: $\gamma/\beta$) |
|-----|---------------------|--------------------------------------------|--------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------
| 74  | Paulo et al. (2018) | Using mobile augmented reality in tourism   | UTAUT 2, TTF                                     | Intention to use ($R^2 = 0.72$) | Task characteristics $\rightarrow$ TTF (0.17)  
                                |                                  | Use behaviour ($R^2 = 0.45$)     | Technology characteristics $\rightarrow$ TTF (0.49)  
                                |                                  |                                | TTF $\rightarrow$ Performance expectancy (0.37)  
                                |                                  |                                | Technology characteristics $\rightarrow$ Effort expectancy (0.66)  
                                |                                  |                                | Effort expectancy $\rightarrow$ Performance expectancy (0.40)  
                                |                                  |                                | TTF $\rightarrow$ Intention to use (0.14)  
                                |                                  |                                | Performance expectancy $\rightarrow$ Intention to use (0.11)  
                                |                                  |                                | Facilitating conditions $\rightarrow$ Intention to use (0.15)  
                                |                                  |                                | Hedonic motivation $\rightarrow$ Intention to use (0.21)  
                                |                                  |                                | Habit $\rightarrow$ Intention to use (0.38)  
                                |                                  |                                | TTF $\rightarrow$ Use behaviour (0.29)  
                                |                                  |                                | Habit $\rightarrow$ Use behaviour (0.31)  
                                |                                  |                                | Intention to use $\rightarrow$ Use behaviour (0.15)  |

**Notes:** *Some of these relationships were not found significant in different hotel segments. **Regression coefficients are reported here for the economy sector. ***Significant relationships and regression coefficients in here are reported for DTPB model only. ***Significant relationships vary per platform. The relationships and coefficients are reported for TripAdvisor.*
<table>
<thead>
<tr>
<th>Belief groups</th>
<th>Definition</th>
<th>Proposed salient belief groups</th>
<th>Example studies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Social norms, social influence, social benefits, subjective norm</td>
<td>Chen (2007); Huh <em>et al.</em> (2009), Morosan and Jeong (2008)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Encouragement by others, peer influence, word of mouth, organisation and management influence</td>
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<td>(continued)</td>
</tr>
<tr>
<td>Behavioural</td>
<td>Beliefs about the presence of factors that may further facilitate or hinder</td>
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<tr>
<td>control beliefs</td>
<td>performance of the behaviour</td>
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</tbody>
</table>

Table III. Selected list of determinants of technology acceptance recurring in multiple studies
body of research that does not provide sufficient insight towards achieving an in-depth understanding of the investigated phenomenon and the inability to provide a robust fundamental theory able to nurture the field’s progress (Baggozzi, 2007; Benbasat and Barki, 2007). Perhaps more important to note are the often-simplistic assumptions about the causal relationship between intention and behaviour that overlook the role of inhibitors and situational variables and ignore the impact of technology characteristics and design (Baggozzi, 2007; Benbasat and Barki, 2007).

The 74 articles reviewed here highlight that adding new constructs to TAM is the most common practice in eTourism technology acceptance research. As stated earlier, TAM and TAM extensions account for over two-thirds of the models used in the 74 articles. What this suggests is that much of the technology acceptance research in eTourism suffers from the limitations of TAM and its preceding cognitive theories. The over-reliance of eTourism technology acceptance research on TAM can be criticised from three interrelated perspectives:

1. redundancy of some of the newly proposed variables and parsimony of these models;
2. violation of the principal assumptions of the underlying cognitive theories (i.e. TRA and TPB); and
3. confining the theoretical boundaries of research in this field to a limited number of classical cognitive consumer behaviour paradigms. These three issues will now be discussed.

4.1 Redundancy of variables and parsimony of models
As seen in Tables II and III, despite using different terminologies, many of the suggested variables are essentially synonymous. In some cases, the variables are added to the models

<table>
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<th>Example studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective/ hedonic responses</td>
<td>Affective, emotive and hedonic responses towards using a behaviour (Slovic et al., 2002)</td>
<td>Attitude, predisposition, preference</td>
<td>Amaro and Duarte (2016), Chang et al. (2016), Khalilzadeh et al. (2017), Kim et al. (2009), Luque-Martinez et al. (2007)</td>
</tr>
<tr>
<td>Personal Traits and profile</td>
<td>Generalised patterns of an individual’s responses to the environment as well as persistent qualities in one’s behaviour (Kassarjian, 1971, p. 409)</td>
<td>Technology experience, expertise, capability, previous experience, familiarity</td>
<td>Gao and Bai (2014), (Ku and Chen, 2015); Okazaki and Hirose (2009), Wen (2012), Yang (2013)</td>
</tr>
</tbody>
</table>
with the hope of increasing the predictive power without considering the parsimony, validity or generalisability of those variables and without providing a theoretical insight to explain why these variables act the way statistical tests demonstrate (Bagozzi, 2007; Rise et al., 2010). Alternatively, if predictive power is sought by researchers, then there is no consistent evidence that the practice of adding new variables to the original TRA, TPB and TAM models will increase their predictivity. For instance, TAM2 (Venkatesh and Davis, 2000), TAM3 (Venkatesh and Bala, 2008), Decomposed Theory of Planned Behaviour (DTPB; Taylor and Todd, 1995), the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003), UTAUT2 (Venkatesh et al., 2012) and UTAUT3 (Al-Sahouly, 2015) are all expanded versions of one of the above models (as illustrated in Figure 1) and are often referred to as TAM++ (Benbasat and Barki, 2007). The principal relationships proposed in each of the above models are presented in Table IV.

However, while the number of variables increase as the new editions of these models are being proposed, there is no consensus on the superiority of any of the above models (Brown et al., 2015; Huh et al., 2009; Hung and Chang, 2005; Mathieson, 1991; Taylor and Todd, 1995; Venkatesh et al., 2003). This lack of consensus on the superiority of models could be because of a wide range of factors, including differences in the technologies investigated, complexities of the behaviour and models as well as the use of different response scales. However, in some direct comparisons of competing models, models with larger numbers of variables (i.e. UTAUT) often had relatively similar or even sometimes less predictive power than models with fewer variables (i.e. TAM; e.g. Huh et al., 2009).

For TPB, Ajzen (2011, pp. 1114-1115) argues that because of methodological limits and some conceptual issues, particularly surrounding stochastic elements of behaviour such as the impact of situational and external variables, a correlation coefficient of about 0.6 (or about 37 per cent of the variance) is perhaps the maximum level of prediction of behavioural intention we can expect from this model. However, as discussed by Pourfakhimi et al. (2018) and as can be seen in Table II, some studies, including eTourism studies, using the extended

Figure 1.
<table>
<thead>
<tr>
<th>Models</th>
<th>Endogenous constructs</th>
<th>Proposed relationships</th>
</tr>
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</table>
| TRA (Fishbein and Ajzen, 1975) | Behavioural beliefs (BB): Perceptions of a subjective probability associating a certain behaviour with certain values and attributes (Fishbein and Ajzen, 1975, pp. 131-135); beliefs about the likely consequences or other attributes of the behaviour (Ajzen, 2002a, p. 665). Normative beliefs (NB): Perceptions of a subjective probability associating a certain behaviour with the normative perception of how specific referent individuals or groups with whom the person's is motivated to comply perceives that object or behaviour (Fishbein and Ajzen, 1975, pp. 131-135); beliefs about the normative expectations of other people (Ajzen, 2002a, p. 665). Attitude (A): A bipolar affective and/or evaluative construct representing a person's favourable or unfavourable dispositions towards a behaviour (Fishbein and Ajzen, 1975, pp. 5-13). Subjective norm (SN): Perceived expectations of specific referent individual or groups a behaviour and a person's motivation to comply with them (Fishbein and Ajzen, 1975, p. 302). Behavioural intention (BI): A conative set of beliefs representing the subjective probability of the persons' association of themselves with the intention to perform a behaviour (Fishbein and Ajzen, 1975, pp. 11-13). Behaviour (B): Overt behaviour, an observable act. | BB → A
|                         |                                                                                         | NB → SN
|                         |                                                                                         | A and SN → BI
|                         |                                                                                         | BI → B |
| TPB (Ajzen, 1985)       | BB, A, NB and SN, BI and B: Refer to TRA Control beliefs (CB): A person's belief about the degree of their control over the personal and external factors that determine the level of likelihood of the performance of a behaviour (Ajzen, 1985, p. 30); beliefs about the presence of factors that may further facilitate or hinder performance of the behaviour (Ajzen, 2002a, p. 665; 2002 b, p. 107). Perceived behavioural control (PBC): Perceived subjective probability concerning the person's control over a range of internal and external factors that determine the level of likelihood of successful performance of a behaviour (Ajzen, 1985, pp. 34-36); the perceived ease or difficulty of performing the behaviour (Ajzen, 2002a, p. 665). | BB → A
|                         |                                                                                         | NB → SN
|                         |                                                                                         | CB → PBC
|                         |                                                                                         | A, SN and PBC → BI
|                         |                                                                                         | PBC and BI → B |
| TAM (Davis, 1985)       | A: Refer to TRA Actual system use (AU): A specific case of B (refer to TRA) Perceived usefulness (PU): The degree to which an individual believes that using a particular system would enhance their job performance (Davis, 1985, p. 26); a specific BB (refer to TRA) Perceived ease of use (PEU): The degree to which an individual believes that using a particular system would be free of physical and mental effort (Davis, 1985, p. 26); a specific CB (refer to TPB). | PEU → PU
|                         |                                                                                         | PEU and PU → A
|                         |                                                                                         | A → AU |
| DTPB (Taylor and Todd, 1995) | A, SN, PBC, BI, B: Refer to TRA and TPB PU and PEU: Refer to TAM Compatibility (COMP): The perception of the degree to which the innovation fits with potential user's existing values, previous experiences and current needs (Rogers, 1983; Taylor and Todd, 1995, p. 152). Peer influence (PI): A specific NB (refer to TRA), related to peers' perceptions | PU, PEU and COMP → A
|                         |                                                                                         | P1 and SI → SN
|                         |                                                                                         | SE, RFC and TFC → PBC
|                         |                                                                                         | A, SN and PBC → BI
|                         |                                                                                         | PBC and BI → B |
|                         |                                                                                         | **(continued)**
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<th>Models</th>
<th>Endogenous constructs</th>
<th>Proposed relationships</th>
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<tr>
<td>TAM2</td>
<td><em>Superior’s influence (SI)</em>: A specific NB (refer to TRA), related to superiors’ perceptions</td>
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<td><em>Self-efficacy (SE)</em>: The belief that one has the capability to perform a particular behaviour (Compeau and Higgins, 1995, p. 189), a specific CB (refer to TPB)</td>
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<td><em>Resources facilitating conditions (RFC)</em>: Available resources such as time and money (Taylor and Todd, 1995, p. 193) that facilitates the use of a technology, a specific CB (refer to TPB)</td>
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<td></td>
<td><em>Technology facilitating conditions (TFC)</em>: Issues related to the compatibility of technology (Taylor and Todd, 1995, p. 193) that facilitates the use of a technology, a specific CB (refer to TPB).</td>
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<tr>
<td>TAM3</td>
<td>SN, BI and B: Refer to TRA and TPB</td>
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<td></td>
<td>PU and PEU: Refer to TAM</td>
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<td></td>
<td><em>Experience (EX)</em>: The degree of user’s ongoing direct use of a technology (Venkatesh and Davis, 2000, p. 190)</td>
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<td><em>Voluntariness (VO)</em>: The extent to which potential adopters perceive the adoption decision to be non-mandatory (Venkatesh and Davis, 2000, p. 188), a specific CB (refer to TPB)</td>
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<td><em>Image (IMG)</em>: The degree to which use of an innovation is perceived to enhance one’s status in one’s social system (Venkatesh and Davis, 2000, p. 189), a specific NB (refer to TRA)</td>
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<td><em>Job relevance (JR)</em>: The degree to which a user believes using a technology is applicable to their job (Venkatesh and Davis, 2000, p. 190)</td>
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<td><em>Output quality (OQ)</em>: [The perception of] what tasks a system is capable of performing (Venkatesh and Davis, 2000, p. 191), a specific PU-related belief (Refer to TAM)</td>
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<td></td>
<td><em>Result demonstrability (RD)</em>: [The perception of] tangibility of the results of using the innovation (Moore and Benbasat, 1991; Venkatesh and Davis, 2000, p. 192).</td>
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<tr>
<td>TAM 3</td>
<td>SN, BI and B: Refer to TRA and TPB</td>
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<td>PU and PEU: Refer to TAM</td>
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<td></td>
<td>EX, VO, IMG, JR, RO and RD: Refer to TAM 2</td>
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<td></td>
<td>SE: Refer to DTPB</td>
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<td></td>
<td><em>Perception of external control (PEC)</em>: The degree to which an individual believes that organizational and technical resources exist to support the use of the system (Venkatesh and Bala, 2008, p. 279; Venkatesh et al., 2003), a specific CB (refer to TPB).</td>
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<td><em>Computer anxiety (ANX)</em>: [The perception of] an individual’s apprehension, or even fear, when she/he is faced with the possibility of using computers (Venkatesh, 2000; Venkatesh and Bala, 2008, p. 279)</td>
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<td><em>Computer playfulness (PLY)</em>: The degree of cognitive spontaneity in microcomputer interactions (Venkatesh and Bala, 2008, p. 279; Webster and Martocchio, 1992)</td>
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<td><strong>PERCEIVED ENJOYMENT (ENJ)</strong>: The perception of an activity of using a specific system being enjoyable in its own right aside from any performance consequences resulting from system use (Venkatesh, 2000; Venkatesh and Bala, 2008, p. 279)</td>
<td>EX x SN, VO x SN &amp; EX x PEU → BI</td>
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<td><strong>OBJECTIVE USABILITY (OUS)</strong>: A comparison of systems based on the actual level (rather than perceptions) of effort required to completing specific task (Venkatesh, 2000; Venkatesh and Bala, 2008, p. 279). A ratio of time spent by the subject to the time spent by an expert on the same set of task (Venkatesh and Bala, 2008, p. 314).</td>
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<td><strong>EXTRINSIC MOTIVATION (EM)</strong>: The perception that users are willing to perform an activity because it is perceived to be instrumental in achieving a valuable outcome, distinct from the activity itself (Davis et al., 1992; Venkatesh et al., 2003, p. 448); analogous to PU (refer to TAM)</td>
<td>EM, JF, PE, RAD, OUX &amp; PBC, BI &amp; B: Refer to TRA and TPB</td>
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<td><strong>JOB-FIT (JF)</strong>: How the capabilities of a system enhance an individual’s job performance (Thompson et al., 1991; Venkatesh et al., 2003, p. 448); analogous to PU (refer to TAM)</td>
<td>PU and PEU: Refer to TAM</td>
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<td><strong>PERFORMANCE EXPECTANCY (PEX)</strong>: The degree to which an individual believes that using the system will help them to attain gains in job performance (Venkatesh et al., 2003, p. 448); analogous to PU (refer to TAM)</td>
<td>COMP: Refer to DTPB IMG,</td>
<td></td>
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<td><strong>RELATIVE ADVANTAGE (RAD)</strong>: The degree to which using an innovation is perceived as being better than a precursor (Moore and Benbasat, 1991; Venkatesh et al., 2003, p. 449)</td>
<td>EX and VO: Refer to TAM 2</td>
<td></td>
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<td><strong>OUTCOME EXPECTANCY (OEX)</strong>: Perceptions of the outcomes and consequences of the behaviour (Compeau and Higgins, 1995; Compeau et al., 1999; Venkatesh et al., 2003, p. 449); analogous to PU (refer to TAM)</td>
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<td><strong>EFFORT EXPECTANCY (EEE)</strong>: The degree of ease associated with the use of system (Venkatesh et al., 2003, p. 450); analogous to PEU (refer to TAM)</td>
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<td><strong>COMPLEXITY (COMX)</strong>: The degree to which a system is perceived as relatively difficult to use (Thompson et al., 1991; Venkatesh et al., 2003, p. 451); opposite of PEU (refer to TAM)</td>
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<td><strong>EASE OF USE (EOU)</strong>: The degree to which using an innovation is perceived as being [not] difficult to use; (Moore and Benbasat, 1991; Venkatesh et al., 2003, p. 451); analogous to PEU (refer to TAM).</td>
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| UTAUT 2         | Social influence (SOI): The degree to which an individual perceives that important others believe they should use the new system (Venkatesh et al., 2003, p. 451); analogous to SN (refer to TRA)  
Social factors (SOF): The individual’s internalisation of the references group’s subjective culture and norms (Thompson et al., 1991; Venkatesh et al., 2003, p. 452) Facilitating conditions (FCO): The degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system (Venkatesh et al., 2003, p. 453).  
Objective factors in the environment that observes agree make an act easy to do (Thompson et al., 1991, p. 454; Venkatesh et al., 2003). | BI and B: Refer to TRA and TPB  
EX: Refer to TAM 2  
PEX, EEX, SOI, FC: Refer to UTAUT  
Hedonic motivation (HM): [The perception of] the fun of pleasure derived from using a technology (Venkatesh et al., 2012, p. 161)  
Price value (PV): Consumers’ cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them (Dodds et al., 1991; Venkatesh et al., 2012, p. 161)  
Habit (HB): The extent to which individuals tend to perform behaviours automatically as a result of learning (Limayem et al., 2007; Venkatesh et al., 2012, p. 161). | PEX, EEX, SOI, FC, HM, PV & HB → BI  
EX x EEX, EX x SOI, EX x FC, EX x HM, EX x PV, EX x HB → B  
BI, HB & FC → B  
EX x HB, EX x BI → B |
models with a larger number of variables had similar or less predictive power than the more parsimonious theoretical models (Huh et al., 2009). The review of the 74 eTourism articles shows that a number of TAM++ studies had relatively similar levels of explaining the variance in behavioural intentions (Chen, 2007; Herrero and San Martin, 2012; Kim et al., 2012; Ku and Chen, 2015; Úsoro et al., 2010; Wang and Wang, 2010) compared to the studies that used more parsimonious classical models (Amaro and Duarte, 2016; Kim, 2016; Kucukusta et al., 2015; Lee et al., 2007; Park et al., 2007; Yang, 2013). Therefore, it remains questionable if the variable-addition practice is an effective approach to achieve either higher predictability or interpretability.

Here, it is important to note that if a researcher’s aim is to predict behaviour, when the predictive power of two models is relatively comparable, then models with a fewer number of variables should be preferred to more extensive ones. In other words, when parsimony and generalisability of a model are taken into account, the original TRA and TPB could be perceived as superior to extended models, because of their relatively comparable predictive power through fewer variables (Huh et al., 2009). But if the researcher’s objective is to interpret and explain the behaviour, then perhaps rather than using confirmatory approaches to evaluate traditional models, taking exploratory approaches and going beyond the rigid boundaries of such classic theories would better serve these aims.

For instance, as illustrated in Table II, among all of the listed determinant groups are those that are originally proposed by TAM (i.e. ease of use and usefulness). These evaluative beliefs are almost consistently found as the strongest determinants of the adoption of technology, appearing in the majority of the studies in this field. The impact of these two variables on technology acceptance is consistently significant across many contexts (Holden and Karsh, 2010; Schepers and Wetzels, 2007). Subsequently, after 35 years of rigorous application of this model, the impact of these variables on users’ behavioural intentions to use a technology could be perceived as trivial. Therefore, if researcher’s aim is to expand our understanding of users’ technology acceptance behaviour, then perhaps the more critical question which remains is how one’s belief about the ease of use or usefulness of a technology is formed or retained (Benbasat and Barki, 2007). In other words, taking a broader and deeper exploratory research to investigate the antecedents of the formation of those beliefs and their interrelationships with other object-oriented or self-oriented beliefs, emotions, habit and other characteristics of technology or users would be more beneficial in deepening our understanding of users’ behaviour.

However, it is also important to note that in spite of the above gaps, a number of existing studies in this field have been successful in providing new insights into understanding of this behaviour. This progress is primarily achieved by investigating the impact of a range of variables that are independent from the variables originally proposed by earlier models. For example, studies investigating the relationship between various aspects and features of technology design on consumers’ trust, risk and adoption of technologies (Bai et al., 2008; Bonsón Ponte et al., 2015; Herrero and San Martin, 2012; Ku and Chen, 2015; Wen, 2013) have significantly expanded the boundaries of academic understanding beyond the classic theories. Furthermore, several research works in this field have included the investigation of a range of personal variables such as motivation (Kim et al., 2012), habit (Escobar-Rodríguez and Carvajal-Trujillo, 2013, 2014) and experience (Järveläinen, 2007). These personal variables benefit from a higher degree of generalisability and seem to be theoretically independent with the core constructs of earlier models.

Additionally, beyond the scope of utilitarianism, investigation of the impacts of affective variables has also significantly contributed to the progress of the generic field of technology acceptance. These variables include hedonic motivation (Venkatesh et al., 2012), hedonic
outcomes (Venkatesh and Brown, 2001), enjoyment (Davis et al., 1992, p. 1125; Ha and Stoel, 2009; Koufaris, 2002; Lee and Chang, 2011; Park et al., 2014; Perea y Monsuwé et al., 2004; Saadé and Bahli, 2005; Venkatesh and Bala, 2008), arousal, immersion, absorption, pleasure and playfulness (Agarwal and Karahanna, 2000; Chu and Lu, 2007; Saadé and Bahli, 2005), flow (Sánchez-Franco and Roldán, 2005), entertainment (Huang, 2008), anxiety (Calisir et al., 2014; Compeau and Higgins, 1995; Perea y Monsuwé et al., 2004; Venkatesh and Bala, 2008), irritation (Huang, 2008), sense of belonging (Lin, 2007) and affect (Compeau and Higgins, 1995; Thompson et al., 1991). While some examples of such variables are adopted in a limited number of eTourism technology acceptance research (Huang et al., 2013; Ku, 2011; Lai, 2013), as tourism increasingly looks to many of these aspects more generally (Garcés et al., 2018; Picard and Robinson, 2012; Skavronskaya et al., 2017), it is expected that eTourism researchers will also opt to more rigorously adopt the investigation of such affective variables in eTourism research.

4.2 Violating the underlying principles of TRA and TPB

The majority of eTourism studies discussed in this paper are based on the Fishbein school of thought. TRA and TPB – the principal theoretical models of this school – use the Stimulus–Organism–Response framework of the cognitive models. From Fishbein and Ajzen’s (1975) perspective, beliefs entail one’s subjective evaluation of the existence of a concept or the link between that concept and other concepts. These beliefs are perceived as attribute-oriented constructs. Beliefs can be directly formed as the result of direct observation (descriptive beliefs), exposure to information from other sources (informational beliefs) or deductive inference of newly accepted information about existing beliefs (inferential beliefs) (Fishbein and Ajzen, 1975, pp. 132-135).

In these theories, salient beliefs are among the antecedents of one’s attitude towards a behaviour, and attitude is perceived as an antecedent of behavioural intention. Here, attitude is postulated as one’s affective psychological predisposition towards a behaviour, which is the direct result of the integration of all one’s salient thoughts, feelings and emotions towards that behaviour. TPB and TRA theories assume sufficiency, which means they posit that one’s behaviour should be predictable by behavioural intention and, in turn, behaviour intention should be predictable from attitude towards the behaviour, subjective norm and perceived behavioural control. Therefore, based on this theory, the variables presented in Table III should be perceived as cognitive and affective antecedents of one’s attitude, perceived subjective norm and/or perceived behavioural control.

In practice, many of the studies in the generic field of technology acceptance research have violated the above principle and added variables to the models arbitrarily, jeopardising the validity and generalisability of the findings. Examples of such violations are widespread in the generic field of technology acceptance research (for example, Morgan Thomas and Veloutsou, 2013, p. 23; Riemenschneider et al., 2003, p. 272; Yi et al., 2006, p. 352). Sometimes a “combine and conquer” strategy is used to integrate various models without considering the theoretical overlaps and redundancies of the models’ core constructs (Riemenschneider et al., 2003). While TAM and TPB were created based on a compensatory model of aggregation of multi-attribute beliefs (Ajzen, 2005, p. 124; Fishbein and Ajzen, 1975, p. 223), many researchers seem to ignore this core principal, assuming the same weight for competing beliefs.

As another example of such violations, in some cases (e.g. by Davis, 1989; Venkatesh and Davis, 2000; Venkatesh et al., 2003; Venkatesh et al., 2012), because of poor statistical results, attitude – a core component in the cognitive theories of human behaviour – is perceived either as an antecedent of belief or as redundant and is subsequently removed in
UTAUT-based models. As another example, while the role of inhibitors has been established since the very early ages of cognitivism (Howard and Sheth, 1969, 1973) and was considered as a component perceived behavioural control in TPB, TAM-based technology acceptance research seems to be heavily biased towards affirmative beliefs. Often these violations have led to the emergence of new models, which have been subsequently used by other researchers.

In many cases, eTourism technology acceptance researchers have adopted these generic TAM++ models without considering their contradiction to the theoretical conceptualisation of TRA and TPB, which recognises a fundamental duality between beliefs and attitudes, conceptualises belief as an attribute-based construct and attitude as an object-based construct. Some TAM++ models also violate the principle of sufficiency of TRA and TPB. This principle specifies that all other endogenous beliefs and perceptions should be perceived as various dimensions of either behavioural, normative and control beliefs (and not independent to them), and the impact of these beliefs and all other exogenous features (such as technology features) on the behavioural intention should be mediated through perceptions of either behavioural control, subjective norm or attitude (Ajzen and Fishbein, 1980). Overall, because of the overreliance of eTourism technology acceptance research on a small number of the widely adopted generic models of technology acceptance, eTourism research has inherited the significant theoretical and conceptual limitations of the preceding generic TAM++ models.

4.3 Limitations of the classical cognitive consumer behaviour paradigm

As illustrated above, the current field of eTourism technology acceptance research seems limited to a few of the classic cognitive theories. While these theories are, to a large extent, considered as one of the predominant paradigms of tourism and hospitality consumer behaviour research (Dunne, et al., 2011; Sirakaya and Woodside, 2005), they are also often criticised. This is because of their assumptions of rational behaviour and simplistic generalisation of human cognition without considering underlying social contexts and lack of attention to the role of affective, emotive, symbolic, hedonic and aesthetic aspects of consumption (Erasmus et al., 2001; Harré, 1992; Henning et al., 2012; Hirschman and Holbrook, 1982). The classic cognitivist paradigm in consumer behaviour is almost entirely based on the assumption of rationality and deliberate reasoning, assuming that if users hold positive salient beliefs about a technology, then they must have an intention to use it, thus entirely ignoring the role of motives (Bagozzi, 2007). Therefore, to a large extent, individual differences, biases, emotions, mood, habit and socially constructed notions, such as meanings, values and fashion, dynamism and context-dependency of human behaviour, are overlooked. Furthermore, there is often no explanation about the impact of users’ trade-offs and contradictory beliefs about a technology.

Since the 1980s, our academic understanding of consumer behaviour has been questioning much of the underlying normative assumptions of the above grand theories. Among the major lines of progress are: recognising the complexities associated with the information processing in our complex dynamic neural network (Jacoby, 2002); the impact of personality, context, intuition, heuristics and simplifications (Bettman, 1979; Bettman et al., 1998; Stanovich and West, 2000; Tversky and Kahneman, 1974); the impact of non-cognitive variables, such as mood and emotions (Bower, 1991; Cohen et al., 2008; Fishbein and Middlestadt, 1995; Forgas, 1995); and the importance of symbolic meanings and the socially constructed nature of consumer behaviour (Cherian and Harris, 1990). While the above avenues of progress have created revolutionary advances in understanding and conceptualising consumer behaviour research, within the scope of eTourism technology
acceptance research, there remains a vast opportunity to integrate these new perspectives to create a deeper understanding of travellers’ use of technologies. In the next subsection, two particularly distinctive pathways are discussed that could provide a path forward for expanding the horizons of research in this field.

5. Alternative perspectives
An important area of progress in the study of consumer behaviour was recognising the fluidity and dynamic processes of consumer choice process (Bettman et al., 1998). This recognises that consumers use various approaches, heuristics and strategies to evaluate products (Kahneman, 2003; Kahneman and Frederick, 2002; Kahneman and Tversky, 1979; Tversky and Kahneman, 1974, 1992). Today, the contemporary view of decision-making, even from an economic perspective, tends to acknowledge the limitations of human cognitive capacities and the impacts of individual differences, affect, emotion and environmental, social and situational forces on decision-making (Thaler, 2000, p. 140). It is now evident that consumers often face incomplete information (Erasmus et al., 2001). There is no doubt that consumers’ decisions are directly affected by non-cognitive variables such as mood, emotions, demographic and social variables (Bower, 1991; Cohen et al., 2008; Fishbein and Middlestadt, 1995; Forgas, 1995; McGuire, 1985). To highlight the importance of hedonic factors on decision-making, various conceptual dichotomies (e.g. utilitarian/hedonic, slow/fast, systematic/heuristic, X/C – often regarded as dual-route theories) have emerged in consumer behaviour literature (Hirschman and Holbrook, 1982; Kahneman, 2011; Stanovich and West, 2000; Venkatraman and Macinnis, 1985; Zaltman, 2000). These dichotomies denote the opposite extremes of a utilitarian, careful and calculative process of processing information, to a less cognitively intense, dynamic and context-dependent behaviour affected by mood, emotions, cognitive errors and biases. Any decision at any given point of time and context may possess varying degrees of each dimension (Havlena and Holbrook, 1986; Sherry, 1990). This modulatory and dynamic interpretation of human behaviour seems to be aligned with how recent neuroscientific consumer research views human behaviour (Phelps et al., 2014; Plassmann et al., 2015).

