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Users' satisfaction evaluation based on ISO standards for tourism and travel mobile applications

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Abstract: This study is based on the results of a survey applied to a sample of 201 users which gave them an opportunity to identify points of improvement that will be used in a proposal for a new application. In addition, it aimed to obtain data that allows analysis metrics to be applied to ISO (International Standard Organization) standards and attempts to understand why individuals use these applications, based on the TAM (Technology Acceptance Model). From the results obtained, it was concluded that there was an average level of satisfaction with the applications of 4.22, on a scale ranging from 1 to 5. Based on the opinions of the respondents, it was also possible to select future improvements for the applications that could contribute to a new tourism and travel application. Finally, it was concluded that there is a direct link between content acceptance and quality.

Keywords: application; user satisfaction; travel; tourism; rating; TAM; ISO standards; mobile applications.

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1 Introduction

The Internet and everything it involves has been revolutionizing the traditional way in which clients and consumers communicate, since it provides new methods for buying, selling, and providing services. Rapid information searching and the need for immediate answers have led to the development of processes and equipment for automating tasks.

Customers have taken on the role of sharing opinions, experiences, interests, and information via social networks, where they have the opportunity to express, share, influence, and compare experiences with other customers. Online user reviews have a significant impact on online hotel bookings and confirm the importance of online word-of-mouth for the performance of tourism firms (Ye, et al., 2011). The interaction between technology and consumers is mainly non-linear and emergent. From Facebook, where the consumer is the product, to user-generated information systems (UGIS) that enable the consumer to create the product (DesAutels, et al., 2014), technological advances in communication have resulted in significant changes to how companies communicate with customers, but also how customers communicate with each other (Parreira, et al., 2021).

ICT (Information and Communication Technologies) have been implemented in the tourism sector since the adoption of the Computer Reservations System (CRS) in the 1960s and the subsequent migration to Global Distribution Systems (GDS) in the 1980s, with visible impacts on the interconnectivity and interoperability of the sector, thus increasing the level of innovation among tourism organizations and competitiveness within the market.

The work of companies such as Expedia.com, which revolutionized the online travel agencies, Booking.com, which changed the hotel booking model, and TripAdvisor.com, which created the direct social relationship model for customers and suppliers (Web 2.0), represent just three examples, from companies that were born exclusively in the digital market and present disruptive business models in a traditional bricks and mortar market that has often been apathetic and/or slow to change processes. The speed and flexibility of these new companies, in a market which has shifted from local to global, was such that currently 6 out of 10 users/customers are now booking online (Ribeiro, 2015).

In recent years technology has advanced at an exponential rate, which is reflected in the most diverse areas. Among them, tourism, which was completely transformed by technologies in every aspect, stands out. One main advantage of this is the possibility of expanding distribution channels, since anyone with internet access can become a customer. In addition, the digitization of records has facilitated the collection and analysis of data through the use of big data strategies, allowing for a deeper understanding of customers, consequently making it easier to close sales and foster loyalty. Over the past decade, large numbers of customers began to use these applications, from the moment they were given the opportunity to explore destinations and budgets on their own.

The development of new technologies, in particular the Internet, has resulted in the expansion and development of the global economy. This has led the communication and culture industries to play an increasingly important role in the global economy (Palos-Sanchez, et al., 2019). Hence, many mobile apps have emerged to support a wide range of businesses, including travel and tourism.

In addition, managers can ask travellers for their opinions on the techniques identified in this research and thus obtain high-quality feedback that enables them to improve their business development (Saura, et al., 2020). The literature therefore indicates that it is

necessary to study mobile apps and the current level of user satisfaction with travel applications, which is the main objective of this study.

The rest of this article is organised as follows: Section 2 describes the related literature and the main concepts that frame this research while Section 3 describes the methodology. The results are listed in Section 4 and discussed in Section 5. Finally, Section 6 details the main conclusions.

2 Related literature

2.1 Smartphones

Nowadays, we live in an information and knowledge society that can also be described as a network society, in which information dependence and interdependence among organizations is a reality (Alturas, 2022).

The introduction of smartphones in our daily lives has revolutionized the way in which individuals communicate with each other, creating a great dependence on being constantly contactable and active on networks. Unlike all their predecessors, these new devices are equipped with a variety of functions, including 5G or Wi-Fi connections, which enable the user to obtain various resources. By accessing these connections from the internet, smartphones also provide access to GPS, among other modalities.

