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Promoting built-for-disaster-purpose mobile applications: An interdisciplinary literature review to increase their penetration rate among tourists

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Abstract
This study focuses on the promotion and use of tourist-oriented built-for-disaster-purpose mobile applications. The investigation relies on two trends that are characterizing modern societies. The first trend refers to the fact that recently, rapidly, and worldwide, the number of mobile applications users increased. The second trend refers to the fact that, worldwide, international tourism demand highly increased from the beginning of the 1960s to the mid-years of 2010s. These travelers are also users of mobile applications, and they use apps for several reasons, including those related to security/emergency issues. International travelers may need information such as risks at the destination, warnings, shelter locator services, emergency routes information, and traveler telephone hotline to be used in the case of earthquakes, tsunamis, infectious diseases, or other disasters. We considered the role of built-for-disaster-purpose mobile applications as a tool to provide information to tourists, increase their risk-awareness, and improve their disaster-preparedness. Previous studies suggest that these tools may have a high impact in that sense. However, the number of users informed about these applications tends to be very low. We systematically reviewed interdisciplinary academic contributions to analyze research on apps-users' intention to adopt mobile applications. Findings suggest opportunities for future tourism-oriented studies aiming at increasing the number of users of built-for-disasters mobile applications. In particular, we provide a research agenda taking into consideration the geographical spread of the studies, the used research techniques, and the adopted theories.

1. Introduction
This study focuses on the promotion of mobile applications (apps) for disaster management in the tourism industry; this use is possible due to two trends characterizing modern societies. The first trend is the recent, rapid increase in mobile phone owners who make up over 90% inhabitants worldwide, while the rate of smartphone owners is higher than 80% (Deloitte, 2017). Since 2014, the average mobile data subscription rate reached 96.4% worldwide, including lower averages in Asia (89.2%) and Africa (69.3%) (United Nations, Department of Economic and Social Affairs, 2017). Mobile phones offer the usage of a wide range of applications, including social media, that have also expanded (Tan et al., 2017). The second trend is the worldwide increase in the demand for international tourism from the 1960s to the mid-2010s (Peng, Song, Crouch, & Witt, 2015).

International tourists combine these trends when they use apps to navigate, socialize, share content, engage with mobile marketing, conduct transactions, enjoy entertainment, and obtain information (Kennedy-Eden & Gretzel, 2012). Apps contribute to improve the interaction between tourists and information technologies, which determines the smartness of tourism destinations (Ghaderi, Hatamifar, & Henderson). Navigation encompasses using Global Positioning System (GPS), augmented reality, and wayfinding to identify a specific path (Kennedy-Eden & Gretzel, 2012; Vlassenroot, Gillis, Bellens, & Gautama, 2015). Tourists can use social media to share travel "experiences" (Munar & Jacobsen, 2014) and share both individual subjective tourism-related evaluations (Tung & Ritchie, 2011) but also knowledge-related aspects about "holiday attributes (e.g., prices, weather conditions, beaches, and other attractions)" (Munar & Jacobsen, 2014, p. 47). They can use mobile marketing apps to buy and receive coupons or tickets; entertainment apps to download games, movies, e-readers; and information apps to access tourism-related
information, including risks at their destination, warnings, shelter location services, and emergency routes information (Aliperti, Nagai, & Cruz, 2020; Kennedy-Eden & Gretzel, 2012).

Therefore, communication through mobile phones is relevant when people travel and have holidays affected by crises and/or disasters. Disaster management requires effective communication between different stakeholders to reduce the risk of negative impact (Aliperti et al., 2020) and mobile informatics, such as disaster mobile apps, may help (Tan et al., 2017). This communication should be tailored to every phase of the tourism disaster management lifecycle (Faulkner, 2001; Mair, Ritchie, & Walter, 2014). The tourism disaster management lifecycle is characterized by six composite and overlapping phases: Pre-Event, Prodomal, Emergency, Intermediate, Long-term (recovery), and Resolution (Faulkner, 2001). All phases should be considered and analyzed when considering the effectiveness of disaster apps (Mair, Ritchie, & Walters, 2014). Our study focuses on the pre-event phase and considers the role of disaster mobile apps as a tool to increase tourists’ risk awareness and disaster preparedness. Mobile applications may have a high impact on these factors (Houston et al., 2015; Tan et al., 2017). However, international tourists are not usually informed about disaster mobile applications, and only a few of those who are aware of them decide to adopt these apps (Aliperti & Cruz, 2019; Nagai et al., 2020).

Previous studies highlighted the necessity to develop systematic reviews to better understand the dynamics that influence the adoption of mobile apps (Tang, 2019). Tang (2019) partially filled this gap by identifying suggestions to promote branded and revenue-generating apps. Recently, scholars started to consider the dynamics that drive international tourists’ intention to adopt disaster mobile apps (Nagai et al., 2020). This literature gap has been partially assessed, suggesting that gamification of disaster mobile apps could help to more effectively communicate hazard information to specific tourist markets (e.g., Chinese, millennials) (Nagai et al., 2020). However, many additional variables may influence users’ intention to download disaster mobile applications. We aim at identifying them by using an interdisciplinary approach to analyze the literature on users’ intention to adopt mobile applications and the strategies that are usually adopted to increase apps’ users. The objective of this study consists of providing opportunities for further research to contribute to the promotion of disaster mobile apps among tourists. Our systematic literature review is the first attempt to evaluate the mobile adoption literature knowledge to adapt it to a disaster management perspective. This contribution is relevant as a comprehensive literature review on mobile informatics (Tan et al., 2017) has already highlighted the importance of such apps as tools to improve disaster preparedness.

2. Literature review

2.1. Crisis informatics: the role of disaster mobile apps

Crisis informatics is a broad research field that integrates “disaster management, information, and communication technology, and socially generated and processed content” (Tan et al., 2017, p. 299). These studies investigate the role of information technology and new media during crises (Tan et al., 2017), emergencies (Sutton & Kuligowski, 2019), and disasters (Palen et al., 2010). Mobiles, wireless devices, and social media are new media that can facilitate the communication process to spread both alerts and warnings (Sutton & Kuligowski, 2019). Alerts “capture the attention” of their audience before warnings are issued, while warnings contain important information in the case of emergencies that require protective behavior (Sutton & Kuligowski, 2019).

Literature concerning public alerts and warnings suggests that protective action compliance improves when warning messages are specific, consistent, confident, clear, and accurate (Mileti & Sorensen, 1990). Alerts and warnings provided through mobile Short Message Service (SMS) usually include messages of up to 90 characters and can be sent using geo-referenced technology to target audiences according to devices’ live-location or last wi-fi access (Sutton & Kuligowski, 2019). These messages can also be delivered by disaster management or general- or different scope (e.g., social media) apps (Tan et al., 2017), although longer messages are available when the message is provided by social networks such as Twitter’s 280 characters (since November 2017) (Sutton & Kuligowski, 2019). Social media has increased the complexity of the disaster communication system due to users’ increased interactions (Manoj & Baker, 2007).

Studies on crisis informatics have risen since 2010, typically focusing on the response and recovery stages rather than disaster preparedness (Tan et al., 2017). Recent studies suggest that, in case of disasters, the public tends to communicate through familiar, frequently used and trusted platforms, such as Google, Twitter, Facebook, etc. (Liu, Fraustino, & Jin, 2016; Tan et al., 2017). Despite this fact, current academic studies tend to primarily focus on disaster apps rather than existing social media (Tan et al., 2017). This trend is justified by the fact that the usage of social-media often depends on the nationality of the travelers (e.g. WeChat in China and LINE in Japan) (Chen, 2016). In addition, several authors highlight additional social media-related issues such as privacy, information quantity, and content quality, which favor the use of disaster apps (Schimak, Havlik, & Pielorz, 2015; Tan et al., 2017, p. 301). This is the case, for instance, of Alipay (wallet app) in China. This mobile application has been used to check users’ health status during COVID-19 infectious disease emergency, suggesting if they should be quarantined or allowed into subways, malls and other public spaces (Mozur & Zhong, 2020). However, this privacy issue seems to be relevant also in the case of built-for-disaster-purpose apps. This is the case, for instance, of Corona 100 m (Co100) or Coronamap in South Korea where the users are informed about when they come close to a spot visited by infected persons (Watson & Jeong, 2020).

Both social media and disaster-focused apps can facilitate several disaster management-related actions along the disaster life cycle (Houston et al., 2015; Tan et al., 2017). They can be used for sharing important information and images to assess post-disaster damages and/or pre-disaster risk; to facilitate dialogue among stakeholders, generating active collaborations; to disseminate alerts and information from authorities to the public; to collate existing relevant multisource disaster management information and adapt them for easier communication to stakeholders; and to notify others about personal status after disasters (Tan et al., 2017). Unlike social media, disasters-specific apps must be initially identified, perceived as an effective tool for disaster risk reduction, and finally downloaded by users. Intuitive applications, with an attractive, well-designed interface and endorsed by authorities, facilitate this process (Tan et al., 2017). However, the level of complexity increases for tourist-geared disasters apps as risk communication strategies that consider tourists’ behavioral characteristics must be developed (Aliperti & Cruz, 2019).