Within the boundaries of cognitivism, often well-researched and well-developed novel models are progressively being proposed that further expand the scope and depth of technology adoption knowledge in eTourism (for example see Technology Readiness Index 2.0 by Parasuraman and Colby, 2014). However, the generation of such novel theories could be facilitated by taking some fundamentally alternative perspectives towards evaluating users’ behaviour. As illustrated in the above paragraph, some major advancements in consumer behaviour theories have occurred as the result of the progress in seemingly “foreign” fields of neuroscience, social psychology, sociology and anthropology or are inspired by taking alternative paradigms – other than positivism – to study consumer behaviour (Solomon, 2009; Zaltman, 2000). As Zaltman (2000, p. 423) elaborates, the blurring boundaries of various paradigms in behaviour research reflect the inherent nature of human behaviour, which deals with fundamentally different systems of the brain, body, mind and society. This gives rise to the two alternative pathways this paper offers to assist the progress of eTourism technology acceptance researchers in moving beyond the current theoretical limitations of common technology acceptance models. Two fundamentally distinctive approaches, born and nourished outside of the classic cognitivism, are proposed as alternative pathways. The rest of this paper discusses how such occasional “hikes” to these presumably “foreign” fields of inquiry could benefit eTourism technology acceptance in research. These two pathways, discussed below, are a modern perspective of consumer neuroscience and a post-modern interpretive paradigm.
5.1 Modern perspective: NeuroIS

The rapidly progressing field of consumer neuroscience has emerged as an interdisciplinary field, combining neuroscience, psychology and economics to apply neuroscientific brain research to understand and predict consumers’ behaviour through examining their central or peripheral nervous systems (Hubert and Kenning, 2008; Kenning and Plassmann, 2008; Khushaba et al., 2013; Lee et al., 2007; Madan, 2010; Minas et al., 2014; Plassmann et al., 2010; Smidts et al., 2014). The cognitive school of consumer behaviour has developed based on mixing a range of observational data and hypothetical constructs, relying almost exclusively on self-report measures. In contrast, the field of consumer neuroscience deals with the objective measurement of physiological elements and somatic variables (Hubert and Kenning, 2008). Neuroscience provides a revolutionary tool to resolve limitations caused by biases associated with self-reports, questionnaire responses and subjective qualitative data in consumer behaviour research (Plassmann et al., 2010).

Within the past decade, researchers have paid increasing attention to applying neuroscientific tools in information systems (IS) research (Dimoka and Davis, 2008; Dimoka et al., 2012; Dimoka et al., 2011; Loos et al., 2010; Pavlou et al., 2007; Riedl et al., 2014; Tams et al., 2014). The resulting interdisciplinary field, an integration of neuroscience and IS, is commonly referred to as NeuroIS (Loos et al., 2010; Pavlou et al., 2007). As technology acceptance research deals with investigating human behaviour, the neuroscientific insight developed in consumer neuroscience can provide technology acceptance researchers with an objective alternative to cognitive theories to investigate the antecedents of human behaviour and inform technology design practices (Loos et al., 2010).

Neuroscientific research is an effective tool to investigate the neural correlates of various constructs that have been previously postulated in cognitive studies. Neuroscientific approaches can be used to evaluate the relationships between these hypothetical constructs by locating the brain sections that are activated or evoked during the experiments (Hubert and Kenning, 2008). Therefore, researchers benefit from a more effective method to test the validity of hypothetical assumptions suggested by earlier cognitive theories, particularly in observing the impacts of emotions, motivation mechanisms, memory functions, habitual choices, automatic responses and rapid information processing (Hubert, 2010; Loos et al., 2010; Plassmann et al., 2010). NeuroIS can particularly help researchers to investigate those constructs where direct objective measurement using self-reports and consumer interviews is impossible or unreliable (Dimoka et al., 2012); enjoyment, absorption, habit, fatigue and emotions are among these constructs (Dimoka et al., 2012; Plassmann et al., 2010). This is achieved by illustrating the activation in those areas of the brain associated with emotional behaviour during the purchase and choice process. Neuroscientific tools also release technology acceptance research from the boundaries of conscious thought and enable researchers to evaluate automatic and subconscious responses and processes (Dimoka et al., 2012; Plassmann et al., 2010).

A common method in consumer neuroscience research is to expose subjects to targeted environmental stimuli (e.g. brands, photos, choices) and measure the magnitude, timing and spatial location of various neural responses in their central or peripheral nervous systems (Plassmann et al., 2010). The measurement of physiological responses (e.g. eye movements, blood pressure and skin conductance) using methods such as eye-tracking, skin conductance response (SCR) and Facial Electromyography (fEMG) has a long tradition in psychological consumer research (Plassmann et al., 2010). Electroencephalography (EEG), positron emission tomography (PET), magnetoencephalography (MEG), transcranial magnetic stimulation (TMS) and functional magnetic resonance imaging (fMRI) facilitate the real-time observation of central neural responses; for example, through the brain's
electrical impulses, neuronal activations and the occurrence of metabolic changes, such as the level of oxygenated versus deoxygenated haemoglobins in the brain blood flow (Hubert and Kenning, 2008; Kenning and Linzmajer, 2011; Kenning et al., 2007; Lee et al., 2007; Morin, 2011; Plassmann et al., 2010). Among these technologies, EEG and fMRI seem to be the most widely used technologies in consumer neuroscience (Karmarkar and Plassmann, 2015; Solnais et al., 2013; Spezio and Adolphs, 2007).

One of the most significant contributions of neuroscientific research to consumer behaviour is providing objective evidence rejecting utilitarian and economic interpretations of earlier theories and illustrating the importance of implicit and automatic aspects of consumer behaviour (Hubert and Kenning, 2008). Neuroscience provides objective evidence to illustrate the significance of emotions and non-rational decision-making (Bossaerts, 2009; Naqvi et al., 2006; Spezio and Adolphs, 2007). The research in this field confirms the context-dependent and constructive nature of consumers’ choices (Phelps et al., 2014; Tymula and Plassmann, 2016), as well as the direct impact of social interactions on consumer behaviour (Rilling et al., 2004; Sanfey, 2007). Neuroscientific evidence shows that there is no clear distinction between entirely emotional or entirely cognitive decision-making modes (referred to above as dual routes) (Phelps et al., 2014) and that in each act of decision-making, multiple neural circuits related to both cognitive and emotional states modulate the decision-making process in a context-dependent fashion (Lempert and Phelps, 2014; Phelps et al., 2014).

Dimoka et al. (2011, p. 688) propose six opportunities through which NeuroIS can contribute to further progress in consumer behaviour. These are: locating neural correlates of cognitive constructs, investigating non-conscious responses, complementing existing data with neurophysiologic data, discovering the antecedents of cognitive constructs, investigating the causal relationships between cognitive constructs and, finally, challenging existing cognitive assumptions (Dimoka et al., 2011).

Neuroscientific research also deals with its own significant methodological and practical limitations, particularly because of the sheer intrusiveness of research tools potentially affecting respondents’ perceptions and emotions, difficulty in interpreting the observations, high costs of equipment and potential ethical concerns. However, for eTourism technology acceptance researchers, neuroscience could still provide an important and novel alternative perspective to bridging some of the theoretical and conceptual gaps that have emerged as a result of over-reliance on classic cognitive theories. For example, neuroscience can be used in exploratory inquiries to shed light on the interrelations between the wide range of underlying mental processes that drive users’ adoption of eTourism technologies. Alternatively, neuroscientific tools could be used in confirmatory research to evaluate, verify and confirm the relationships that have previously been developed and proposed using cognitivist theories.

It is increasingly imperative for eTourism researchers to “take a hike” (Zaltman, 2000) from current TAM-based practices to make use of the opportunities created by neuroscience. While there are signs of increasing attention to the potentials of neuroscience from eTourism researchers (Ma et al., 2014; Marchiori et al., 2017; Noone and Robson, 2014, 2016; Pan et al., 2013; Panyik and Gonçalves, 2018; Parrinello, 2012; Tosun et al., 2016), it is significant to note that this paper’s review of the 74 studies still illustrates the dominance of TAM models. The potential for the emergence of an interdisciplinary field of neurotourism, created as a result of the integration of neuroscience techniques and knowledge in the academic field of eTourism (itself an interdisciplinary field of hospitality and tourism, business and IS studies) is vast. And this is only one example of how eTourism could benefit from following Zaltman’s (2000) advice to broaden its horizons.

729
5.2 Post-modern perspective: Postmodernism in information systems

As outlined above, the current field of eTourism technology acceptance research is largely constructed based on the assumptions of early cognitivist consumer behaviour models. Cognitivism, in essence, was built on the assumption of the supremacy of human cognitive functions in a framework that recognises only one version of the reality (i.e. the objective truth), independent from human perception (Hudson and Ozanne, 1988; Pachauri, 2001). However, this conceptualisation of the human being (and the world) has been criticised from a post-modern perspective (Byers, 2014).

The majority of technology acceptance research in eTourism is confined within the boundaries of positivism (Spencer, 2015). Yet the importance of taking alternative interpretivist perspectives in IS research is long established and has been asserted in multiple studies (Chen and Hirschheim, 2004; Kaplan and Duchon, 1988; Klein and Myers, 1999; Myers, 1997; Orlikowski and Baroudi, 1991; Walsham, 1995). The contextual and processual nature of the relationships between technology and human behaviour that a critical interpretivist paradigm offers could play an important role in complementing existing insights created by modernist research, enriching the academic understanding of human–technology relationships (Klein and Myers, 1999; Orlikowski and Baroudi, 1991; Walsham, 1995). In this case, rather than economics of human behaviour and assumptions of utility maximisation, research agendas could be informed by alternative epistemological and ontological schools, such as critical theory (Alvesson, 1994), symbolic interactionism (Leigh and Gabel, 1992), social constructionism (Buttle, 1998), critical relativism (Anderson, 1986), hermeneutics (Arnold and Fischer, 1994) and humanism (Hirschman, 1986). There is evidence of researchers applying alternative qualitative or mixed-method methodologies to conduct more in-depth investigations of users’ behaviour from alternative postmodern perspectives (Parasuraman and Colby, 2014). These include ethnography (Myers, 1999), semiotics (Stamper et al., 2000), phenomenology (Boland, 1986), discourse analysis (Belkin et al., 1987), visual analysis (Keim et al., 2008), grounded theory (Urquhart et al., 2010), hermeneutics (Myers, 1995), ethnoscience (Myers, 1999), ethnomethodology (Dourish and Button, 1998) and thematic analysis (Ruhode, 2016). As researchers’ aims shift from prediction towards the more dynamic and context-specific aspiration of interpretation of behaviour, research can provide a thicker and deeper interpretation of the meanings and roles associated with technological artefacts in users’ everyday lives and the social environment that surrounds them.

Taking a postmodern perspective shifts our ontological perspective from perceiving users as clusters of cognitive mechanisms to the postmodern perception of individuals as discursive, social and active agents. This shifts our thinking from behaviour that follows certain cognitive rules to consider those who live their lives according to social rules and standards that have been collectively constructed and learned in socio-cultural settings and enacted through material-discursive activities. This philosophical perspective releases researchers from the dogmatic boundaries of positivism and enables them to yield deeper, more meaningful and more intimate understandings of individual perceptions towards technological artefacts (Byers, 2014; Harré, 1999). Therefore, hypothetical and metaphysical constructs, such as mind, emotions, motivations, beliefs, attitudes, preferences, purchase, consumption, experience, satisfaction and behaviour, are perceived as social artefacts, constructed through time, that are the result of our form of life and social interactions with society and our environment (Byers, 2014; Gergen, 1985; Williams, 1999). These constructs are perceived to be made out of the same ingredient: discourse. Investigating them requires a researcher to be positioned in the same socio-cultural frame of analysis. Thus, historical and cross-cultural investigation methods replace surveys and experiments as the core analytical
tools to understand these constructs (Gergen, 1985). Consequently, users’ perceptions of technology in a certain situation are jointly constructed by the user and others within their surrounding socio-cultural environment. It becomes essential to understand the social context, norms, conventions and rules that have shaped one’s social life and evaluate users’ relationships with symbolic meanings of technology (Harré, 2009; Pachauri, 2001). As a result, rather than a superficial prediction, interpretivism can aid technology acceptance researchers to achieve a thick and deep description of technology adoption as a socially constructed behaviour (Geertz, 1975; Harré, 2009; Pachauri, 2001).

Contemporary knowledge of user behaviour could be enriched through reconciling the inconsistencies of competing positivist and interpretivist paradigms (Goldkuhl, 2012; Mingers, 2004; Smith, 2006). This can be achieved by adopting pluralist, pragmatist and compatible ontologies that holistically embrace the diversity of multiple paradigms (Howe, 1988; Hudson and Ozanne, 1988; Mingers, 2001). For example, relativism accepts each approach for what it is and either evaluates the outcome of each only relative to the axioms of the respective approach (critical relativism) or, in its more radical terms, accepts that every approach has something to offer in spite of their conflicts (Anderson, 1986; Hudson and Ozanne, 1988; Proctor, 1998). Similarly, critical realism recognises the inherent diversity of knowledge and the necessity to apply multiple paradigms to investigate different aspects of a phenomenon to create a holistic understanding of interrelationships between various dimensions (Mingers, 2004). Such pluralist approaches highlight the opportunities and emphasise the potential of multi-paradigmatic IS research to reconcile competing paradigms and further advance the research in this field (Mingers, 2001; Smith, 2006).

As stated, positivism remains dominant within eTourism technology adoption research (Spencer, 2015). However, it is exciting to note that eTourism researchers are taking alternative postmodern interpretivist perspectives to investigate users’ adoption of a range of technologies in hospitality and tourism (Brunger and Perelli, 2009; Gretzel, 2011; Nodder, et al., 2003; Noone and Robson, 2016; Papathanassis and Knolle, 2011). Yet interpretivist research in eTourism technology is still limited and it is becoming increasingly necessary to recognise that taking such postmodern perspectives can significantly assist eTourism researchers to create richer understandings of the adoption of technologies within the tourism and hospitality context.

6. Conclusion
6.1 Conclusions
This paper has argued that eTourism technology acceptance research remains heavily reliant on the fundamental assumptions of the positivist paradigm in general and a few classical cognitivist models in particular. Early cognitivist theories such as TRA, TPB and TAM are still dominant in eTourism technology acceptance research, in spite of the existence of a wide range of alternative philosophical perspectives and methodological tools. The 74 articles reviewed in this paper highlight a number of fundamental conceptual and theoretical issues that currently limit the applicability and generalisability of some eTourism research.

6.2 Theoretical implications
The complexity of human behaviour and multidimensionality of our social environment means that understanding users’ behaviour requires adaptation of our current knowledge and use of insight from an integration of a wide range of academic fields, including philosophy, neuroscience, social psychology, sociology, anthropology, IS and business. However, the review of 74 articles in this paper highlights that the over-reliance of eTourism
technology acceptance research on only a few of the above aspects has resulted in the dominance of a limited number of cognitivist theories, representing only a narrow theoretical school of thought. Therefore, eTourism technology acceptance research faces the risk of becoming an immensely voluminous yet theoretically shallow field of research. We need to “take a hike” (Zaltman, 2000) and consider broader alternatives.

6.3 Practical implications
From a practical perspective, the results of this review provide valuable insight in directing future research in the eTourism field. This paper has shown two particular pathways for innovative eTourism research: neuroscience and interpretivism. Both alternatives are fundamentally distinctive to cognitivism and can offer thicker and deeper understandings of eTourism technology acceptance, diversifying traditional theoretical foundations, facilitating creation of a new generation of ground-breaking theories and opening up eTourism to exciting new research agendas. As wider technology acceptance literature moves towards new ways of thinking and researching users’ adaptation and use of technology, eTourism researchers must embrace these changes or risk falling behind. We must take the journey Zaltman (2000) suggests, grasp the opportunities at hand and lead the field of technology acceptance by recognising how some seemingly “foreign” pathways, such as NeuroIS and interpretivist paradigms, can be our way forward.

6.4 Limitations and future research
This review of research is conducted based on the English language academic articles accessible via the search engines specified in Section 2. Therefore, this review does not cover the vast volume of research works in this field published in the languages other than English or in conference proceedings and journals not accessible in the above databases. Furthermore, this review is conducted using a purposive sample of the existing research, which may not represent the entire spectrum of research in this field. Further research in this field could use a systematic literature review methodology to meta-analyse the results of a broader spectrum of research in this field systematically. In addition, among all the possible pathways for the advancement of knowledge in this field both within and beyond cognitivism, only two alternatives pathways of neuroscientific and interpretivist research are highlighted. Another line of important potential further research could be to explore further innovative theoretical perspectives both within and beyond cognitivism that could facilitate the production of cutting-edge research in this field beyond the status quo.

References


Further reading

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Google Trends in tourism and hospitality research: a systematic literature review

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Abstract
Purpose – This paper aims to conduct a review of the literature published, between 2006 and 2018, that used search engine data on tourism and hospitality research, namely, Google Insights for Search and Google Trends. More specifically, it intends to identify the purpose and context of the data use, ascertaining the main findings and reviewing the methodological approaches.

Design/methodology/approach – A systematic literature review of Scopus indexed research has been carried out. Given the novelty of search engine data use in tourism and hospitality research and the relatively low number of search results in Scopus, other databases were used to broaden the scope of analysis, namely, EBSCO and Google Scholar. The papers selected were subjected to content and statistical analyses.

Findings – Google Trends data use in tourism and hospitality research has increased significantly from 2012 to 2017, mainly for tourism forecasting/nowcasting; knowing the interest of users’ searches for tourist attractions or destinations; showing the relationship between the official tourism statistics and the search volume index of Google Trends; and estimating the effect of one event on tourism demand. The categories and search terms used vary with the purpose of the study; however, they mostly focus on the travel category and use the country as the search term.

Originality/value – Google Trends has been increasingly used in research publications in tourism and hospitality, but the range of its applications and methods used has not yet been reviewed. Therefore, a systematic review of the existing literature increases awareness of its potential uses in tourism and hospitality research and facilitates a better understanding of its strengths and weaknesses as a research tool.

Keywords Google Trends, Tourism and hospitality, Systematic review, Search engine data, Google insights for search

Paper type Literature review
1. Introduction

The rapid development of the internet led to the possibility to generate, store and access a large amount of data, which paved the way to the opening of the big data era. Big data is one of the buzzwords of the twenty-first-century, being studied in different scientific areas. Different researchers use diverse definitions, however, there are three defining properties or dimensions of big data introduced by Laney (2001) – “volume”, “variety” and “velocity” – being added “value” as the forth characteristic by Gantz and Reinsel (2011). Although there is no consensual definition, big data and big data technologies have contributed to the improvement of scientific research, including in tourism, where this concept is an emerging topic of research (Li et al., 2018) with great prospects of application in academic studies and market research.

Despite being recent, there has been a great interest in using big data mainly to better understand consumer behaviour, which is constantly changing. Given that big data is too vast for traditional data management to handle (Sivarajah et al., 2017), the use of big data analytics can be of great assistance to decision-making. It can be used to know patterns and trends and to offer the right services that suit the consumers’ preferences at the right time, contributing to enhance their tourism experience. Moreover, as timely information can be gathered in a simple way, and sometimes at no costs (Dinis et al., 2017), it can be used to complement official statistics or create new indicators. In the scope of the European Union, Eurostat has already started exploring new sources for tourism statistics, leading to a pioneering project on using big data for official statistics (European Commission, 2014), which has become an important reference for statisticians interested in using big data. This work paved the way to other initiatives (European Commission, 2015) so as to debate the diversification of sources of big data (e.g. mobile positioning data, data using traffic control cameras, flight reservation systems’ data, payment cards data) and the enhancement and/or replacement of more traditional sources for tourism statistics.

According to Kaushik (2010), there are several tools that can be used to assist organizations in their strategies in big data analysis, which can be chosen according to the needs and financial, human and technical capacity of the organization. Some of these tools are associated with search engines, which are often referred to as the first step in the consumer decision-making process (Xiang and Fesenmaier, 2006). Google is the search engine with the largest market share in the world (90.1 per cent) (StatCounter, 2018), therefore stored data on consumers’ searches are representative of the internet users’ intentions and interest in a given topic.

In 2006, Google launched a tool named Google Trends to visualize the popularity of searches over time. Because of the good results achieved with this tool, two years later, it launched Google Insights for Search with the objective of providing statistics based on search volume patterns conducted in the Google’s search engine (Dinis et al., 2013). In 2012,
Google Insights for Search was merged with Google Trends, including features from both products and a “new interface to give a clearer view of what’s on the world’s mind” (Mathias, 2012). In May 2018, it was updated with “new features, simpler navigation and more ways to explore data and stories around one of the world’s biggest journalistic data sets” (Smith, 2018).

Google Trends is a publicly available tool (https://trends.google.com/) that reports an index of the volume of Google queries, which can be filtered by category, search type, geographic location and time range. “Google Trends analyzes a portion of Google Web searches to compute how many searches have been done for the terms you enter, relative to the total number of searches done on Google over time” (Google, 2012a). To ensure that the underlying characteristics of the data sets can be compared, the query share is then normalized and scaled. This means that data sets are divided by a common variable to cancel out the effect of the variable on the data, so when the user compares the data from two different locations, interest is being compared, i.e. the proportion of searches rather than volume (Smith and White, 2011). Therefore, data are presented in relative values, instead of absolute numbers for the search volume, on a scale of 0 to 100. The value 100 represents the peak of search and all others are displayed as the search volume ratio in relation to this; the value 0 is displayed when the search volume is insufficient (Google, 2012b).

The data are available at a daily or monthly basis and can be visualized by interest over time, interest by subregion, top searches and related searches. Google Trends allows comparing search volume patterns by search terms. Users can specify until five entries of search terms or up to a maximum of 30 search terms grouped in a single entry using quotation marks, to return searches that match an exact expression, and use the “+” or “−” signs between the search terms to include or exclude search terms, respectively (Google, 2012c). The query index is available, with data since 2004, for several countries and some states or regions, and for different Google products (e.g. web, videos, image), being the search terms classified under 25 categories (one of them being “travel”) and 288 subcategories.

Google Trends data provide information, that is, not only available from other sources (e.g. official statistical data), being possible to be used to support decision-making in tourism but also to carry out market or academic research. Its advantages relate to its availability in a timely manner, on a regular basis, being easily upgradable, at no cost, and refer to a large amount of data representing the population from all over the world (Dinis, 2016). However, when analyzing and interpreting Google Trends data it is necessary to consider its inherent limitations and pitfalls. The most relevant ones are the use of relative rather than absolute volumes of searches; search terms may have different meanings in different languages, and, on the other hand, searches terms in just one language do not to capture all searches for a certain topic; search results are presented based on the internet protocol (IP) address, thus, existing the risk of including searches made by users that are not in the geographical location of the IP address, for instance in case of using virtual personal networks (VPN); it does not present results for search terms with low search volume, thus, eliminating searches with less common or unusual terms, more restricted time intervals or certain geographical locations (Smith and White, 2011). It is necessary to bear in mind these limitations and pitfalls while analyzing Google Trends data, therefore, for a better understanding of the tourism phenomena, big data should be used as a complement to other data statistical sources and not as a substitute.

Due to this granularity and classification, Google Trends data have been used by researchers of different areas of knowledge, notably from health sciences, economics, communication, marketing and cinema. It can be used to know, compare and predict the
behaviour and interests of the public on a certain subject, however, in existing papers the potentialities and limitations of the tool, as well as the purpose of the data and methodological choices of researchers, are still poorly understood and explored. Although there has been an increasing number of studies using this data in tourism and hospitality research (Chamberlin, 2010; Saidi et al., 2010; Gawlik et al., 2011; Artola and Galán, 2012; Artola et al., 2015), they are still relatively scarce, remaining largely unknown to practitioners and scholars. Therefore, this paper aims to systematically review the literature that used Google Insights for Search or Google Trends to identify the purpose and context of the data use, ascertaining the findings that are of particular relevance and reviewing the methodologic approaches. A systematic review of the existing literature benefits both practitioners and academics, by increasing awareness about the topic and equipping them with knowledge on its use in tourism and hospitality research and facilitating a better understanding of its strengths and weaknesses as a research tool.

2. Methodology

This paper carries out a systematic literature review, to have a comprehensive view of the state-of-the-art on the use of Google Insights for Search or Google Trends in tourism and hospitality research, and possibly identifying future avenues for research. With this review, we aim to assess the articles published on this topic and get an overview of the purpose of the studies, the methods used to collect and analyze data, as well as the main findings. Given that it is one of the first reviews on this issue, the study has an exploratory objective. This section details how this literature review was conducted, describing the process of article selection and analysis, and presenting the research streams of the selected articles.

2.1 Selection of the articles

To select the publications to be analyzed in this paper, the Scopus and the EBSCOhost databases were used. These databases were selected due to being among the largest and most popular abstract and citation databases of peer-reviewed publications and widely used for literature reviews in the tourism area (Leung et al., 2013; Damian and Suárez–Barraza, 2015; Martins and Costa, 2017; Dorcic et al., 2018). Data collection were conducted on July 12th, 2018, using the following search string on the title, abstract and keywords: (“Google Trends” OR “Google Insights for Search”) AND (tourism* OR travel* OR hospitality OR hotel*). The inclusion criteria relates to the year of publication, being limited to the period between 2006 and 2018, the language of publication (English) and the type of publication, which was limited to full-text articles published in refereed academic journals, following other review studies in different research areas in the tourism and hospitality fields (Leung et al., 2013; Schuckert et al., 2015; Cardoso et al., 2017; Yang et al., 2017; Ólafsdóttir and Tverijonaite, 2018). The selection process is presented on Figure 1.

The search yielded a total of 45 records (33 from Scopus and 12 from EBSCOhost), of which 13 were excluded for being duplicated or not meeting the inclusion criteria. In the second stage of analysis, titles and abstracts of retrieved publications were checked against eligibility requirements, and 10 articles that had no substantial use of Google Insights for Search or Google Trends data were also excluded. Each record was verified by two researchers to determine its inclusion for analysis, which was based on their joint agreement of its relevance to the purpose of the study. Despite this independent analysis, it is possible that personal bias may have existed. Nonetheless, the consensus of the researchers, experienced in IT and tourism, should have minimized it. To the 22 selected articles, 11 more
were added from the review of daily Google Alerts received from 2012 to 2018 regarding new publications added to Google Scholar on this topic. The added papers followed the same inclusion criteria, that is, language and type of publication. To complement this analysis, a Google Scholar search was conducted to find publications prior to 2012. From this process, 11 new articles were added to the records. At the end, a total of 33 published studies were determined to be relevant and were included in the analysis.

2.2 Data analysis
Following the selection of publications, a systematic analysis was conducted on the selected articles, with data from each article being organized onto a table with several categories and associated concepts that were identified as relevant for the analysis of the articles: purpose, limitations and novelty of the study, methods’ variables, type of analysis, primary findings and number of citations (Table I). If the information to be collected was not explicitly stated it was marked as not reported, and when it was not clearly evident it was marked unclear.

To ensure the accuracy and objectivity of the article assignment and minimize the probability of bias, two authors independently reviewed all the selected articles and assigned them to five research streams (Table II). If the study focus was multifaceted, as Google Trends data can be used in several ways, one study was assigned to more than one research stream.

3. Results
In this section, the characterization of the studies and the identification of the methods’ variables are introduced. The key findings and discussions in the articles of each research stream are also presented and their limitations and contributions.
3.1 Characterization of the selected articles

In the search process, no articles were found until 2008, which might be due to the fact that Google Trends was only launched two years back. The first article published is Wolk and Wöber (2008) comparative study of information needs of city travellers in Europe, published in the journal “Information Technology and Tourism”. Sporadic articles were published between this year and 2015 when research on the topic began to emerge. As then, a general growth trajectory until current days is recorded. Although the articles of 2018 are only until July, the number of publications is the same as of the previous year, showing a clear sign of growing interest on the topic. The temporal distribution of articles can be seen on Figure 2.