While the Mobile Computing Promotion Consortium (MCPC) states in its report that the smartphone is a universal designation that helps promote the free acquisition of applications, extensions of functionalities and/or customization for its users (Shiraishi, et al., 2011), the potential of smartphones is also enhanced by the range of smartphone applications (apps) available (Tavares and Alturas, 2018).

In July 2020 the Marktest Telecommunications Barometer (Marktest, 2020) reported that 7.2 million people owned a smartphone in Portugal, which represents 84.2% of the population. This reveals a significant increase in comparison to the figures for 2012, when this percentage was less than 30%.

2.2 Mobile operating systems

The arrival of smartphones in the daily lives of individuals has completely changed the way in which they interact with each other and have become permanently active and contactable.

According to Carvalho and Freire (2017), the immense growth and popularity of smartphones is a global phenomenon, and their popularity is continuing to expand. However, statistics show that despite the existence of 5 billion mobile subscribers around the world, there are only 1 billion smartphone users, although the market is growing roughly 42% per year.

The development of applications for mobile devices has also grown, in addition to their popularization. In parallel with the increasing development of applications for the platforms, the use of the operating system has also expanded. Different means can be used to create applications for mobile devices, resulting in various forms of applications.

Three main types of applications have been created:

- Native applications: It is possible to fully exploit the full range of resources available on the device, such as the sensor, accelerometer, compass, calling and interface capabilities, graphics processing and others, allowing for the construction of feature-rich applications capable of processing high resolution videos and images. These applications can use system notifications and run offline (Carvalho and Freire, 2017);

- Web applications: Internet pages can be accessed through a browser installed on a mobile device. These websites are developed with widely used technologies, such as HTML, CSS (Cascading Style Sheets) and JS (JavaScript), making the development process more agile as it does not require different codes for each platform. However, by depending on an internet connection to access content, web apps have limited access to the hardware and data resources of the device, (Carvalho and Freire, 2017);

- Hybrid applications: In this case, the aim is to combine the advantages of native and web development to create applications. Different frameworks and tools are used to assist the developer (Carvalho and Freire, 2017).

Android is a Linux-based operating system designed specifically for smartphones and tablets. Google is known to invest in a wide range of areas, from artificial intelligence to solar panels, and smartphones have proved no exception: hence, in 2008 Google launched the Android operating system.

The Android operating system includes the Google Play store, or Android Market, which serves as a software repository, from which users can download paid or free applications (with paid content) to the respective platform. The Google Play store provides a simple creation process which does not oblige developers to go through an initial approval process. Users not only have access to applications, but also their respective updates (Morimoto, 2009).

According to Google, the Android operating system currently has 2.5 billion active devices, i.e. 5G smartphones and tablets (Google, 2020).

IOS is an operating system from Apple Inc. originally developed for the iPhone, iPod Touch, iPad and Apple TV. Apple does not allow IOS to run on third-party hardware, instead releasing annual versions, the most recent of which is IOS 16. The different versions reinvent the most commonly used classic functions of the system to make them even more useful and personal. This includes a revamp of the Widgets, new organization of the application library, new ways for users to express themselves and communicate through messages, new “memojis” (for creating caricatures), and a built-in translator for 11 languages, among other new features and innovations (Apple, 2022).

2.3 Tourism and travel applications

An application is defined as software designed through programming language to perform a set of functions, tasks, or activities that can be installed on a mobile electronic device, administered by a manager and used by the various profiles that access the available functionalities through permissions assigned to them (SetupTech, 2019).

Nowadays, all kinds of applications feature in our daily activities, in particular those designed for travel and tourism, since more and more individuals are now acting completely independently, whether in booking holidays, a sightseeing tour or a restaurant, without having to make a phone call or a reservation in person. That said, it is the most widely used applications that will be the subject of the comparative study, according to the number of downloads from the App Store and Google Play, namely:

- Booking

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- Airbnb
- eDreams
- Tripadvisor
- Skyscanner

The ongoing evolution of smartphones, wireless access, and mobile technologies in general has awakened the market's interest in investing in mobile applications to improve the tourist experience. There has been a significant increase in the use of these applications in tourism and they have been incorporated into the sector by various niche markets. Travel apps have become a useful resource for consumers and have transformed tourists' experiences (Filho, et al., 2017; Gupta, et al., 2018).