2.2. Risk communication and tourists’ seeking behavior

During disasters, tourists—especially international tourists—are highly vulnerable (Aliperti & Cruz, 2019). They use several infrastructures, such as airports and roads (Huan, Beaman, & Shelby, 2004), that are part of unfamiliar environments that may be characterized by different languages and rules, and have minimal connections with local communities (Jeuring & Becken, 2011). Tourists tend to be poorly informed about their destination’s risks (Johnston et al., 2007; Nagai, Ritchie, Sano, & Yoshino, 2019), and, due to their mobility, it is often difficult to transmit relevant information to them (Bird, Gisladottir, & Dominey-Howes, 2010). As result, the tourism industry tends to be inadequately prepared for disasters (Becken & Hughey, 2013; Pridaux, Laws, & Faulkner, 2003), and tourists often ignore the risks that they face (Rüttichainuwat, 2013).

Tourists and residents (Tan et al., 2019) must be previously
Several conditions and actors. The number of investigations aiming at phones (Aliperti & Cruz, 2019; Xiang, Magnini, & Fesenmaier, 2015). Travelers, resulting as main users of internet, social media, and smartphones suggest that the decision to adopt and use a mobile application will also change depending on tourists' available time for applications (Rittichainuwat & Chakraborty, 2009). In addition, previous studies on tourism mobile typology of travel (Rittichainuwat & Chakraborty, 2009), their age and behavior may also change depending on the tourism destination (Aliperti et al., 2020). Government agencies are usually responsible for creating, communicating, and disseminating warnings and risk information (Arce, Onuki, Esteban, & Shibayama, 2017). Academics promote and integrate disaster risk-management approaches in the tourism industry (Aliperti et al., 2020). Tourism suppliers can directly communicate with tourists and therefore are essential to the risk-communication process (Ritchie, 2008). For example, hotel managers may use lobby and guest rooms to disseminate risk information and increase tourists' disaster awareness (Nguyen, Imamura, & Iuchi, 2017). However, tourists have a low predisposition toward receiving risk information (Becken & Hughley, 2013), and communicating risk information may affect their behavior. In particular, increasing risk perception may generate more last-minute bookings (Hystad & Keller, 2008) and cancellations (Huang & Min, 2002). Accordingly, tourism suppliers fear that providing risk-related information to tourists may negatively influence their business (Becken & Hughley, 2013; Bird et al., 2010; Rittichainuwat, 2013). This concern is justified by the fact that when tourists need to choose a tourist destination, they increasingly tend to evaluate risks (Cui, Liu, Chang, Duan, & Li, 2016) and, according to the Perceived Risk Theory, people's purchasing decision is influenced by the perceived risk (Bauer, 1960; Cox & Rich, 1964; Pappas, 2016; Yu, Lee, & Damhorst, 2012). However, tourists must be prepared for disaster occurrences. The challenge is balancing tourists' vulnerability with maintaining the tourism destination's attractiveness. Disaster applications represent an opportunity to reach tourists with warnings and other risk information, while avoiding invasive and overloaded risk communication. Especially in countries prone to natural disasters, such as Japan, local governments have facilitated app development to improve tourist disaster-preparedness (e.g., Pocket Shelter, Safety Tips, Disaster Preparedness Tokyo App, etc.). Unfortunately, tourism suppliers and tourists tend to ignore these applications and rarely download them (Aliperti & Cruz, 2019). Therefore, effective communication strategies are required to improve tourists' use of disaster apps, taking into consideration that tourists from different countries may have different cultures, and risk-information seeking and processing (Aliperti & Cruz, 2019). Their risk perception and behavior may also change depending on the tourism destination (Quintal, Lee, & Soutar, 2010), the hazard (Quintal et al., 2010), the typology of travel (Rittichainuwat & Chakraborty, 2009), their age (Aro, Varti, Schreck, Turtialainen, & Utetla, 2009), and sex (Amir, Ismail, & See, 2015). In addition, previous studies on tourism mobile applications suggest that the decision to adopt and use a mobile application will also change depending on tourists' available time for traveling, financial resources, and accessibility to mobile data (Dickinson et al., 2014; Wang, He, & Leung, 2018). Tourists will consider the performance expectancy, the social influence, the cost, the prior usage habits, the perceived risk, and the perceived trust (Gupta, Dogra, & George, 2018). From this perspective, perceived risk and perceived trust refer to the reliability of the app and its developer/promoter (Gupta et al., 2018). Taking into consideration the tourists' age, Gen Y and Z are recognized to be the most technology-oriented travelers, resulting as main users of internet, social media, and smartphones (Aliperti & Cruz, 2019; Xiang, Magnini, & Fesenmaier, 2015). This scenario is characterized by a complex interaction between several conditions and actors. The number of investigations aiming at analyzing complex scenarios and their dynamics is on the rise, especially when focusing on crisis communication (Zhai, Zhong, & Luo, 2019). These dynamics tend to follow ordered patterns but are also characterized by a high unpredictability, generating a chaotic (chaos and order) system, which is typical of tourism, especially in the presence of crises (Pappas, 2018). This is in line with the Complexity theory, which highlights the difficulty of explaining all the dynamics by following a cause and effect relationship (Pappas & Brown, 2020). Given the complexity of the setting of this study, an interdisciplinary analysis of the literature on mobile application adoption may contribute to identifying suggestions and opportunities for further studies to increase the tourists' use rate of disaster mobile applications.

2.3. Adoption and use of information and communication technology: main theories

The literature investigating the adoption and use of crisis informatics, including disaster apps, is still at a relatively early stage. Considering a wider, multisectoral perspective, investigations on the "usage" of apps such as mobile banking, payments, financial services, health services, data services, games, and learning are increasing (Harris, Brookshire, & Chin, 2016). However, the “adoption” process and users' behavioral factors that influence this process are substantially under-investigated (Harris et al., 2016). Interestingly, expanding the perspective on the literature on apps to include the adoption of more general information and communication technology (ICTs), the number of studies on their adoption increases (Palau-Saumell, Forgus-Coll, Sánchez-García, & Robres, 2019; Song, Baker, Wang, Choi, & Bhattacharjee, 2018).

Studies investigating the adoption of ICTs have primarily applied different theoretical models and theories (Palau-Saumell et al., 2019), such as the theory of reasoned action (TRA), the theory of planned behavior (TPB), the technology acceptance model (TAM), the unified theory of acceptance and use of technology (UTAUT) 1 and 2, the innovation diffusion theory (IDT), and the social cognitive theory (SCT) (Song et al., 2018). The TRA has been developed to study human behavior from a social psychology perspective by considering one's feeling toward a specific behavior (attitude) and their perception regarding other people's perspective about that specific behavior (subjective norms; Kang, Ha, & Hambrick, 2015). According to the TPB (Ajzen, 1991), people are likely to carry out a particular type of behavior if they believe it will lead to a valued outcome (attitude), their important referents will value and approve of the behavior (subjective norms), and they have the necessary resources, abilities, and opportunities to perform such behavior (perceived behavioral control) (Quintal et al., 2010). Expanding on the TRA and TPB, Davis' (1989) technology adoption model (TAM) aims at predicting users' intention to use emerging technology (Kang et al., 2015). The TAM has been largely used to analyze why and how people decide to adopt emerging technology (Kang et al., 2015). This model is based on two main constructs: perceived usefulness and perceived ease. Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her performance" (Davis, 1989, p. 320), and perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). In other words, a user would be more prone to accept and use technology if it is perceived as easy to use and useful (Kang et al., 2015). However, this model has been criticized by several authors highlighting the impossibility for the two variables to address other important psychological factors that may influence users' decisions to adopt technology as a limitation (Kang et al., 2015; Park, Kim, Shon, & Shim, 2013). Accordingly, researchers tried to extend the TAM by introducing additional constructs from different theories (Kang et al., 2015). The UTAUT-1 introduces four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions (Palau-Saumell et al., 2019). The latter construct influences technology use, while the first three constructs affect the intention to use new technology (Palau-Saumell et al., 2019). These relationships are moderated.
by several additional variables such as gender, age, experience, and voluntariness of use (Palau-Saumell et al., 2019). Switching from simple user to consumer perspective, the UTAUT-2 was developed by introducing three new variables (Palau-Saumell et al., 2019). The first two variables are hedonic motivation and price value, and they influence the intention to use; the third variable is a habit that can influence both the intention to use and actual usage (Palau-Saumell et al., 2019).

