New Avenues in Mobile Tourism

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Abstract—This paper analyzes the increasing importance of mobile technologies in the tourism industry by reviewing, examining and synthesizing studies related to it. The main aim of this paper is to provide academics and practitioners with the current developments and practices of the alleged mobile tourism. In particular, we investigate the key enablers of mobile tourism, namely: social media marketing, sentiment analysis, recommender systems, Internet of Things, and virtual assistants. Finally, we focus on investigating how mobile technologies are significantly altering the tourism industry as well as providing an agenda for future research.

I. INTRODUCTION

Tourism is becoming one of the largest and fastest-growing economic sectors in the world, accounting for 9% of the global GDP [121]. Throughout the last decade, information communication technologies in tourism (e-tourism) have been used on all operational, organizational and strategic levels as they became much quicker, smaller, more intelligent, and more entrenched in the users' environment [18], [78]. This is highly visible when it comes to consumers such as tech-savvy tourists who are frequently prepared with the latest pioneering mobile technology mainly characterized by smartphones and their respective mobile applications (apps) [49], [125].

Mobile tourism is highly beneficial for contemporary tourism since approximately 1 billion people now use smartphones. Subsequently, in the latest years there has been much effort spent in order to nurture and offer suitable mobile services in the tourism industry [80]. The remainder of this paper is organized as follows: Section II explores the current mobile tourism literature; Section III discusses the impact of mobile technology on the tourist experience and behavior; Section IV lists the key enablers of mobile tourism; Section V presents discussion and implications; finally, Section VI provides a synopsis and concluding remarks.

II. ADOPTION OF MOBILE TECHNOLOGY IN TOURISM

Tourism propers on the huge volumes of information respectively handled and communicated. Undoubtedly, there is an intense necessity on the part of tourists as well as tourism organizations for information (e.g., prices, transport, climate, consumer trends, suppliers, destinations, tourism flows and marketing) and information communication technologies upsurge to process it. [50] recognized that the Internet provided various means where tourists are able to construct the tourism experience through learning, understanding, and feeling the destinations as well as the respective cultures deep-rooted in them. Hence, this effect is even more prevalent when they are equipped with mobile technologies [48], [133], [97].

[77] and [133] advocated that smartphones are mobile devices which became key for tourists due to their ability of connecting to the Internet anytime and anywhere. Indeed, smartphones not only enhance the *"culture of communication"* initially introduced by mobile phones [65], but also the diffusion of the Internet within individuals' lives [99]. Academic research on the usage of smartphones for tourism purposes has been focusing on matters such as the adoption of smartphones as a general information communication tool [43], [68], the impact of smartphone usage on particular aspects of the touristic experience [74], [117] and the expansion of mobile apps [104], [106]. Without a doubt, mobile technology has been rapidly shaping the tourism industry, leading marketers, academics as well as tourists to realize new prospects which facilitate more personalized tourist experiences [97]. However, academic research on the role of mobile technologies in the tourism industry is still in its infancy when compared to computer science and its allied subjects.

The daily adoption and use of mobile technologies has the potential to create a new generation of modern tourists including the *"creative tourist class"* [52], the *"lifestyle travelers"* [40], the *"flashpackers"* [55] as well as other members of the novel *"mobile elite"* [9].

In fact, the expansion of mobile technologies gave the opportunity for tourists to become more desynchronized from the traditional travel and tourism timetables [115]. In brief, the adoption of mobile technology is generating a huge impact in the tourism industry [4], [126].

III. IMPACT OF MOBILE TECHNOLOGY ON TOURISM

The expansion of mass media alongside with technology has brought progress for tourism intermediaries [125]. Smartphones have become the new kind of media by offering a variety of information services to assist elementary travel endeavors (e.g., planning, booking and map-reading) in addition to numerous *"micro-moments"* throughout the travel process (e.g., finding restaurants, entertainment or attractions) [124]. Thus, smartphones turned out to be a must-have for tourists due to their wide range of features and functionalities, which together with reliable and limitless Internet access, suited the *"spatiotemporal"* setting of tourism [46], [66], [104], [119], [129].