The latest apps have many useful features. The vast majority are connected to GPS, thus allowing for geolocation, namely the ability of a device to process information to determine its geographical position. From a commercial point of view, they are known as Location Based Services (LBS). In the tourism field, the adoption of LBS depends on the social and environmental benefits obtained by the downloaded app (Palos-Sanchez, et al., 2017).

Personalization, which gives users the opportunity to choose the information shown to them and to access only what they think is most relevant to them and their selected destination, is another important characteristic. These features, if correctly studied, can provide app users with destination experiences that enhance their appreciation of travelling (Palos-Sanchez, et al., 2021).

Internet users can alter an individual's reasons for visiting a tourist destination through their posts, references, and comments (Llodrá-Riera, et al., 2015). Customers have taken on the role of sharing opinions, experiences, interests, and information via social networks, and have the opportunity to express, share, influence and compare experiences with other customers (Costa, et al., 2023). Monitoring customer satisfaction and perceptions by means of travel applications is crucially important in the tourism industry.

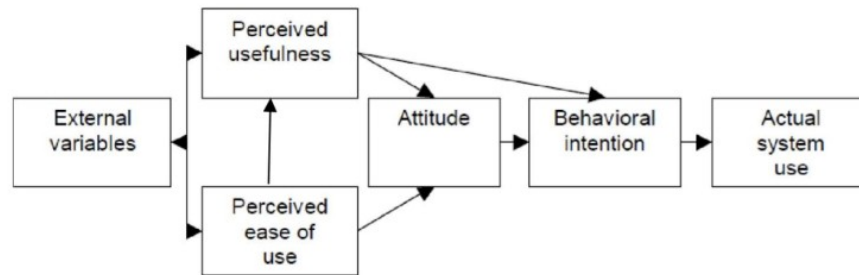
Apps represent brands or are brands themselves, and the technical characteristics of M-internet have a positive effect on the attitude of the parent brand. Furthermore, the attitude of the parent brand positively influences brand extension evaluation, brand trust and perceived fit. Lastly, brand extension evaluation is subject to the positive impact of brand trust and perceived fit, in addition to the attitude of the parent brand (Zhu and Wang, 2023).

2.4 TAM – Technology Acceptance Model

The TAM, which aims to evaluate the behaviour of technology use by analysing attitudes towards the use of IS (Information Systems) ranging from usefulness to ease of use, consists of an adaptation of TRA (Theory of Reasoned Action), originally proposed by Davis (1989). It assumes that acceptance of the information system is mainly linked to two variables: perceived usefulness (Perceived Fullness) and perceived ease of use (Alturas, 2021).

According to Lee et al. (2003), the Technology Acceptance Model (TAM) is considered the most influential and widely applied theory to describe individual acceptance of an information system (Lee, et al., 2003).

Figure 1 Technology Acceptance Model (TAM)



In Figure 1, it can be seen that the Perceived Usefulness and Perceived Ease of Use variables are directly influenced by external factors and consequently are correlated to the user's attitude and the behavioural attitude towards use, and to actual use in the system.

According to Dwiyanita Putra (2019), perceived utility is defined as "the degree to which an individual believes that using a particular system will increase his or her performance." This definition was generated from the word "utility" which signifies advantage in use, whereas perceived ease of use defines the degree to which the user believes that using a given system will not require physical and mental effort (Dwiyanita Putra, 2019).

According to Dulipovici and Vieru (2015), TAM cannot be used in its original form because it does not consider the nature of shared knowledge (Dulipovici and Vieru, 2015). Venkatesh and Davis (2000), using the foundations laid by TAM, developed TAM2 and TAM3 which elucidate perceived usefulness and usage intention in terms of external variables, namely social influence processes and the instrumental cognitive process (Venkatesh and Davis, 2000). Later, Venkatesh et al (2003) proposed the Unified Theory of Acceptance and Use of Technology (UTAUT), based on TAM and other models, which is currently one of the models most widely used by technology adoption researchers.

TAM has already been applied to different technologies, including mobile applications, for example by Tavallae, Shokouhyar, and Samadi (2017). The UTAUT has also been applied, for example by Palos-Sanchez, Correia, and Saura (2019), who used UTAUT2 to investigate the influence of various factors on user behavioural intention of use for mobile applications in Spain and Portugal, countries that have many more smartphones per inhabitant than any other European country. Constructs from these two models were also used to evaluate the Kahoot! Application in classrooms, concluding that it increases student motivation and helps to achieve better results (Palos-Sanchez et al., 2022).