The UTAUT-2 suggests a significant relationship between facilitating conditions and the intention to use. Changing from the simple user to consumer perspective suggests further modifications regarding the UTAUT-1, particularly, considering that “in the consumer environment consumption is always voluntary, UTAUT-2 eliminates voluntariness of use as a moderating variable. Instead, it introduces experience as a moderator in the relationship between intentions to use and usage” (Palau-Saumell et al., 2019, p. 23). Finally, the UTAUT-2 suggests that the intention to use a technology is influenced by performance expectancy, effort expectancy, social influence, hedonic motivation, price value, and habit; at the same time, the actual usage is mainly influenced by the intentions to use, facilitating conditions, and habit (Palau-Saumell et al., 2019). An additional theory that has been often used in ICTs literature is the IDT (Song et al., 2018). This theory includes variables such as relative advantage (of economic gains or perceived convenience), complexity (of the necessary effort), compatibility (with users’ values, needs, and experience), observability (the degree to which innovation products are visible to others), and trialability (the degree to which products are experimented with before adoption) (Song et al., 2018; Min, So, & Jeong, 2019, based on Rogers, 1995, pp. 212–251).

When focusing on technology adoption, the IDT suggests that social status is a major motivational driver (Fan, Wu, Mattila, & Yang, 2019). For example, the adoption of mobile technology innovation can help users enhance their self-image and status (Choi & Kim, 2016), even within their social network (Graf-Vlachy, Buhtz, & König, 2018). Finally, the SCT suggests that in the context of innovation acceptance, the individual judgments of a person’s capabilities to perform a behavior (self-efficacy) and the perceived value are two key drivers of users’ behavior (Zhu, So, & Hudson, 2017).

Returning to mobile adoption literature, a limited number of studies attempt to understand the adoption behavior of different mobile devices and services (Hallikainen, Alamäki, & Laukkanen, 2019). Studies on the adoption of new technology show that the integration of multiple theories can further strengthen the study on users’ behavior (Kang et al., 2015). We propose a systematic review of literature on mobile adoption literature to identify suggestions for further research to support the spread of disaster mobile apps among tourists. Following this perspective, we conduct our review with the aim to identify different theories and factors that have been previously considered to increase the users’ motivation/intention to download mobile applications. According to the scoping review process (see Tan et al. (2017), based on Arksey & O’Malley (2005)), we identified a broad research question: “Can the literature on the promotion of mobile applications contribute to facilitating the spread of disaster-management apps among tourists?” Following this initial question and according to the scoping process, we formulated two further questions: “Does the literature on mobile application adoption consider the promotion of disaster apps among tourists? What can we learn from mobile application literature to identify suitable promotion strategies for tourist-oriented disaster management apps?”

### 3. Methodology

The scoping review process has been selected as methodology as it has been previously used to frame the nature of existing literature on information systems, software engineering, and technology adoption (Tan et al., 2017). After considering the initial broader question and the following more detailed questions, we (i) identified the relevant studies, (ii) selected the articles to be included in the review, (iii) charted the data, and (iv) analyzed and collated the results (Arksey and O’Malley, 2005; Tan et al., 2017).

The analysis of the literature has been conducted by considering peer-reviewed articles published in SCOPUS. Only documents in English have been considered. The search covered the period from 2003 until the end of 2019. Search criteria included the combination of the following keywords: ‘mobile application’ AND ‘intention’; ‘mobile application’ AND ‘motivation’; ‘mobile application’ AND ‘download’; ‘mobile application’ AND ‘adoption’; ‘mobile application’ and ‘marketing’.

The final result included 561 articles. The study is focusing on the adoption process of the disaster mobile applications, rather than considering their use of their contents. Therefore, the Inclusion Criteria consists of considering only those articles that were focusing on the factors able to increase the users’ motivation/intention to download mobile applications (see Table 1). After considering the Inclusion Criteria, the total amount of articles has been reduced to 148. After removing duplicates, the total number of articles was reduced to 93. Table 1 summarizes the literature search process and results. Table 2 indicates the articles included in this review.

Table 1: Summary of the literature search results (2003–2019).

| Initial search criteria results | SCOPUS |
|-------------------------------|--------|
|                             | 1st Result | After Exclusion Criteria |
| ‘mobile application’ AND ‘intention’ | 137 | 41 |
| ‘mobile application’ AND ‘motivation’ | 118 | 15 |
| ‘mobile application’ AND ‘download’ | 36 | 8 |
| ‘mobile application’ AND ‘adoption’ | 161 | 59 |
| ‘mobile application’ AND ‘marketing’ | 112 | 19 |
| Total | 561 | 148 |

* Inclusion Criteria: Focusing on factors that may increase the users’ motivation/intention to download mobile applications.

### 4. Results

#### 4.1. Publications trends: number per years and main topics

The first attempts to investigate users’ adoption of apps occurred in 2007/2008 (Fig. 1). However, only after 2013 did the annual number of contributions on this topic consistently increase, reaching the highest point so far in 2019 with 31 articles.