The 33 selected articles are published in 28 different journals, showing a wide dispersion of publication sources, ranging from the field of tourism and hospitality studies (12 journals), and several other areas, such as agricultural science, computer science, engineering, economics and business studies. The most featured journals are tourism management (4 articles), International Journal of Tourism Research (2 articles) and tourism
management perspectives (2 articles). Of all the articles, Pan is the most significant author, with three publications, followed by Costa, Dinis, Guo, Kuminoff, Lengyel, Liu, Önder and Pacheco, each having published two articles on the topic, while the remaining 61 have just authored or co-authored one publication.

### 3.2 Purpose of the studies

The aims of the studies under analysis are manifold; however, it is possible to find some common aspects, which are in line with the research streams identified in Table II. These relate essentially in using Google Trends to forecast or nowcast tourism demand in destinations, either countries or cities (Antolini and Grassini, 2018) or in specific tourism services, such as hotels (Pan et al., 2012) and casinos (Kim and Malek, 2018). Other group of studies aims to identify the interest and popularity of search terms related to tourism and hospitality (Al-Kabi et al., 2012) or understand online search behaviours of potential tourists choosing destinations using Google Trends data (Padhi and Pati, 2017). With less expression, there is also studies that aim to determine whether Google Trends data regarding tourism has similar distribution patterns, and therefore, is correlated to official tourism statistics (Dinis et al., 2016). The last group of studies aims to estimate the effect of one event (e.g. pollution, pandemic influenza and weather) in tourism demand, the interest in a tourism destination or the use of tourism services (Palos-Sanchez and Correia, 2018).

Figure 3 depicts the areas under analysis in the selected articles. The great majority (58 per cent) deals with studies that do not target any specific tourism subsector, mostly dealing with travel flows (Artola et al., 2015; Park et al., 2017; Antolini and Grassini, 2018), as these

<table>
<thead>
<tr>
<th>Research streams</th>
<th>Description</th>
<th>Publications</th>
</tr>
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<tbody>
<tr>
<td>Forecasting</td>
<td>Studies that make predictions of the future based on past and present data, mostly by analyzing the trends</td>
<td>Artola et al. (2015); Bangwayo-Skeete and Skeete (2015); Choi and Varian (2012); Dergiades et al. (2018); Kim and Malek (2018); Önder (2017); Önder and Gunter (2016); Padhi and Pati (2017); Pan et al. (2012); Park et al. (2017); Rivera (2016); García Rodriguez (2017); Siliverstovs and Wochner (2018); Yang et al. (2015)</td>
</tr>
<tr>
<td>Nowcasting</td>
<td>Studies that examine how the data can be used to monitor trends as they happen, avoiding the time lag of official statistical releases</td>
<td>Antolini and Grassini (2018); Jackman and Naitram (2015)</td>
</tr>
<tr>
<td>Interest, popularity and consumer behaviour</td>
<td>Studies that aim to identify the interest and popularity of search terms related to tourism and hospitality or understand the consumer behaviour</td>
<td>Al-Kabi et al. (2012); Ballatore and Arsanjani (2018); Chang et al. (2017); Correia et al. (2018); Tang et al. (2018); Kuminoff et al. (2010); Lengyel (2015, 2016); Liu et al. (2017); Palos-Sanchez and Correia (2018); Wolk and Weber (2008)</td>
</tr>
<tr>
<td>Relation between search engine data and official tourism statistics</td>
<td>Studies that relate the interest in travel of internet users with effective tourism demand</td>
<td>Chamberlin (2010); Dinis et al. (2016, 2017)</td>
</tr>
<tr>
<td>Estimation of the effect of one variable on another variable</td>
<td>Studies that estimate the effect of one event on tourism demand, the interest in a tourism destination or the use of tourism services</td>
<td>Fenichel et al. (2013); Rosselló and Waqas (2016); Palos-Sanchez and Correia (2018); Xu and Reed (2017)</td>
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**Table II.** Research streams of selected papers
studies are linked with tourism demand forecast/nowcast in different geographical areas (e.g. Japan, Spain, China, Italy, South Korea, UK and USA). The second-largest category of studies focus on hotels (Wolk and Wöber, 2008; Kuminoff et al., 2010; Pan et al., 2012; Bangwayo-Skeete and Skeete, 2015; Rivera, 2016; Chang et al., 2017; Liu et al., 2017), being the rest scattered in other tourism services, such as casinos, restaurants and airlines (Fenichel et al., 2013; Kim and Malek, 2018; Tang et al., 2018), wellness experiences (Lengyel, 2015, 2016), protected areas (Correia et al., 2018) and a geographic information platform (Ballatore and Arsanjani, 2018).

3.3 Methods variables
The object of the search in most of the studies (76 per cent) is a destination (either a country or a region), the remaining focussing on a specific service or company. The geographic location searched is mainly in Europe (52 per cent), with a prevalence of studies addressing
Spain and Portugal (Artola et al., 2015; Dinis et al., 2016, 2017; Rosselló and Waqas, 2016; García Rodríguez, 2017; Önder, 2017). Other searched destinations are located in Asia (24 per cent) – mainly China and South Korea (Fenichel et al., 2013; Yang et al., 2015; Park et al., 2017; Xu and Reed, 2017; Kim and Malek, 2018) – and America (24 per cent), notably countries in the Caribbean. The maximum time period searched is 13 years, from 2004 until 2017 (Chang et al., 2017), with each article considering, on average, 7.5 years in the analyses.

In only 33 per cent of the articles, the query category or subcategory was able to be identified: “travel” (Artola et al., 2015; Jackman and Naitram, 2015; Önder and Gunter, 2016; Rivera, 2016; Önder, 2017; Antolini and Grassini, 2018), Hong Kong (Choi and Varian, 2012), “hotels and accommodations” (Dinis et al., 2016, 2017) and “food and drink” (Tang et al., 2018). One of the articles (Chamberlin, 2010) used more than one category (“travel”, “vacation destinations”, “hotels and accommodation”, “air travel” and “cruises and charters”).

Regarding the data source, given that Google Insights for Search was merged with Google Trends in 2012, it was used solely by Al-Kabi et al. (2012) and by Palos-Sanchez and Correia (2018), who resorted to both tools to extract data. The date of access to Google Trends was mentioned in only 12 per cent of the articles (Rivera, 2016; Antolini and Grassini, 2018; Ballatore and Arsanjani, 2018; Correia et al., 2018) and 67 per cent identified the country of origin of the search, the remaining referring to worldwide searches, without specifying a precise location (Wolk and Wöber, 2008; Fenichel et al., 2013; Yang et al., 2015; Chang et al., 2017; Xu and Reed, 2017; Antolini and Grassini, 2018; Ballatore and Arsanjani, 2018; Correia et al., 2018; Kim and Malek, 2018; Siliverstovs and Wochner, 2018).

Merely 15 per cent of the articles refer to the search tools used in the analysis: web and image were used by Önder and Gunter (2016) and Önder (2017), web and video were used by Lengyel (2015, 2016), while Rivera (2016) used the only web search engine.

In terms of the periodicity of the data, given that in forecasting studies, most of the times, the tourism demand (independent) variable is available at a monthly frequency and Google Trends indices are retrieved either on a weekly or a daily basis, it is necessary to aggregate them to monthly data, by averaging. Önder and Gunter (2016), Önder (2017) and Antolini and Grassini (2018) opted for the four-week average, Choi and Varian (2012) used the average query index in the first two weekly observations of the month, while García Rodríguez (2017, p. 956) “transformed the data from weekly into monthly data by implementing dynamic tables”.

The process of search terms’ selection is vital in studies that use web search data, giving that empirical results are highly dependent on the selection methods (Li et al., 2018). Keyword selection methods derive primarily from researchers’ experience (Choi and Varian, 2012; Bangwayo-Skeete and Skeete, 2015; Jackman and Naitram, 2015; Kim and Malek, 2018). In a smaller scale, there are studies that are based on knowledge obtained from the existent literature (Park et al., 2017), feedback from experts (Rivera, 2016) and keywords recommended by Google Trends or other technological tools. For instance, Siliverstovs and Wochner (2018) built several Google Trends indices, each of them composed by 30 queries related to top hotel-bed-intensive political municipalities in any given Swiss tourism region with support from Google Knowledge Graph. Other authors used combined methods, such as García Rodríguez (2017), who selected the research terms based on the literature, the related queries provided by Google Trends and also statistical methods, namely the Pearson correlation.

Most studies select the search terms as the name of a country or city (Jackman and Naitram, 2015; Önder and Gunter, 2016; Önder, 2017), sometimes associated with accommodation (Dergiades et al., 2018) or the terms “tourism”, “travel” or other elements of
the tourism supply, such as “restaurants” (Pan et al., 2012; Artola et al., 2015; Kim and Malek, 2018). Choi and Varian (2012) and Chamberlin (2010) did not use any search term, considering only the category, while the rest chose only one service (e.g. hotel or restaurant).

Some studies (Pan et al., 2012; Antolini and Grassini, 2018) directly used the raw data, however, other researchers chose to use a combination of search terms in a single entry, such as Yang et al. (2015), who aggregated search data into one to construct a composite search index using a shift and sum method. Park et al. (2017, p. 362) state that when “the number of keywords is large, it is more efficient to construct a composite index rather than to use all keywords in the regression”, having applied a similar method to that used by Yang et al. (2015). Dergiades et al. (2018) have combined keywords identified for each outbound country to Cyprus to a single search, aggregating keywords using the sum method. However, to construct the corrected aggregate intensity index, they performed a separate search using Google Trends’ comparison feature for search terms.

The number of citations allows assessing the leveraging of articles on this topic by the academia, however, we should have in mind that citation rates are heavily dependent on the discipline and the number of people working in that area. Choi and Varian’s (2012) study seems to be a highly visible publication, achieving 422 citations, followed by Kuminoff et al. (2010) with 60. The average number of citations of all the selected articles is 21, showing a wide gap between articles, with 11 that have not been cited yet, being all published in recent years (2017 and 2018).

3.4 Analysis, findings, limitations and novelty of the studies
3.4.1 Forecasting and nowcasting. Önder (2017) transformed Google Trends indices into natural logarithms to ensure a linear functional relationship between the variables. Park et al. (2017) investigated the non-stationarity and seasonality of the data. On the other hand, Jackman and Naitram (2015) decided to use raw data from Google Trends (seasonally unadjusted), while Yang et al. (2015) converted the Google Trends variable to logarithm to reduce the impact of outliers.

The methods of analysis are diverse (Table III). For instance, Siliverstovs and Wochner (2018) used the Mincer–Zarnowitz regression model on Swiss tourism demand forecasts and concluded that search-based tourism predictions are, on average, highly accurate approximations of reality. Bangwayo-Skeete and Skeete (2015) compared the performance of the autoregressive mixed-data sampling (AR-MIDAS) model with two other models – seasonal autoregressive integrated moving average (SARIMA) and autoregressive (AR) – having evaluated the accuracy of the models using mean absolute percentage error (MAPE) and the root mean squared error (RMSE), and concluded that Google Trends data offers significant benefits for forecast tourism demand for Caribbean destinations. Kim and Malek (2018) used the autoregressive integrated moving average (ARIMA) with interventions, also concluding that using Google Trends data significantly improves forecasting models for casino revenue. The forecasting accuracy was tested through RMSE e MAPE. Rivera (2016) used a dynamic linear model for predicting the number of hotel non-resident registrations in Puerto Rico and found that the proposed model results in more realistic prediction intervals, namely, when making forecasts on a horizon of over six months. Choi and Varian (2012) confirmed the power of Google search data to predict the present values of economic indicators by forecasting visitors to their travel destination (Hong Kong), having concluded that the model that includes Google search data improves the prediction capacity.

3.4.2 Interest, popularity and consumer behaviour. One-third of the studies under analysis used Google Trends data to understand the behaviour and search interest for certain topics of internet users. For example, Ballatore and Arsanjani (2018) used it to know
the online visibility of a volunteered geographic information project – Wikimapia – and compare it with OpenStreetMap, over time and regarding the spatial distribution of its searches around the world. They concluded that searches over time present different patterns of interest and are strongly seasonal, and there are widely divergent and segregated geographies of searches. Moreover, Chang et al. (2017) used Google Trends to compare a variety of hotel brands and the interest in Hilton and TripAdvisor over time and by subregion. They also identified the related topics and keywords that users usually search together with a “Hilton hotel” query.

Tang et al. (2018) used Fourier transform and Parseval’s theorem to compare the online search behaviour from the USA and China demonstrated by restaurant consumers. Lengyel (2015, 2016) demonstrated that there is a strong and rising interest in mindfulness, both globally and for major outbound countries to Hungary, and that in the last few years the popularity of search terms concerning meditation and mindfulness has been growing steadily.

The findings of Al-Kabi et al.’s (2012) study showed that the majority of Arab internet users search for topics related to entertainment, recreation, computer and internet, searching for images, songs, chat, forums and new feeds, mainly in their native language. Kuminoff et al. (2010) used Google Trends to track the online search volume for phrases that prospective travellers are likely to use in a search for green lodging, estimating a hedonic model of hotel room pricing, which reported that travellers can expect to pay a significant premium for a standard room in a green hotel.

Although Wolk and Wöber (2008, p. 128) just used Google Trends as an example to analyze the trend of internet users’ search behaviour, mentioning it as a topic for further research, they concluded that it offers great opportunities to compare internet data, giving “a
good example for type of insights managers can gain by performing longitudinal studies based on log file data”. However, they also mentioned that the amount of information and possibilities for comprehensive competitive studies is very limited, as Google Trends do not provide the absolute numbers of queries, and it is not possible to perform comparisons for more than five search terms simultaneously. “In addition, the selection of terms used for the comparisons need to be provided by the analyst because the most frequently searched terms are not available by this tool.” (Wolk and Wöber, 2008, p. 129).

3.4.3 Relation between search engine data and tourism official statistics. There are a few studies that compared Google Trends with official data sets. These studies showed moderate to strong strengths of association, which demonstrates the potential of this tool to be used for researching tourism-related topics. For example, Dinis et al. (2016) found a strong correlation between a set of search terms and Portuguese official tourism data. The study concluded that Google Trends can provide information about the intentions of online search behaviours of potential tourists choosing accommodation, with the results showing that the actual nights spent in accommodation establishments by foreign tourists are strongly correlated with the Google index. Moreover, Dinis et al. (2017) showed that Google Trends could be used to forecast overnights in hotel establishments by Portuguese residents, as the official data are strongly correlated with the Google index. Chamberlin’s (2010) study aimed at looking at the correlation between official data and Google Trends data of over 30 categories, ranging from retail sales to foreign trips. In terms of tourism, the research concluded that none of the Google Trends categories were significant in a regression with the numbers of foreign trips. Nonetheless, the study unveiled that the “travel” category showed similar seasonal movements to the official statistics.

3.4.4 Estimation of the effect of one variable in another variable. As aforementioned, this group of studies aims to estimate the effect of one event in tourism demand, the interest in a tourism destination or the use of tourism services. Rosselló and Waqas (2016) investigated the role of weather variables in explaining short-term variability in Google searches related to Majorca from its main tourist markets (Germany and UK). For that, they estimated a regression model and the results show that weather conditions are significantly related to a higher interest in Majorca. Xu and Reed (2017) used a VAR model to examine the interaction between perceived pollution, measured by Google Trends data, and inbound tourism in China, concluding that it leads to lower levels of inbound tourism. Fenichel et al. (2013) used Google Trends data to measure public knowledge about swine flu. They verified that a subset of passengers, who had already purchased tickets, chose not to fly in response to swine flu. The results suggest that they do not respond to actual reported cases, but perhaps to media attention to the epidemic. Palos-Sanchez and Correia (2018) used the Goal-Question-Metric methodology with the purpose of verifying if the rise of internet searches has an impact in the Airbnb service. The results indicate that Google Trends constitute a potential source for the observation of the preferences and interests of consumers and the evolution of demand for this service.

4. Discussion
Currently, in the face of the increasing popularity of the internet and the use of search engines in the travel planning process, search engine companies hold data on query formulations, which can contribute to the establishment of consumer behaviour patterns. Access to these data are increasingly facilitated because search engine companies are increasingly providing their own tools for data mining (Kaushik, 2010). The growing number of articles published in scientific journals, which use Google Trends data in the tourism sector, reveal that this tool is growing in importance in the field of big data for tourism.
However, from the analysis of the selected articles, it was found that Google Trends data are still little explored academically, since the articles using this data are quite recent, being the first study published in 2008, and scattered in different journals of several scientific areas. This study has contributed to systematize this research and, mainly, to show its purpose and how it has been developed. It was concluded that Google Trends data are being used in tourism and hospitality research for different purposes, although most studies have focussed on forecasting/nowcasting of tourism demand and on the comparison of interest and popularity of search terms related to tourism destinations or services. These studies have introduced a certain degree of innovation by using data from several geographical contexts (e.g. worldwide regions and countries) and tourism activities (e.g. accommodation, casinos and restaurants), and data that relate tourism with other phenomena (e.g. weather and pollution). The methods have been refined to improve the accuracy of the results, namely, in terms of search terms, as is the case of the study of Yang et al. (2015), who have proposed a systematic mechanism to better pick search queries. Research has also been conducted to identify the models that present the best accuracy using Google Trends data.

Despite the progress made by the literature in terms of knowledge about Google Trends data and tourism, in most of the articles the potentialities and limitations of this tool, as well as the purpose of the data and methodological choices of researchers are still poorly understood and explored. There is a generalized lack of information in the analyzed variables, which makes it difficult to understand the methodologies used in the studies and the reproducibility of the findings, similarly to what Nuti et al. (2014) concluded about the use of Google Trends in healthcare research. One of the reasons for the existing limitations is that “researchers may not have known how to document their methods as this is still a nascent tool for research, without guidance or methodological standards for its use by either Google Inc. or the research community” (Nuti et al., 2014, p. 46).

Another crucial issue in studies that use Google Trends data are the selection of search terms, and it is currently a mostly arbitrary process, as such, we recommend a relatively systematic method in tourism research for web selection search data, and the need to test other statistical methods to find the most predictive web search data, which is in line with what has been suggested by Li et al. (2018). Furthermore, the existing methods for index search construction require clarification in the methodology and in the keyword aggregation criteria, being also evident that studies on identifying which method is most advantageous are scarce, that is, whether it is better to use a keyword or a set of keywords (index construction). It is, therefore, essential that researchers make efforts to clearly state their rationale and describe the methodology used in the study to ensure the reproducibility of results.

Researchers should continue to explore the potentialities of Google Trends data for tourism, as there is still a lot of room to progress, namely, in terms of other issues that can be studied, such as the effect of extreme events and terrorism in tourism demand (or the reasons and impact of significant peaks of search interest for certain tourism destinations) or other important factors in tourism (e.g. tourism revenue and environmental carrying capacity) (Li et al., 2018). For future research, it would be interesting to define standard methodologies so that they could be replicated by other researchers and allow the comparability of results. In addition, it is suggested a literature review of studies using Google Trends data in tourism published in other databases or journals, thus increasing the knowledge on this subject. Data quality and ethical concerns related to big data analytics should also be more discussed in the literature, to identify its future implications (Davis, 2012; Bunnik et al., 2016).
5. Conclusion

Although search engine data has been used in tourism and hospitality research, to the best of our knowledge, this article is one of the first in reviewing the range of applications and methods used, by performing a systematic literature review on the use of Google Trends data in tourism and hospitality research. This systematic review contributes mainly to better understand the aim, methods and results of the analyzed articles, allowing to identify potential uses of Google Trends data in tourism and hospitality research and to facilitate a better understanding of its strengths and pitfalls as a research tool. Moreover, this study contributes to identify gaps in the literature and to point the way toward future research.

As seen before, Google Trends data can be used to know, compare and predict the behaviour and interests of the public on a certain subject, being its use in tourism and hospitality research still quite recent. It is noted that the number of studies using this tool has increased significantly from 2012 to 2017, mainly with the aim of:

- tourism forecasting/nowcasting;
- knowing the interest of users’ search for tourist attractions or destinations;
- showing the relationship between the official tourism statistics and the search volume index of Google Trends; and
- estimating the effect of one event in tourism demand.

The categories and search terms used vary with the purpose of the study, however, mostly focussing in the “travel” category and using the country as the search term.

Google Trends has a great potential, as a free and easily accessible means to big data, to provide meaningful insights about internet users’ behaviour and its link to tourism and hospitality. However, to be used as a reliable research tool, there should be more transparency in the Google Trends data gathering algorithm and the studies that use it should also better explain the methodology used, to increase the trustworthiness of the results and its general applicability for tourism and hospitality.

Although a systematic review involves several steps to ensure its methodological transparency, we recognize the limitations of the search process and possible biases in document selection and analysis. Due to the parameters of the databases and search criteria, some relevant literature might have been excluded from this study. Even though measures were taken to be objective, some bias is inherent in the review process. Nevertheless, a large portion of available literature on the topic has been reviewed, providing insights on the use of Google Trends in tourism and hospitality research, highlighting gaps in knowledge and showing opportunities for future research.

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Social media analytics in hospitality and tourism
A systematic literature review and future trends
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Abstract
Purpose – The purpose of this paper is to provide a review of hospitality and tourism studies that have used social media analytics to collect, examine, summarize and interpret “big data” derived from social media. It proposes improved approaches by documenting past and current analytic practice addressed by the selected studies in social media analytics.

Design/methodology/approach – Studies from the past 18 years were identified and collected from five international electronic bibliographic databases. Social media analytics-related terms and keywords in the titles, keywords or abstracts were used to identify relevant articles. Book chapters, conference papers and articles not written in English were excluded from analysis. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) guided the search, and Stieglitz and Dang-Xuan’s (2013) social media analytics framework was adapted to categorize methods reported in each article.

Findings – The research purpose of each study was identified and categorized to better understand the questions social media analytics were being used to address, as well as the frequency of each method’s use. Since 2014, rapid growth of social media analytics was observed, along with an expanded use of multiple analytic methods, including accuracy testing. These factors suggest an increased commitment to and competency in conducting comprehensive and robust social media data analyses. Improved use of methods such as social network analysis, comparative analysis and trend analysis is recommended. Consumer-review networks and social networking sites were the main social media platforms from which data were gathered; simultaneous analysis of multi-platform/sources of data is recommended to improve validity and comprehensive understanding.

Originality/value – This is the first systematic literature review of the application of social media analytics in hospitality and tourism research. The study highlights advancements in social media analytics and recommends an expansion of approaches; common analytical methods such as text analysis and sentiment analysis should be supplemented by infrequently used approaches such as comparative analysis and spatial analysis.

Keywords Comparative analysis, Sentiment analysis, User-generated content, Social media analytics, Topic modeling, Spatial analysis, Text analytics

Paper type Literature review

摘要
研究目的 – 本文对酒店旅游学科中采用社交媒体数据分析的文献进行梳理。本文通过审阅其相关分析方法的文献来提出分析方法的改进策略。

研究设计/方法/途径 – 样本数据包括过去18年中五个国际在线文献索引库中的文献。搜索通过标题、关键词、或者摘要中出现社交媒体数据分析等相关主题的文章。书目表、会议论文、以及非英文文章未被收录在索引中。系统回顾和文献综述的方法（PRISMA）指导本文文献索引。Stieglitz和Dang-Xuan（2013）社交媒体数据分析框架作为本文文献分类的方法。
1. Introduction

The internet has profoundly changed the way tourists search for information, plan their trips and even how they share travel experiences with others (Buhalis and Law, 2008; Hays et al., 2013; Xiang and Gretzel, 2010). The advent of Web 2.0 developed new channels for internet users to communicate and cooperate with each other, and to share user-generated content (UGC) such as forums, online reviews, photos and videos throughout different social media (SM) platforms.

SM is a group of Web 2.0 online tools, applications, platforms and media that allows people to create and exchange UGC in peer-to-peer communication channels, ranging from social networking and consumer review sites to online content communities, wikis and other types of information and communication technology tools (Kaplan and Haenlein, 2010; Zeng and Gerritsen, 2014). Travelers can post their opinion about a diverse range of hospitality and tourism products, from hotel room cleanliness and restaurant and food services, to the quality of tourism destination attractions. These online comments and reviews in turn affect the perceptions and decision processes of other potential tourists. SM is also a place for hospitality and tourism actors to initiate conversation with their consumers, draw inspiration for long-term strategies, promote their brands and make better business decisions.

Early studies of SM and UGC tended to use small samples of data. However, data sets are growing so fast and are so complex that special analytics, technological infrastructures and tools are becoming necessary to tackle this so-called “big data.” SM analytics examines large amounts of available data on SM platforms through advanced analytical techniques, revealing hidden patterns and themes, and discovering unspecified correlations and other beneficial information not identifiable through traditional methods (Elgendy and Elragal, 2014). Social media analytics (SMA) applies robust natural language processing (NLP) and machine learning techniques to collect and analyze data from SM websites. Tourism-related SM domains present a rich source of content for this growing analytics field (Xiang et al., 2017).

This paper reviews the hospitality and tourism studies applying a diversity of analytic tools and methods to collect, analyze, summarize and interpret SM data. The main purposes of this systematic review are to provide an integrated definition of SMA covering the wide range of research methods; identify the main research purposes that scholars have pursued through the application of SMA and map the methods most frequently used to address them; document, over time, the most and least common SMA methods and recommend application of under-used methods relevant to the advancement of the tourism sector; identify the disciplinary literature where tourism and hospitality SMA studies have been published, specifying the countries and industries of focus; and finally, highlight knowledge gaps and recommend research agendas for tourism and hospitality related SM data analysis.
2. Social media analytics: an integrated definition

The tremendous growth of SM and the proliferation of internet-based SM applications have redefined tourism and hospitality research and practice. Web 2.0 enabled SM platforms to provide vast amounts of UGC existing in microblogs, SNS, discussion forums and multimedia sharing websites to practitioners and service providers who seek to understand, attract and satisfy their consumers. Knowledge derived from SM is a must for service providers who seek to identify hidden risks and potential opportunities, optimize their performance and grow competitive advantage. However, gaining meaningful insights into SM’s massive amount of information, opinions and sentiments is complicated by the volume of the content generated daily and the number of users on a variety of platforms.

SMA is an interdisciplinary field of study designed to assist analyses of SM’s structured and unstructured big data. In fact, SMA “is concerned with developing and evaluating informatics tools and frameworks to collect, monitor, analyze, summarize, and visualize social media data, usually driven by specific requirements from a target application” (Zeng et al., 2010, p. 14). In other words, SMA combines a variety of techniques such as Web crawling, computational linguistics, machine learning and statistical methods to collect, analyze and interpret SM data for different purposes such as tracking trending topics, opinion mining and sentiment analysis, or even spatial analysis of geo-referenced information (Xiang et al., 2017). Main steps toward SMA are data collection, data preparation, pre-processing and lastly evaluation of the results through a variety of analytical and visualization techniques including text summarization and classification, NLP application and spatial clustering methods (Andrienko and Andrienko, 2013; Hippner and Rentzmann, 2006). A range of analytic approaches have recently been applied in hospitality and tourism for different purposes such as examining the underpinnings of satisfied versus unsatisfied hotel customers (Berezina et al., 2016), understanding preferred hotel attributes and main concerns of hotel customers through opinion mining and sentiment analysis of online reviews (He et al., 2017), investigating the co-creation process and travelers’ knowledge-sharing behaviors in online communities (Edwards et al., 2017) and analyzing geo-tagged Twitter messages for mapping global patterns of international travelers’ mobility by country of residence (Hawelka et al., 2014). To guide this review of SM analytic techniques and trends in hospitality and tourism, definitions of the most common SM analytic approaches are provided below.

2.1 Text analysis and sentiment analysis

While text analysis and text mining have a broad scope and generally aim to parse textual data to extract machine-readable facts, sentiment analysis is a specific form of text analysis for valence identification and subjectivity analysis of UGC. The overall contextual polarity of Web-based textual information and different forms of UGC, whether positive, neutral or negative, can be measured through the application of sentiment analysis methods (Alaei et al., 2017). Drawn from progress in computing science, information technology and linguistics, sentiment analysis reveals subjective opinions and feelings about a product or service through different analytical methods such as NLP, computational linguistics and text analysis.

Sentiment analysis can be used at three different levels: document-level, sentence-level and aspect-based. The purpose of document-level sentiment analysis is to determine the overall opinion on a particular entity such as a product, service, hotel or tourism destination. On the other hand, sentence-level sentiment analysis assumes that one document contains multiple opinions, and splits different sentences into phrases where the polarity of each subjective sentence can be further analyzed and classified into positive or negative classes.
Finally, aspect-based sentiment analysis applies when a range of attributes is involved, and the goal is to recognize sentiment expressions and identify different opinions about one entity (Feldman, 2013). For example, Chang et al. (2017) proposed an integrated framework for sentiment analysis and category detection of Hilton hotel reviews and ratings from TripAdvisor, revealing the most negative terms being used by dissatisfied business travelers during their stay.