2.5 ISO 25010:2011 – Quality in use and quality as a software product

The International Organization for Standardization (ISO) is an independent, international, non-governmental organisation with members from several countries. Founded in 1947, the organisation promotes international standards for products, services, and systems with the aim of creating uniform standards for quality, efficiency, and safety for all countries.

The quality model defined for product quality evaluation represents an important milestone for the product. This project considers the model defined by ISO 25010:2011 - Systems and Software Quality Requirements and Evaluation (ISO, 2011), which replaced the former ISO 9126-1 Information technology - Software product quality, Part 1, Quality model (ISO, 2001). The standard states that the quality of a software product should be

based on a quality model consisting of a hierarchical structure defined according to users' needs (Tavares and Alturas, 2018).

ISO 25010:2011 has added the main "security" and "compatibility" characteristics to the existing six characteristics defined in Standard 9126-1: functionality, reliability, usability, efficiency, maintainability, and portability.

The internal characteristics are presented in Figure 2.

Figure 2 Internal and External Characteristics Quality Model: source, ISO 25010:2011



System quality is the degree to which the system satisfies the implicit needs of its stakeholders and still adds value. This model should be applied according to the business, product design and business core, since it is impossible to predict and assess product quality simply by applying the model without taking into account the area in which it is applied.

2.6 ISO 25012:2008 – Software Product Quality Requirements and Evaluation – Data Quality Model

As ISO 25012:2008 addresses the quality of data performance, data quality is recognized as relevant for decision-making in operational processes, decision-making activities, and requirements for cooperation between organizations (Batini, et al., 2009).

Data quality varies according to its specific application, and each dimension of data quality is relevant to a specific aspect of data, such as visualization, values, and representation (Cappiello, et al., 2004). The term data quality is described as data that is "fit for purpose," that is, data that is considered appropriate for a purpose that may not have sufficient attributes for the said purpose (Tavares and Alturas, 2018).

The data quality model consists of 15 characteristics, which are integrated into one or both of the inherent and pending perspectives of systems (ISO, 2008).

The inherent perspective refers to the degree to which the characteristics of the data have the intrinsic potential to satisfy implicit and expected needs when the data is used under specific conditions.

The outstanding system perspective refers to the degree to which data quality is achieved and preserved within a system when used under certain conditions.

According to Rafique et al., (2012), the 15 features are defined as:

1. Accuracy, the degree to which the data is accurate and discriminating.
2. Completeness, the degree to which the data contains sufficient breadth and depth in the context in question.
3. Consistency, the degree to which information has attributes that are free of contradictions and are consistent with other information.
4. Credibility, the degree to which information is reliable and objective.
5. Currentness, the degree to which data is up to date

6. Accessibility, the degree to which data can be accessed in a specific context of use.
7. Compliance, the degree to which data follows the applicable rules and regulations.
8. Confidentiality, the degree to which data is accessed and interpreted by authorized users.
9. Efficiency, the degree to which data is processed and maintains the expected levels of performance.
10. Precision and accuracy, the degree to which data is exact and precise.
11. Traceability, the degree to which data has records of changes and audits, modifications, and audits performed.
12. Understandability and comprehensibility, the degree to which information has attributes that allow it to be read and interpreted by users and expressed by language and symbols in a specific context of use.
13. Availability, the degree to which information has attributes that allow it to be retrieved by authorized users.
14. Portability, the degree to which information has attributes that allow it to be replaced or moved from one system to another while preserving the existing quality of the information.
15. Recoverability, the degree to which information has attributes that allow it to maintain and preserve a specific level of operations and quality, even in the event of a system failure.

3 Methodology

Following an analysis of the state of the art with regard to investigating the current level of satisfaction of users of travel applications, the main objective of this study can be detailed in the following five specific and two generic objectives:

1. Knowing how often users book trips.
2. Ascertaining how often people use travel apps.
3. Identifying the perceived usefulness and perceived ease of use of travel applications.
4. Knowing which applications are used most.
5. Evaluating the quality and content of the applications.
6. Identifying missing functionalities or improvement points for tourism and travel applications.
7. Assessing the level of satisfaction of users of tourism and travel applications.

The chosen research methodology was a quantitative approach based on the instrument used for data collection, namely the questionnaire. After a pre-test administered to university students, it was distributed using social networks (Instagram, WhatsApp and Facebook) for a period of approximately one month. A convenience sample of 201 respondents was obtained. Statistical methods were then used to analyse the data.