Considering the journals that have published articles on this topic (Fig. 2), multidisciplinary interest on the topic emerges. Articles have been published by journals that primarily focus on information...
| N. | Year | Title | Journal | Authors |
|----|------|-------|---------|---------|
| 1  | 2019 | Does the digital footprint act as a digital asset? – Enhancing brand experience through remarketing | International Journal of Information Management | Arya, V., Sethi, D., Paul, J. |
| 2  | 2019 | Examining an extended technology acceptance model with experience construct on hotel consumers' adoption of mobile applications | Journal of Hospitality Marketing and Management | Huang, Y.-C., Chang, L.L., Yu, C.-P., Chen, J. |
| 3  | 2019 | Time, money, or convenience: what determines Chinese consumers’ continuance usage intention and behavior of using tourism mobile apps? | International Journal of Culture, Tourism, and Hospitality Research | Xu, F., Huang, S., Li, S. |
| 4  | 2019 | A study of consumer perception towards mobile wallets | International Journal of Scientific and Technology Research | Sharma, D., Aggarwal, D., Gupta, A. |
| 5  | 2019 | Consumer adoption of the Uber mobile application: Insights from diffusion of innovation theory and technology acceptance model | Journal of Travel and Tourism Marketing | Min, S., So, K.K.F., Jeong, M. |
| 6  | 2019 | An analysis of the factors affecting mobile commerce adoption in developing countries: Towards an integrated model | Review of International Business and Strategy | Tan, A.K.Y. |
| 7  | 2019 | A systematic literature review and analysis on mobile apps in m-commerce: Implications for future research | Electronic Commerce Research and Applications | Roh, M., Park, K. |
| 8  | 2019 | Adoption of O2O food delivery services in South Korea: The moderating role of moral obligation in meal preparation | International Journal of Information Management | Chen, Q., Lu, Y., Gong, Y.Y., Tang, Q. |
| 9  | 2019 | Why do users resist service organization's brand mobile apps? The force of barriers versus cross-channel synergy | International Journal of Information Management | Hallikainen, H., Almáni, A., Laukkanen, T. |
| 10 | 2019 | Lead users of business mobile services | Journal of Surgical Education | Eaton, M., Scully, R., Schuller, M., (…), Fryer, J.P., Meyerson, S.L. |
| 11 | 2019 | Value and Barriers to Use of the SIMPL Tool for Resident Feedback | Computers in Human Behavior | Stoechi, L., Michaelidou, N., Micevski, M. |
| 12 | 2019 | The reasons why elderly mobile users adopt ubiquitous mobile social service | Journal of Continuing Education in the Health Professions | Ali, M.M., Maideen, M.B.H. |
| 13 | 2019 | Adoption and Use of Mobile Learning in Continuing Professional Development by Health and Human Services Professionals | Journal of Product and Brand Management | Arora, N., Malik, G., Chawla, D. |
| 14 | 2019 | Drivers and outcomes of branded mobile app usage intention | International Journal of Recent Technology and Engineering | Fardi, M.H., Marvi, R. |
| 15 | 2019 | A study on factors influencing the adoption of a crowdsourcing mobile application among generation Y and Z in Maldives | Global Business Review | Kuo, T.-S., Huang, K.-C., Nguyen, P.H. |
| 16 | 2020 | User acceptance of mobile apps for restaurants: An expanded and extended UTAUT2 | Sustainability | Mahardika, H., Thomas, D., Bwong, M.T., Taputra, A. |
| 17 | 2020 | Determinants of m-ticketing adoption using smartphone app among IT employees of Bengaluru city-an extended UTAUT2 approach | International Journal of Business Innovation and Research | Palau-Saumell, R., Forgas-Coll, S., Sánchez-García, J., Robres, E. |
| 18 | 2020 | Extended expectation-confirmation model to predict continued usage of ODR/ride hailing apps: role of perceived value and self-efficacy | Information Technology and Tourism | Ahmed, K.A., Kranthi, A.K. |
| 19 | 2020 | Examining the Antecedents and Consequences of Customers’ Trust Toward Mobile Retail Apps in India | Journal of Internet Commerce | Malik, G., Rao, A.S. |
| 20 | 2020 | Does “hospital loyalty” matter? Factors related to the intention of using a mobile app | Patient Preference and Adherence | Kaushik, A.K., Mohan, G., Kumar, V. |
| 21 | 2020 | User acceptance of emergency and disaster response mobile application in the Philippines: An investigation based on the unified theory of acceptance and use of technology model | International Journal of Enterprise Information Systems | Lin, Y.-H., Guo, J.-L., Hsu, H.-P., (…), Fu, Y.-L., Huang, C.-M. |
| 22 | 2020 | Acceptance of a mobile-based educational application (LabSafety) by pharmacy students: An application of the UTAUT2 model | Education and Information Technologies | Ameri, A., Khajouei, R., Ameri, A., Jahani, Y. |
| 23 | 2020 | The Joint Impacts of need for Status and Mobile Apps’ Social Visibility on Hotel Customers’ Behavioral Intentions | International Journal of Hospitality and Tourism Administration | Fan, A., Wu, L., Mattila, A.S., Yang, W. |
| 24 | 2018 | Continued use intention of lifestyle mobile applications: the Starbucks app in Taiwan | Electronic Library | Hsiao, K.-L., Lin, K.-Y., Wang, Y.-T., Lee, C.-H., Zhang, Z.-M. |
| 25 | 2018 | Updates management in mobile applications: iTunes versus Google Play | Journal of Economics and Management Strategy | Comino, S., Manenti, F.M., Mariuzzo, F. |
| 26 | 2018 | Explaining user experience in mobile gaming applications: an fsQCA approach | Internet Research | Pappas, I.O., Mikalef, P., Giannakos, M.N., Kourouthanassis, P.E. |
| 27 | 2018 | E-business evolution: an analysis of mobile applications’ business models | Technology Analysis and Strategic Management | Cristofaro, M. |
| 28 | 2018 | The effects of human-game interaction, network externalities, and motivations on players’ use of mobile casual games | Industrial Management and Data Systems | Molinillo, S., Muñoz-Leiva, F., Pérez-García, F. |
| 29 | 2018 | Acceptance and usage of a mobile information system services in University of Jordan | Education and Information Technologies | Almaitah, M.A. |
| N. | Year | Title                                                                 | Journal                                | Authors                                      |
|----|------|----------------------------------------------------------------------|----------------------------------------|----------------------------------------------|
| 34 | 2018 | Adoption of E-Government Applications for Public Health Risk Communication: Government Trust and Social Media Competence as Primary Drivers | Journal of Health Communication       | Park, H., Lee, T.D.                           |
| 35 | 2018 | Evaluating Consumers' Adoption of Mobile Technology for Grocery Shopping: An Application of Technology Acceptance Model | Vision                                  | Shukla, A., Sharma, S.K.                     |
| 36 | 2018 | The moderating role of device type and age of users on the intention to use mobile shopping applications | Technology in Society                  | Natarajan, T., Balasubramanian, S.A., Kasilingam, D.L. |
| 37 | 2018 | Platform adoption by mobile application developers: A multitudinal approach, | Decision Support Systems                | Song, J., Baker, J., Wang, Y., Choi, H.Y., Bhattacharjee, A. |
| 38 | 2018 | Exploring undergraduate students' usage pattern of mobile apps for education | Journal of Librarianship and Information Science | Wai, I.S.H., Ng, S.S.Y., Chiu, D.K.W., Ho, K.W.K., Lo, P. |
| 39 | 2018 | An empirical study on customer adoption of mobile payment application in India | International Journal of Enterprise Network Management | Joseph, J., Serinam, K., Rodrigues, L.L.R., Mathew, A.O., Gana, K.C. |
| 40 | 2018 | Willingness to pay and disposition toward paying for apps: The influence of application reviews | International Journal of E-Services and Mobile Applications | Farmer, C.P., Zinko, R.A.                     |
| 41 | 2018 | What drives users' intentions to purchase a GPS Navigation app: The moderating role of perceived availability of free substitutes | Internet Research                      | Wang, Y.-Y., Lin, H.-H., Wang, Y.-S., Shih, Y.-W., Wang, S.-T. |
| 42 | 2018 | Users' acceptance of innovative mobile hotel booking trends: UK vs. PRC | Information Technology and Tourism      | Tsao, M., Nawaz, M.Z., Nawaz, S., Butt, A.H., Ahmad, H. |
| 43 | 2018 | A focus group study observing maternal intention to use a WIC education app | American Journal of Health Behavior     | Friedman, B.L., Silva, M., Smith, K.          |
| 44 | 2018 | Factors affecting acceptance of mobile library applications: Structural equation model | Libri                                   | Rafique, H., Anwer, F., Shamim, A., (…), Qureshi, M.A., Shamsir, S. |
| 45 | 2018 | A bidirectional perspective of trust and risk in determining factors that influence mobile app installation | International Journal of Information Management | Chin, A.G., Harris, M.A., Brookshire, R.      |
| 46 | 2018 | Factors affecting tablet computer users' intention to purchase mobile applications | Journal of Marketing Management         | Lee, S., Park, E.-A., Cho, M., Jin, B.       |
| 47 | 2018 | The rules of engagement: how to motivate consumers to engage with branded mobile apps | Journal of Applied Economics            | Stoechi, I., Michaelidou, N., Pourazad, N., Mivekisi, M. |
| 48 | 2018 | Analysing customer behaviour in mobile app usage among the representatives of generation X and generation Y | Telematics and Informatics              | Bensak, A., Machová, R., Zigmund, T.         |
| 49 | 2018 | The role of regulatory focus in decision making of mobile app downloads: A study of Chinese college students | Advanced Science Letters                | Zhang, C., Ha, L., Liu, X., Wang, Y.         |
| 50 | 2018 | Analysis of behavioral intention of mobile application usage using partial least squares | Sustainability                         | Tanakijintal, G.H., Sondoh, S.L., Alfred, R., Andrias, R.M. |
| 51 | 2018 | The behavioral response to Location Based Services: An examination of the influence of social and environmental benefits, and privacy | Service Industries Journal              | Narte, B., Mahmoud, M.A., Amoh, S.           |
| 52 | 2018 | Mobile customer behavioural intentions towards mobile money services adoption in Ghana | Journal of Health Communication         | Lin, T.T., Bautista                          |
| 53 | 2018 | Understanding the Relationships between mHealth App Characteristics, Trialability, and mHealth Literacy | Journal of Information Technology Education: Research | Frandes, M., Delácí, A.V., Timar, B., Luneanu, D. |
| 54 | 2017 | Instrument for assessing mobile technology acceptability in diabetes self-management: A validation and reliability study | International Journal of Contemporary Hospitality Management | Zhu, G., So, K.K.F., Hudson, S.             |
| 55 | 2017 | A proposed framework to understand the intrinsic motivation factors on university students' behavioral intention to use a mobile application for learning | Journal of Information Technology Education: Research | Shroff, R.H., Keyes, C.J.                   |
| 56 | 2017 | Apps for academic success: Developing digital literacy and awareness to increase usage | Education for Information                | Camuel, R., Mackenzie, E., Senior, A., Torabi, N. |
| 57 | 2017 | E-grocery supply chain management enabled by mobile tools | Business Process Management Journal     | Cagliano, A.C., De Maro, A., Rafele, C.       |
| 58 | 2017 | Determinants of citizens' mobile apps future use in Chinese local governments: An analysis of survey data | Transforming Government: People, Process and Policy | Reddick, C.G., Zheng, Y.                     |
| 59 | 2017 | Driver behavior with a smartphone collision warning application – A field study | Safety Science                          | Botzer, A., Musicant, O., Perry, A.          |
| 60 | 2017 | Mobile applications: Integrated user acceptance model | Advanced Science Letters                | Emergentias, N.F., Sarwono, B., Eriyanto, E., Irwansyah, I. |
| 61 | 2017 | Understanding usage intention in innovative mobile app service: Comparison between millenial and mature consumers | Computers in Human Behavior             | Hur, H.J., Lee, H.K., Choo, H.J.            |
| 62 | 2017 | Determinants of intention to use the mobile banking apps: An extension of the classic TAM model | Spanish Journal of Marketing - ESIC     | Muñoz-Leiva, F., Climent-Climent, S., Lébana-Cabanillas, F. |
| 63 | 2017 | Determinants of intention to use food delivery apps | Social Behavior and Personality          | Lee, E.-Y., Lee, S.-B., Jeon, Y.J.J.        |
| 64 | 2017 | Mobile applications in crisis informatics literature: A systematic review | International Journal of Disaster Risk Reduction | Tan, M.L., Prasanna, R., Stock, K., (…), Leonard, G., Johnston, D. |
| 65 | 2017 | The impact of initial experience and user attachment on application downloads: Information-seeking and -sharing applications | Internet Research                      | Son, J.                                     |
| 66 | 2017 | An adoption framework for mobile augmented reality games: The case of Pokémon Go | Computers in Human Behavior             | Raушкин, P.A., Rossmann, A., tom Dieck, M.C. |
| 67 | 2016 | Understanding the impact of personality traits on mobile app adoption - Insights from a large-scale field study | Computers in Human Behavior             | Xu, R., Frey, R.M., Fleisch, E., Hic, A.     |
| 68 | 2016 | Factors affecting stickiness and word of mouth in mobile applications | Journal of Research in Interactive Marketing | Kim, S., Bæsk, T.H., Kim, Y.-K., Yoo, K.    |
| 69 | 2016 | Why Don't Farmers Use Cell Phones to Access Market Prices? Technology Affordances and Barriers to Market Information Services Adoption in Rural Kenya | Information Technology for Development | Wyche, S., Steinfield, C.                  |
| 70 | 2016 | (continued on next page) | (continued on next page)               | (continued on next page)                     |
| N.  | Year | Title                                                                 | Journal                                                                                   | Authors                        |
|----|------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------|
| 71 | 2016 | Modeling guests' intentions to use mobile apps in hotels: The roles of personalization, privacy, and involvement | International Journal of Contemporary Hospitality Management                             | Morosan, C., DeFranco, A.     |
| 72 | 2016 | Identifying factors influencing consumers' intent to install mobile applications | International Journal of Information Management                                           | Harris, M.A., Brookshire, R., Chin, A.G. |
| 73 | 2016 | User acceptance of tourism and hospitality mobile applications in Indonesia | Journal of Marketing                                                                    | Irmayyah, I., Triputra, P.    |
| 74 | 2017 | The implications of offering free versions for the performance of paid mobile apps | Journal of Business Research                                                             | Arora, S., Hofstede, F.T., Mahajan, V. |
| 75 | 2015 | Users' adoption of mobile applications: Product type and message framing's moderating effect | Journal of Textile and Apparel, Technology and Management                              | Shen, G.C.-C.                 |
| 76 | 2015 | Willingness to use fashion mobile applications to purchase fashion products: A comparison between the United States and South Korea | Journal of Hospitality and Tourism Technology                                             | Moon, E., Domina, T.          |
| 77 | 2015 | Mobile application for the timeshare industry: The influence of technology experience, usefulness, and attitude on behavioral intentions | Journal of Hospitality and Tourism Technology                                             | Rivera, M., Gregory, A., Cobos, L |
| 78 | 2015 | Identifying factors in influencing consumers' intent to install mobile applications | Journal of Information Management                                                       | Harris, M.A., Brookshire, R., Chin, A.G. |
| 79 | 2015 | What catalyzes mobile apps usage intention: An empirical analysis | Industrial Management and Data Systems                                                  | Arora, S., Hofstede, F.T., Mahajan, V. |
| 80 | 2015 | A mixed-method approach to exploring the motives of sport-related mobile applications among college students | Journal of Sport Management                                                             | Arora, S., Hofstede, F.T., Mahajan, V. |
| 81 | 2015 | What drives purchase intention for paid mobile apps? An expectation confirmation model with perceived value | Electronic Commerce Research and Applications                                             | Arora, S., Hofstede, F.T., Mahajan, V. |
| 82 | 2015 | Mobile banking applications: Consumer behaviour, acceptance and adoption strategies in Johannesburg, South Africa (RSA) | Mediterranean Journal of Social Sciences                                                | Arora, S., Hofstede, F.T., Mahajan, V. |
| 83 | 2015 | Mobile application for the timeshare industry: The influence of technology experience, usefulness, and attitude on behavioral intentions | Journal of Hospitality and Tourism Technology                                             | Rivera, M., Gregory, A., Cobos, L |
| 84 | 2014 | Identifying factors in influencing consumers' intent to install mobile applications | Journal of Information Management                                                       | Harris, M.A., Brookshire, R., Chin, A.G. |
| 85 | 2014 | What catalyzes mobile apps usage intention: An empirical analysis | Industrial Management and Data Systems                                                  | Arora, S., Hofstede, F.T., Mahajan, V. |
| 86 | 2014 | A mixed-method approach to exploring the motives of sport-related mobile applications among college students | Journal of Sport Management                                                             | Arora, S., Hofstede, F.T., Mahajan, V. |
| 87 | 2014 | What drives purchase intention for paid mobile apps? An expectation confirmation model with perceived value | Electronic Commerce Research and Applications                                             | Arora, S., Hofstede, F.T., Mahajan, V. |
| 88 | 2014 | Mobile banking applications: Consumer behaviour, acceptance and adoption strategies in Johannesburg, South Africa (RSA) | Mediterranean Journal of Social Sciences                                                | Arora, S., Hofstede, F.T., Mahajan, V. |
| 89 | 2013 | Concerns vital for mobile CRM in banking: A qualitative study | International Journal of Electronic Customer Relationship Management                  | Arasht, P., Sangle, P.S.     |
| 90 | 2013 | Comparing mobile and internet adoption factors of loyalty and satisfaction with online shopping consumers | International Journal of e-Business Research                                             | Amoroso, D.L., Ogawa, M.     |
| 91 | 2013 | Bon appetít for apps: Young American consumers' acceptance of mobile applications | Journal of Computer Information Systems                                                   | Yang, H.C.                   |
| 92 | 2007 | Why won't consumers adopt m-commerce? an exploratory study | Journal of Internet Commerce                                                           | Kwon, J.M., Bae, J.-S., Blum, S.C. |
| 93 | 2007 | Young Australians’ perceptions of mobile phone content and information services: An analysis of the motivations behind usage | Journal of Internet Commerce                                                           | O'Doherty, K., Maio Mackay, M., Rao, S. |
technology, health, psychology, social behavior, and tourism. However, only four journals have published more than two articles on the topic. These studies include different topics, with articles focusing on mobile apps in the tourism industry on the rise; 20 tourism studies are included in this review (Table 3; Fig. 3). These articles are generally published by tourism-oriented journals, except for journals such as Sustainability (2 articles), International Journal of Information Management (1), Journal of Business Economics and Management (1), International Journal of Enterprise Information Systems (1), and Social Sciences (1).