Two main approaches exist for valence classification of UGC – the classic lexicon-based approach (also referred to as “unsupervised technique”), and the supervised classification method. The lexicon-based approach compares the features of the text against pre-defined positive and negative sentiment lexicons, and determines whether the document has a more positive or negative tone. One potential challenge for the sentiment detection of online reviews through a lexicon-based approach is that this method is highly domain-dependent, so constructing domain-specific sentiment lexicons matching the hospitality and tourism context and reporting changes appears to be crucial (Xiang et al., 2015). In the supervised classification method, a training data set is first developed to distinguish a document’s characteristics, and is further applied to test data (Feldman, 2013). Both methods have been used for sentiment analysis of hospitality and tourism studies such as multi-dimensional sentiment analysis of restaurant reviews or the evaluation of online destination images through massive UGC (Gan et al., 2017; Marine-Roig and Clavé, 2015).

2.1.1 Supervised machine learning. Supervised learning refers to a machine learning classification technique that uses sample pairs of input–output data to learn a classification model, also known as labeled training data set, to further determine the class labels for unobserved instances. This new set of input data predicts the output variables and class attributes for the unlabeled data by using one of the common classification algorithms (e.g. support vector machine [SVM], naïve bayes [NB], logistic regression or K-Nearest Neighbors) (Feldman, 2013; Pang et al., 2002).

Although supervised machine learning techniques have shown relatively better performance than unsupervised methods (Chaovalit and Zhou, 2005; Kirilenko et al., 2017), they are not widely used in hospitality and tourism research. One limitation could be the need for large expert annotated training data to be created from scratch, as the method may fail when training data is insufficient. In one of the first attempts to apply the supervised classification method in hospitality and tourism, O’Mahony and Smyth (2010) tried to identify the most helpful TripAdvisor hotel reviews by comparing the performance of different classification techniques (“helpfulness analysis”). They proposed an automatic recommender system that suggests the most helpful reviews to end-users based on the classifier used. In another study by Ye et al. (2009) that reported sentiment classification and review mining of travel blogs for popular travel destinations in the USA and Europe, three supervised machine learning algorithms, namely, NB, SVM and N-gram model were compared. Their results indicated that the SVM and N-gram approaches outperformed the NB approach, while all three approaches reached acceptable accuracy levels when used for larger training data sets.

2.1.2 Unsupervised machine learning. Unlike supervised learning, the unsupervised approach to SM analysis does not require prior training to classify the data, as only input data (X) is used. The lexicon-based method is a popular unsupervised method for determining the polarity and semantic orientation of SM statements that involves predefining lexicons of positive and negative words and phrases (Taboada et al., 2011; Turney, 2002). The vast majority of the hospitality and tourism studies apply an unsupervised approach of sentiment identification to investigate attributes and sentiments of SM data. Examples include a multidimensional sentiment analysis of restaurant online
reviews for explaining differences in star ratings (Gan et al., 2017), comparing sentiments expressed on major online review platforms such as TripAdvisor, Expedia and Yelp (Xiang et al., 2017), and analyzing travelers’ perceptions of place through sentiment detection of destination marketing organizations (DMOs) official websites, user-generated content from review blogs, and editorial content of Anglo-American news media sites (Költringer and Dickinger, 2015).

2.2 Computer-assisted content analysis and topic modeling

Content analysis is a popular research method used in the humanities, social sciences and recently the engineering field for systematically studying, examining and categorizing documents and written texts (Berelson, 1952). From an epistemological perspective, content analysis can be divided into qualitative and quantitative content analysis. In contrast to qualitative approaches where human readers examine text and images for patterns through repeated, systematic readings of the same data (Halpenny and Blye, 2017; MacKay et al., 2017), quantitative content analysis uses statistical methods to infer from the text by applying substitution and correlational methods (Stepchenkova et al., 2009). Quantitative content analysis has received special attention in recent years because of the exponential growth of electronic and online data such as that found on SM platforms and virtual communities. This massive amount of easily accessible textual data, along with the emergence of computer-based textual data analysis methods, has revolutionized the use of content analysis research in social sciences (Macnamara, 2005).

Topic modeling is a probabilistic method that employs statistical machine learning techniques such as probabilistic latent semantic analysis and latent dirichlet allocation to identify abstract patterns and hidden semantic structures in textual data (Blei et al., 2003). In hospitality and tourism, topic modeling has been used for different purposes such as comparative analysis of multiple online review platforms (Xiang et al., 2017), tourist satisfaction analysis of hotel visitors (Guo et al., 2017), consumer perceptions of hotel products and services (Xu et al., 2017), and exploring TripAdvisor posts to document international tourists’ experiences of a Chinese entertainment show (Pearce and Wu, 2018).

Cluster analysis is another classification method for grouping unknown categories and data based on a suitable measure of similarity and distance between two documents, commonly known as vectors. Cluster analysis and topic modeling are closely related. However, cluster analysis aims to create similar groups and to partition data into coherent sections through a range of clustering algorithms, while topic modeling seeks latent themes and topics in the corpus through the use of probabilistic generative models that identify similar words occurring in similar contexts (Grimmer and Stewart, 2013). As an example, Bassolas et al. (2016) used Twitter data to perform a hierarchical cluster analysis of group visitors at different tourist sites, and classified travelers by different factors such as country of residence and spatial networks. In another study by Jankowski et al. (2010), a spatial clustering was conducted to classify tourists’ preferences for landmarks based on their photos posted on Flickr.

2.3 Trend analysis

Trend analysis refers to techniques and methods for extracting, identifying and predicting behavioural patterns and trends through analysis of time series and other longstanding statistical methods, from forecasting the growth of visits from a tourism destination to predicting the effectiveness of tourism marketing campaigns, which would otherwise be hidden because of noisy data (Fan and Gordon, 2014). Demand prediction and strategic decision-making support systems for tourism and hospitality have been demonstrated
through analyzing the photo-sharing SM platform, Flickr (Miah et al., 2017), predicting customer trends and needs for value creation of smart tourism destinations (Del Vecchio et al., 2018), exploring Google Trend data for trend identification in travelers’ hotel ratings and reviewing behaviors (Chang et al., 2017), and proposing a functional model for estimating destination tourists’ future trends and preferences through TripAdvisor review analysis (Pantano et al., 2017).

2.4 Predictive analytics
Predictive analytics seek to uncover patterns and predict future outcomes by applying a variety of regression and machine learning techniques to historical and current data (Gandomi and Haider, 2015). In practice, predictive analytics in hospitality and tourism can be applied to forecast travelers’ and visitors’ next moves based on where and when they go to a destination and what they say on SM. Studies are using regression methods to predict linear change in customer ratings for hotels based on change in customer sentiment polarity (Geetha et al., 2017), estimating hotel demand from user-generated data obtained from multiple SM sources (Ghose et al., 2012), exploring rating prediction accuracy of user reviews in tourism through the application of the root mean squared error technique (Rossetti et al., 2016), and proposing a decision support model to help independent tourists find satisfactory restaurants based on social information retrieved from TripAdvisor (Zhang et al., 2017).

2.5 Social network analysis
Social network analysis encompasses methods that uncover associations between actors (nodes) and their relationships (links) within a social network, from physical connections to intangible relationships such as information sharing, friendships or their affiliations (Carrington et al., 2005). The application of social network analysis in the hospitality and tourism context is rare and very recent but this method can provide comprehensive patterns and structures of ties and relations between tourists within different SM platforms. In recent research by Edwards et al. (2017), the social network of the major contributors to TripAdvisor’s Sydney Travel Forum was visualized, and knowledge structures of local experts and ambassadors of the destination were explored. A second study by Jin et al. (2018) used social network analysis to explore the temporal heterogeneity in tourist flow networks corresponding to length of trip.

2.6 Spatial data analysis: the importance of where
Tourism is a fundamentally spatial phenomenon. Geographically referenced (geo-tagged) photos on SM platforms such as Flickr, Twitter or Facebook make tourists traceable, and allow their preferred destinations, landmarks and routings to be easily revealed (Goodchild, 2007; Majid et al., 2013). DMOs, hospitality industries and food service companies can investigate the spatial associations and relationships of popular tourism regions and territorial units using geographic information system tools and spatial data analysis methods.

Spatial analysis refers to the process of turning geographical raw data into useful information through the application of analytical methods and techniques (Haining and Haining, 2003). Fischer and Wang (2011) suggest dividing spatial data based on discreteness of the variable values, resulting in four categories: point pattern data, field data (geostatistical data), area data and spatial interaction data, with the latter two categories as the most commonly used in hospitality and tourism-related research and elaborated on here. The focus of area data is on the analysis of object data (i.e. tourist) where the observations
relate to areal units such as a tourist’s movements or their information transmission, while in spatial interaction data an analysis of origin–destination flow is the main point of interest (Fischer and Wang, 2011).

Exploratory spatial data analysis, mapping and geovisualization of the spatial area data helps suppliers and marketers describe the spatial distributions of popular tourism locations and predict high demand areas. It also helps to discover patterns of spatial clusters, as well as visualize and explore spatial interaction data such as daily tourists’ traffic flow (Bassolas et al., 2016; Chua et al., 2016; Jin et al., 2018; Oender, 2017; Önder et al., 2016; Zhou et al., 2015).

Huang et al. (2017) proposed a model to describe the relationship between travelers’ destination choice and characteristics of the environment by analyzing online check-in activities and geo-tagged SM data. They concluded that locations with greater diversity of services are more attractive to tourists, while locations with more similar types of services such as restaurants and recreational services can attract more mainstream visitors. In a study of Barcelona Airbnbs, Gutiérrez et al. (2017) analyzed geo-tagged SM photographs from sightseeing city spots and compared spatial patterns of hotels and peer-to-peer accommodations. Their results revealed spatial associations between tourists’ accommodation and places visited, confirming that tourists tend to stay at locations close to attractions they wish to visit. In a relatively similar study Salas-Olmedo et al. (2018) examined Madrid tourists’ SM posts. Three data sources, namely, Panoramio for sightseeing components, Twitter for connectedness and accommodation, and Foursquare for interactions on the social networks were compared, and digital footprints and different activities of tourists were tracked. Their results strongly recommend that researchers compare results from multiple data sources in a complementary manner when analyzing the presence of tourists in a tourism destination.

2.7 Comparative analysis
Comparison plays an important role in social science research, ranging from evaluating products and services in business settings, to contrasting individuals and groups within societal contexts. Comparative analysis refers to any direct, item-by-item comparison of two or more comparable alternatives such as methods, products, qualifications, data sets, etc. While closely related, comparative sentence mining (CSM) differs from opinion mining and sentiment analysis. The main focus in sentiment analysis is on opinion extraction and sentiment classification of one entity based on the subjective opinion of the author into positive or negative. In contrast, CSM is a type of comparative analysis of textual data (e.g. UGC, forum discussions, blogs, etc.) that seeks to mine comparative relations including extraction of entities, features being compared and comparative keywords through classifying comparative sentences into harmonized groups (Jindal and Liu, 2006). Comparative opinions are normally provided by highly experienced customers and can help service providers understand their products or services in comparison to their competitors’, the so-called “competitiveness analysis.” Comparative relation mining enables businesses to analyze positioning and market structure, identify competitors and recognize strengths and weaknesses. For example, in a study completed by Gao et al. (2018), a competitiveness analysis of competitor identification using comparative text mining and sentiment analysis was applied, through which strengths and weaknesses of Chinese restaurants against their competitors were compared. In another study by Chiu et al. (2015) comparing Chinese weblogs, sentiment classification performance of supervised semantic orientation was used to reveal customers’ opinions about hotels. This mixed method approach produced more robust classification and forecasting performance.
With this overview of the diverse range of SM data types and related techniques and tools used for their analysis, the documentation of researchers’ efforts to engage in SMA can now be discussed, along with the methods this paper uses to examine the scholarly literature.

3. Research methodology
This systematic review builds upon the “preferred reporting items for systematic reviews and meta-analyses” (PRISMA) guidelines, in an effort to systematically assess the quality and quantity of hospitality and tourism research employing SMA (Liberati et al., 2009; Moher et al., 2009). Inclusion and exclusion criteria at different stages are described in a reporting flowchart (Figure 1).

The review protocol, including search terms, databases and screening criteria, was developed and guided by study objectives to conduct the literature search. First, an explorative search in Google Scholar was conducted to identify relevant search terms such

![PRISMA flowchart]

**Figure 1.** PRISMA flowchart

**Source:** Adapted from Moher et al. (2009)
as “SMA,” “opinion mining,” “sentiment analysis,” “text analysis,” “predictive analytics,” “topic modeling,” “spatial analysis” and “comparative analysis.” Search strings combining these search terms were used to identify studies that had used SMA in hospitality and tourism-related research. To reduce the number of search strings, wildcard symbols (e.g. *) were also used when necessary. Combinations of two sets of keywords were used, with the first term being “SMA” (“tourism and hospitality” were also added to ScienceDirect and Scopus databases), the second term being the rest of the keywords.

Five academic databases were identified from prior hospitality and tourism review publications and searched for this review. They included: SAGE, EBSCOhost, Google Scholar, Science Direct and Scopus (Leung et al., 2013; Yang et al., 2017). To safeguard the quality of this review, it considered only original research articles published in English-language peer-reviewed journals from 2000 to 2018 that contained the aforementioned search terms in the title, abstract or keywords. Book chapters, conference papers and articles not written in English were excluded. Additional filters were used in certain databases, such as EBSCOhost and Scopus, that provide options to limit the search to hospitality and tourism complete, social science, or business management and accounting. Publications were selected from 2010 onwards, since that is when SMA began to emerge in the academic and business communities.

As of 1 March 2018, the literature search against the five databases resulted in 1,973 records. These were exported to RefWorks reference management software for further analysis. After removing 1,379 duplicate references, the remaining 594 records were screened against the literature selection criteria. As the assessment progressed, each paper was independently reviewed by each author to determine its relevance. Abstracts were read first, and the full text of articles was assessed when additional clarity was needed. Further, studies were discarded because of the methodological analysis technique used (e.g. qualitative, human coding of text). Additionally, studies were rejected that used the use of crawlers and scraping services, which use analytic tools to extract data but not analyze it. Articles that did not have a sufficient tourism or hospitality focus (e.g. travel related to daily commuting rather than tourism) were similarly eliminated. The screening process yielded 146 records, of which the full texts were carefully reviewed for eligibility in the final analysis. Only 82 studies were identified as eligible. During this stage, the reference lists of eligible articles were also independently cross-checked by the authors to identify papers that might have been overlooked. This hand-search revealed three additional studies, bringing the total to 85 studies for the final analysis. Figure 1 outlines the number of studies screened and excluded at different stages of the literature review. The reporting flowchart was in accordance with the PRISMA statement with minor adjustments (Moher et al., 2009).

3.1 Classification framework

In this study, the SMA process proposed by Stieglitz and Dang-Xuan (2013) was used to inform the classification framework (Figure 2). Based on this widely accepted SM analytical framework (Stieglitz et al., 2014, 2018), the process of analyzing SM content included three steps: tracking, preparation and analysis. After a thorough review of SMA methods used to achieve these processes, relevant scholarly journal articles were categorized and evaluated based on the application of the following SM analytical methods:

- text analysis;
- sentiment analysis;
- content analysis;
- trend analysis;
- predictive analytics;
The reviewed articles were also sorted by context: (a) hospitality, (b) travel and tourism and (c) food and beverage. Depending on the types of SM platforms on which each study focused, articles were also sorted into the following categories: (a) social networking sites (SNS), (b) media and content communities, (c) discussion forums and (d) consumer review sites. SNS refers to web-based applications and services such as Facebook, Twitter or Sina Weibo (China’s equivalent of Twitter), where public or semi-public users can connect with each other and share similar personal interests, lifestyle or activities based on the nature of the site (Boyd and Ellison, 2007). While SNSs are mainly organized around people rather than interests, publicly accessible online discussion forums such as TripAdvisor Travel Forum were developed so that people with common interests can share their knowledge and experience in different areas. Media and content communities refer to web and mobile applications, which enable their users to share particular kinds of content such as photos (Flickr and Panoramio) and videos (YouTube). Finally, consumer review sites refer to platforms on which consumers can post content on products and services. Online review platforms in hospitality, tourism and food services can vary from community-based platforms such as TripAdvisor and Yelp, to transaction-based online travel sites such as Expedia and Bookings.com. While both types of review sites are perceived as electronic word-of-mouth, different sociocultural and economic systems with distinctive business models are followed by each (Xiang et al., 2017). Initial coding effort results were compared, and disagreements were clarified through several meetings between the co-researchers. At
the end of this process, research articles were coded using a collaboratively agreed upon coding approach (Creswell and Creswell, 2017; Wamba et al., 2015).

4. Results
4.1 Descriptive analysis of articles by overall growth, publication source and research regions
Descriptive analysis of published articles on hospitality, tourism and food services using SMA revealed that application of these methods is still at an early stage of development (Figure 3). A strong growth trend between 2014 and 2017 was observed, with 27 publications documented in 2017.

Articles were published in 39 different journals affiliated with the following disciplinary subject areas: hospitality and tourism management; business, management and marketing; computer science, information technology and artificial intelligence; and transportation, geography and environmental science. Results show the willingness of a variety of journals to publish studies from the multidisciplinary hospitality and tourism research area (Figure 5). Among them, top journals were *Tourism Management* (17 publications), *Information Technology and Tourism* (6), *International Journal of Hospitality Management* (6), *Journal of Travel Research* (5), *Information and Management* (4), *International Journal of Information Management* (3) and *Expert Systems with Applications* (3) (Figure 4).

![Figure 3. Distribution of articles by year of publication](image)

*Note: Only 6 months of 2018 included in analysis*

![Figure 4. Distribution of articles by the publication source](image)

*Note: Journals with single articles are not reported*
Studies were based in Asia, Europe, North and South America and Oceania, with North America and Asia serving as the most frequent study settings (Figure 6). The USA was the leading study context with 29 studies, followed by China with 10 studies, and Australia and Italy with six. Also, 12 articles used a combination of different locations mainly for the purpose of comparative analysis, while seven studies did not report where the research was based.

4.2 Distribution of articles by the area of study
Hospitality and tourism experience is a multi-dimensional phenomenon in which different elements such as eating, sleeping and even transportation play important roles. Food, an essential component of the travel and tourism experience, has become a popular subject area of study in recent years (Vu et al., 2017; Zhang et al., 2011), and this was parceled out as a separate subject matter when categorizing the selected articles. Since early SMA research in the hospitality and tourism domain targeted hotel industries for their case studies, it is not
surprising that the highest number of publications in SMA focuses on hotels in our collection of articles (38 publications). Travel and tourism destinations and attractions ranked second with 37 articles, followed by 15 studies on food and beverage sectors. Only five studies considered a combination of different domains mainly for comparative analysis or quality assurance purposes.

4.3 Distribution of articles by the type of social media

As was discussed earlier in this article, SM platforms were divided into four main categories including SNS, media and content communities, discussion forums and consumer review networks (Table I). The largest number of articles examined UGC and online reviews from a variety of consumer review networks such as TripAdvisor or its Chinese equivalent Daodao.com (34 publications), Booking.com and Expedia (9 each) and Yelp (3). The second largest group of articles featured SNS data mainly from Web-based applications such as Twitter or its Chinese equivalent Sina Weibo (14) and Facebook (4). Following close behind, media and content community platforms were most commonly used for SMA by hospitality and tourism scholars. Flickr was one of the most used content communities in 11 publications, mainly used for its geospatial analysis because of its geo-referencing feature, followed by a discontinued geo-tagged photo-sharing web application named Panoramio. Finally, the use of discussion forum data for SMA in hospitality and tourism studies ranked last by having only five cases drawing from TripAdvisor Travel Forum and Yahoo Travel Forum. While around 20 per cent of the articles (18 publications) used multiple platforms mainly from the same type of SM platforms (e.g. TripAdvisor and Booking.com, or Travelblog and other related blogs), only four studies considered a combination of two or more types of SM platforms for their analysis such as Twitter and TripAdvisor, or Twitter, Facebook and Instagram (Kirilenko et al., 2017; Del Vecchio et al., 2018; Salas-Olmedo et al., 2018; Gutiérrez et al., 2017).

The top five SM platforms reported on in the articles were: TripAdvisor or its Chinese equivalent Daodao.com (35 publications), Twitter and its Chinese equivalent platform Sina Weibo (14), Flickr (11), and Booking.com (6). The first two aforementioned platforms are among the most popular SM platforms especially in hospitality and tourism, with TripAdvisor having over 600 million reviews and opinions, and Twitter having approximately 320 million monthly active users worldwide (Statistica.com, 2018).

One of the challenges of overreliance on a single source of data in SMA research is sampling bias because of the unique sociocultural characteristics of each platform’s users (Tufekci, 2014). From our collection of articles, 18 studies chose to use a variety of sources for their analytics, which in turn likely decreased validity problems, data availability biases and authenticity concerns (Chiu et al., 2015; Garcia-Pablos et al., 2016; Höpken et al., 2015; Ma et al., 2018; Phillips et al., 2015).

<table>
<thead>
<tr>
<th>Social media types</th>
<th>No. of articles</th>
<th>Percentage of articles (total = 85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social networking sites (SNS)</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>Media/content communities</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Discussion forums</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Consumer review networks</td>
<td>53</td>
<td>62</td>
</tr>
<tr>
<td>Combination</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Table I. Distribution of articles by the type of social media
<table>
<thead>
<tr>
<th>Type of analysis</th>
<th>Articles</th>
<th>Percentage of articles (total = 85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of analysis</td>
<td>Articles</td>
<td>Percentage of articles (total = 85)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Trend analysis</td>
<td>Chang et al. (2017), Del Vecchio et al. (2018), Li et al. (2015), Li et al. (2015), Miah et al. (2017), Pantano et al. (2017)</td>
<td>7</td>
</tr>
<tr>
<td>Social network analysis</td>
<td>Edwards et al. (2017), Jin et al. (2018), Park et al. (2016)</td>
<td>4</td>
</tr>
</tbody>
</table>
4.4 Distribution of articles by the type of analysis

Table II represents frequencies of use for different types of SM analysis. This helps to identify gaps in SMA use and tendencies toward specific methods. Influenced by the SM analytical framework proposed by Stieglitz and Dang-Xuan (2013), types of analytical methods are divided into text analysis, content analysis, sentiment analysis (opinion mining), social network analysis and trend analysis. This definition was expanded by adding predictive analytics, spatial analysis and comparative analysis as potential categories. Topic modeling and cluster analysis were the two common approaches for content analysis. It is no surprise that many articles fit more than one of the eight categories. This was especially true for the categories of text analysis, sentiment analysis and topic modeling, which showed the interdependency of the aforementioned methods and techniques such as text mining and NLP. Of the 85 articles, text analysis (65 publications), sentiment analysis (38; 23-applied unsupervised, 18-supervised and 4-combined both), and topic modeling/cluster analysis (35) were the methods most often used, followed by spatial analysis (27), predictive analytics (16) and comparative analysis (15).

These observations can be explained by the fact that UGC, and online reviews in particular, contain useful textual information for consumers and travelers, which can both help them in their decision-making process, and offer valuable insights for DMOs and service providers to align their marketing objectives with the consumers’ needs. Also, further investigation of the articles that conducted a sentiment analysis revealed that 62 per cent of studies applied unsupervised machine learning methods to determine the contextual polarity of textual entities, and 48 per cent used supervised approaches for detecting valence and emotions from text. Only 11 per cent of collected articles used both supervised and unsupervised techniques (Table III). Therefore, incorporating supervised and mixed methods can produce more robust and reliable results and improve the performance of the sentiment classification of the hospitality and tourism SM data (Chaovalit and Zhou, 2005; Kirilenko et al., 2017).

4.5 Distribution of articles by the purpose of research

The purpose of research was categorized into four main streams: opinion mining, travel patterns, accuracy and performance testing and visitation prediction (Table IV). Two-thirds of the studies generated a list of attributes for hotels, destinations or restaurants (quality, features, etc.) and aggregated opinions about them using SM analytic methods, most commonly text analysis, sentiment analysis, topic or cluster analysis, spatial analysis and comparative analysis. Research identified as opinion mining fits this description in its emphasis on extracting and analyzing judgments on particular aspects of destinations, hotels or restaurants, namely, image of given items (e.g. destination image), satisfaction, review helpfulness and competitiveness analysis.

Identifying travel patterns and tourist flow, popular tourist locations and desired tourism activities are other common goals of the hospitality and tourism-focused research. One-third of collected studies investigated these travel patterns, with the most common analysis

<table>
<thead>
<tr>
<th>Type of sentiment analysis method</th>
<th>No. of articles</th>
<th>Percentage of articles (total = 37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsupervised learning</td>
<td>23</td>
<td>62</td>
</tr>
<tr>
<td>Supervised learning</td>
<td>18</td>
<td>48</td>
</tr>
<tr>
<td>Mixed method</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>
methods being spatial analysis, topic and cluster analysis, text analysis and predictive analysis. Performance measurement and accuracy testing of SM analytical methods was another purpose of research followed by 7 per cent of collected studies in which the most common analysis methods measured and assessed were predictive analytics, spatial analysis, trend analysis, topic modeling and text analysis. Finally, the main purpose of research for six articles was to predict places, hotels, landmarks and restaurants that tourists would visit, through the application of analysis methods such as text analysis, sentiment analysis, predictive analytics and comparative analysis.

5. Discussion
In the past 18 years, the rapid increase in the amount of information that tourists create and share on SM platforms has provided tourism promoters and suppliers an invaluable, but also overwhelming amount of data, which requires rigorous, relevant and responsive approaches to effectively engage this data to support tourism success. This paper presents a systematic literature review of hospitality and tourism-related SMA studies with a view to addressing this big data opportunity. As different SM platforms contain unique types of information that may need specific analytical methods, a classification of SM type and analytical techniques was conducted. The paper provides researchers with an understanding of past application of SMA in hospitality and tourism research, and contributes to the field by identifying historical shortcomings, including excessive reliance on particular data types and analytical methods. The paper also highlights the potential of SM spatial data, which, along with relevant analytic methods, is underused. The availability of Volunteered Geographic Information and geo-referencing features in SM platforms such as Facebook, Twitter and Instagram, offers a wealth of spatial information that can be harnessed to improve the understanding of tourist behavior and preferences.
as Twitter and Flickr have shaped common domain knowledge between disciplines, which study tourists’ footprints, including geography and environmental science, computer science and information technology, as well as hospitality and tourism. This study integrates previous definitions of and approaches to SMA into a more inclusive suite of analytics, which not only includes typical analytical methods such as text analysis and sentiment analysis but also elevates less adopted approaches such as comparative analysis and spatial analysis.

Among SMA methods, comparative analysis is increasing in popularity in the hospitality and tourism research. However, use of other methods such as social network analysis for identifying and visualizing hidden patterns and relationships in a large network of tourists (Jin et al., 2018; Park et al., 2016), or trend analysis for providing tourism providers with insights into tourist trends and seasonal effects (Miah et al., 2017), can benefit hospitality and tourism industry and scholarship by providing enriched understanding of this multifaceted sector. Another important finding is the small but constant increase in the number of publications, which have applied a combination of analytical methods, showing increased interest in achieving more comprehensive and more robust SMA. There is still room for improving and expanding use of applications such as tourism demand prediction and destination recommendations based on trend analysis, which can in turn provide hospitality and tourism researchers with detailed understanding of collective tourism behavior and predictive insights (Miah et al., 2017; Rossetti et al., 2016). As an example, a potential future research avenue could be the application of SM predictive analytics using explanatory evaluation methods with high predictive power.

As for the levels of sentiment analysis, results of the present literature review show that almost all hospitality and tourism studies that applied this analysis focused on document and sentence levels inferred from the sentiment, while very few studies targeted sentiment detection at an aspect level (Marrese-Taylor et al., 2014), previously referred to as “aspect-based sentiment analysis.” Exploring sentiments at a variety of levels beyond simply determining whether a review or a piece of text is negative, positive or neutral is needed (Feldman, 2013). While an online reviewer can speak positively about specific features of a destination, such as restaurants or nightlife, they might have expressed a negative attitude toward another component, such as transportation.

With respect to the supervised versus unsupervised methods for sentiment analysis, results reveal that 62 per cent of articles used unsupervised learning, 48 per cent supervised and only 11 per cent applied a combination of both methods for subjectivity detection of UGC (Table III). Since a lexicon-based sentiment analysis is highly domain-dependent, and considering the limitations of using manually and automatically created sentiment lexicons, it is surprising to see that only a few studies have either used or reported domain-specific sentiment lexicons that could be more suitable to the hospitality and tourism domain (Xiang et al., 2017). Future hospitality and tourism research on content and sentiment analysis of SM would benefit from domain-specific dictionaries for sentiment and topic detection, and this can only be achieved by collaborative research between hospitality and tourism researchers and textual data and NLP scientists. Considering the relatively enhanced performance of supervised learning methods compared to unsupervised lexicon-based methods (Chaovalit and Zhou, 2005; Kirilenko et al., 2017), future work is needed to improve the performance of the sentiment classification of the hospitality and tourism SM data through the application of supervised techniques or combined methods.