Studies based on the Technology Acceptance Model (TAM) were consulted to help construct the questionnaire to assess acceptance. This is the most commonly used model for assessing the adoption of mobile applications (Jacob, et al., 2020).

In order to ensure a better understanding of the questionnaire, an introductory section was added explaining the purpose of the survey and the protection and confidentiality of all responses in accordance with the current regulations of the general data protection

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system. In addition, there were questions designed to identify the respondent, such as age, nationality, and professional occupation, and questions related to the main theme. The scales used vary from *never* to *always*; *completely disagree* to *completely agree*; *very dissatisfied* to *very satisfied*, and open response questions were also used.

At the end of the questionnaire phase, 201 responses had been obtained, all of which were considered valid so there were no rejections. The statistical analysis was performed with SPSS (Statistical Package for the Social Sciences).

4 Results

After the data had been collected, the results obtained from the empirical study were analysed. There were 201 participants in this study (N=201), 61.7% of whom were male and 38.3% female. The average age was 22.5 years, ranging from a minimum of 15 to a maximum of 57 years. The majority were male (61.7%), had secondary school education (55.7%), were students (46.8%), and lived in households of 4 or more people (47.7%).

One of the key questions concerned how often individuals booked trips using either a physical agency, an online agency, or travel apps: the results show that trips are most often booked using an app (43.3%) or online agencies (25.4%).

Since the majority used travel apps, the participants were also asked which of 5 previously mentioned apps they used most. It was found that the most frequently used travel agency apps were Booking (45.3%) and Airbnb (24.4%).

Table 1 App quality assessment

	Mean	Standard deviation
Adequate functionality	4.26	.652
Accurate results	4.08	.639
Protection of information	3.91	.810
Avoidance of errors	3.74	.765
Use in different tasks	3.87	.705
Learning tutorials	3.24	.934
Attractiveness to the consumer	4.11	.642
Adequate response times	4.11	.654
Same actions in different environments	4.01	.775
Install on different devices	4.17	.751
Accuracy and integrity	4.10	.640
Security minimums	4.02	.678
User satisfaction	4.16	.620

Questions were then asked to assess the quality of the apps. The feature which the respondents considered most important was adequate functionality, followed by the option of being able to install the app on different devices, while the feature considered least significant was the learning tutorials (Table 1).

With regard to evaluating the content of the apps, the point to which the respondents attributed most importance was accessible information, followed by reliable and real information. The point considered least significant was receiving coherent information (Table 2).

Table 2 App content evaluation

	Mean	Standard deviation
Real information	4.14	.664
Suitable depth	4.01	.696
Coherent information	3.84	.797
Reliable information	4.14	.600
Updated information	4.01	.731
Accessible information	4.19	.659
Good performance levels	4.02	.640
Accurate and detailed information	3.96	.730
Multiple languages	4.07	.728

The analysis of the relational structure of the scale items was performed through the exploratory factor analysis correlation matrix technique, using the principal components method for extraction of factors by Varimax rotation in order to reduce the number of variables, since there were 22 items from questions 14 and 15. The common factors retained were those with an eigenvalue greater than 1. The validity of the factor analysis was measured using the KMO (.933, excellent) and Bartlett's test (significant) and indicated acceptable values for its continuation. The factor analysis converged to a solution with 3 principal components that explain 59.5% of the total variance. It was verified the saturation of items ($> .40$) in each of the principal components. The first component explains 46.9% and groups the 9 items related to perceived usefulness, the second explains 6.7% and includes the 9 items related to information quality, while the third explains 5.8% and has been designated Ease of use.

The internal consistency of the dimensions, analysed with the Cronbach's alpha internal consistency coefficient, ranged from a minimum of .760 (reasonable) to a maximum of .904 (excellent). The categorization of Alpha values is as referenced in Hill and Hill (2005).

The Pearson correlation coefficient measures linear correlation between two sets of data: it is the ratio between the covariance of two variables and the product of their standard deviations. In general, the correlation coefficients of the constructs under analysis are statistically significant, positive, and moderate (Table 3). The highest correlation between variables occurs between Quality of information and Perceived usefulness ($r = .781$, $p < .001$). The correlation coefficients for Satisfaction with the app are all significant and positive. Thus, the higher the perceived usefulness of the content, information quality of the content, and ease of use, the higher the perceived usefulness of the content, quality of information in the content, and ease of use of the app, hence the higher the satisfaction with the app.