Other relevant topics include mobile commerce (m-commerce) in branded apps (12 publications); health-related apps (9 publications); mobile services apps (9 publications, including private and public services); educational-purpose apps (5 publications); food-related apps (4 publications); retail apps (4 publications); bank services apps (3 publications); gaming apps (3 publications); and barcode, crowdsourcing, GPS, and sport apps (1 publication each). In this review we also found two articles focusing on disaster management, one of which considers tourism industry dynamics. In this study, it has been considered a tourism-oriented publication (see Fig. 3 and Table 3).

Fig. 1. Publications per year (2003–2019).

Fig. 2. Publications per journal
Note: Only four journals have published more than two articles on the topic (International Journal of Information Management, six articles; Computers in Human Behavior, four articles; Internet Research, three articles; Journal of Hospitality and Tourism Technology, three articles).
| Year | Title                                                                 | Journal                                                                 | Authors                                                                 | Typology                        |
|------|----------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------|---------------------------------|
| 2019 | Examining an extended technology acceptance model with experience construct on hotel consumers' adoption of mobile apps | Journal of Hospitality Marketing and Management                           | Huang, Y.-C., Chang, L.L., Yu, C.-P., Chen, K.-L. | Tourism Apps                  |
| 2019 | Tourism apps: A synthesis of research and future directions          | International Journal of Culture, Tourism, and Hospitality Research     | Xie, F., Hsiung, S., Li, S.                                         | Tourism Apps                  |
| 2019 | Consumer adoption of tourism mobile application: Insights from diffusion of innovation theory and technology acceptance model | Journal of Travel and Tourism Marketing                                 | Min, S., Soo, K.K.F., Jeong, M.                                     | Tourism Apps                  |
| 2019 | Adoption of mobile applications for identifying tourism destinations by travelers: An integrative approach | Journal of Business Economics and Management                            | Kuo, T.-S., Huang, K.-C., Nguyen, P.H.                               | Tourism Apps                  |
| 2019 | User acceptance of mobile apps for restaurants: An expanded and extended UTAUT-2 model | Sustainability Palau-Saumell, R., Forgas-Coll, S., Sánchez-García, J., Robres, E. |                                   | Tourism Apps                  |
| 2019 | Extended expectation confirmation model to predict continued usage of ODR/ride hailing apps: An empirical study on Chinese consumers | Information Technology and Tourism                                     | Malik, G., Rao, A.S.                                                | Tourism Apps                  |
| 2019 | User acceptance of emergency and disaster response mobile application in the Philippines: An exploratory study | International Journal of Enterprise Information Systems                | Orong, M.Y., Hernandez, A.A.                                       | Tourism Apps                  |
| 2019 | The Joint Impacts of need for status and mobile apps’ social visibility on hotel customers’ behavioral intentions | International Journal of Hospitality and Tourism Administration          | Fan, A., Wu, L., Martilla, A.S., Yang, W.                            | Tourism Apps                  |
| 2019 | Mobile applications in the hospitality industry | Journal of Hospitality and Tourism Technology                           | Kwon, J.M., Bae, J.-I.S., Blum, S.C.                                | Tourism Apps                  |
| 2019 | User acceptance of tourism and hospitality mobile applications in Indonesia | Journal of Hospitality and Tourism Technology                           | Im, J.Y., Hancer, M.                                                | Tourism Apps                  |
| 2019 | Mobile Technology: An Exploratory Study of Hotel Managers' Use of Mobile Technology | Journal of Convention and Event Tourism Management                     | Lee, S.S., Lee, C.H.                                               | Tourism Apps                  |
| 2018 | Shaping travelers’ attitude toward travel mobile applications | Journal of Hospitality and Tourism Technology                           | Kong, J.M., Bae, J.-I.S., Blum, S.C.                                | Tourism Apps                  |
4.2. Geographical spread of the studies