The ability to perform appropriate and accurate reporting on analytic methods helps hospitality and tourism organizations make more informed and evidence-based decisions. Undetected inaccuracies and improper reporting in analytics methods such as text mining...
and sentiment analysis can produce bigger inaccuracies in subsequent analytic efforts, that can in turn cause a snowball effect in reporting (Hayes et al., 2005). As few as 36 per cent of the studies of the current review conducted performance measurement metrics and reported accuracy testing results for measuring the sensitivity and relevance of the applied methods. That said, a further suggestion would be to evaluate and report on the accuracy testing results of the applied classifiers and performance analysis of supervised machine learning techniques for sentiment analysis of the hospitality and tourism SM data.

The studies were divided into four main study purpose categories: opinion mining, travel patterns, accuracy and performance testing and visitation prediction. This research identified which analytical methods were overemphasized in each category, and tracked under-used or missing methods. Results show that SMA studies in hospitality and tourism placed an excessive emphasis on text analysis, sentiment analysis and topic modeling or cluster analysis when researching different aspects of image, tourism satisfaction, review helpfulness and/or competitiveness analysis of destinations, hotels or restaurants. Potential analysis methods that have received little or no attention within subcategories of this classification are spatial analysis, predictive analytics, trend analysis and social network analysis. This is important because the applications of these methods appear to be highly effective in generating a better understanding of many facets of destination image and tourist experience (MacKay and Fesenmaier, 1997).

For the literature reporting travel patterns such as popular landmarks, tourist flow and travel activity, it is no surprise that spatial analysis, topic modeling and cluster analysis are more commonly used, as these are the most well-known methods for analyzing spatial data and tourists’ movements (Fischer and Wang, 2011; Haining and Haining, 2003). One important missing method that holds promise is the application of text analysis techniques on SM data, used in comparison with geoinformation and spatial data for a better understanding of tourists’ travel behaviors and activity patterns (Girardin et al., 2008; Ji et al., 2011). Predictive analytics and trend analysis are among the other methods that should be applied more frequently when researching tourist satisfaction, provider competitiveness, predicting visits to popular locations and travel pattern identification. Finally, when the purpose of research is predicting visits to destinations, hotels and restaurants, the most under-used yet relevant analytical methods are identified as trend analysis, topic modeling and cluster analysis.

Consumer review networks and SNS were the dominant SM platforms, and most SMA studies have focused on TripAdvisor, Twitter and their Chinese equivalents over other channels. Underuse of multi-type data such as UGC and geo-tagged information, or multiple SM platforms such as TripAdvisor and Flickr was also in evidence. The majority of existing articles focused on single types of information and media (Table 1); however, using multiple sources of information and multi-type data is recommended to fully understand the multifaceted characteristics of the hospitality and tourism system (Del Vecchio et al., 2018; Gutiérrez et al., 2017; Kirilenko et al., 2017; Salas-Olmedo et al., 2018). The complex nature of the tourism experience and the role of food, excursions and transportation in creating such an experience suggest that consideration of cross-domain data in SMA research is essential. Yelp, a crowd-sourced review forum on food services and restaurants, is an example of an under-used source of SM data, as dining preferences, satisfaction and behaviors have significant influence on destination performance.

6. Conclusion and future research directions
The growth in SM data and accompanying SMA-related research highlights the need to construct an integrative framework for tracking the application of SMA to facilitate
systematic and comprehensive analysis of this complex topic. This study appears to be the first work that systematically reviews SMA in the hospitality and tourism domain. To characterize this emerging research topic in hospitality and tourism, we looked at SMA research from seven different perspectives: the overall growth, publication source, research regions, disciplinary home, SM types, types of analysis and research purpose.

Research using SMA in hospitality and tourism has increased rapidly since 2014, with an extreme bias toward choosing destinations, hotels and restaurants in the USA and China for case studies and only 12 articles compared a combination of different locations. Greater study location diversity and more comparative studies should be prioritized in scholarly efforts (Guo et al., 2017; Nakayama and Wan, 2018).

The highest number of hospitality and tourism SMA studies examined hospitality services and hotels, followed by travel and tourism destinations and finally food, restaurant and beverage sectors. Adoption of a more holistic understanding of the tourist experience is recommended, by studying SM data sourced from all three of these domains, simultaneously is needed. An example of this kind of comprehensive examination can be seen in a study by Thomaz et al. (2017), in which different components of tourists’ experiences such as food and beverage, hospitality and transportation a FIFA World Cup 2014 host city were investigated. Also facilitating holistic understanding would be the increased application of supervised methods of sentiment analysis and the use of domain-specific dictionaries for sentiment and topic detection when analyzing UGC.

As for the distribution of articles by type of SM, SNS and consumer review networks were the leading sources of data, with TripAdvisor and Twitter as the dominant SM platforms, followed by content communities and discussion forums. Few studies report data from multiple SM platforms. Rather than a reliance on single types of SM, analyzing several sources of information and multi-type data is imperative to fully understand the complexity of the hospitality and tourism system. Prioritizing the incorporation of geolocative data into data selection and analysis decisions in combination with textual analysis from several SM platforms is an example of this.

More research studies need to apply accuracy testing and performance measurement of analytic methods (Ye et al., 2009; Zhang et al., 2011) to evaluate the robustness of analysis. Additionally, a number of methods appear to be underused in tourism and hospitality SMA including predictive analytics using explanatory evaluation methods, social network analysis, trend analysis, comparative analysis and spatial analysis. Expansion of the use of these methods may accelerated SMA research relating to travel patterns and visitation prediction, which were identified a less frequently investigated than tourist opinion mining.

In closing, this paper provides a comprehensive description of trends and the current state of the application of SMA in hospitality and tourism research. Future reviews of SMA in this field should include detailed explanations and recommendations regarding SMA best practice to guide hospitality and tourism researchers in their selection of SMA methods and their respective executions. These best practice approaches, in part, will need to be identified and adopted from other field of research such as information communication technology studies.

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Progress on the role of ICTs in establishing destination appeal
Implications for smart tourism destination development

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Abstract
Purpose – This paper aims to analyse the role of information and communication technologies (ICTs) in establishing destination appeal and reflect on the implications for smart tourism destination development. The focus is on identifying and analysing technological solutions by considering six elements shaping tourism destination appeal, namely, attractions, public and private amenities, accessibility, human resources, image and character and price.

Design/methodology/approach – To deliver public and private sector implications, the authors have reviewed and analysed relevant papers that were published in hospitality and tourism journals (42 Q1 and Q2 ranked journals based on SCImago Journal Rank) between 2010 and 2018.

Findings – ICTs affect the marketing and management of tourism destinations. They foster their innovativeness (e.g. interpretation of destination factors, new travel trends, innovative products, VA and AR), contribute sustainability (e.g. visitor management and reducing the use of resources) and improve accessibility (e.g. information provision, navigation, availability of sites and travel planning). The adaptation of technological solutions in the hospitality industry can be related to increased productivity, profitability and quality of services. Additionally, ICTs facilitate visitor decision-making (e.g. online distribution channels and information accessibility), influence overall travel experience and enable the sharing of visitors' impressions.

Research limitations/implications – The significant limitations of this study include restrictions on the timing of publication and on journal selection.

Originality/value – This paper reviews full-length research papers that were published in relevant tourism and hospitality journals. This paper complements the current literature by addressing the role of ICTs in establishing destination appeal and reflecting on implications for smart destination development and future research.

Keywords ICT, Hospitality, Tourism research, Information and communication technology, Destination appeal, Smart destination

Paper type Literature review

The authors would like to express their gratitude to both reviewers for their comprehensive reviews and suggestions that have contributed improve the quality of the paper.
1. Introduction

Smart tourism reflects increasing reliance of tourism destinations on emerging forms of information and communication technology (ICT) that enable data to be transformed into knowledge. The concept of smart tourism encompasses touristic activities that are informed and supported by smart technology and involves three main components and layers of ‘smart’ that are supported by ICT: smart destinations, smart experiences and smart businesses (Gretzel et al., 2015a). Consequently, a smart tourism ecosystem (STE) can be defined as a tourism system that takes advantage of smart technology in creating, managing and delivering intelligent touristic services and experiences and is characterised by intensive information sharing and value co-creation (Gretzel et al., 2015b). In the literature, smart destinations are seen as an integral part of STEs with conceptual roots in smart cities.

As a concept, a smart city strategically introduces ICT within an urban area to incorporate urban processes with the aim of enhancing the competitiveness of the city as a tourist destination whilst simultaneously enhancing the local quality of life (Boes et al., 2015). A city may be categorised as ‘smart’ when sustainable economic growth and high quality of life are achieved through investment in human capital and an adequate level of government participation and the existence of infrastructure that supports proper dissemination of information throughout the city (Caragliu et al., 2011). Thus, smart cities should base their smartness on three main pillars, namely, human capital, infrastructure/info-structure and information (Kominos et al., 2013; in Buhalis and Amaranggana, 2014). Such cities are seen mostly as innovative ecosystems that empower communities’ co-creation of the design of innovative living resulting in dynamic, modern spaces and engagement with all stakeholders (Schaffers et al., 2011). In recent research literature, smart destinations tend to be seen as specific cases of smart cities in their application of smart city principles to urban and rural areas considering both residents and tourists through their efforts to support mobility, resource availability and allocation, sustainability, quality of life and visit (Gretzel et al., 2015a; Boes et al., 2015; Lamsfus et al., 2015). However, the basic concept of a destination, and thus smart destinations, is much broader. The simplest definitions describe tourism destinations as physical spaces of any scale (country, region, island, village, town or city or self-contained centre) in which tourists make at least one overnight stay (UNWTO, 2007). Those broader definitions consider destinations to be a
complex network that involves a large number of co-producing actors delivering a variety of products and services (Buhalis, 2000; Murphy et al., 2000; Haugland et al., 2010). Recent definitions of smart destinations include reference to technology as a synonym for smart (Lamsfus et al., 2015) with different destination elements and aspects of destination management. In this manner, López de Ávila et al. (2015) defines the smart destination as:

[... an innovative tourist destination, built on an infrastructure of state-of-the-art technology guaranteeing the sustainable development of tourist areas, accessible to everyone, which 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.

A similar approach can be found in Lamsfus et al. (2015), who consider how: a tourism destination is said to be Smart when it makes intensive use of the technological infrastructure provided by the smart city to:

- enhance the tourism experience of visitors by personalising and making them aware of both local and tourism services and products available to them at the destination; and
- by empowering destination management organisations (DMOs), local institutions and tourism companies to make their decisions and take actions based upon the data produced in within the destination, gathered, managed and processed by means of the technology infrastructure.

Both definitions have a consumer perspective, which highlights the role of the ICT in the improvement of visitors’ satisfaction and experience of the destination and residents’ quality of life. The critical aspect of smart destinations is the state-of-the-art technological infrastructure that consequently supports destination management, local community empowerment and assures sustainable tourism development. Moreover, ICT appears to be a “nervous system” of a smart destination (López de Ávila et al., 2015). Building on that, this paper explores the progress in the role of ICTs in establishing destination appeal. We focus on analysing the development and introduction of various technological solutions in the marketing and management of a destination, considering the following six elements that shape tourism destination appeal (UNWTO, 2007):

1. attractions;
2. public and private amenities;
3. accessibility;
4. human resources;
5. image and character; and
6. price.

Previous studies that address the role of ICTs in hospitality and tourism have focussed on delivering supplier perspective (Ip et al., 2010; Mandić and Garbin Praničević, 2019), consumer-supplier perspective (Law et al., 2009), and industrial implications (Law et al., 2014; Liang et al., 2017) and have thus failed to comprehensively address the impacts of ICTs on the appeal of tourism destinations comprehensively. To address this research gap, in this paper, we have employed content analysis to examine all relevant research papers addressing one of six elements of tourism destination appeal (UNWTO, 2007) that were published in select tourism and hospitality journals during the period of 2010 to 2018. We expect that this analysis will be beneficial to all key public and private sector stakeholders.
by providing insights into the role of technological solutions in establishing destination appeal and reflecting on implications for smart tourism destination development.

2. Methodology
To determine how far researchers have progressed in a research area that requires further exploration, this paper reviews and critically analyses relevant papers published in hospitality and tourism journals between 2010 and 2018. The data collection and analysis were conducted in December 2017 – March 2018. To enable the state-of-the-art findings and discussion relating to the tourism and hospitality literature to be presented we have:

- Included in this research 42 relevant journals that are based on ScImago Journal Rank (SJR) indicator (Scopus® database from 1996) ranked as Q1 and Q2 journals, which makes them relevant journals in the subject area (based on impact factor, H index and referencing).
- Searched within each journal with the relevant keywords “ICT” and “smart”.

Considering the selected journals’ aims and scopes, we should have focussed primarily on those journals that cover destination management and planning. However, the aim was to address all six essential elements outline above which lead to a destination’s appeal and positive associated experiences. Since tourism is interdisciplinary, and in light of limitations on space and time, we have decided to exclusively examine all Q1 and Q2 journals that are included on a Scimago Journal and Country Rank (SJR) list. Based on advanced individual search results for each journal, we have carefully examined keywords and abstracts of each full-length research paper. Within each journal, we have first selected relevant terms, i.e. tourism destination, attractions, amenities, human resources, image, price, after which we have included ICT and smart as keywords. We did this to retain relevant ICT-related publications and because “smart” is often applied as a prefix to indicate unique capabilities and intelligence (Gretzel et al., 2015b). If the scope of the paper was considered relevant for at least one of six key themes, then we retained it for further analysis. The decision to include a paper was primarily based on its direct relevance to the topic of implementation of specific technological solutions in the hospitality and tourism industry. Additionally, some papers were excluded, as they were judged to lack relevance to the current research topic. At the end of the journal search, 95 published articles were determined to be relevant to the topic and thus were carefully examined using content analysis. The final number and distribution of research papers retained in this analysis has been addressed at the beginning of the discussion section. Additionally, we follow the recommendations by Aguinis et al. (2018) regarding methodological transparency in each step of the research process (Table I).

3. Information and communication technologies and their impacts on destination appeal – key findings
Destinations integrate various elements that attract the visitors and which satisfy their needs. These elements shaping destinations’ appeal and visitors’ experiences can be broken down into the following categories: attractions, amenities, accessibility, human resources, image and price. Their provision and quality will be influential in the visitors’ decisions to make their trip the first time and to return to the destination. The studies that are summarised in this section demonstrate that ICTs play an essential role in all aspects of tourism destination appeal.
<table>
<thead>
<tr>
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Table I. Research journals included in the analysis.
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**Notes:** SJR – SCImago Journal Rank indicator. It is a measure of journals’ impact, influence or prestige. It expresses the average number of weighted citations received in the selected year by the documents published in the journal in the three previous years. H index – Journals number of articles (h) that have received at least h citations over the whole period. Total docs. – Journals published articles in 2016. All type of documents is considered. Total refs. – A number of references included in the journals published articles in 2016. Total cites (three years) – citations in 2016 received by journals documents published in 2015, 2014, 2013. Cites/Doc (two years) – average citation per document in a two-year period. This metric is widely used as impact index.
3.1 Attractions
The term ‘attraction’ refers to all tangible and intangible factors which are often the focus of visitors’ attention and may provide the initial motivation for the tourist to visit a destination (Jafari and Xiao, 2016). Further development of the smart concept facilitated the emergence of smart tourism attractions (STA), introduced by Wang et al. (2016). They revealed how STA encompasses eight broad categories, namely: smart information systems; intelligent tourism management; smart sightseeing; e-commerce systems; smart safety; intelligent traffic; smart forecasts; and virtual tourist attractions. Tourist preferences relating to STA are multifaceted. They imply that ICT implementation is required to improve not only the way in which a product is shaped but also the way in which it is delivered as well as how the overall visitor experience is managed (Wang et al., 2016). The most substantial proportion of papers in this section address the way that ICT is used for the interpretation of different tangible and less tangible destination resources and sites. Jung et al. (2015), Claudia Tom Dieck et al. (2016) and Tussyadiah et al. (2017) explore the role of the augmented reality (AR) technology in tourism activities. According to Jung et al. (2016), theme parks are tourist attractions that offer a potential future market for AR applications. However, it is essential to identify the needs and wants of the target market in relation to application design and functionalities; i.e. while highly innovative users require high-quality systems within an application, less innovative users look for high-quality content to enhance their tourism experiences (Jung et al., 2016). As such, ICT is not an end in and of itself. AR should be seen as a medium through which to deliver high-quality content, education and enjoyment to visitors (Claudia Tom Dieck et al., 2016). Wolf et al. (2013) compare the interpretative performances of modern technical media (GIS-triggered multimedia tours and an MP3 player audio tour) with traditional, text-rich pamphlets and signs. Modern media, namely, Geographic Information Systems (GIS), have proven to be efficient and versatile tools to ascertain three performance measures for interpretative media, specifically, the attracting, holding and distracting (the power to encourage people to visit attractions off the main path) powers of interpretative media (Wolf et al., 2013). The implementation of mobile guide systems can be associated not only with an increase in satisfaction towards the individual attraction (e.g. visited museums) but also with the overall visit experience (Kang et al., 2017). Furthermore, smartphone applications, i.e. mobile technologies, positively influence overall visitor experience by fostering education, entertainment and participation (Kim et al., 2015; Xu et al., 2017) and have the power to influence the post-travel experience (Lee et al., 2017).

Technology enables the sustainable use of destination resources. It provides tools to mitigate the pressures that are induced by tourism development, particularly in maturing and environmentally “sensitive” destinations. Researchers explore the application of global positioning systems (GPS) (East et al., 2017; Hallo et al., 2012; Kádár, 2014), smartphone applications (Yun and Park, 2014) and radio frequency identification (Della Lucia, 2013). Visitor tracking is used to plan tourism flows in large sites and at individual attractions. In their research, East et al. (2017) have used GPS to track different groups of visitors around a single attraction to determine where they went and how long they dwelt at a particular location. Hallo et al. (2012) indicate that ICTs are a prerequisite for sustainable nature-based tourism development at sites struggling with pollution and carrying capacity. Furthermore, Yun and Park (2014) demonstrate that smartphone applications can be used to analyse visitor behaviour while visiting micro destinations and unique attractions, e.g. amusement parks and fairs. Such information on socio-economic sustainability and the role of the individual attractions in overall tourism development is essential to future tourism development planning. In addition to this critical role in sustaining tourism development, ICTs enable the development of tourism attractions (Marques and Borba, 2017; Tomczyk
3.2 Public and private amenities
A wide range of services and facilities (e.g. utilities, transport, public infrastructure, accommodation, recreation facilities and visitor information) support visitor stays, most of which can be influenced by ICTs. Destination cards are perhaps the most comprehensive example of how technology supports the provision of public and private amenities. Angeloni (2016) describes an innovation called “tourist kit – made in Italy” as an intelligent system for the generation of destination cards, that facilitates the process by which tourists can build a dynamic and personalised service package and calculate the total cost of services that are chosen. The destination cards facilitate not only service delivery but also provide insight into spatial and activity destination concentrations and visitor segmentation (Zoltan and McKercher, 2015). ICTs (e.g. smartphones and social media) foster the co-creation of new services (Sarmah et al., 2016; Boys et al., 2017; McGillivray, 2014), influence new travel trends (e.g. self-organised travel, as in Kristensen, 2013), and foster demand for travel and attraction to certain destinations (eVisa, as in Çakar et al., 2018). Technologies have transformed the information exchange process between visitors and their destinations (i.e. service providers). Mobile devices (e.g. smartphones) are becoming the primary means for many travellers to access the internet in search of travel-related information (Stienmetz et al., 2012). Therefore, destinations (DMOs) and service providers (Duarte Alonso et al., 2013) must consider all the factors that influence the usability of their website (whether it is responsive, provides sufficient and important information, etc.) and must also be aware of the reasons why visitors use their websites (as a source of information, for booking, etc.). Tussyadiah and Wang (2016) explore tourists’ attitudes towards proactive contextual recommendations pushed by smartphones while experiencing tourist destinations. In general, the majority of ICT users perceive the benefit of ICT as improving their tourism experience. Their technological acceptance is influenced by perceived informativeness, performance and effort expectation, social influences and facilitating conditions (Lai, 2013). Therefore, mobile technology should be designed in such a way as to provide triggers in the form of proactive, contextual, personalised recommendations to influence tourist behaviour and enhance their experiences (Tussyadiah and Wang, 2016).

In the hospitality industry, the development of ICTs has influenced the way restaurant services are presented, promoted and delivered. Researchers pay attention to e-tablet restaurant menus (Beldona et al., 2013; Yepes, 2014), smart apps (Okumus and Bilgihan, 2013), daily deals (Soo Ong, 2015), near field communication technologies1 (Egger, 2012), and, most recently, to front of house (FOH) and back of house technology applications (Cavusoglu, 2019). Beldona et al. (2013) have concluded that e-tablet menus are significantly superior to the traditional paper-based menus in terms of order information quality, menu usability and ordering satisfaction of the customers. Moreover, Yepes’ (2014) results support these conclusions. In this win-win situation, visitors appreciate extended information (e.g. numeric caloric values and percentage of daily intake) provided in restaurants using e-menus (e.g. iPad), while restaurants gain positive marketing effects (Okumus and Bilgihan, 2013). Furthermore, hotels benefit from the implementation of technological solutions when focusing on a specific market segment, e.g. Gen X, Gen Y (Kim and Bernhard, 2014) and...
technophiles. Wang et al. (2015), Morosan and DeFranco (2015) and Sarmah et al. (2016) explore the application of smartphone apps and individual willingness to share personal information via apps in the hotel industry. The research findings on co-creation in hotel service innovation using apps suggest that luxury hotel guests are willing to co-create their travel arrangements when they closely collaborate with the service provider and thus create a unique travel experience (Sarmah et al., 2016). Co-creation enhances consumers’ intentions to re-purchase travel services and to recommend the travel company to their friends. Hotels significantly utilise apps as a distribution channel and as a way to engage with today’s travellers (Wang et al., 2015). However, there is a significant degree of variation among different hotel property apps in terms of their design and functional features, which seems to suggest there is little consensus about these aspects (Wang et al., 2015). Kuo et al. (2017) address the implementation of robotics services in hotels. Their successful implementation requires hotels to adapt their organisational structures and management. Furthermore, future development and application of robots and robotic services are profoundly influenced by the demand side (government support, potential market development, and future development of the robotic industry) and the supply side (capabilities for ICT development, raising money, and talent development) factors of the hospitality market and business.

3.3 Accessibility
A tourism destination becomes accessible to the population, including travellers, if it is approachable via transport means and from different directions (UNWTO, 2007). Over time, travel infrastructure and transportation systems are becoming smarter with regard to their provision of travel information (Papathanassis, 2017). In that context, it is expected that “port of entry and specific entry conditions” will be supported with technological infrastructure, including smart, up-to-date applications to enable the delivery of multiple services through different functionalities, interaction, modalities and interfaces (Pantano, 2016).

Smartphones, which support a wide range of travel information services that can be accessed anytime from anywhere, foster a culture of information exchange (Wang et al., 2012). They are considered new distribution channels (Berezina et al., 2016) that significantly influence destination visibility by enhancing information accessibility. Due to embedded technologies, they help “digital tourists” (Bodker, 2016) to navigate and explore various sites, for example, by using GPS as “the primary tool of wayfinding” (Chang, 2015; Chua et al., 2016). The information on mobility patterns and datasets obtained from such applications (Raun et al., 2016) can be used to improve strategic management and marketing of tourism destinations. A growing number of location-based applications have been implemented on smartphones (Tussyadiah and Zach, 2012), as well as social media apps, foster destinations’ visibility by allowing users to share various content (Vu et al., 2017). Access to information through mobile applications installed on travellers’ smartphones enhances the perception of visitor satisfaction (Chu et al., 2012) and improves the overall personal experience (Garrigós-Simón et al., 2015), e.g. hotel mobile applications with different smart functionalities and simple interfaces can make the reservation process more convenient (Wang and Wang, 2010).

In addition to providing transportation and information accessibility, various technological solutions foster inclusive, i.e. accessible, tourism. People with disabilities represent a primarily underestimated niche in the tourism market, both in numerical and economic terms (Agovino et al., 2017; Darcy and Dickson, 2009), although approximately 15 per cent of the world population has at least one disability (World Bank, 2016). ICTs can contribute to the elimination of environmental (site, service and information accessibility...
(Chang and Chen, 2011; Grady and Boyd Ohlin, 2009), intrinsic (physical and psychological dependency), and interactive barriers (communication) (Lee et al., 2012) and can avoid the creation of the “accessibility islands” (World Health Organization, 2016). Furthermore, researchers have also shown (Lyu, 2017; Tutuncu, 2017) that people with disabilities place distinctive weights on each travel product attribute to attain their maximisation of travel satisfaction. Barcelona, which is one of the leading tourism destinations, has recently launched barcelona-access.com, which is a website that is dedicated to disabled travellers with the aim of creating a cohesive city that will favour quality of life and respect for diversity. The website highlights, among other features, the museums that are adapted for blind patrons, hotels without barriers, accessible beaches and sign language tours. Most of these services are based on smart tech solutions to some extent, e.g. safer intersection crossing, pre-trip concierge and virtualisation, shared-use, automation, robotics, smart wayfinding and navigation systems, integrated payment systems, and standard accessibility data platforms.

3.4 Human resources
Tourism is a labour intensive activity (UNWTO, 2009), which immediately highlights the importance of human resources for tourism. Employees in the tourism industry are facing numerous challenges related to its significant growth. Moreover, they are expected to manage their businesses according to their destination’s strategy and to interact intensively with local communities. Due to the importance of personal touch in the tourism industry, it is difficult to expect that technological solutions will provide a feasible alternative to a human workforce; however, ICT can enable employees to be more efficient and professional (Arana et al., 2015). Human resources contribute to the delivery of tourism products and visitor experiences, and staffs are thus expected to be well trained. Employees in tourist information offices have an essential role in shaping visitor satisfaction. Their performances, especially in the context of information provision and booking services, can be improved with a range of different smart solutions, e.g. augmented and virtual reality, ChatBots, Amadeus Destination, etc. (Arana et al., 2015). Technology will surely not substitute personal human encounters but rather serve as an instrument to strategically improve human-led processes by equipping individual employees with ICT for an enhanced service and experience creation process (Neuhofer et al., 2015). Undoubtedly, technology-driven service customisation and personalisation have become primary drivers of change, thereby influencing the tasks and skills that are required for employees in the tourism and hospitality industry (Solnet et al., 2015). ICT development and trends have had a significant impact on tourism as a whole. Thus, the improvement of human resources, the transformation of staff working habits and the improvement of the adaptation and integration of ICTs in business activities need to follow any ICT development. Regardless of the previously presented benefits of smart technologies, development and implementation of any technology on its own remains less critical compared with the potential and importance of the human factor in the provision of the front stage services.

Along with the improvement of performance, ICTs can contribute to solving another challenge that the hospitality industry faces, i.e. hard-to-fill vacancies and attracting suitable employees (Ladkin and Buhalis, 2016). ICT fosters (Gregory et al., 2013) the development of innovative methods to make recruitment practices more effective, efficient and personal via platforms, i.e. web and social networking sites.
3.5 Image and character

Image is crucial in attracting visitors to tourism destinations (UNWTO, 2007). Among different online strategies and means with the potential to promote a destination’s image, i.e. branding, travel media and e-marketing, smart technologies are recognised as vital drivers. A destination’s image refers to uniqueness, sights, scenes, environmental quality, safety, service levels and friendliness of people (UNWTO, 2007). Most of the studies included in this review support the conclusion that ICT contribute significantly to a destination’s image by enabling the sharing of destination audio, visual and textual materials.

Technological changes, especially the emergence of smartphones and tablets, have revolutionised the tourism industry into a digitally supported travel service network (Alaei et al., 2017). Moreover, smart device functionalities support the overall travelling cycle (Baka, 2016). For example, smartphones encourage the sharing of experiences among travellers, which makes visitors more aware of services and products and influences a destination’s image (Dube and Helkkula, 2015; Rivera et al., 2016; Shao et al., 2016; Prideaux et al., 2018). By providing constant access to online social networks, smartphones influence the destination’s image by enabling the creation of consumer-generated websites, as well as access and contribution to a continually growing volume of reviews (Mauri and Minazzi, 2013). Smartphones are an example of mobile technology that simplifies travellers’ decision-making processes and supports online travel planning. Different smartphone and social network functionalities foster the understanding of how various communication and sharing practices build social capital and provide opportunities to satisfy various preferences in tourism communities (Dickinson et al., 2016). Technological innovativeness encourages smartphone users and digitally advanced travellers, e.g. millennials, to be more open to recommendations and influence when making on-site decisions, making them a valid target for context-based marketing (Tussyadiah, 2015). The development of ICTs has led to the emergence of virtual reality (VR) and augmented reality (AR), which enable visitors to be introduced to and appreciate more sites by moving beyond time, space and language barriers (Chung et al., 2017; Liu and Mattila, 2017).