As a matter of fact, mobile technology is able to address tourists' needs at various stages of the travel process, including pre-trip (anticipatory), on-site (experiential), and post-trip (reflection) experiences [50], [125]. On its own, mobile apps encourage instant sharing and feedback of tourists' journeys in social media sites such as Facebook, Twitter, Instagram, TripAdvisor or Snapchat [125]. Indeed, Travel 2.0 (Web 2.0 in tourism) brought along these sites which enable tourists to be the *"media"* themselves for sharing travel knowledge [81], [111]. Smartphones boosted interaction by empowering consumers to share their choices, reactions, approval or disapproval on products and services [118], [126]. Younger generations tend to have a higher adoption rate of mobile technology and young tourists are no exception [69].

Only recently academics have started to understand how smartphones and their respective apps are modifying tourism organizations as well as tourists' attitudes and feelings [41], [79], [104], [125], [126]. Namely, [74] identified that smartphones had the ability to effortlessly alter tourists' endeavors, whereas [107], [116], [124] recognized that smartphones are able to interfere in psychological and behavioral extents of the tourist experience, confirming the view that smartphones have the potential to build a resilient *"mediated gaze"* [75]. Table I shows some examples of how the use of smartphones led to changes in tourists' activities [133].

Lastly, it was not long ago that destination marketing organizations (DMOs) as well as tourism organizations have been significantly impacted by the Internet revolution [51], meaning the rising number of tourists with smartphones is bringing up a variety of new issues. [72] draw attention to the fact that the international roaming service has an important role in combining technologies and tourism, while [71], [73] as well as [105] added that expensive fees and unavailable mobile service areas are the most common causes for non-use of mobile apps overseas. Also, tourists might have no or restricted data services at more costly rate than in their country of residence [8], [10], [38]. As such, it is necessary to explore how today's mobile technologies are affecting tourism marketing.

IV. Key enablers of mobile tourism

Mobile technologies have become a central part of everyday life by shaping the way individuals connect and network with each other due to their progress into multi-functional smart tools [41], [70]. Five key enablers of the transition from old-school tourists to a new generation of modern tourists are: social media marketing (Section IV-A), sentiment analysis (Section IV-B), recommender systems (Section IV-C), Internet of Things (Section IV-D), and virtual assistants (Section IV-E).

A. Social Media Marketing

Mobile technologies have considerably influenced marketing strategies, especially the distribution of products and services along with establishing and strengthening customer relationships and brand loyalty [6], [127]. Undeniably, mobile technologies have amplified connectivity, communica-

tion together with online content creation and consumption, leading to the rise of social media marketing. It designates an interactive method of communication and promotion of products or services directly to consumers deprived of time or place restrictions through personal mobile devices [21], [7], [70], [110], [126]. It provides a low-cost solution for inter-activity along with personalization which reaches countless target consumers [44]. Also, progresses on these social media marketing methods are answering decisively to the main need of tourists, which is information [53]. Thus far, the landscape of tourism marketing is being transformed by the fast adoption of social media marketing since marketers can give assistance to tourists by providing them with information (e.g., hotel offers and promotions) not only at their home but also during the trip [126].

The increasing adoption of social media marketing opens up even more possibilities for tourism organizations. For instance, accommodation is often described as one of the most imperative features of the tourist experience starting with reservations and closing with the guests' checkout and mobile technologies have come to enhance this process [2]. As such, hotels and online travel agencies (OTAs) launched apps or websites aimed for mobile devices. These apps explore the concept of social computing whereby social media is integrated to permit experience sharing and online customer reviews are visible to ease decision-making [17], [92], [127]. Online rating sites dedicated to the assessment of hotels have been gaining immense popularity amongst tourists. Also, they offer hotels benchmarking and comparative insights about customer satisfaction. Thus, one way to improve the accommodation sector would be by better understanding tourists through these ratings and reviews.