The geographical spread of the studies is summarized in Fig. 4, which includes participants’ nationality (when indicated). Fig. 4 includes the analysis of four periods (2003–2016/2017/2018/2019) and a general summary of the whole period 2003–2019. Results suggest that the highest number of investigations consider the behavior of users from Asian/Pacific countries (40 publications since 2003), led by India with nine publications. However, the US is the most investigated country (20 publications since 2003), which is largely due to the

Note: The Tourism Apps category includes one paper that is focusing on Disaster Management.

Fig. 3. Relevant topics
Note: The Tourism Apps category includes one paper that is focusing on Disaster Management.

Fig. 4. Geographical spread of the studies.
geographical demographics of the 2003–2016 period (12 US-focused publications). From 2017 to 2019, studies focusing on Asia/Pacific and Europe increased, while Oceania, Africa, and the Middle East remain underrepresented, and no Central or South American studies have been conducted.

4.3. Methodologies, theories, and variables

Most studies included in this review adopted a quantitative methodology (84%), followed by the mixed-method (10%), qualitative (4%), and literature review (2%; see Fig. 5). This a relatively recent area of investigation and academics approached this topic by preferring quantitative methodologies.

Fig. 6 summarizes the theories that have been used to analyze this new and under-investigated research area. Our study confirmed the frequent use of classical theories such as the TAM, to which at least 36 articles refer, adapt to different settings, and extend by including additional variables. Consistent with studies on ICTs adoption, our findings also confirmed that authors tend to consider theories such as the IDT, UTAUT-1 and -2, SCT, TRA, and TPB. Our systematic approach facilitated the identification of further theories that have been adopted in these studies, including original models developed by authors combining elements from multiple theories. As discussed in the following section, the analysis of the application of these conceptual models can be used to consider new variables and identify new research paths to promote disaster apps among tourists. In particular, our results include studies that have considered the following theories: theory of personal innovativeness (TPI); complexity theory; configuration theory; theory of resistance; motivation scale for sport online consumption (MSSOC); service quality model (SERVQUAL); information system success (ISS) model; e-commerce adoption model (EAM); mobile services acceptance model; information adoption model (IAM); theory of citizens initiated
contacts with government; flow theory; media richness theory; theory of affordances; signaling theory; word of mouth (WoM); expectation-confirmation model; regulatory focus theory; value-based adoption model; perceived value theory; personalization privacy theory; uncertainty reduction theory; uses and gratification theory; network externality (NeS) paradigm; and conspicuous consumption theory.

Literature suggests that mobile application adoption is an innovative behavior (Hallikainen et al., 2019). The TPI has been used to evaluate the adoption of business mobile services, and its results suggest that to the primary factors for adopting the mobile application are job level (e.g., higher for senior management) and the relative perceived importance of mobile applications and social media in work-related contexts (Hallikainen et al., 2019). However, the complexity theory and configuration theory suggest that users’ decision to adopt any type of app may be influenced by alternative sets of causal conditions (Pappas, Mikalef, Giannakos, & Kourouthanassis, 2019). According to the complexity theory, relations among variables are complex and depending on their combination; users may download an economically convenient app even if they are unsatisfied with its content (Pappas et al., 2019). At the same time, due to the concept of causal asymmetry included in the configuration theory, users may decide to download very expensive apps due to a combination of other valuable factors (e.g., higher perceived content quality; Pappas et al., 2019). Individual perceptions of a specific app may vary by person (Yang & Lin, 2019), as some users may decide to adopt the mobile application, while other groups of potential users may resist. According to the theory of resistance, resistors are divided in three categories: postponers who decide to delay adoption until a more suitable time; opponents who have a more negative attitude toward adoption of new technology; and rejecters who reject the adoption the innovation (Chen, Lu, Gong, & Tang, 2019). Depending on apps’ typology, several perspectives and variables have been considered to facilitate the adoption of mobile applications (see Table 4).

All mobile applications need to improve users’ experience. Improving users’ experience requires their involvement from a holistic perspective (Rauschnabel, Rosmann, & tom Dieck, 2017). According to flow theory, flow is an important construct that involves the user and influences technology and media use (Webster, Trevino, & Ryan, 1993). Mobile applications must be promoted by guaranteeing users perceived full control over the environment, a clear understanding about app usage, and avoiding distraction during use (Rauschnabel et al., 2017). The experience may be also enriched by improving the interactivity of the media, facilitating communication with other users by using pictures, texts, videos, and sounds (Yang & Lin, 2019). According to the media richness theory, mobile application richness is also influenced by users’ subjective perception of media richness, which is the number of functions guaranteed by the app. To facilitate users’ adoption and use, innovative mobile applications should be intuitive and perceived as affordable, as suggested by the theory of affordances (Wyche & Steinfield, 2016).

The benefits generated by the adoption of mobile applications should be highlighted by conducting a marketing campaign among citizens (Reddick & Zheng, 2017). Positive results may be facilitated by reputational information. Based on the signaling theory, Shen (2015) demonstrated that depending on app type and perceived level of risk related to its use, users tend to change their attitude toward downloading and using the app. When apps focus on hedonic products/services and their adoption is perceived as low risk, the most important reputational driver is the app popularity. Users’ experience is the main factor in the case utilitarian products/services and perceived high-risk conditions. Lacking reputational information, a good strategy is represented by WoM, in which consumers who previously used the mobile application relate their experience to others with similar needs. The expectation-confirmation model has been used to introduce the concept of habit, which means the automatic performance of a behavior after learning the mobile application’s characteristics and use (Limayem, Hirt, & Cheung, 2007). To facilitate this learning process, a try-before-you-buy strategy has been suggested to encourage users to use the app (Hsu & Lin, 2015). To promote by WoM or a try-before-you-buy strategy, app developers may face two macro-categories of users to be contacted: “promotion-focused” and “prevention-focused consumers” (Zhang, Li, Liu, & Wang, 2018).

According to the regulatory focus theory, the promotion-focused consumers’ behavior is generally influenced by the evaluation of benefits generated by the adoption of the app, while, the prevention-focused consumers focus on avoiding negative consequences (Zhang et al., 2018). The promotion-focused consumers tend to test multiple app typologies to check their benefits; the prevention-focused consumers reduce the number of apps to reduce the risk of loss (Zhang et al., 2018). Generally, according to the value-based adoption model, users will evaluate the benefits and the sacrifices that will derive from the decision to download the app (Kim, Chan, & Gupta, 2007; Wang, He et al., 2018; Wang, Lin, Wang, Shih & Wang, 2018). Perceived value theory suggests considering all perceived benefits, perceived costs, and how they influence the perceived value of the mobile application (Zhu et al., 2017). Several previous contributions tried to categorize benefits and costs (see Table 5).