According to Dinhopol and Gretzel (2015), visitors’ obsession with selfies has induced the self-directed tourist gaze concept, i.e. tourists are taking selfies to ascribe the characteristics that are associated with sights onto themselves. Moreover, rather than exploring the destination, tourists are focussing on themselves. Tribe and Mkono (2017) discussed if smart technologies foster alienation among tourists and the local community. Can those technologies cause tourists to be more detached in terms of destination stakeholders and authenticity? We suggest that there is a need for integrating into the tourism-related literature more constructive criticism of smart technology usage. This is important since in the future, a destination’s image will be affected by the cognition that smartphones and mobile connectivity have endowed visitors with “telematics power”, i.e. the ability to regulate everything by remote control (Hunter, 2015). In light of such technological innovations (Pfahl et al., 2012), attention should be devoted to the development of smart tourism destination strategies aiming to facilitate local destination integration into the global tourism ecosystem (Ivars-Baidal et al., 2017).

3.6 Price

The application of technological solutions in the context of pricing is yet to be explored in the tourism-related research literature. Pricing is an essential aspect of a destination’s competitiveness that relates to the cost of transport, accommodation, attractions, food and tour services (UNWTO, 2007). ICT application affects the prices of integral tourism products and financial outlay of businesses by affecting cost reductions (e.g. sustainable
transportation, and e-tickets to attractions) and revenues gained (e.g. improvement of hotel operations, green hotels, and facilitation of service delivery). Several papers have illustrated the role of ICT in hotel yield management. Melián-González and Bulchand-Gidumal (2016) conclude that information technologies affect hotel operational productivity, customer service and commercialisation, all of which affect hotel revenues and profitability (Toh et al., 2011). Wang et al. (2016) explore the factors that influence hotels’ adoption of mobile reservation systems. Research results have demonstrated how compatibility, hotel size, ICT competence, and critical mass positively affect mobile hotel reservation system adoption.

4. Discussion and conclusions
Technological developments have led to a revolution in the hospitality and tourism industry. Currently, hospitality and tourism managers are expected to understand the potential advantages of ICT adoption and devote their time and effort to taking advantage of new technologies to remain competitive in the current business environment (Ip et al., 2010). Despite their significant contribution to the understanding of the role of the ICTs in hospitality and tourism, previous researchers have mostly focussed on its specific aspects, i.e. supplier perspective (Ip et al., 2010; Mandić and Garbin Praničević, 2019), consumer-supplier perspective (Law et al., 2009), and industrial implications (Law et al., 2014; Liang et al., 2017) and have thus failed to address the influence of ICTs on tourism destinations’ appeal. To fill this void, in this research, we have reviewed 95 relevant papers (Table II) that were published from 2010 to 2018 in 42 Q1 and Q2 SJR-rated tourism and hospitality journals. The focus is on the development and introduction of various technological solutions with regard to the six essential elements that shape tourism destination appeal: the attractions, amenities, accessibility, human resources, image and price. Considering the share of the papers addressing attractions (24.21 per cent), amenities (23.16 per cent), accessibility (24.21 per cent) and image (17.89 per cent), the sample is almost equally distributed. However, only a few papers deal with human resources (6.32 per cent) and prices (4.21 per cent). Regarding journal distribution, Tourism Management (19 publications = 20.00 per cent) and Journal of Travel Research (12 publications = 12.6 per cent) are the most represented journals within the sample, i.e. have the most significant individual shares.

4.1 Public sector implications
Technological advances are causing fundamental disruptions in tourism by empowering tourism actors to form new markets, offerings, management practices and competitive strategies (Buhalis and Leung, 2018). Consequently, ICTs are transforming tourism management and marketing from a static and utilitarian mode (whereby managers and tourists use ICTs as tools) to a transformative conceptualisation, whereby tourism markets

<table>
<thead>
<tr>
<th>Dimension of destination appeal</th>
<th>Smart tourism-related research papers</th>
<th>% share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractions</td>
<td>23</td>
<td>24.21</td>
</tr>
<tr>
<td>Public and private amenities</td>
<td>22</td>
<td>23.16</td>
</tr>
<tr>
<td>Accessibility</td>
<td>23</td>
<td>24.21</td>
</tr>
<tr>
<td>Human resources</td>
<td>6</td>
<td>6.32</td>
</tr>
<tr>
<td>Image and character</td>
<td>17</td>
<td>17.89</td>
</tr>
<tr>
<td>Price</td>
<td>4</td>
<td>4.21</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100.0</td>
</tr>
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Table II.
Number and distribution of smart tourism-related studies
and actors (tourism providers, stakeholders, intermediaries and tourists) both shape and are shaped by ICT (Sigala, 2018). Indeed, ICT fundamentally affects the way tourism destinations are managed and overall tourism experiences shaped. Moreover, technology has facilitated the initial transformation of traditional to smart tourism destinations, and it seems that this process continues (Mandić and Garbin Praničević, 2019). DMOs of the future are expected to be a “boundary spanners” between the internal destination environment and the external competitive environment (Sheehan et al., 2016), i.e. technologically supported intelligent agents that can identify, engage and learn from disparate stakeholders both within and outside the destination. Abbate et al. (2015) see them as open innovation intermediaries, an independent third party with crucial roles, e.g. information provision, knowledge transfer and networking, in “living labs”, i.e. evolved, more advanced and sophisticated technologically supported forms of tourism destinations. Although this appears to be a good, sustainable alternative for both destinations and DMOs, there are still substantial knowledge gaps, i.e. guidelines in a context of roles and policies required to operationalise this conception.

Technology fosters innovations (product, process, and management), sustainability (e.g. use and interpretation of resources) and accessibility (e.g. development of infrastructure, accessibility of sites for disabled individuals) of tourism destinations. According to Chiodi (2016), the widespread e-participation in urban planning and comprehensive planning approaches contribute to the implementation of safer cities, thereby creating safer destinations. ICTs enable and foster the process of material and socio-cultural revitalisation of maturing destinations, which creates links between tangible and intangible elements of destination heritage to be more interactive (Marques and Borba, 2017). However, DMOs do not rely on ICT as much as they should to encourage visitor participation and co-creation of tourism services, i.e. there are limited examples of destinations and sites using VR and AR technology for interpretation of local heritage. Moreover, the review suggests that destinations occasionally use different technological solutions to track visitor movements in time and space and analyse other aspects of visitor behaviour. Those solutions are mostly specific to destinations and sites that experience massive tourism-generated pressures and excessive carrying capacity. The ICT provides destination planners with tools and solutions to be proactive and prevent untenable pressure on resources. Moreover, the incorporation of various technological advances into the sustainable management of tourism destinations (López de Ávila et al., 2015) may be the solution in light of the power of control that such tools, e.g. big data, sensors, and Wi-Fi, have to offer when processing large volumes of data and when capturing strategic information about what is happening in the region. Most recently, the SHAPETOURISM project (www.shapetourism.eu/) has delivered the ShapeTourism Observatory, i.e. a big data-based, smart, integrated tourism decision support system for MED regions that provides destination stakeholders with valuable business ecosystem information, future tourism-development scenarios and indicators of attractiveness, competitiveness and sustainability. DMOs of the future are expected to develop and utilise such intelligent, technologically based solutions for the benefit of all stakeholders.

ICT appears to be “central nervous system” (López de Ávila et al., 2015) of smart destinations, i.e. a fundamental infrastructure vital for the management of destinations and industry. Ongoing innovations in digital mobile technology have contributed to the substitution of traditionally used technology with more advanced technological solutions, e.g. GPS with apps. To some extent, these technological advances have provided DMOs and destination planners with free of charge, real-time information on visitor movements, and their travel and onsite behaviour. Consequently, they are expected to possess the tools necessary to generate and exploit the intelligence5, to provide, among other features, unique
experiences for visitors and fair benefit-sharing for the local community (López de Ávila et al., 2015).

Smart technology induces new travel trends (e.g. self-organised travel, self-directed tourist gaze6) and allows service providers and destination managers to influence travel experiences. Technological developments have provided new opportunities for how tourism and hospitality experiences can be created. Smart technologies can function as a catalyst of change that can assist in the facilitation of dynamic service encounters, agile consumer profiling and experience co-creation processes that are equally shared between companies and consumers (Neuhofer et al., 2015). Most researchers agree that information technology, particularly specialised web platforms (e.g. digital platforms, OTAs and specialised DMO sites) and social media (e.g. Facebook, Instagram, Twitter and Flicker), boost exposure and openness and influence the overall image of tourism destinations (Alaei et al., 2017; Dube and Helkkula, 2015; Rivera et al., 2016). Visitors are encouraged to share reviews on consumed products and services. Consequently, an enormous number of online visitor reviews are posted on specialised websites, e.g. TripAdvisor has several hundred thousand reviews (TripAdvisor “Top Things to do” number of reviews for selected sites: Rome – Colosseum (120,354 reviews); Paris – Eiffel Tower (119,291 reviews); Istanbul – Hagia Sophia Museum/Church (Ayasofya) (35,493 reviews); Venice – Canal Grande (35,209 reviews); Athens – Acropolis Museum (28,271 reviews)). When reviews are unbiased and honest, they are incredibly useful. However, unfair or malicious reviews have the opposite effect. Addressing fake and contested reviews remains an ongoing challenge for both tourism destinations and businesses. In that manner, TripAdvisor has launched the Review Tracking System (www.tripadvisor.com/TripAdvisorInsights/w3690), which is an automatic tool that analyses hundreds of pieces of information to defend against fake reviews.

Finally, ICT facilitates travellers’ decision-making and online travel planning with the development of a digitally supported travel service network. It advances the visitors’ appreciation of local heritage, moving beyond time, space and language barriers to boost education and entertainment related to the site. In some manner, technology contributes to tourist alienation (also known as ‘e-lienation’). It creates opportunities for alienation where it can promote, for example, normlessness, isolation, and bringing work on a holiday, which contrasts with notions of travel being stress-free and restorative and demonstrating important distinctions between home and away, work and leisure. Additionally, ICT can frustrate any tourism quest for authenticity by stimulating anxiety, addiction, narcissism and mindlessness, which contrasts with the idea of travel as self-enlightenment and a journey of becoming (Tribe and Mkono, 2017). These negative psychological influences of technological dependence on visitors, which have been stressed by a limited number of authors (Gretzel, 2010; Tribe and Mkono, 2017), should be substantially addressed in future research.

4.2 Private sector implications

Undoubtedly, ICTs have changed the travel industry and tourism-related consumer behaviour (Liang et al., 2017). They influence, among other things, the ways in which tourism facilities are developed and products are shaped and delivered, and they foster travel security. Smartness, data, and connectivity, the three ICT features, reinforce the need to challenge and further study how firms respond and should respond to their impacts (Sigala, 2018). Smartness through interoperability and interconnectivity of all network partners increasingly enables hospitality organisations to develop their competitiveness and decision-making processes through improved understanding of consumers and market conditions (Buhalis and Leung, 2018). The growing reliance of the tourism industry on various technological advances has stimulated the participation of visitors and their
involvement in co-creation of new services. Consequently, tourism-related services and products are becoming more “tailor-made” and personalised. Such customisation of tourism services reflects both visitors’ participation but also the growing availability of data on different market segments’ tourism needs and motives. Technology influences the way in which visitors’ experiences are shaped and shared (Lee et al., 2017; Kim et al., 2012; Kim and Feesenmaier, 2014; Kang et al., 2017). Moreover, smart solutions can provide a tourist with an enhanced on-site experience and induce a positive return (Qin et al., 2017). However, the authors agree with Dorcic et al. (2018) that there is a need for more critical analysis of consumer experiences, i.e. how ICTs mediate travel experience, their consequences for consumer behaviour, and finally whether smart tourists have indeed improved the travel experience. Furthermore, ICT facilitates information exchange and improves booking opportunities. The adoption of different technological solutions in the hospitality industry relates to increased productivity (e.g. e-tablet menus, app keys in hotels, etc.) and professionalism. The quest for quality customer service alongside increased profitability leads some businesses to explore the use of artificial intelligence (AI) and robots within traditionally human roles. Most researchers agree that AI and robots enhance the provision of hospitality services, e.g. ICT in hotel operations (digital check-in, smartphones and robots). However, the massive adoption of AI in tourism and hospitality businesses may stimulate “technology overload” and result in lack of serendipity that is essential to meaningful tourism experiences and an increasing desire to escape ICT while on holiday (Gretzel, 2010). On the other hand, Sigala (2018) indicate that strong personal attachment to ICT transforms a person’s identity to a new form of techno-human identity. Consequently, there is a need to explore in depth the new visitors’ behaviours, the role of the ICT in a tourism-related decision-making, technology uses and experience outcomes.

Data support and enable all smart tourism activities. Information governance and privacy, with particular questions relating to the value of information and the maintenance of safety and security in an open and ubiquitous info-structure (Gretzel et al., 2015a, 2015b), appears to be the primary area of future research required for smart tourism to develop and evolve. Due to technology, both visitors and service providers are becoming more visible. In many cases, visitors are willing or request sharing their personal information before they use different online tools, applications and platforms, e.g. social media, mobile guides, online review sites, etc., thereby giving service providers access to valuable data. Morosan and DeFranco (2015) indicate that hotel firms should be aware of and respect the overall trust that consumers place in them by providing personal data. In smart tourism, business builds on an extensive “info-structure”, and big data that sustains it is to a large extent either actively or implicitly provided by consumers (Gretzel et al., 2015a, 2015b). Consequently, smart tourism businesses rely and to some extent become dependent upon free information and access to open technology platforms to be transformed into a value proposition. The latter can lead to new information asymmetries that can be commercially exploited (Tachizawa et al., 2015).

Finally, connectivity destroys linear tourism value chains and replaces them with a complex tourism ecosystem that enables and supports various forms of interactions and collaborations among a variety of actors, e.g. firm-to-firms, customer-to-firm, machine-to-customer, machine-to-machine (Sigala, 2018). Hospitality and tourism managers should be able to compete in this new environment. The authors believe tourism firms should be more agile, flexible and open to various technological advances, but there is still limited information about how tourism firms should organise their ICT governance and adjust their organisational culture and structure. Moreover, the potential of different ICTs within the tourism industry is still relatively unexplored (Claudia Tom Dieck et al., 2016). This problem
may be related to the fact that in the industry, practitioners and ICT experts do not always communicate well with each other, i.e. managers are concerned with marketing strategy and business alliance, but ICT experts are concerned with distribution systems, big data and cloud computing (Law et al., 2015). Since different technological solutions could potentially change the way destinations are marketed and tourism products are shaped (Aluri, 2017), researchers should focus on bridging this gap. In the current Interreg Italy-Croatia BLUTOURSYSTEM project (www.italy-croatia.eu/standardplus), researchers are working closely with practitioners to develop a big data-based networking “Living Lab” that will provide market intelligence and support eco-innovation in the creative tourism sector required to tackle the challenges of seasonality and suitability. Creative approaches to a smart business ecosystem similar to this encourage the innovativeness of local stakeholders, foster the creation of critical mass required to face global competition and challenges, and serve as a guiding light for researchers and practitioners.

4.3 Research limitations
This study aimed to analyse the role of the ICTs in establishing destination appeal. It synthesises relevant studies, provides implications for smart tourism destination development and discusses future research perspectives. Building on a holistic approach, this research provides additional arguments to the overall importance of ICTs for the hospitality and tourism industry. Despite its significant contribution to the existing body of literature and to the understanding of the smart tourism destination phenomena, this study has three significant limitations. The first limitation is the restriction of the publication timing. To present current state-of-the-art findings on the role of the ICTs in establishing destination appeal in the tourism and hospitality literature, we focus on the period from 2010 to 2018. Until that time, the concept of ICTs in hospitality and tourism had been partially addressed (Law et al., 2009; Ip et al., 2010; Law et al., 2014). Building on that, we utilised the UNWTO (2007) framework to explore the impacts of ICTs on different dimensions of tourism destination appeal. The conclusions of this review provide valuable insight into the relationship between destination appeal and ICT and serve as a good starting point for organising future research. The second major limitation is the restriction on the journal selection. In this study, we have included 42 leading journals that are ranked as Q1 and Q2 based on SJR indicator (Scopus® database from 1996) and are indexed in Scopus and Web of Science. The complete SJR list includes 84 Q1 - Q4 rated journals. Additionally, there is a list of potentially valuable research papers that have been published in conference proceedings. We suggest that future research should also consider including at least those SJR (Q3 and Q4) journals that address destination management, marketing, and ICT in tourism as well as specialised conferences, such as ENTER, which is organised by International Federation for Information Technologies and Travel and Tourism (IFITT). Furthermore, there is also a need to identify and explore current ICT related solutions, implemented in leading tourism destinations. Finally, this research reflects on the impact of technological advances on elements shaping tourism destination appeal. ICTs are indeed the “central nervous system” of smart destinations, a necessary infrastructure for the communication flow of information and a prerequisite for the management of destinations and tourism companies. However, technological solutions are only one element of smart destinations. The authors suggest that future researchers should reflect more on smart governance, which is an insufficiently addressed dimension of smart destinations that reflects the participation and involvement of the local community and the creation of a feasible environment for achieving local sustainable development.
Notes
1. NFC refers to technological solutions offering various possible applications for the tourism industry, e.g. making payment via mobile phone, replacing keys and opening doors, revolutionising ticketing for events and in the transportation sector, to exchanging data between mobile phones, retrieving information from tags and smart posters and much more (Egger, 2012).

2. Tribe and Mkono (2017) refer to technology-driven alienation as e-lienation.

3. Compatibility and complexity in the technological context have a significant effect on hotels’ adoption of mobile hotel reservation systems (MHRS). To facilitate organisational adoption, MHRS developers need to ensure that adoption is a simple process and that systems are compatible with hotels’ existing information infrastructure. Additionally, firm size and technological competence in the organisational context have a significant positive effect on the adoption of MHRS. In that manner, larger hotels are likely to have resources to support this adoption. Consequently, MHRS suppliers may consider larger hotels as primary potential customers, and focus promotion of these systems to them (Wang et al., 2016).

4. Typology of innovations according to Hjalager (2010).

5. Knowledge associated with decision making through structured processes (López de Ávila et al., 2015).

6. The tourist experience is socially constructed and builds on specific knowledge which guides tourists’ encounters with their environment-host communities, other tourists, and tourist attractions as well as activities, or, more broadly, place. The tourist gaze represents individual experiences and personal forms of seeing and understanding (Dinhopf and Gretzel, 2015).


References


**Further reading**


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Progress on Airbnb: a literature review

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Abstract

Purpose – The purpose of this paper is to review the extant literature on Airbnb – one of the most significant recent innovations in the tourism sector – to assess the research progress that has been accomplished to date.

Design/methodology/approach – Numerous journal databases were searched, and 132 peer-reviewed journal articles from various disciplines were reviewed. Key attributes of each paper were recorded, and a content analysis was undertaken.

Findings – A survey of the literature found that the majority of Airbnb research has been published quite recently, often in hospitality/tourism journals, and the research has been conducted primarily by researchers in the USA/Canada and Europe. Based on the content analysis, the papers were divided into six thematic categories – Airbnb guests, Airbnb hosts, Airbnb supply and its impacts on destinations, Airbnb regulation, Airbnb's impacts on the tourism sector and the Airbnb company. Consistent findings have begun to emerge on several important topics, including guests' motivations and the geographical dispersion of listings. However, many research gaps remain, so numerous suggestions for future research are provided.

Practical implications – By reviewing a large body of literature on a fairly novel and timely topic, this research provides a concise summary of Airbnb knowledge that will assist industry practitioners as they adapt to the recent rapid emergence of Airbnb.

Originality/value – This is the first paper to review the extant literature specifically about Airbnb.

Keywords Airbnb, Literature review, Sharing economy, Peer-to-peer, Short-term rental

Paper type Literature review

论Airbnb的发展：文献综述

摘要

研究目的 – 本论文旨在综述过去文献对Airbnb的研究。旅游业中出现新的住房方式之一，以衡量迄今为止的研究发展历程。

研究设计/方法/途径 – 经过大量文献搜索，共132份被同行评审型期刊文章，来自不同研究领域，被作者审阅。每个文章的关键信息被摘抄出来，本论文采用内容分析方法来分析文本。

研究结果 – 经过文献综述，作者发现大多数Airbnb研究都发表在近几年，往往发表在酒店/旅游期刊，期刊文章作者集中在美国/加拿大和欧洲。基于内容分析结果，发表的期刊文章被分类在六个主题：Airbnb住宿、Airbnb服务提供、Airbnb供应商，以及其对旅游目的地的影响，Airbnb规范、Airbnb对旅游行业的影响，以及Airbnb公司。研究结果还归纳出几项重要的话题，包括顾客动机和民宿地理分布。然而，大多数研究空白仍然存在，因此，本论文总结出多项未来研究方向。

研究实践意义 – 该论文通过综述大量较新和较旧的文献，对Airbnb的有关知识进行了精准梳理，这个研究结果对从业者应用Airbnb较新较快发展的现象，有着实践意义。

关键词 – Airbnb、文献综述、共享经济、P2P、短期出租
Introduction
The emergence of Airbnb is unquestionably one of the most significant and transformative recent developments within the worldwide tourism sector. Although Airbnb only has existed for roughly 10 years, by revolutionizing the age-old practice of peer-to-peer lodging with a new technology-driven distribution platform, the company has unleashed a timely innovation that has grown faster than virtually anyone had expected (Guttentag, 2015). Airbnb has now expanded to the point that it is impacting some traditional tourism accommodations (Zervas et al., 2017), transforming countless individuals into hospitality micro-entrepreneurs and making tourism lodging a major policy issue in cities worldwide (Guttentag, 2017). Although Airbnb is far from the only company dedicated to peer-to-peer short-term rentals, owing to its immense size and vast impacts, most would agree that Airbnb is the most important company of its type and it has become a poster child of the so-called “sharing economy.” Consequently, academic research into peer-to-peer short-term rentals has often looked explicitly at Airbnb, and this research area has grown significantly in recent years. This paper represents the first review of the academic literature specifically focused on Airbnb.

Airbnb is an online platform through which individuals can rent out their spaces as tourist accommodation. These spaces typically entail either an “entire place” (house, condominium, etc.) or a “private room” in a residence where the host is also present. Airbnb’s diverse inventory additionally includes some fairly exotic accommodations (castles, igloos, treehouses, etc.), and Airbnb listings range from quite modest to extremely luxurious. For “guests,” the process of finding and booking Airbnb accommodation is relatively similar to using an online travel agency (e.g. Expedia), although the booking process may require some personal communication with the “host.” For the hosts who own and/or manage Airbnb listings, the Airbnb platform offers the ability to freely and almost effortlessly become a tourism lodging provider – posting descriptions and photographs of one’s accommodation, communicating with potential guests and accepting reservations and payments from around the world.

Unlike pure matchmaking platforms such as Craigslist or distribution platforms like Expedia, Airbnb is involved in numerous aspects of the transactions it facilitates. Most obviously, Airbnb processes the payments from guests to hosts and earns money by charging a “service fee” (i.e. commission percentage) from both parties. Airbnb importantly also encourages both guests and hosts to publically review one another, which helps foster the underlying trust necessary for such a service to thrive (Jøsang et al., 2007). Airbnb further promotes trust and security by offering various identity verification measures, free property damage protection (“Host Guarantee”), free liability insurance (“Host Protection Insurance”) and a “Guest Refund Policy” that protects against issues like inaccurate listing descriptions. Moreover, Airbnb has introduced various innovations to further enhance and expand its services. Some of its more noteworthy innovations have included an “Instant booking” feature that permits some reservations to be placed immediately, without explicit host approval; a “Superhost” status badge for particularly active and well-reviewed hosts; a “For work trips” filter that highlights listings appropriate for business travel; and an “Airbnb Plus” status badge for top-quality listings that have been personally inspected by an Airbnb representative. Furthermore, Airbnb has partnered with several travel management companies in order to facilitate corporate travel (Griswold, 2016), and recently even partnered with a real estate developer to build apartment complexes designed for Airbnb renting (Quackenbush, 2018). Airbnb also has extended beyond tourism lodging, and now additionally processes restaurant reservations and offers “Experiences”, which involve tours or other excursions led by local guides.

Given Airbnb’s diverse product portfolio and immense popularity, it is easy to forget that the company was founded just very recently, in 2008. Airbnb usage was limited very early on, but beginning around 2011 the company began growing very rapidly (Griswold, 2018). More
specificially, Airbnb had 140,000 guest arrivals in 2010; 800,000 in 2011; three million in 2012; six million in 2013; 16 million in 2014; 40 million in 2015; 80 million in 2016; an estimated 115 million in 2017; and an estimated 164 million in 2018 (Molla, 2017; Team, 2018). To accommodate these guests, at the time of writing the company boasted over five million active worldwide listings (Airbnb, 2018), which was higher than the room capacity of the top five worldwide hotel companies combined (Hartmans, 2017). Furthermore, it recently was estimated that if Airbnb were to go public, its market capitalization would be around $60 billion – significantly higher than even Marriott International (Ting, 2018).

Unsurprisingly, Airbnb’s rise has triggered reverberations in the tourism sector and beyond. The company’s most direct potential impacts are on the tourism lodging industry, although the extent of these impacts are debatable. Airbnb denies it competes with hotels (Business Insider Intelligence, 2017; Trenholm, 2015), and numerous hotel executives have dismissed the potential threat posed by Airbnb (DePillis, 2016; Handley, 2017; Trejos, 2018). On the other hand, media headlines frequently highlight Airbnb’s supposed threat to hotels (Griswold, 2016; Ting, 2017), and trade groups including the American Hotel and Lodging Association (Benner, 2017), the British Hospitality Association (Witts, 2016) and the Hotel Association of Canada (Press, 2018) all have pushed for greater regulatory oversight and enforcement against Airbnb.

In addition to potentially disrupting the hotel sector, Airbnb also often is perceived as disrupting communities around the world as residences for locals are transformed into tourism lodging. These transformations have prompted countless regulatory battles, which have focused on issues such as hosts’ tax obligations, the safety of Airbnb rentals, Airbnb’s impacts on housing markets and residential quality of life concerns (noise, community fabric, etc.) (Guttentag, 2017). The Airbnb policy debate is quite divisive and heated, as it relates to matters people feel very strongly about – their ability to earn money, their rights regarding their homes and the fabric of their communities. These tensions are crystallized in New York City, where protesters from both sides have held dueling rallies at City Hall (Durkin, 2018), the State Attorney General subpoenaed Airbnb’s data and published a report criticizing the company (Schneiderman, 2014), a State Assemblymember secretly recorded her own undercover Airbnb sting operation (Golding, 2015), Airbnb released video ads claiming it is being scapegoated for housing affordability issues (Reader, 2018), and the Hotel Association of New York City and a hotel workers union created an ad linking Airbnb with terrorism (Lovett, 2017).

With Airbnb becoming an increasingly important issue in both tourism and public policy, scholarly research on Airbnb has increased over the past several years, scattered throughout journals in various disciplines. Nonetheless, to date, research specifically focusing on Airbnb has never been summarized in a single literature review, so this article intends to fill that gap. The only existing article that has somewhat summarized the extant Airbnb research is Prayag and Ozanne’s (2018) review of the broader peer-to-peer accommodation literature from 2010 to 2016. However, there is particular value in a more focused examination of solely Airbnb, as the peer-to-peer accommodation sector is fairly diverse, comprising disparate services like Couchsurfing (in which hosts offer guests accommodation free of charge) and HomeAway (which only offers entire home rentals and has branded itself as distinct from the sharing economy) (Vranica, 2016). Furthermore, a plethora of Airbnb articles have been published between Prayag and Ozanne’s (2018) review and the present study; in fact, only 26 of the 132 (19.7 per cent) articles included in the present study were examined by Prayag and Ozanne.