Developments in mobile apps nurtured a new realm of opportunities in social media marketing. Tourism organizations are able to use apps in order to create personalized content (Fig. 1) that promotes brand engagement and gives the mobile handset a *"sustainable utility"* [39]. This includes context-aware mobile apps (e.g., [56]), mobile recommendation systems (e.g., [104], [106], high-tech for high-touch experiences (e.g., [96]), and mobile tour guides for personalized routes along with location-relevant information (e.g., [11], [54], [62], [109]).

B. Sentiment Analysis

Apps are creating *"big data"* databases that include information associated to tourists' behaviors, business trades, and tourism destinations, considerably advancing the tourism industry [123]. These databases are able to be used for commercial purposes such as tracking trending topics and popular sentiments as well as identifying opinions and beliefs about products. In recent years, sentiment analysis has become increasingly popular for processing social media data on online communities, blogs, wikis, microblogging platforms, and other online collaborative media [22], [29]. Sentiment analysis is a branch of affective computing research that aims to mine opinions from text (but sometimes also images [103] and

TABLE I
CHANGES IN TOURIST EXPERIENCE DUE TO THE USE OF SMARTPHONES [133]

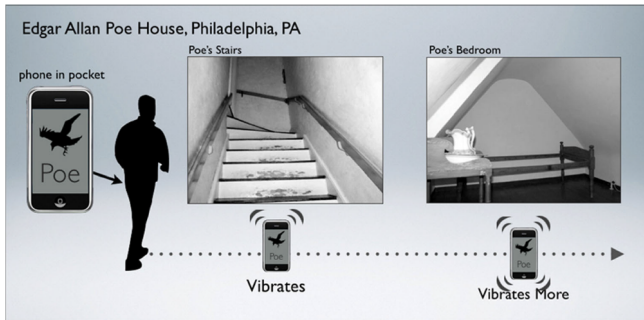| Category	Changes	Examples of quotations
Changes of travel activities	Easy planning More flexibility during trips More planning before trips Less after trip follow up Increase trips	1. "It's almost like without iPhone, I have to really plan ahead... But with iPhone, I don't really have to plan that carefully... 2. I can connect to an app or the internet and be able to change my mind and be able to do it. It's much more spontaneous." 3. "I would say it's pretty different. I remember when I was little and I'd go over to Ireland with my dad, I just didn't even bother bringing my phone over... Now looking back at it like now, I wouldn't want to leave the country without my phone because I've just become so used to it."
Changes of affective experience	More connected with others More informative Gaining better value of trips More fun during trips Travel is less stressful Travel is more secure More confident about travel	4. "Sure yeah, it's been quite amazing-well traveling because before you?d have to call the restaurant. Whereas now you can just look it up online and typically find out the location, the hours, the menu and then you can check Trip Advisor, which I like to do a lot. 5. "If I travel alone, being a female, I have my cell phone; ... I feel, safer... You can find a hotel quick, you can get around, you can, look everything up on the phone to book a hotel and find a restaurant, and find local happenings and things that are in the area.

Fig. 1. Example of a mobile tour guide: Brick City Tours prototype using augmented reality projection by [12]

videos [37]). Most of the literature is on English language but recently an increasing number of works are tackling the multilinguality issue [86], especially in booming online languages such as Chinese [101] and Spanish [33].

Sentiment analysis techniques can be broadly categorized into symbolic and sub-symbolic approaches: the former include the use of lexicons [135], ontologies [42], and semantic networks [28] to encode the polarity associated with words and multiword expressions; the latter consist of supervised [36], semi-supervised [59] and unsupervised [26] machine learning techniques that perform sentiment classification based on word co-occurrence frequencies. Among these, the most popular are algorithms based on deep neural networks [83], belief networks [35], randomized networks [57], generative adversarial networks [84], and capsule networks [139]. There are also some hybrid frameworks that leverage both symbolic and sub-symbolic approaches [25], [88].