According to the uncertainty reduction theory, people that need to pay to adopt a mobile application may need to reduce their perceived uncertainty regarding the apps’ ability to meet their needs (Furner & Zinko, 2018). The uses and gratification theory suggests that the attitude towards performing a behavior, such as adopting a mobile application, is positively influenced by the satisfaction of previous expectations (Molina, Muñoz-Leiva, & Pérez-García, 2018). Identifying the

### Table 4

| Apps’ typology                  | Main Variables                                                                 |
|---------------------------------|---------------------------------------------------------------------------------|
| **Sport-related App (m-sport)** | As explained by the MSSOC (Kang et al., 2015), "fanship" is a unique and important driver to join and use m-sport applications. M-commerce adoption has been investigated in developing countries by integrating the UTAUT-2 with SERVQUAL model’s constructs, including system, service, and information quality (Tarhini, Alawan, Shammout, & Al-Radi, 2019), which significantly affect users’ satisfaction, according to the ISS model adopted by Hsiao, Lin, Wang, Lee, and Zhang (2019). The IAM (Moon & Domina, 2015) highlights the importance of developing innovative mobile applications that consider how users’ cultures may affect their personal needs, expectations, and approaches to technology. |
| **Mobile-commerce (m-commerce)**| Mobile-commerce applications have been analyzed by using the mobile services acceptance model. This model extends the TAM with four additional variables: trust, personal characteristics and features, context, and perceived security, and the most significant constructs included in the model are trust, perceived ease of use, and perceived usefulness (Almahia, 2018). The TAM has been adopted to analyze users’ perceptions of the usefulness of information (Fard & Marvi, 2019). Three variables seem to influence it: argument quality, source credibility, and quantity of information (Fard & Marvi, 2019; Gunawan & Huang, 2015). Focusing on information provided by mobile applications, the quality of the information is the primary behavioral factor, followed by source credibility and quantity of information (Fard & Marvi, 2019). Mobile-government apps may contribute to improving the destinations’ governance (Gill-Garcia, Helbig, & Ojo, 2018; Reddick & Zheng, 2017). According to the theory of citizens initiated contacts with government, m-government apps should allow the government to obtain user information in exchange for guaranteeing a positive experience (Reddick & Zheng, 2017). |
motivational factors that influence the decision to adopt an app is fundamental to promote the media (Molinillo et al., 2018). Motivational factors are generated by social and psychological needs (Rubin, 2009), that are divisible into five categories: cognitive, social integrative, tension-released, affective, and personal integrative (Katz, Blumler, & Gurevitch, 1973; Rauschnabel et al., 2017). Cognitive needs refer to the information gathering to increase personal understanding regarding a specific issue; social integrative needs refer to the role of media in facilitating the creation and maintaining of relationships (e.g., social media); tension-released needs refer to the necessity to find activities (e.g., mobile games) to escape routine life; affective needs refers to all the emotions that people may be interested to feel; personal integrative needs refer to the necessity of people to improve their image and social status (Rauschnabel et al., 2017). Some of these needs are also reported by the Nes paradigm that suggests that the adoption of the mobile application (e.g. m-game) by several users will increase the grade of enjoyment of the single user (Molinillo et al., 2018). The conspicuous consumption theory suggests that conspicuous consumption may satisfy an individual’s need for social status (Fan et al., 2019). The concept of conspicuousness derived by the app usage is consistent with the observability dimension of the IDT (Fan et al., 2019). Those people that have a lower need for social status exhibit lower intention to perform status-seeking behaviors, such as conspicuous consumption (Fan et al., 2019).

5. Discussion

5.1. Mobile application literature vs. disaster mobile application literature

Since the mid-2000s, studies on users’ attitudes and intention to adopt mobile applications are on the rise. This trend is characterized by multisectoral publications. Tourism-oriented publications represent a relevant portion of these studies. Due to the recent interest in the topic, only a few journals have published more than two articles focusing on it. Future research may contribute to further increase tourism-oriented investigations of build-for-disaster-purpose apps.

The geographical spread of the studies on mobile application adoption suggests that the current findings are mainly based on users from Asia/Pacific countries and users from the United States of America. Only recently has the number of studies on European users increased. Further studies need to be developed in Europe to maintain this trend. Additionally, future investigations need to consider users from Oceania, Africa, Middle East, Central and South America. This approach is required because, according to the EAM (Moon & Domina, 2015), different cultures may generate different users’ behaviors. Focusing on disaster apps for tourists, studies involving different cultures and countries are particularly required since international tourists may vary their risk-information seeking and processing (Aliperti & Cruz, 2019). Worldwide, there is a lack of studies specifically focusing on -disaster apps for tourists. Surprisingly, our results do not show any case studies on existing disaster apps for tourists, such as Safety Tips in Japan. Further studies need to focus on existing disaster management mobile applications to analyze users’ perceived benefits and barriers. Finally, tourism destinations more prone to natural disasters (e.g., Australia, New Zealand, etc.) that may benefit from the use of disaster apps for tourists, require more investigations. The development of these studies may contribute to enrich the general literature on mobile application adoption in the under-investigated areas of the globe (e.g. Oceania).

The majority of the studies on mobile application adoption proposes a quantitative methodology. This trend may be justified by the fact that this a pretty recent research area and researchers tended to analyze user’s behavior from a quantitative perspective. However, qualitative research is now required to identify new variables and constructs able to enrich the discussion. Focusing on disaster apps, quantitative studies are still required. Additionally, a comprehensive literature review on mobile informatics (Tan et al., 2017) has already contributed to the discussion on the importance of such apps as tools to improve disaster preparedness. Our literature review contributes to the literature by enriching the knowledge about the dynamics that influence the adoption of mobile apps (Nagai et al., 2020; Tang, 2019), particularly focusing on the disaster management perspective. Also, this article enriches Tan et al.’s (2017) study on mobile informatics by identifying additional opportunities for further research described in the following research agenda.

5.2. Disaster mobile applications: research agenda

The users’ adoption of disaster apps is under-investigated. Further studies may follow the more general mobile application adoption and ICTs adoption literature by considering the primary theories such as the TAM, DIT, UTAUT 1 and 2, SCT, TRA, and TPB. Extended versions of these models and theories can be applied in the specific context of tourism and disaster management. Some variables and constructs to be added to these models emerge from the analysis of our results.

The literature on mobile application adoption shows how the complex relationship between behavioral variables and their causal asymmetry influences the users’ behavior (Pappas et al., 2019). These dynamics, the individual perceptions of apps (Yang & Lin, 2019), and the potential presence of resistors to their adoption (Chen et al., 2019) are also expected to influence the success of disaster apps. The current low use among tourists (Aliperti & Cruz, 2019) supports the idea that many barriers may influence international tourist behavior, facilitating the presence of several opponents or rejectors to the adoption. Further studies need to investigate these dynamics to clearly state which is the tourists’ attitude toward the adoption of this technology.

This approach may help to highlight perceived expectations, benefits, and barriers. The users’ expectations are under-investigated. The application of uncertain reduction theory (Furner & Zinko, 2018), the uses and gratification theory (Molinillo et al., 2018), or the value-based adoption model, seems to be appropriated in this setting since no previous studies on disaster management mobile applications have been developed by considering these fundamental aspects. Identifying the users’ perceived benefits results to be important as, to convince them to adopt mobile applications, it is necessary to highlight and communicate the guaranteed benefits (Reddick & Zheng, 2017). From this perspective, future studies on disaster app adoption should analyze the five categories of motivational factors generated by social and psychological needs: cognitive, affective, social integrative, tension-released, and personal integrative (see Rauschnabel et al., 2017). Focusing on cognitive needs, disaster apps are used to share information, warnings, and alerts (Tan et al., 2017) and they may satisfy a cognitive need. In this
Table 6: Findings, future research, and managerial implications.