Table 3 Pearson Correlation for the variables under study

	Satisfaction with the App	Perceived usefulness	Quality of information
Satisfaction with the App			
Perceived usefulness	0.652***		
Quality of information	0.593***	0.781***	
Ease of use	0.369***	0.567***	0.571***

*** All correlation values are significant at significance level $p \leq .001$.

5 Discussion

Smartphones have completely changed the way in which interactions between users take place and have enabled them to remain connected and active at all times. The Telecommunications Barometer states that 6,900,000 individuals in Portugal had this type of mobile application in 2018, with a significant usage rate of 99% among younger age groups.

These tourism and travel applications consist of exchanges of information at a distance between clients and hotels, hosts, restaurants, and airline companies among others, which facilitates planning without needing to visit other premises. The applications may be considered to provide the remote communication of information in order to facilitate holiday bookings, as well as reduce the waiting times associated with physical travel agencies dealing with high levels of demand.

Based on the sample obtained, it was possible to verify that the vast majority of users of this type of application are aged between 15 and 57 and mainly consists of individuals who have had a secondary school education. The average satisfaction rating for the applications is 4.22 on a scale of 0 to 5.

This study requested the user's opinion of mobile applications in terms of quality, content and use, as well their acceptance, in order to gauge the current user satisfaction with tourism and travel applications. The applications which feature in this study were selected because they are market share leaders, according to the App Store and Google Play, and therefore provide access to a greater number of users in order to assess their data.

Using the inherent characteristics of the TAM technology acceptance model, we evaluated the attributes that determine technology acceptance by users in relation to the possibility that, in general terms, these applications are, accepted with relative ease, and considered easy to use and useful. Starting with the inherent bases of the characteristics defined in ISO 25010:2011, the qualities of the applications were evaluated as software products and it was concluded that, in relation to functionality, efficiency, compatibility, usability and reliability the respondents agreed that the applications are able to satisfy all conditions with these characteristics, emphasising that the security features present in the applications are able to protect the integrity of data linked to the profile and permission of each user without any leakage or unauthorised access.

With regard to quality of use, the users consider that the apps achieve this effectively and efficiently, and the vast majority are satisfied with the ability of the applications to meet the user's needs. Regarding quality of content, they highlighted that the applications

match the expectations of their users, considering the information to be accessible, up-to-date, reliable, real, and containing a level of depth appropriate to the context in question.

It should be noted that most users consider that the information presented in the applications is often not completely comparable with other ways of accessing the same information. Having concluded that acceptance by the users of tourism and travel applications is mediated between the perceived usefulness of the content, the information quality of the content, and ease of use, the factor that contributes most to satisfaction with the applications is the perceived usefulness of the content.

To sum up, users consider adequate functionalities and real information to be the most relevant factors that lead to their acceptance of tourism and travel applications. An average rating of 4.22 was obtained for satisfaction, which demonstrates that improvements can still be made to this type of application.

Input from the respondents concerning possible future implementations in tourism and travel applications repeatedly highlighted the following: a 360° video of the space presented (house, hotel room) and a facility to enable the user to walk through the rooms as an avatar; more accessible travel facilities for larger numbers of people (group packages); the lack of any customer support chat facility to enable the user to ask questions in real time and to present travel itineraries (flight, hotel, car, activities, restaurants) for those who do not know the destination and only have limited budget and dates on which they intend to make the trip.

6 Conclusion

Overall, all the objectives of this study were met, with good results. The main contribution it can offer to the business community is the possibility of implementing improvements to tourism and travel applications, based on the opinions and current levels of satisfaction of its users. For the rest of the scientific community it provides an evaluation of user satisfaction of tourism and travel mobile applications based on the metrics defined in ISO 25010:2011 and 25012:2008, considering the quality of an application as a software product, the quality of the content, and quality of use.

The main limitation of the study lies in the size of the sample (201 responses) which does not enable us to obtain additional data to further substantiate the results obtained, as well as the fact that we do not know whether the respondents answered the questions objectively. Moreover, user satisfaction may vary, depending on the context and less positive past experiences.

It is also necessary to emphasize that the study focussed on five tourism and travel applications (Booking, Skyscanner, Tripadvisor, Edreams and Airbnb) which are market share leaders, whereas there are other alternatives in the same market.

This study enabled us to obtain users' opinions on possible improvements to this type of application. As a proposal for future work, it would be interesting to create an implementation model for some of these improvements and subsequently evaluate how these changes affect satisfaction and acceptance levels.

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