While most works approach it as a simple categorization problem, sentiment analysis is actually a complex research problem that requires tackling many NLP tasks [27] , including subjectivity detection [34], aspect extraction [87], aspect target sequence modeling [102], word polarity disambiguation [132], time expression recognition [140], intensity measure [3], and commonsense reasoning [24].

Sentiment analysis has raised growing interest both within the scientific community, leading to many exciting open challenges, as well as in the business world, due to the

remarkable benefits to be had from financial forecasting [134], healthcare [23], biomedical [20], outbreak management [64], dialogue systems [137], and many more. Sentiment analysis has also numerous applications with many purposes including the analysis of touristic sites through tourists' comments [5], [45], [14]. Hence, there is a need of growing literature on sentiment analysis to collect, analyze, and interpret online consumer reviews since it is a rich data source that reflects tourists' experiences and evaluation of products and services which could be used to understand a range of research problems in the tourism industry.

In fact, social media sites allow tourism organizations to better identify and satisfy consumers' needs as well as explore new market trends [122], [111]. This means that social media offers tourists and tourism organizations various occasions online for networking, social collaboration, community building and learning intelligence [67]. It is able to influence the tourism organizations' reputation, revenues and even survival. As follows, marketers answer by applying social media marketing practices including electronic word-of-mouth (e-WOM), relationship marketing and viral marketing [16]. Plus, these practices are now done anywhere and at anytime due to the upsurge of mobile technology.

C. Recommender systems

The fast-growing e-tourism scenario brings new challenges to traditional collaborative filtering because the huge amount of users and items requires large storage and efficient recommendation systems. Hence, hashing for collaborative filtering has attracted increasing attention as binary codes can significantly reduce the storage requirement and make similarity calculations efficient [85].

While sentiment analysis has enabled the collection of huge amounts of data, in fact, it has made information search and selection progressively burdensome for some tourists, as non-tech-savvy tourists may be overwhelmed by choices which they may not have the time or knowledge to evaluate. Recommender systems emerged as a valuable mobile device tool for consumers to deal with the information overload [1], [106]. The purpose of recommender systems is to present products and services suggestions based on the details of registered user profiles and habits of the entire community.
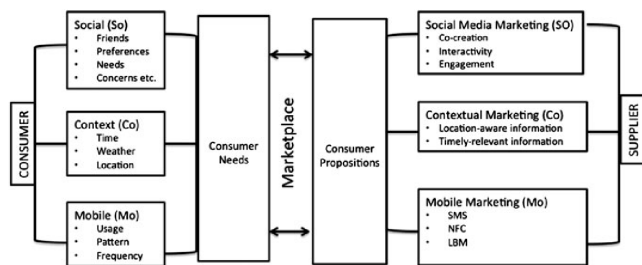
Fig. 2. Graphical representation of the SoCoMo marketing approach prototype by [17]

Recently, recommender systems have become considerably important within e-tourism since they offer recommendation for products and services such as tour, events, activities, packages and points of interest (POIs) [63], [130]. In this manner, recommender systems in tourism go far beyond from being mobile electronic versions of printed tourist guides rather providing advanced context-aware services [56].

D. Internet of Things

Presently, the latest generation of mobile devices have been set with sensors that are able to precisely estimate the users' physical environment, enabling the implementation of marketing practices consider the creation context-relevant information, e.g., emotional state, weather and level of interest [82], [131], [114], [60], [93]. In this way, location aware-marketing (LAM) is a form of marketing established which uses technologies to connect and involve consumers with their environment on top of forecasting their preferences and behavior [7], [120].