| Main findings | Opportunities for future research | Managerial Implications |
|---------------|-----------------------------------|-------------------------|
| 1 | Since the mid-2000s, studies on mobile application adoption are on the rise. | ☑ Further studies are needed to support this trend. | ➢ Built-for-disaster-purpose mobile application developers and promoters need to consider the findings emerging from this literature. |
| 2 | Tourism-oriented studies represent a relevant portion of this literature. | ☑ It is necessary to develop studies on tourism built-for-disaster-purpose mobile application adoption as no previous investigation considers this aspect. | ➢ Built-for-disaster-purpose mobile applications developer and promoter may benefit from this additional tourism- and disaster-focused literature. |
| 3 | Current studies on mobile application adoption mainly focus on Asia/Pacific countries and the United States of America. | ☑ Further studies on mobile application adoption need to focus on European countries, Oceania, Africa, Middle-East, Central, and South America. ☑ Further studies on tourism built-for-disaster-purpose mobile application adoption need to focus on hazard-exposed tourism destinations mainly (e.g., Australia, New Zealand, Japan, etc.). ☑ Further studies on tourism built-for-disaster-purpose mobile application adoption need to analyze the efficacy of existing mobile applications such as, for instance, Safety Tips in Japan. | ➢ Investigations focusing on built-for-disaster-purpose mobile applications may contribute to maintain the increasing trend of the studies on mobile application adoption. ➢ At the same time, these studies may contribute to improve disaster risk management in the tourism industry, taking into consideration cross-countries perspectives. |
| 4 | The majority of the studies on mobile application adoption proposes a quantitative methodology. | ☑ Qualitative research is now required to identify new variables and constructs able to enrich the discussion. ☑ Focusing on built-for-disaster-purpose mobile applications, both quantitative and qualitative studies are required. ☑ A comprehensive literature review on mobile informatics (Tan et al., 2017) has already contributed to enrich the discussion on the importance of built-for-disaster-purpose mobile applications as a tool to improve disaster preparedness. Our literature review enhances Tan et al.’s (2017) contribution by identifying additional opportunities for further research. | ➢ The development of a research agenda focusing on built-for-disaster-purpose mobile applications may contribute to identify essential findings able to support governments and disaster risk managers in the selection of communication tools. |
| 5 | The users’ adoption of built-for-disaster-purpose mobile applications is under-investigated. | ☑ Future studies on built-for-disaster-purpose mobile application adoption need to focus on users’ expectations, perceived benefits, and perceived barriers. Further studies may follow the more general mobile application adoption and ICTs adoption literature by considering main theories such as the TAM, DIT, UTAUT 1 and 2, SCT, TRA, and TPB. | ➢ These studies may support governments and disaster risk managers to identify users’ expectations, perceived benefits, and perceived barriers. |
| 6 | Extended versions of these models and theories can be applied in the specific context of tourism and disaster management. | ☑ Future studies need to consider variables and constructs emerging from interdisciplinary studies focusing on mobile application promotion. | ➢ These studies may support governments and disaster risk managers to refine the promotion of built-for-disaster-purpose mobile applications. |
| 7 | Built-for-disaster-purpose mobile applications can potentially satisfy cognitive needs, affective needs, integrative social needs, tension-released needs, and personal integrative needs. | ☑ Future studies on built-for-disaster-purpose mobile application adoption may consider and analyze these five categories of motivational factors (see Rauschnabel et al., 2017). | ➢ These studies may support governments and disaster risk managers to identify these benefits clearly and to inform the audience about them adequately. |
| 8 | Referring to built-for-disaster-purpose applications, barriers are the complexity of the app, the required time to download it, the required effort, and the limited available memory on the mobile devices. These applications are usually free, and the perceived monetary price cannot be considered as a barrier. | ☑ Further studies are required to identify a more comprehensive list of barriers, taking into consideration the tourism and disaster management setting. For instance, future cross-countries studies on built-for-disaster-purpose mobile applications and related privacy issues are required. | ➢ These studies may support governments and disaster risk managers to identify barriers and strategies to overcome them. |
| 9 | To increase the number of international tourists adopting built-for-disaster-mobile applications, it is necessary to focus on ‘promotion-focused consumers’ due to their predisposition to test mobile apps. | ☑ Future studies may investigate effective strategies to keep in contact with ‘promotion-focused consumers’, possibly involving different stakeholders. | ➢ Partnerships between different stakeholders (e.g., governments and tourism suppliers) are required to identify and contact tourists that are prone to try mobile applications (‘promotion-focused consumers’). |
| 10 | Due to the characteristics of these apps, instead of ‘try-before-you-buy’ strategies, it may be necessary to promote ‘try-before-you-download’ and WoM strategies. | ☑ Future studies may investigate the effectiveness of ‘try-before-you-download’ and WoM strategies. | ➢ These studies may support governments and disaster risk managers to optimize financial resources for the promotion of built-for-disaster-mobile applications. |

(continued on next page)
setting, the cognitive need is represented by the necessity to increase the international travelers' personal understanding regarding disaster risk information in hazard exposed tourism destination. At the same time, this typology of mobile applications may also contribute to satisfying affective needs as travelers may need to feel safe when traveling to dangerous tourism destinations. Focusing on social integrative needs, disaster apps should be developed considering the opportunity to facilitate user interaction. This feature will improve the perceived interactivity of the applications, as suggested by the flow theory adopted by Rauschnabel et al., 2017. Finally, it will also increase the perceived number of functions that are guaranteed by the mobile application, as suggested by the media richness theory adopted by Yang and Lin (2019). These features need to be considered as they may improve the enjoyment of mobile usage and help to satisfy also the tension-released needs. Accordingly, the perception of the disaster apps among tourists will improve. Referring to the personal integrative needs, disaster apps are usually free applications (e.g., Safety Tips) and do not require any form of payment. Therefore, it seems difficult to apply the conspicuous consumption theory (see Fan et al., 2019) to satisfy the individual’s need for social status. However, people’s image and social status may be increased by developing an increased knowledge about disaster risk reduction activities among disaster apps users respect those people that do not adopt these applications. Personal integrative needs may also improve by increasing the users’ perceived innovativeness (see Hallikainen et al., 2019) of mobile applications. From this perspective, interactivity may improve this perception. In addition, disaster apps need to be technologically advanced, intuitive (Wyche & Steinfield, 2016), easy to use and possibly be integrated with other technologies (e.g., GPS, external links to website, connection with national SMS-alarm system such as J-Alert in Japan, etc.). From this perspective, disaster app developers and promoters must constantly monitor rapid technology development. Referring to the barriers, in addition to the complexity of the app (Wang, He et al., 2018; Wang, Lin et al., 2018), other problems may be the required time to download it, the required effort (Yang, Yu, Zo, & Choi, 2016; Zhu et al., 2017), and the limited available memory on the mobile devices. On the contrary, as these applications are usually free, the perceived monetary price (Yang et al., 2016; Zhu et al., 2017) cannot be considered as a barrier. Further studies are required to identify a more comprehensive list of barriers, taking into consideration the tourism and disaster management setting.

To increase the number of international tourists adopting disaster apps, it is necessary to identify the users to be targeted with promotion-focused communication. According to the regulatory focus theory (Zhang et al., 2018), initially, it may be more effective to focus on “promotion-focused consumers” due to their predisposition to test mobile applications. To attract these potential users, it will be necessary to get in contact with them (e.g., approaching international tourists in the airport; involving several tourism suppliers to facilitate the promotion of disaster apps among tourists pre- and during-their trips; etc.). Due to the characteristics of these apps, instead of “try-before-you-buy” strategies, it may be necessary to promote “try-before-you-download” strategies. This approach may help to get information and suggestions to improve the mobile applications. At the same time, it may also contribute to increase the reputational information (Shen, 2015) that will need to be supported by positive WoM.

Studies on mobile-information applications extended the TAM by considering variables such as trust and source credibility, personal characteristics and features, context, perceived security argument quality, and quantity information (Almiahia, 2018; Fard & Marvi, 2019; Gunawan & Huanng, 2015). Quality of information, quantity of information, and source credibility seem to be the three main behavioral drivers (Fard & Marvi, 2019). Therefore, disaster app developers and promoters need to carefully analyze and test the quality of the information provided through the applications. Risk communication, warnings, and alerts, through mobile, require clear and concise messages (Sutton & Kuligowski, 2019). Further studies may investigate how the disaster-related context may influence tourists’ attitudes toward the quantity of information. Finally, due to the importance of source credibility and the fact that many disaster apps are managed by government agencies, future research is needed to analyze the international tourists’ trust toward the tourism destination’ local governments.

5.3. Managerial implications

In sum, built-for-disaster-purpose mobile application developers and promoters need to consider the findings emerging from this literature review to promote these apps among international tourists and improve their disaster preparedness. In particular, the suggested research paths will support governments and disaster risk managers in the selection of risk communication channels, taking into consideration the users’ expectations, their perceived benefits, and their perceived barriers. They will be able to promote disaster mobile apps by clearly explaining to the tourist the benefits of adopting them. The collaboration between different stakeholders will be facilitated as the governments will need to be supported by tourism suppliers to identify the “promotion-focused consumers”. Governments and disaster risk managers will optimize financial resources for the promotion of built-for-disaster-mobile applications by adopting “try-before-you-download” and WoM strategies.
6. Conclusion

This study enriches the literature on adoption of mobile apps by considering a disaster management perspective. It includes an in-depth analysis of the literature on mobile application adoption to identify opportunities for further research on disaster apps for international tourists. Table 6 summarizes main findings, suggestions for future research, and managerial implications.

This study had some limitations. As with all literature reviews, our findings are based on the results of the articles included in the analysis. To assure the robustness of the synthesis provided, only papers published in peer-reviewed journals published on SCOPUS are included in the review, potentially leaving out interesting works, directly related to the subject and published in other sources. Future studies may enlarge the number of sources to be included in the review. Also, this study is only focusing on the adoption of disaster mobile apps. Our findings highlight the importance of focusing on the quality and the quantity of the information provided through the applications and the role of governmental trust. Further investigations need to focus on the use of disaster mobile apps and their contents. These studies need to consider the chaotic system, which is characterizing the tourism scenario. For instance, additional studies can include different tourist typology and tourist behavioral characteristics.

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Declaration of competing interest

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