Methods
This study sought to retrieve every peer-reviewed journal article on Airbnb published in English by July 2018, when the literature search was conducted. To be as comprehensive as possible, this study sought articles published in journals from any discipline. Also, like
many literature reviews (Ip et al., 2011; Law et al., 2009), in order to focus exclusively on the highest level of scholarship only peer-reviewed journal articles were considered (including both full-length articles and research notes). Other publications were excluded, such as book chapters, conference proceedings, working papers, industry reports, theses and editor prefaces. Papers published in law review journals were excluded because such publications are not refereed, and a few papers were excluded because they were published in journals of dubious merit, as determined by the Australian Business Deans Council’s Journal Quality List and Google Scholar’s journal metrics. Finally, each paper needed to focus explicitly on Airbnb. This focus did not have to be exclusive (e.g. a paper could focus on both Airbnb and Couchsurfing), but Airbnb had to feature very prominently in the paper. Broader research on peer-to-peer accommodations or the sharing economy was excluded.

Numerous online databases were searched – ScienceDirect Journals, EBSCOhost Hospitality and Tourism Complete, EBSCOhost’s full database, Emerald Insight, IngentaConnect, Web of Science and Google Scholar. Subsequently, Google Scholar was used to examine all of the articles that had referenced the two most highly-cited Airbnb articles (Guttentag, 2015; Zervas et al., 2017). All searches were conducted using the keyword “Airbnb”. Article titles, keywords and/or abstracts were examined to determine whether an article was retrieved for further consideration, and in this initial retrieval stage any article that seemed possibly relevant was saved, resulting in 293 saved articles. Subsequently, each article was examined more carefully to make a final decision on its inclusion, and 132 articles were kept and a content analysis was undertaken. As part of this analysis, the articles were divided into thematic categories based upon the primary topic being researched, and key attributes of each article (journal name, publication date, etc.) were recorded.

**General characteristics of Airbnb research**

The vast majority of Airbnb studies were published very recently (see Figure 1), with 87.8 per cent published in 2017, in 2018 (through July), or only had been published online by July 2018. Also, the majority of these papers (58.3 per cent) were published in journals related to hospitality/tourism. In fact, of the six journals that had published at least five Airbnb articles, all were hospitality/tourism-focused – *International Journal of Hospitality Management, International Journal of Contemporary Hospitality Management, Current...*

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**Note:** Despite this literature review being conducted in July 2018, one article had already been dated 2019, but was excluded from this chart.
Issues in Tourism, Tourism Management, Annals of Tourism Research and Journal of Travel and Tourism Marketing. Together these six journals accounted for 39.4 per cent of all of the articles examined (see Table I). Beyond hospitality/tourism journals, Airbnb papers were published in journals associated with a range of disciplines, including business/management, urban studies and information technology.

The majority of Airbnb research has employed quantitative methods (61.5 per cent), and the remainder consists of qualitative studies (18.5 per cent); theoretical, conceptual, or review articles (11.5 per cent); and mixed methods studies (8.5 per cent). Among the quantitative, qualitative and mixed methods studies, data publically available on the Airbnb website (e.g. listing attributes or guest reviews) were most commonly used. Such data were used in 48.7 per cent of the studies (keeping in mind that some studies had multiple data sources), and was derived from manual collection, independently programmed scraping scripts, Inside Airbnb (www.insideairbnb.com), or AirDNA (www.airdna.co). Data also commonly were obtained from surveys, interviews and experiments. With regards to geography (again keeping in mind that some studies collected data from multiple locations), 40.2 per cent of the studies collected their data in the USA/Canada, 29.5 per cent in Europe, 13.4 per cent in Asia, 7.1 per cent in Australia/New Zealand, 1.8 per cent in Africa, 1.8 per cent in the Caribbean/Latin America and 13.4 per cent from the entire world.

With regards to the geographic location of the researchers (as per the first author’s byline), most Airbnb research was conducted by researchers in Europe (42.4 per cent) or the USA/Canada (33.3 per cent), with the remainder conducted by researchers in Asia (13.6 per cent), Australia/New Zealand (9.1 per cent) and Africa (1.5 per cent). The five most common individual countries were the USA (24.2 per cent), Canada (9.1 per cent), Australia (7.6 per cent), the United Kingdom (6.8 per cent) and Spain (6.1 per cent). The departmental affiliation of each lead author also was examined, revealing that about two-thirds worked in business, management, or economics (33.1 per cent) or hospitality, tourism, or leisure (32.3 per cent). The other authors were scattered amongst a range of disciplines, including information technology, urban/regional planning and geography.

Research themes and literature review
The papers were divided into thematic categories based on the primary focus of each study. Six thematic categories (plus various sub-categories) were established – Airbnb guests,
Airbnb hosts, Airbnb supply and its impacts on destinations, Airbnb regulation, Airbnb’s impacts on the tourism sector and the Airbnb company. As can be observed in Table II, research on Airbnb guests was by far the most common thematic category. The following review of the literature includes every paper categorized within each theme. Papers that generated findings relating to more than one theme sometimes are mentioned under multiple themes, as space allowed.

**Airbnb guests**

*Why travelers choose airbnb.* When reflecting upon the rapid emergence of Airbnb, perhaps the first question that arises is why millions of travelers are opting to stay in the (oftentimes unlicensed) homes of strangers found online, rather than just simply booking a hotel. In Guttentag’s (2015) early look at Airbnb through the lens of disruptive innovation theory, he proposed that even though Airbnb may underperform in comparison with hotels when considering hotels’ primary performance attributes (e.g. service quality and security), Airbnb offers an alternative value proposition centered around cost-savings, household amenities and the potential for a more authentic local experience.

Numerous researchers have since tackled this motivation question empirically, and their research has repeatedly highlighted the particular importance of Airbnb’s practical/utilitarian benefits, while also sometimes recognizing the importance of experiential benefits. For example, Sthapit and Jiménez-Barreto (2018a) interviewed worldwide Airbnb users and found price and location were the two primary drivers of Airbnb use. Likewise, So et al. (2018) conducted a mixed-methods study that determined economic benefits, enjoyment and household benefits significantly impacted attitudes towards Airbnb, which in turn influenced behavioral intentions. In contrast, constructs including authenticity, social interaction and sharing economy ethos were not found to exert meaningful influence. Guttentag et al. (2018) surveyed over 800 Airbnb users, mostly in Canada and the USA, and concluded they were attracted primarily by Airbnb’s practical benefits (e.g. price, location and household amenities), yet experiential ones (e.g. social interaction, authenticity and novelty) were still important for some guests. Finally, Paulauskaite et al. (2017) interviewed

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<th>Theme</th>
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<tr>
<td>Airbnb guests</td>
<td>55</td>
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<td>Why travelers choose Airbnb</td>
<td>12</td>
<td>(9.1)</td>
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<td>How guests choose their Airbnb accommodation</td>
<td>18</td>
<td>(13.6)</td>
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<td>The Airbnb guest experience</td>
<td>15</td>
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<td>Loyalty towards Airbnb</td>
<td>10</td>
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<td>Airbnb hosts</td>
<td>25</td>
<td>18.9</td>
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<td>Hosts’ motivations</td>
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<td>Hosts’ experiences, strategies, and conduct</td>
<td>9</td>
<td>(6.8)</td>
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<td>Airbnb accommodation pricing</td>
<td>14</td>
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<tr>
<td>Airbnb supply and its impacts on destinations</td>
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<td>16.7</td>
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<td>Airbnb’s impacts on the tourism sector</td>
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**Note:** The sub-category percentages, displayed within parentheses, indicate percentage of the overall total, and sum to the percentages shown for their parent categories.
Airbnb guests and found cost-savings to be their primary motivator. Nevertheless, that study focused explicitly on authenticity, and the researchers also found authenticity contributed to Airbnb’s appeal, as related to three key areas – the accommodations, the social interactions with hosts and the interactions with local culture.

Guttentag et al. (2018) additionally argued that Airbnb users are not homogenous, and the authors conducted a cluster analysis dividing their sample into motivation-based segments. The five resulting segments differed primarily according to the Airbnb users’ desire for social interaction (with a host and other locals) and their use of entire homes (versus shared accommodations). Focusing on the disabled traveler segment, Boxall et al. (2018) noted that Airbnb homes are better suited than hotels for disabled people to develop feelings of place identity, yet the authors also acknowledged that widespread availability of disabled-access Airbnb rooms would probably only come from government intervention.

Also, two studies looked at Airbnb through the theoretical lens of the Theory of Planned Behavior and the closely related Theory of Reasoned Action. So et al.’s (2018) previously mentioned study found Airbnb behavioral intentions also were positively influenced by perceived behavioral control, trend affinity and social influence, and negatively impacted by perceived insecurity. Amaro et al. (2018) surveyed German and Chinese Millennials and found intentions to use Airbnb were driven, respectively, by subjective norms, an affinity for Airbnb’s unique and varied listings, positive attitudes towards online shopping and perceived economic benefits. Interestingly, Amaro et al. found economic benefits to be of far lesser import than had other studies, plus the researchers found perceived risk did not exhibit a significant impact on behavioral intentions, unlike So et al.’s (2018) finding about perceived insecurity.

Numerous researchers also have explored perceptions of the Airbnb brand and service, thereby providing an alternative lens through which to understand Airbnb’s appeal. For example, very early on Yannopoulou et al. (2013) analyzed Airbnb’s website and social media, and found the company’s brand identity focused on the everyday nature of its hosts, the friendship and warmth guests can experience and the balance between authenticity and professionalism that guests can enjoy. Lee and Kim (2018a) surveyed users’ perceptions of Airbnb’s brand personality and found highest agreement with the dimensions of exciting, sincere and competent (rather than rugged or sophisticated), and with the traits of original, friendly, up-to-date, unique and reliable. The authors additionally found that such perceptions were felt more strongly by users exhibiting higher levels of Airbnb involvement. Yang et al. (2018) surveyed Airbnb users and found that guests’ trust in the Airbnb brand was fostered by their trust in individual hosts (which in turn was fostered by interaction with hosts), hosts’ perceived credibility (based on reviews), perceived emotional bonding with hosts, and individual listing attributes. Finally, Stollery and Jun (2017) surveyed South Korean Airbnb users and found value perceptions of Airbnb were positively influenced by monetary savings, hedonic benefits and novelty (but not social interaction), and were negatively influenced by psychological risk (but not performance risk, physical risk, or time risk).

Finally, a pair of studies have more generally compared the characteristics of Airbnb guests with hotel guests. Volgger et al. (2018) compared international Airbnb and hotel guests in Western Australia and found Airbnb users were comparatively more likely to be visiting for pleasure, to visit attractions, to not be travelling alone, to be staying in semi-peripheral regions, and to be from Singapore or Malaysia. Nevertheless, many other characteristics were similar between the two groups, including total trip expenditure and most trip activities, leading the authors to conclude that Airbnb users did not represent a particularly alternative, non-mainstream type of visitor. In a somewhat similar study, Poon
and Huang (2017) surveyed tourists who were using Airbnb and hotels in Hong Kong and found Airbnb users were somewhat older and better educated, more focused on price and security when choosing accommodations, more allocentric, on longer trips, and more likely to be with friends. In contrast, the hotel users were more interested in service and more likely to be on trips that were shorter and/or with family.

How guests choose their Airbnb accommodation. In many destinations, Airbnb guests have a multitude of Airbnb listings to choose from, and numerous studies have examined how such decisions are made. Gunter and Önder (2018) examined which listing attributes influenced Airbnb listing demand in Vienna and found that listing size, photo quantity and host response rates increased demand, whereas price, distance from city center and host response time decreased demand. Visser et al. (2017) surveyed Airbnb guests to Cape Town and found the most important attributes guests focused on when choosing their accommodations were, respectively, location, price and facilities. Similarly, Varma et al. (2016) surveyed Airbnb users and found they placed the greatest importance on location, price, reviews, service quality and past experience, which aligned somewhat with the attributes seen as most important by hotel users (who also were surveyed). Abrate and Viglia (2017), looking at several European cities, found host revenue was boosted by having a verified identification; a Superhost badge; more time on the platform; and, to a lesser degree, higher review quantity and professional photos. Xie and Mao (2017) examined nearly 6,000 listings in Austin, TX and found demand was impacted by hosts’ Superhost status, response rate, membership duration and number of listings, in addition to the accommodation’s rating, review count, price and capacity. Also highlighting the appeal of Superhosts, Liang et al. (2017) examined Hong Kong Airbnb listings and concluded that listings managed by Superhosts were more likely to receive reviews (often seen as a proxy for booking volume) and higher ratings, plus guests were willing to pay a premium to stay with such hosts. Finally, Mauri et al. (2018) examined UK and Italian Airbnb listings and found popularity (operationalized as a combination of rating scores, review quantity and times saved to “wish lists”) was driven largely by reputation, which itself was particularly impacted by personal narrative storytelling in hosts’ self-descriptions.

While price is clearly an important factor as Airbnb guests assess their options, several researchers have instead examined the more general concept of value. Chen and Chang (2018) surveyed both Airbnb users and non-users and found star rating had a positive influence on perceived value, which in turn had a positive influence on purchase intentions, whereas rating volume had a direct positive influence on purchase intentions. Also, Zhang et al. (2018) surveyed Airbnb users and found they were willing to pay a premium (versus a hotel) based on perceived functional and social value early on in the buying process.

Acknowledging potential heterogeneity among Airbnb guests, Lutz and Newlands (2018) explored the more general choice of entire home versus shared space renting. Through a survey of Airbnb users, the authors found entire home renters tended to have higher incomes and education, were more often traveling with a partner/spouse, and were less comfortable with social interaction. In contrast, guests staying in shared spaces were more likely to be male, have a lower income, be traveling alone or in a large group and be open to social interaction. Looking at generational differences, Chang and Wang (2018) had members of Generations X (ages 35-49), Y (ages 21-34) and Z (under 20) rank Airbnb listings, and found Generations Y and Z were comparatively more focused on cost whereas Generation X was more focused on cleanliness. Nonetheless, all generations were influenced by reviews, shown in part via sentiment ratio scores that the authors calculated to efficiently indicate the positivity of reviews.
Reviews are indeed a central feature of Airbnb, because they help establish the required trust between guest and host, and several researchers have specifically investigated how reviews impact Airbnb choices. Abrahao et al. (2017) conducted an experiment with several thousand Airbnb users in which the authors manipulated the demographics (age, gender, marital status and home state) and reputation (star ratings and review quantity) of hypothetical hosts, and found that positive reputations successfully counteracted biased distrust that arose due to social distance. The authors subsequently tested this notion by examining one million actual Airbnb interactions, and further confirmed their initial conclusions. Considering similar themes, Bae et al. (2017) surveyed South Korean Airbnb users and found decreased social distance increased the perceived credibility of reviews, and in turn purchase intentions.

Looking at reviews from a different angle, Bae and Koo (2018) conducted a netnography and a subsequent experiment, which found that South Korean Airbnb guests did not fully trust review content, and therefore employed various decision heuristics like focusing on review quantity and pictures rather than review content, and using reviews primarily as an initial anchor value for future information gathering. Also, some individuals were more strongly impacted by text, and some by pictures. Looking more generally at the concept of trust, Mittendorf (2018) surveyed Millennials and found that intentions to inquire about an Airbnb listing or request a booking were driven by both perceived trust in the host and trust in the Airbnb platform, with trust in the host having a greater impact on inquiries and trust in Airbnb having a greater impact on booking requests. Also, Martin-Fuentes et al. (2018) developed a machine learning classification technique based on data from several million hotels, which generally succeeded in assigning hotels to their correct star-rating category by focusing on review volume, price, review score and users’ wish lists, rather than the criteria that are typically used. The authors showed that this same technique could be used to assign a hotel-like star rating to Airbnb listings (budget, mid-low range, mid-high range and superior), which could prove more useful than existing Airbnb star ratings due to their positive skew. Somewhat similarly, Nguyen et al. (2018) found that the ambiance of Airbnb listings could be determined by assigning them certain adjectives either via crowdsourcing or pre-trained neural networks.

In addition to reviews, host profile pictures also can influence guests’ decisions. Ert et al. (2016) analyzed Airbnb pricing in Stockholm and conducted a pair of discrete choice experiments, which found that the perceived trustworthiness of hosts’ photos increased booking probability and prices. Perhaps surprisingly, the authors also found that review scores had no impact on guests’ choices. Similarly, Fagerstrom et al. (2017) conducted a conjoint experiment in which they manipulated hosts’ facial expressions, and found that neutral and positive expressions increased booking tendencies, whereas negative facial expressions and a lack of host pictures reduced booking tendencies, even when complemented by low prices and positive ratings.

The Airbnb guest experience. Once Airbnb guests select and book an accommodation, they will have the experience of actually staying there, and the characteristics of Airbnb guest experiences have proven to be another popular area of study, with researchers often gleaning their findings from what guests write in their (public) reviews. Such studies have found that reviews tend to focus on a similar collection of themes relating to both the host (e.g. hospitality and social interactions) and the accommodation (e.g. comfort and location). For example, Cheng and Jin (2019) analyzed Sydney Airbnb reviews and found they were overwhelmingly positive and focused chiefly on location convenience; accommodation amenities; and hosts’ helpfulness, flexibility and communication. Somewhat similarly, Tussyadiah and Zach (2017) cluster analyzed Airbnb reviews in Portland, USA and found
they focused on the service, the facility, the location (convenience and neighborhood character), feeling welcome and the comfort of staying in a home (ambiance and hospitality). Interestingly, however, whereas Cheng and Jin (2019) interpreted their results as paralleling hotel assessments in many ways, Tussyadiah and Zach (2017) interpreted their findings on the importance of hosts and feeling welcome in a home as underscoring the distinct nature of Airbnb. Tussyadiah and Zach also found that reviews focusing on location and feeling welcome were associated with higher rating scores. von Hoffen et al. (2018) developed a sentiment analysis toolkit and applied it to Airbnb reviews and tweets about Airbnb, and concluded that Airbnb guests particularly value cleanliness, bed comfort, fully-equipped kitchens, spaciousness, a good view, a central and quiet location and a non-intrusive host. Confirming the general consistency that is evident in the previously described studies, Brochado et al. (2017) compared reviews of Airbnb listings in the USA, India and Portugal and, contrary to the authors’ expectation that different cultural norms surrounding individualism would lead to divergent review patterns, the authors detected homogeneity between the reviews. This finding led the authors to conclude that enjoyable Airbnb experiences were similar across different countries.

A pair of studies also have used Airbnb reviews to better understand the Airbnb experience through the prism of value co-creation that occurs between guests and hosts. Johnson and Neuhofer (2017) analyzed Airbnb reviews in Jamaica and found that value arose from a combination of the home, the surrounding community and the hosts, while the guests also found value in traveling like a local, cooking and cleaning with the host, cultural learning and relaxing. Somewhat similarly, Camilleri and Neuhofer (2017) analyzed Airbnb reviews in Malta and found the reviews focused on six common themes relating to value co-creation — arriving and being welcomed, expressing positive/negative feelings, evaluating the accommodation and location, interacting with and receiving help from hosts, recommending the accommodation to others and thanking one another.

Moving beyond looking solely at Airbnb, several studies have compared Airbnb experiences with hotel experiences. Belarmino et al. (2017) compared Airbnb reviews with TripAdvisor hotel reviews and found Airbnb guests tended to focus on interactions with the hosts, neighborhood ambiance and local businesses, whereas hotel guests tended to focus on room amenities, property amenities and location relative to attractions. Mody et al. (2017) added four new constructs (serendipity, localness, communitas and personalization) to the experience economy framework, and found surveyed Airbnb guests rated each experience construct more highly than hotel guests, yet hotels were equally able to translate guest experiences into extraordinary and memorable outcomes that in turn led to intentions to recommend and repurchase. In a subsequent survey study, Mody et al. (2018) added a hospitableness construct into the experience economy framework, and found hospitableness was not greater in Airbnb stays, prompting the authors to argue that hotels could leverage their hospitableness to compete with Airbnb by providing memorable experiences. Nonetheless, Birinci et al. (2018) surveyed Airbnb and hotel guests and found perceived authenticity was higher amongst the Airbnb guests, whereas safety/security risks, time/convenience risk and product performance risk showed no significant differences between the two groups.

Also using data other than review comments to examine Airbnb experiences, Priporas et al. (2017b) surveyed Airbnb guests in Phuket, Thailand and found convenience and assurance in accommodation quality contributed most highly to perceived service quality. Additionally, Airbnb guests interviewed by Sthapit and Jiménez-Barreto (2018a) highlighted how positive host interactions were strong contributors to overall enjoyable Airbnb experiences.
It is important to have such research on Airbnb experiences that does not rely on reviews because Airbnb reviews tend to be extremely positive (Zervas et al., 2015), partly due to various characteristics of the review system that seem to encourage positive reviews (Guttentag, 2017). In fact, Bridges and Vásquez (2016) examined Airbnb reviews (by hosts as well as guests) and found they were overwhelmingly positive, with only 2 per cent classified as categorically negative. Nonetheless, the authors noted that reviewers sometimes subtly indicated dissatisfaction by sandwiching a negative comment between positive comments, or simply leaving a fairly neutral review. Also, it is important to remember that not every Airbnb guest leaves a review. Bae et al. (2017) found that guests became more likely to leave reviews as an Airbnb experience increasingly differed from expectations (either positively or negatively), and as the quality of the experience deviated from neutral (either positively or negatively).

Indeed, not every Airbnb experience will be a positive one, and several researchers have looked specifically at negative Airbnb experiences. For instance, as part of their previously mentioned interviews, Sthapit and Jiménez-Barreto (2018b) found negative Airbnb experiences most commonly revolved around poor communication between guests and hosts, leading to lost time and/or money. Also, Phua (2018) analyzed complaints posted about Airbnb on a third-party website and found the complaints tended to focus on a few core issues – poor customer service attention from Airbnb, uncertainty and a lack of trust (e.g. last-minute cancellations and accommodations not meeting expectations) and technological issues (e.g. the verification process). Finally, Bucher et al. (2017) interviewed Airbnb users about how guest-host closeness can lead to “interpersonal contaminations”, which were categorized as relating to poor environmental hygiene, hosts’ personal objects, interpersonal contact and privacy intrusions. Nevertheless, a subsequent survey found that perceived authenticity overrode concerns about the first three contaminants, thereby suggesting that guests tolerate some undesirable issues so long as the experience is considered authentic.

**Loyalty towards Airbnb.** Airbnb guests’ experiences in turn influence their loyalty towards Airbnb, and the question of what influences Airbnb guest loyalty has been a common subject of research. This research has most frequently used survey data and structural equation modeling in which different constructs serve as antecedents for satisfaction, which in turn is positioned as an antecedent of loyalty (or repurchase intentions). For example, Möhlmann (2015) surveyed German Airbnb users and found cost savings, familiarity with Airbnb, trust in Airbnb and acceptance of Airbnb as a hotel substitute all positively influenced satisfaction, which in turn positively impacted intentions to reuse Airbnb (or comparable services). Numerous other constructs – including the belief that Airbnb promotes feelings of community belonging or reduces one’s environmental impact – were not found to have significant impacts. Priporas et al. (2017a) surveyed Airbnb guests in Phuket and found service quality positively impacted satisfaction, and both constructs in turn impacted loyalty. Liang et al. (2018a) surveyed North American Airbnb users, examining both “transaction-based” satisfaction with the Airbnb purchase process and “experience-based” satisfaction with the Airbnb accommodation experience, and found transaction-based satisfaction was particularly important in influencing both experience-based satisfaction and repurchase intentions, which was a relationship partly mediated by trust in the Airbnb hosts and the Airbnb company. Lee and Kim (2018b) surveyed USA Airbnb users and determined that both perceived hedonic value and utilitarian value positively impacted satisfaction, which in turn positively impacted loyalty, plus hedonic value (but not utilitarian) had an additional direct impact on loyalty. Also, these
relationships held even when taking customer involvement into account as a moderating variable.

Taking a more theoretical approach, Wang and Jeong (2018) surveyed USA Airbnb users with a model based on the Technology Acceptance Model and Innovation Diffusion Theory, and found that Airbnb loyalty was significantly impacted by both satisfaction (based on the quality of amenities, and the host’s hospitality) and attitudes (based on perceived usefulness of the Airbnb website, and trust in the Airbnb website, with personal innovativeness serving as an antecedent for both). Also, Tussyadiah (2016) surveyed USA peer-to-peer short-term rental (primarily Airbnb) users and found enjoyment, economic benefits and amenities all had a significant positive impact on satisfaction, which in turn had a positive impact on repurchase intentions. On the other hand, social benefits and local benefits were not found to be significant, and sustainability surprisingly had a negative impact on satisfaction. Tussyadiah further compared entire home guests with private room guests and found that perceived social benefits promoted satisfaction in only the latter. Birinci et al. (2018) took a slightly different approach by surveying both Airbnb and hotel users and found that for both groups perceived authenticity influenced satisfaction, which in turn influenced repurchase intentions. Also, satisfaction was further predicted by safety/security risk among Airbnb users, whereas time/convenience risk and product performance risk were not significant for either group.

Although the majority of Airbnb loyalty studies have used satisfaction as an antecedent of loyalty, several have not. For example, Liang et al. (2018b) found use of electronic word-of-mouth, price sensitivity, perceived value and perceived risk all significantly impacted repurchase intentions, with the latter two constructs also acting as a mediator for the initial two constructs and for perceived authenticity. Additionally, Mao and Lyu (2017) surveyed USA Airbnb users with constructs based on the Theory of Planned Behavior and Prospect Theory, and found repurchase intentions were most strongly impacted by attitudes, which were themselves most strongly impacted by unique experience expectations. Subjective norms also exhibited a direct positive impact on repurchase intentions, yet perceived behavioral control did not. Finally, Lalicic and Weismayer (2018) surveyed Airbnb users and found Airbnb loyalty was significantly impacted by the host’s service quality and the enjoyment of social and authentic experiences, but was not impacted by perceived economic benefits or lack of risk.

Airbnb hosts
Hosts’ motivations. As the research on Airbnb guests clearly demonstrates, Airbnb hosts are a critical part of the Airbnb experience, plus they are essentially the foundation of the Airbnb company, as without hosts there would be no Airbnb. Several studies have investigated why individuals become Airbnb hosts, although this topic has received far less attention than its guest equivalent. Like Airbnb guests, the hosts seem to be attracted by both financial and experiential benefits. For example, Karlsson and Dolnicar (2016) surveyed Australian hosts with an open-ended motivation question, and found answers fit into three primary categories – income (covering expenses or earning additional money), social interaction (enjoying meeting new people) and sharing (utilizing unused space and sharing one’s world). Visser et al. (2017) surveyed Cape Town Airbnb hosts and found that financial incentives were the most common reason for hosting. Finally, Ladegaard (2018) interviewed Boston Airbnb hosts and found they saw hosting as an opportunity to interact with the foreign “Other” and achieve cosmopolitanism, but the hosts still often cherry picked guests for a certain degree of familiarity, which Ladegaard dubbed “comfortably exotic.”
Ladegaard also found these encounters helped hosts acquire social capital related to the
global knowledge and social connections they attained.

Hosts’ experiences, strategies and conduct. Whereas Airbnb host motivation research
has focused on the benefits of hosting, several studies on the hosting experience have
underscored its numerous challenges. Malazzi *et al.* (2018) surveyed Airbnb hosts in
Northern Cyprus about their risk perceptions and found host satisfaction was negatively
impacted by financial concerns (e.g. regarding online payments) and security concerns, and
this satisfaction in turn directly related to future hosting intentions. Such intentions also
were directly impacted by financial concerns, security concerns and political concerns (e.g.
political conflicts between a host’s and guest’s countries). Using a different methodological
approach, Roelofsen (2018) conducted an autoethnography in which she stayed at 11 Airbnb
listings in Sofia, Bulgaria, and found that Airbnb hosting altered the very essence of “home”
for the hosts by blurring the lines between “front stage” and “back stage”. Roelofsen
additionally found that Airbnb homes became commodified, that certain objects were
staged for the guests’ experience, and that the privacy of intimate spaces had to be silently
account of the authors’ experiences as Airbnb hosts in Manchester, UK The authors
described tensions associated with maintaining a sense of privacy and preserving routines
while simultaneously making guests feel welcome. The authors also highlighted the
significant and sometimes unpleasant labor required to maintain a high standard of
cleanliness. Finally, Roelofsen and Minca (2018) critiqued how Airbnb has commercialized
people’s living spaces, which is a sacrifice hosts must make in order to join the Airbnb
community. Roelofsen and Minca further argued that hosts are reduced to quantifiable data
signaling their ability to provide hospitality experiences, the pinnacle of which is the
Superhost.

In addition to being hospitality providers, hosts also must market themselves to potential
guests. For example, Lutz and Newlands (2018) compared the listing descriptions written by
hosts of entire home and shared space rentals, and found entire home hosts explicitly
targeted older guests, couples, business travelers and high-income professionals, while
highlighting professional-level cleanliness and ensuring privacy. In contrast, shared room
hosts targeted younger and frugal guests, did not boast about cleanliness and assured social
interaction was a part of the experience. Tussyadiah and Park (2018) analyzed USA Airbnb
hosts’ profile descriptions, and found hosts tended to describe themselves either as well-
traveled individuals eager to meet new people or with a focus on their professions. In a
follow-up survey of peer-to-peer accommodation users, the authors found potential guests
perceived the hosts describing themselves as well-traveled were deemed more trustworthy,
and booking intentions towards these hosts were higher. Another way to stand out as a host
is to achieve Superhost status, but Airbnb offers only general guidance, rather than precise
detail, on how this status can be achieved. Gunter (2018) explored this subject by examining
San Francisco host characteristics and found that obtaining and maintaining excellent
reviews was easily the most important criterion for becoming a Superhost, followed by
reliable cancellation behavior, responsiveness and sufficient demand.