The acquisition of *"spatiotemporal"* information became absolutely indispensable for tourism marketing since it is possible to infer what time and where tourists are going and so offer them the prospect of generating ever-present recommendations such as restaurants, hotels, attractions and other activities [49], [63], [91]. For instance, Fig. 2 summarizes the framework of SoCoMo marketing approach which considers this important information, presenting an extremely powerful and innovative way for tourism organizations to communicate with tourists. Then, discovering tourists' patterns is rather more important than the trip planning or tourist hot-spot detection because it designates where the tourists are but also at what time they will be there, and where they are likely to go next [13]. Therefore, such information is able to influence tourism organizations marketing mix tools such as advertising, pricing and packaging.

E. Virtual Assistants

In recent years, data-driven approaches to building conversation models have been made possible by the proliferation of social media conversation data and the increase of computing power. Most work on this area assumes text-based conversation, where the user message is modeled as a sequence of words in a vocabulary [136].

While still far from emulating a natural human conversation, chatbots have turned out to be useful for many businesses, and tourism is no exception[1]. Many travel brands have already launched their own versions, e.g., Skyscanner created an intelligent bot to help consumers find flights in Facebook Messenger. Users can also use it to request travel recommendations and random suggestions. Unlike e-commerce or retail brands using chatbots, which can appear gimmicky, there is an argument that examples like Skyscanner are much more relevant and useful for everyday consumers. After all, with the arrival of many more travel search websites, consumers are being overwhelmed by choice. Consequently, a chatbot like Skyscanner is able to cut through the noise, connecting with consumers in their own time and in the social media spaces they most frequently visit [108], [31].

With voice-activated search, moreover, the experience of researching and booking travel has the potential to become quicker and easier than ever before. Similarly as Amazon Echo and Google Home start to become commonplace, more hotels could start to experiment with speech recognition to ramp up their customer service. This means devices and bots could become the norm for brands in the travel and hospitality industry, e.g., in voice controlled hotel rooms.

V. Discussion

Today's world is highly technology-mediated. All facets of our lives and all industries have been importantly impacted by recent technology development, including the remarkable mobile technology evolution. This is also true for the tourism industry where the advances in mobile technology have opened a wide range of new tools.

Similarly, it is possible to infer the significance of smartphones in the tourism industry through the growing number of articles published on this topic from 2010 to 2017. Interestingly, the number of articles from the tourist perspective is much larger than the number of articles analyzing the phenomenon from the marketers' perspective. This result indicates that much attention has been paid to tourists, while the marketer side has not been explored to the same extent. Then, efforts should be made to better analyze the phenomenon from the marketer perspective.

Tourism organizations must start or continue to put into practice mobile technologies in their operational, organizational, marketing and strategic levels in order to remain lucrative and innovative since the limitless influence of smartphones in tourism has turned mobile technologies into a decisive channel for them. Moreover, mobile technologies show vigorous outcomes for tourism because it is an industry extremely reliant on the prosperous creation of remarkable experiences to diminish the interchangeability of its products and services. They are functioning as a facilitator of change and should be considered as key tools to encourage participation and create tailor-made experiences for tourists.

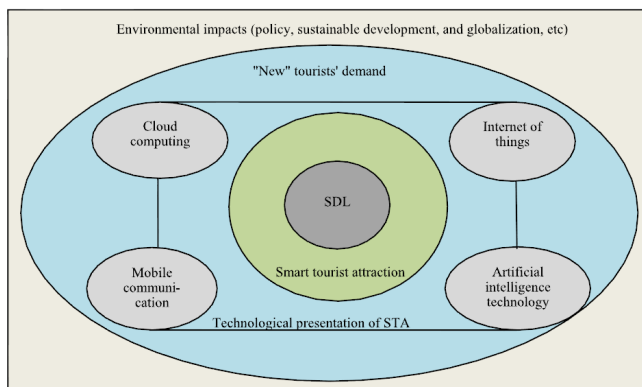[1]http://tinyurl.com/future-travel-hospitality

Fig. 3. A conceptual model of structuring Smart Tourism Attractions by [128]

Similarly, mobile technologies enable tourism organizations to embrace more innovative methods to identify profitable opportunities to target tourists. For instance, capturing tourists' opinions based on their personal interests through online customer reviews and ratings became a dynamic way to get travelers' truthful feelings on tourism products and services.

Then again, the notion of mobile tourism represents today's reality since the latest mobile technologies such as smartphones are deep-rooted throughout the tourism process. The concept of *"smart tourism"* is novel practically and theoretically, emerging in literature with the expansion of the alleged smart cities (see [89], [94], [19], [30], [76], [95]). For instance, Singapore represents the case of a city-state which strives to be a smart city, where individuals are empowered by technology to lead significant and satisfied lives [32]. In their discussion of Singapore, [58] as well as [98] referred to the city-state as a typical *"mobile city"* whereby hotels have even begun to provide *"handy smartphones"* to in-house guests in order to not only overcome language barriers, but also offer Internet access while traveling around the city. Similarly, [128] assessed tourists' preference of Smart Tourism Attractions (STAs) along with analyzing their strengths and weaknesses (Fig. 3). Nevertheless, smartphones have proven to be an important element for destinations to remain competitive by distinguishing and adding value to their products and services.

In fact, smart tourism is grounded on the expansion of mobile technologies, plus it incorporates e-tourism sources such as the Internet of Things (IoT), artificial intelligence and cloud computing to provide unambiguous information and adequate services for tourists [138]. Though academic literature on smart tourism is still at its infancy, a variety of different subjects have been explored. For instance, [128] pointed out the development of smart tourism destinations (definition, initiative, conceptualizing framework as well as critical technology) [15], [123], smart hotels [112], smart cards [90], smart recommendations [47], smart guides [100], [113], as well as augmented reality technologies [61]. Overall, the development of *"smarter"* tourism is required because mobile technology is changing tourists' behaviors, opinions, emotional states and needs, along with tourism marketing.

On the basis of the above, the increasing penetration of mobile technology in tourism has come to reconfigure the industry by bringing forward new opportunities as well as challenges for both tourists and marketers. Tourism organizations are now able to offer more relevant information at anytime and anywhere, but competition is becoming fierce between them when it comes to providing innovative personalized services. Likewise, tourists have now access to all kinds of information throughout the trip, while being able to share their choices, reactions, approval or disapproval on products and services. Yet, they are overwhelmed by information overload, making the search and respective selection progressively burdensome. Marketers and academics should look into the prospect of combining five enablers, namely social media marketing, sentiment analysis, recommender systems, IoT, and virtual assistants, in order to not only potentially overcoming these challenges, but also offering a turning point for the tourism industry. Nevertheless, mobile tourism has shown tremendous growth and its unique characteristics are able to dynamically interconnected all the stakeholders involved, thus this study represents a first step within larger research works on it.

VI. CONCLUSION

In this paper, we analyzed the increasing importance of mobile technologies in the tourism industry by reviewing, examining and synthesizing studies and key enablers related to it. It has not generated ultimate and faultless explanations for the discussed topics due to the fact that mobile tourism is a fairly new phenomenon accompanied by limited literature on it. Yet, it identified new trends in practice and aspects of mobile tourism including how mobile technology is being adopted in tourism, its assistance in tourism marketing as well as its impact on the tourist experience and behavior.

Accordingly, this study is useful for academics, practitioners and other keen individuals as it delivered them the current development and practices of mobile technology in the tourism field. Future studies are planned in a variety of topics to understand: (1) the outcomes of social media marketing approaches in tourism by analyzing the performance of tourism organizations; (2) how mobile technology is altering tourists' behaviors, opinions, emotional states and needs through the application of sentiment analysis techniques in online customer reviews; (3) how recommender systems could better facilitate tourists' decision-making process anytime throughout the trip; (4) the implications of using the Internet of Things in shaping tourists' experiences; and finally (5) the benefits to be had from increasing the use of virtual assistants to ease and speed up travel search and booking.

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