Once potential guests are attracted, hosts additionally can choose whether or not to
accept a booking request (unless the host is using Instant booking), and numerous studies
have explored how such decisions are made. Karlsson *et al.* (2017) conducted a choice
experiment in which they presented Australian Airbnb hosts with several pairs of
hypothetical booking requests, and found hosts preferred certain personal characteristics –
older, female, a profile picture (although facial expression did not matter, unlike what was
found by Fagerström *et al.*, 2017), a picture of couples and a picture without kids. Also, hosts
preferred guests who requested longer bookings, made a positive self-reference about their behavior, were travelling with a partner, were not travelling with family/friends, were travelling to attend a wedding, and were not celebrating their birthday.

It seems natural that hosts may exhibit preferences for guests deemed trustworthy, compatible and profitable, yet the ability to deny booking requests also permits inappropriate forms of discrimination, like racial discrimination. In fact, numerous racial discrimination complaints have been levied against Airbnb, and the company has responded with various actions including the establishment of a Nondiscrimination Policy (Benner, 2016; Glusac, 2016). Useful insight into Airbnb discrimination is provided by Edelman et al. (2017), who conducted an experiment in which they sent inquiries to Airbnb hosts from fake accounts with distinctively white or African American names, and discovered the African American requests were 16 per cent less likely to be accepted than the white ones. Discrimination was demonstrated by both male and female hosts, by both African American and white hosts, by hosts offering entire homes and shared accommodations, by hosts with significant experience and multiple properties, by hosts with high- and low-priced units, by hosts in diverse and homogenous neighborhoods, and towards both male and female potential African American guests. Nevertheless, hosts who had previously hosted African American guests did not discriminate, leading the researchers to conclude that discrimination primarily was exhibited by a particular subset of hosts. The discrimination issue has received fairly significant media attention, and Cheng and Foley (2018) examined reader comments to a Guardian article about Airbnb’s anti-discrimination policy. The authors found that people viewed the issue from varying perspectives, such as in terms of economic implications for the company, governmental regulations, and hosts’ rights regarding their ability to select who they accept into their homes.

*Airbnb accommodation pricing.* Unlike some other sharing economy services (e.g. Uber), Airbnb hosts have the freedom to set their own prices, and copious research has used hedonic regression models to better understand how different host and listing attributes influence price. (It is worth noting that while pricing is a direct responsibility of hosts, and therefore included in this section of the paper, pricing also relates to the consumer side of Airbnb by highlighting what guests value most.) These studies often have been conducted with large data sets – up to nearly 500,000 listings (Benitez-Aurioles, 2018b) – and have included listings from a wide range of destinations in Canada (Gibbs et al., 2018a), Germany (Teubner et al., 2017), Italy (Magno et al., 2018), Spain (Azmar et al., 2018a; Benitez-Aurioles, 2018a), the USA (Chen and Xie, 2017; Kakar et al., 2018; Zhang et al., 2017) and worldwide (Benitez-Aurioles, 2018b; Wang and Nicolau, 2017).

These studies have tended to find that price is positively associated with review scores, offering an entire home (versus shared accommodation), bedroom count, bathroom count, guest capacity, Superhost status, host’s time as a member, certain amenities (e.g. parking) and photo count. In contrast, price generally has been negatively associated with distance from a destination’s city center, a host having multiple listings, more flexible cancellation policies, Instant booking availability and review count. Although these pricing patterns have been fairly consistent, it is important to note that studies looking at multiple destinations have found noteworthy differences between them (Gibbs et al., 2018a), plus some studies’ findings have not conformed with these general patterns. For example, Kakar et al. (2018) did not find that cancellation policies significantly impacted price, and neither Teubner et al. (2017) nor Chen and Xie (2017) found that Superhost status significantly impacted price. Also, several studies have acknowledged that it is somewhat counterintuitive that flexible cancellation policies, Instant booking and review count would...
negatively impact price, as such attributes should make a listing more attractive to potential guests, and authors have rationalized this phenomenon in different ways. For instance, Benítez-Aurioles (2018b) explained it in economic terms, claiming that hosts simply are encouraging demand with strategies including both lower prices and more appealing booking policies. Somewhat differently, Gibbs et al. (2018a) explained it as commercially-oriented hosts being more likely to use Instant booking and reduce prices to ensure demand, while casual hosts have a higher minimum threshold for the compensation that makes hosting worthwhile. Additionally, Teubner et al. (2017) detected an interaction effect between review scores and quantity as related to price, with the negative impact of high review volume being greater for listings with low rating scores.

Also, most Airbnb price studies have looked at additional variables beyond what has been described. For instance, Kakar et al. (2018) used their analysis to look specifically at racial discrimination and found that, all else being equal, Asian and Hispanic hosts in San Francisco tended to charge eight to ten per cent less than white hosts. Nonetheless, occupancy rates were the same, and neither gender nor sexual orientation had a similar impact on price. Furthermore, Ram and Hall (2018) looked at both Airbnb listings and hotels in Tel Aviv to explore the relationship between walkability and price, and found no significant relationship in either case.

Rather than examining static prices, numerous studies have examined the degree to which Airbnb hosts have adopted revenue management practices, adjusting prices strategically. Magno et al. (2018) found that hosts in Verona, Italy were increasing their prices in response to increased demand, thereby demonstrating basic dynamic pricing behavior. However, Aznar et al. (2018b) examined Barcelona Airbnb listings and hotels and found that Airbnb hosts varied prices by season, but, unlike hotels, did not vary much by day of week. Similarly, Gibbs et al. (2018b) examined nearly 40,000 Airbnb listings and over 1,000 hotels in Canada, and found that while dynamic pricing among Airbnb hosts was evident by day of week and by season, many Airbnb hosts were shifting prices minimally or never. Also, Airbnb price fluctuations tended to be less pronounced than those of hotels, and hotel rates correlated more closely with their occupancy levels. Lastly, Oskam et al. (2018) examined dynamic pricing by Airbnb hosts in Amsterdam and found that hosts who adjusted prices more frequently performed better in terms of occupancy levels and daily rates.

**Airbnb supply and its impacts on destinations**

Complementing research on hosts and guests, numerous studies have examined Airbnb supply in various destinations to more generally understand its characteristics and impacts. For example, Abdar and Yen (2017) examined over 673,000 Airbnb listings from 16 countries and found that apartments and houses were the most common property types, entire homes were the most common room type, and most listings had a 4.5 or five star rating. Crommelin et al. (2018) examined Airbnb listings in Hong Kong, London, New York City, Paris and Sydney and found the majority of listings were entire homes, and a substantial proportion were “dedicated units” available over 90 days per year and/or owned by a host with multiple listings, which the authors contrasted with the supposed ethos of the sharing economy. Also, Adamiak (2018) examined 737,000 listings in 432 European cities and identified meaningful differences between the Airbnb supply characteristics of different countries (e.g. more or fewer fully-dedicated Airbnb units), and concluded that Airbnb supply volume roughly corresponded with a city’s size and status as a leisure destination. Adamiak additionally found the relative proportion of entire homes dedicated to short-term renting was higher in major tourist destinations, and Airbnb seemed to play a particularly
important role in rapidly growing inbound markets like Iceland. This form of large-scale inventory analysis requires purchasing or otherwise attaining scraped Airbnb data, and Oses Fernández et al. (2018) offered methodological guidance for such Airbnb data scraping to assist with sector monitoring. Also, Palos-Sanchez and Correia (2018) found that the volume of Google searches for different keyword terms associated with Airbnb could successfully predict income from short-term rentals.

By examining large Airbnb data samples, researchers have gained insights into public health questions as well. For example, Kennedy et al. (2018) investigated the fire safety and first-aid features that hosts claimed at over 120,000 listings in various USA cities. The authors found 80 per cent had smoke detectors, 58 per cent had carbon monoxide monitors, 42 per cent had fire extinguishers and 36 per cent had first-aid kits, suggesting less safety preparedness than would be found in hotels. The authors also noted that smoke alarms and carbon monoxide detectors were comparatively more prevalent in cities that had Airbnb permits requiring such devices. Looking at a different public health issue, Kennedy et al. (2017) found significant disparity between Canadian cities regarding the percentage of Airbnb listings permitting smoking, and the authors predicted that Airbnb may fill a gap as hotels increasingly become smoke-free environments.

Large data sets also permit analyses of the geographic dispersion of Airbnb rentals. This form of research has been conducted in Austin, Boston, Chicago, San Francisco and Washington, D.C. (Wegmann and Jiao, 2017); New York City (Dudás et al., 2017a); Barcelona and Madrid (Benítez-Aurioles, 2018a; Gant, 2016; Gutiérrez et al., 2017); Berlin (Schäfer and Braun, 2016) and Hamburg (Brauckmann, 2017); Budapest (Boros et al., 2018; Dudás et al., 2017b; Smith et al., 2018); Cape Town (Visser et al., 2017); Sydney and Melbourne (Alizadeh et al., 2018; Crommelin et al., 2018); Utrecht, Netherlands (Ioannides et al., 2018); and Warsaw (Győdi, 2017). With the exception of Cape Town, these studies consistently have found that Airbnb listings are highly concentrated in city centers and around tourist attractions and facilities. For example, Benítez-Aurioles (2018a) found that in Barcelona and Madrid over 80 per cent of Airbnb listings were found within a three-kilometer radius of the city centers. Consequently, this body of research has largely concluded that Airbnb listings reflect fairly similar spatial patterns to hotels, although there are distinctions when considering proportional densities in different areas (Győdi, 2017; Ioannides et al., 2018), plus Airbnb is introducing tourism lodging into some previously residential neighborhoods (Gutiérrez et al., 2017). Moreover, Wegmann and Jiao (2017) found evidence in some cities that Airbnb listings cluster around transit lines. This area of research also has repeatedly found that, demographically, Airbnb listings are primarily found in relatively affluent (Alizadeh et al., 2018; Visser et al., 2017; Wegmann and Jiao, 2017) and predominately white areas (Visser et al., 2017; Wegmann and Jiao, 2017), aside from in Hamburg, where Airbnb was more prevalent in multicultural neighborhoods (Brauckmann, 2017).

Some researchers have examined the consequences of Airbnb’s rapid expansion throughout destinations. Freytag and Bauder (2018) looked at Airbnb as one of various change agents precipitating the “touristification” of Paris, and determined that Airbnb disperses tourists throughout the city and immerses them in local neighborhoods, thereby introducing tourism into new areas of the city beyond the traditional “tourist bubbles”. Also, Fang et al. (2016) examined Airbnb’s impact on tourism sector employment in Idaho, USA, and found the relationship was positive, as Airbnb brings increased tourists to the destination. Nevertheless, the authors cautioned that this lift could be offset as Airbnb potentially grows to the point that it reduces hotel employment. Finally, Gurran and Phibbs (2017) examined Airbnb’s impacts in Sydney by analyzing
written submissions by local planners and other interested parties to a government inquiry into short-term letting. The authors found greater opposition coming from urban areas, characterized by concerns about issues like noise, traffic, parking and waste management.

In addition to disrupting the daily life of locals, Airbnb also may impact local housing markets by reducing supply and raising prices, which is an important issue in many of Airbnb's regulatory battles. In fact, several of the previously mentioned studies on Airbnb's spatial patterns and impacts suggested that impacts on housing were possible in neighborhoods of high Airbnb density (Alizadeh et al., 2018; Brauckmann, 2017; Gurran and Phibbs, 2017). Multiple other studies have focused specifically on this issue. For example, in Berlin, Schäfer and Braun (2016) found that over 5,500 Airbnb units were being offered beyond the nightly limit prescribed by law, representing 0.3 per cent of Berlin's housing, but this figure increased to seven per cent in areas of particularly high Airbnb density. The authors also found that rental rates had increased more significantly in areas with higher Airbnb density. In Boston, Horn and Merante (2017) determined that every standard deviation increase in Airbnb inventory volume was associated with a 0.4 per cent increase in asking rents (and up to 3.1 per cent in areas of high Airbnb density), and a 5.9 per cent decrease in long-term rental unit supply. In simpler terms, the authors found that every 75.8 Airbnb listings equated with 4.5 fewer long-term rental units. In Barcelona, Gant (2016) found that in high-density areas, like the Gothic Quarter, Airbnb rentals represented up to 17 per cent of homes. Gant also interviewed locals in the Gothic Quarter about Airbnb's impacts and found nearly all of her 42 interviewees spoke of displacement concerns. Gant summarized that displacement occurs in various forms, including housing shortages, rent increases and frustrations with daily disruptions, which together produce a snowball effect of residents leaving and being replaced by tourism investors. Finally, in New York City, Wachsmuth and Weisler (2017) explained that because Airbnb creates a new opportunity to generate revenue through residential housing, it creates and augments a "rent gap" in which landlords' actual earnings are smaller than their potential earnings, leading to loss of rental housing via direct evictions and indirect displacement as housing is made unaffordable. With a particular focus on gentrification, the authors found that although Airbnb revenue was greatest in wealthier areas (e.g. Times Square), some peripheral areas (e.g. Harlem) appeared ripe for gentrification.

Airbnb regulation

Concerns over housing markets are one of just various reasons why policymakers across the world are looking to regulate Airbnb. Existing regulatory frameworks were not prepared for the rapid rise of a technology-driven peer-to-peer short-term rental platform like Airbnb, and the regulatory battles that have ensued have often been highly contentious affairs. Crommelin et al. (2018) compared short-term rental laws in five large global cities and found that different regulatory instruments were used, but each city historically had regulations on short-term letting prior to Airbnb, and each city has limited the number of nights a short-term rental could be let out annually. Ferreri and Sanyal (2018) explored how Airbnb is pushing to shape the short-term rental regulatory environment in London. The authors additionally highlighted the challenges associated with identifying and collecting evidence on violators of London's 90-night quota passed in 2015, which necessitated data scraping and triangulation. The authors argued that such difficulties raised questions about the degree to which platform companies like Airbnb should be involved in the rule enforcement process. Taking a more general look at Airbnb regulation, Gurran (2018) summarized the debate from an urban policy
perspective and highlighted key concerns with Airbnb – consumer protection measures are challenging to enforce, Airbnb disrupts local neighborhood life and Airbnb adversely impacts housing markets. Gurran also presented a future research agenda, calling for greater knowledge regarding how Airbnb is changing conceptualizations of “home”, how Airbnb is triggering gentrification and more general neighborhood change and how well companies like Airbnb can self-regulate.

Looking at Airbnb’s approach to its regulatory battles, McKee (2017) critiqued how Airbnb has successfully framed the regulatory debates such that the default position has been legality, even though Airbnb listings have often been illegal and produce negative externalities. McKee posited that Airbnb’s success on this front has come from its association with notions of open markets (that are themselves positioned as natural, politically neutral, consensual and efficient), family and technology. Similarly, Stabrowski (2017) examined the Airbnb regulatory debate in New York City by describing how Airbnb had positioned itself using alternative notions of community, sustainability and governance, with a particular focus on individual economic empowerment coming from transformed meanings of “home”.

Different jurisdictions have approached Airbnb regulation very differently, and several studies have explored these differences. Tham (2016) compared Australia and Singapore and found that the Australian government’s response has been more fragmented and localized, whereas Singapore’s response has been more driven by the federal government. Tham also noted that Singapore was more resistant than Australia to Airbnb, despite being fairly welcoming towards Uber. Hong and Lee (2017) interviewed various government and Airbnb employees in South Korea and found that federal government officials were more open than local ones to adapting regulations in a manner favorable to sharing economy services like Airbnb, because the local officials were more beholden to their local constituents. Somewhat similarly, Hong and Lee (2018) examined Airbnb regulatory policies in 47 USA cities and determined that political competition (i.e. degree of victory in most recent election) was positively associated with more favorable regulatory action towards sharing economy companies like Airbnb, which is consistent with the general phenomenon of more entrenched government administrations tending to favor the status quo, and vice versa.

Offering a path forward, based on their examination of Airbnb data in five major USA cities, Wegmann and Jiao (2017) suggested four guiding principles for Airbnb policymakers – web scraping is imperfect but still cheap and effective for data gathering, regulation should take into account local factors including Airbnb usage patterns, regulation is only meaningful if paired with dedicated enforcement (often financially supported by permit fees), and commercial operators should be distinguished from other hosts. The enforcement issue is particularly important because it can be so challenging, as was highlighted by Ferreri and Sanyal (2018) and Leshinsky and Schatz (2018). However, Leshinsky and Schatz (2018) also noted that some jurisdictions are therefore enlisting the assistance of private companies, but the authors argued that this practice raises questions about the role that private companies should play in the enforcement of public regulations.

_Airbnb’s impacts on the tourism sector_
One of many factions involved in the Airbnb regulatory debates has been the hotel industry. Hotels are naturally vulnerable to competition from Airbnb, but questions remain as to whether Airbnb has a material negative impact on hotels, with some studies detecting impacts while others have not. In their seminal study on Airbnb’s hotel impacts, Zervas et al. (2017) examined nearly seven years of Airbnb and hotel data in
Austin and found that Airbnb supply negatively impacted hotel revenues, primarily by pressuring hotels to lower their rates, and particularly in hotels that were budget-priced and/or had a limited business clientele. The authors additionally determined that this negative impact was especially pronounced during peak demand times, when Airbnb supply would surge. Also looking at Austin, Xie and Kwok (2017) found Airbnb supply increases exerted a significant negative impact on hotel RevPAR. However, this impact decreased as the price differential between a hotel and nearby Airbnb listings increased or the dispersion of Airbnb prices increased. Looking at New York City hotels, McGowan and Mahon (2018) found that Airbnb growth had exerted small, but statistically significant, effects on hotel revenue, occupancy and rates. The authors additionally noted that despite Airbnb’s limited apparent impacts, hotels should nonetheless be concerned due to Airbnb’s rapid growth.

Guttentag and Smith (2017) examined the substitution question at a micro level by surveying Airbnb guests about what they would have done if Airbnb and other similar platforms had not existed. The authors found that nearly two-thirds indicated they would have otherwise used a hotel, with the majority indicating a mid-range hotel. Additionally, over 25 per cent of the respondents indicated they would have used a hostel or a bed-and-breakfast, and fewer than six per cent claimed they would have stayed with friends/family or not taken the trip. The authors also examined guests’ comparative performance expectations from their last Airbnb with hypothetical nearby hotels, and found Airbnb was generally expected to outperform budget hotels/motels, underperform upscale hotels, and have mixed outcomes versus mid-range hotels when considering traditional hotel attributes (e.g. cleanliness and comfort). When considering attributes more closely associated with Airbnb (experiential attributes and low price), Airbnb was expected to significantly outperform all three hotel classes.

Despite such findings, other research has not found that Airbnb has a material impact on hotels. For example, Choi et al. (2015) found that Airbnb listing volume had virtually no impact on hotel revenues in South Korea, and Ginindza and Tichaawa (2017) found that hotel occupancy and Airbnb occupancy rates were positively correlated in Swaziland. Additionally, Blal et al. (2018) examined several years of San Francisco hotel and Airbnb data, and found Airbnb supply was unrelated to hotel RevPAR, and increases in average Airbnb prices actually were associated with RevPAR increases among luxury hotels. On the other hand, Blal et al. also found that increases in Airbnb satisfaction (as per user reviews) were associated with RevPAR decreases, suggesting that improvements in Airbnb quality may impact hotels negatively.

Researchers conducting qualitative research with hotel representatives also have found limited levels of concern over Airbnb. For example, Koh and King (2017) interviewed representatives from Singaporean economy/mid-tier hotels and hostels and found they tended to feel as though a stricter regulatory environment was needed, although Airbnb was not perceived as an immediate threat. Indeed, some hostel owners even indicated that they listed rooms on Airbnb. Likewise, Varma et al. (2016) interviewed a dozen USA hotel executives and found they doubted Airbnb was impacting the hotel industry, feeling instead that Airbnb was targeting a different segment of travelers. Nonetheless, whereas the larger hotels seemed satisfied to simply monitor Airbnb, smaller hotels tended to be more active in opposing Airbnb through actions like regulatory lobbying and enhancing their hotel products. Also, Tham (2016) analyzed tourism industry responses to Airbnb in Australia and Singapore and concluded the responses had been quite limited in both places.
Finally, a handful of papers have examined Airbnb’s potential competition with hotels through a more conceptual lens. Hansen Henten and Windekilde (2016) explained the emergence of Airbnb from a transaction cost theory perspective, explaining that Airbnb facilitates transactions that would not have otherwise occurred, due to the prior challenges for hosts and guests to find each other, establish trust and engage in a transaction. The authors posited that Airbnb has created a new market that both complements and competes with the traditional hotel industry. Also using transaction cost theory, a proposition paper by Akbar and Tracogna (2018) predicted that Airbnb’s inherent uncertainties, lack of specificity (i.e. Airbnb listings are not built to be short-term rentals) and low transaction frequency may push the service to evolve from a strictly peer-to-peer platform to a more “integrated” platform in which there are tighter standards, more centralized control and asset ownership. Forgacs and Dimanche (2016) summarized some of the reasons why Airbnb has proven so successful (e.g. strong business model, intuitive and user-friendly website and an association with authentic local travel), but argued that hotels have ample opportunities to compete on these same grounds – by competing on value rather than rate, enhancing their websites, incorporating local elements into their properties and embracing customer relationship management practices. Lastly, Sovani and Jayawardena (2017) discussed how the Canadian tourism sector should respond to sharing economy services like Airbnb, based on a travel conference panel discussion on the sharing economy that included a representative from Airbnb. Sovani and Jayawardena recommended that the Canadian tourism sector have a positive attitude towards change, carefully revise relevant laws and regulations, encourage technological innovations, try to quantify part-time employment in the sharing economy and think outside the box in promoting healthy competition.

The Airbnb company
The final category of Airbnb research comprises articles that have examined the Airbnb company more generally. For example, Boswijk (2017) summarized how value is co-created by Airbnb and its community, as established by the company’s vision, the unique experience of staying in a local’s home, Airbnb’s creation of a trusted marketplace, the company’s culture and its innovative business model. Midgett et al. (2018) posited that Airbnb should typically be more sustainable than hotels, and the authors presented various associated propositions regarding energy use, emissions, water use, waste production, users’ economic well-being and the creation of social ties. Taking a more critical stance, O’Regan and Choe (2017) critiqued Airbnb through the prism of cultural capitalism, highlighting that the company has contributed to the commodification of life experiences. She further argued that, although Airbnb adopts appealing rhetoric of sharing and speaks of other ideals like sustainability and transformative travel, the company is just another profit-driven lodging enterprise that is introducing new market-based problems into the tourism accommodation sector.

Looking at Airbnb’s advertising efforts, Pera and Viglia (2016) interviewed several Airbnb users about an Airbnb YouTube ad that tells a host’s story. Many viewers were emotionally engaged by the story and even became eager to meet the host and visit the sites presented in the video. Considering hypothetical advertising techniques, Liu and Mattila (2017) explained that two of Airbnb’s key appeals are feeling a sense of belongingness and the uniqueness of Airbnb accommodations. The authors conducted an experiment in which they manipulated people’s sense of power, and found that individuals feeling a sense of powerlessness responded more favorably to hypothetical
Airbnb advertising focusing on belongingness, whereas individuals feeling a sense of power responded more favorably to hypothetical Airbnb advertising focusing on uniqueness, and these relationships were mediated by individuals’ self-brand connection. Such forms of experimentation align well with a data-driven tech company like Airbnb and, indeed, Airbnb employees Bion et al. (2018) described how they use the free statistical software program \textit{R} for various tasks, including data analysis, experimentation and data visualization. Finally, Oskam and Boswijk (2016) mapped out possible future scenarios for Airbnb, based on a travel sector workshop and a Delphi panel, and suggested that Airbnb’s evolution will differ between different cities, primarily as a function of consumer demand and regulatory policies.

**Future research**

The plethora of studies that have been published on Airbnb in the past couple of years demonstrate how academia can generate a large body of knowledge on a novel phenomenon in a fairly short time. Nonetheless, this initial wave of research still has many limitations and leaves many questions left unanswered. As was shown, the majority of the extant Airbnb research has been conducted by researchers in the USA/Canada and Europe, and much of it has similarly focused on these same regions, while destinations in the Caribbean, Latin America, Africa and the Middle East have received minimal attention. Likewise, much of the research has focused chiefly on large urban destinations (e.g. New York City, Barcelona and Sydney) rather than destinations that are less populous and/or popular with tourists, though the dynamics of Airbnb may be very different in such locales.

Methodologically, there is also a need for greater diversity. While myriad methods have been used to examine Airbnb, many research questions have been looked at repeatedly using the same methods. Generally speaking, surveys have been used to understand guest motivations, experiments have been used to investigate accommodation choice, surveying with structural equation modelling has been used to examine loyalty, hedonic regressions have been used to examine the importance of different listing attributes, text mining and content analysis have been used to analyze Airbnb reviews and profiles, and scraped data with geographic information systems have been used to examine Airbnb dispersion. Nevertheless, these same questions undoubtedly could be examined with other approaches. For example, choice experiments could be used to examine guests’ motivations to use Airbnb, interviews with Airbnb guests could be used to investigate satisfaction and loyalty, questionnaires could be used to investigate why Airbnb listings tend to concentrate in certain areas, and hosts’ reviews of guests could be used to better understand host experiences. In general, quantitative methods have been most common thus far, and have helped to establish foundational knowledge on many topics, but there is ample opportunity for more qualitative research that could offer rich insights into the many questions surrounding Airbnb. Indeed, a large number of studies have relied on relatively easily accessible listing and review data that is scraped from the Airbnb website, but it is time for more researchers to tackle their research questions in more ambitious ways.

Also, by looking back at the Airbnb research agenda that Gutentag (2015) laid out several years ago, it is clear that many important questions remain mostly unanswered. For example, more research is needed regarding how Airbnb impacts destinations’ tourism economies beyond the lodging sector, how non-hotel accommodations (e.g. hostels and bed-and-breakfasts) are being affected by Airbnb, how online travel agencies and guided tour companies are being affected by Airbnb, why Airbnb reviews tend to be so positive, whether tourists actually save money by using Airbnb and what they do with those savings, how businesses and business travelers perceive and use Airbnb, how users’ (or the general public’s) attitudes towards Airbnb have shifted over time, how later adopters differ from earlier adopters, how different regulatory
measures impact Airbnb inventory and host behavior, and how residents perceive Airbnb and the factors that influence such attitudes. Also, it must be recognized that because Airbnb and its regulatory environment are evolving so rapidly, older findings could quickly become outdated and need to be re-examined.

Conclusion

This paper has reviewed the research progress that has been made on the topic of Airbnb since the company’s inception. The literature review grouped the extant Airbnb research into six different thematic categories – Airbnb guests, Airbnb hosts, Airbnb supply and its impacts on destinations, Airbnb regulation, Airbnb’s impacts on the tourism sector and the Airbnb company. By reviewing this large, recent body of literature, this paper fills a significant research gap. It additionally has highlighted several areas of Airbnb knowledge that are beginning to mature as consensus emerges between similar studies. For example, repeated findings have demonstrated the importance of money in motivating both Airbnb guests and hosts, the importance of attributes like room type and guest capacity in determining listing prices, and the geographical concentration of Airbnb listings in many city centers.

This literature review offers clear theoretical and practical implications. In terms of theoretical implications, this review advances comprehension of the peer-to-peer economy, it adds a new layer to understandings of tourism lodging choice and the various factors (e.g. perceived authenticity) that influence such choice, and it similarly offers new perspectives for thinking about innovation and value co-creation. In terms of practical implications, this paper provides a valuable synthesis of Airbnb knowledge that should be useful to Airbnb and other tourism lodging providers as they compete for guests, Airbnb and other peer-to-peer short-term rental platforms as they look to attract and retain hosts, destination marketing organizations as they seek to better cater towards modern tourist preferences and policymakers as they look to more effectively manage the Airbnb phenomenon.

Despite the sizeable body of research that has been covered in this review, there remain countless knowledge gaps that need to be filled by future research, and numerous recommendations for such research have been provided. Such research is particularly important due to the speed of technological innovation and regulatory flux that is constantly shifting the Airbnb landscape. Fortunately, given the rapid pace at which Airbnb research has been conducted over the past several years, one can be optimistic that researchers will continue generating findings of both theoretical and practical value on the increasingly important subject of Airbnb.

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