



## The factors affecting tourism mobile apps usage

### Os fatores que afetam o uso de aplicativos móveis de turismo

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#### Abstract

The purpose of this study is to determine the key factors affecting the behaviour of using tourism mobile apps. Contrary to previous studies, the present paper highlights the key factors by evaluating the perceived advantages and technological self-efficacy together. So as to evaluate overall measurement quality and test the hypothesised relationships, a two-step approach was applied. In the first step, confirmatory factor analysis (CFA) was employed to test the validity of the measurement scales. Then, the dataset was analysed using the PLS-SEM method to test the proposed hypotheses. Data were collected from 213 adult participants through an online survey. The study revealed that time-saving is a key determinant of tourism mobile apps usage with the highest beta coefficient (0.335,  $p < 0.01$ ). The effects of convenience (0.293) and technological self-efficacy (0.201) were also significant and positive. However, the perceived financial advantage does not have a significant effect on the behaviour of tourism mobile apps usage. Given the growing value and market potential of mobile applications, this research provides crucial empirical evidence for application developers and tourism researchers about the use of mobile applications for the tourism industry.

**Keywords:** Tourism mobile applications, mobile apps, user behaviour, technological self-efficacy, tourism and technology, ICT in tourism.

#### Resumo

O estudo visa determinar os fatores que afetam o comportamento de uso de aplicativos móveis de turismo. Ao contrário de estudos anteriores, o presente trabalho destaca os fatores chave ao avaliar as vantagens percebidas e a autoeficiência tecnológica conjuntamente. Para avaliar a qualidade geral de medida e testar as relações hipotéticas, foi aplicada uma abordagem em dois passos. Na primeira etapa, foi utilizada a análise fatorial confirmatória (CFA) para testar a validade das escalas de medida. Em seguida, o conjunto de dados foi analisado usando o método PLS-SEM para testar as hipóteses propostas. Os dados foram coletados de 213 participantes adultos através de um inquérito *online*. O estudo revelou que o ganho de tempo é um determinante chave com o maior coeficiente beta (0,335,  $p < 0,01$ ). Os efeitos da conveniência (0,293) e da autoeficiência tecnológica (0,201) também foram significativos e positivos. No entanto, a vantagem financeira percebida não tem um efeito significativo no comportamento de uso de aplicativos móveis de turismo. Dado o crescente valor e potencial de mercado de aplicativos móveis, esta pesquisa fornece evidências empíricas cruciais para desenvolvedores de aplicativos e investigadores de turismo.

**Palavras-chave:** Aplicativos móveis de turismo, apps de turismo, comportamento do utilizador, autoeficiência tecnológica, turismo e tecnologia, TIC no turismo.

#### 1. Introduction

Nowadays, in the so-called digital age, the speed of development of technology continues exponentially compared to each passing year (Ali et al., 2021). In this development process, the rate of information and communication technology usage among consumers increases rapidly (Wahab, Setiawan, & Wahdiniwati, 2017, p. 120). Portable gadgets such as smartphones and tablets have been used frequently in many areas of daily life. Accordingly, mobile devices have become the primary method for accessing the Internet for more than half of global mobile users (Guo et al., 2019). Moreover, the rapidly increasing adoption of smartphones dramatically increases the number, popularity, and usage of mobile applications. With the advent of smartphones, tourists have started to use various mobile applications. Among the information and communication technologies, mobile applications, smartphones, and tablets are

the most used technologies. Mobile applications (apps) are software devised to run on wireless mobile gadgets like smartphones and tablets. Applications are designed in various ways (games, travel, e-commerce, etc.), considering the limitations and features of mobile devices. In addition to pre-installed apps on mobile devices, users can download various apps through app stores such as App Store for Apple, Google Play Store for Android devices, and AppGalery for HarmonyOS. Worldwide, 218 billion mobile applications were downloaded in 2020, and the most used application store is Google Play. As of 2019, more than 2 million applications can be downloaded in the Google Play store, while 1.83 million applications are available in the Apple App Store (Statista, 2021). Moreover, in 2019, 462 billion dollars of revenue was generated through paid downloads and in-app advertisements of mobile applications. Mobile apps



have become one of the ways people communicate with each other, shop, organise their lives, play games, and even work (Jia, Li, & He, 2016). Mobile devices and applications are widely used in the tourism sector as well as in all areas of life (Ozturk et al., 2021). Mobile applications offered in the tourism sector contain important features that can facilitate the travel of tourists and their movement at the destination (Hashim & Isse, 2019). Tourism businesses not only use mobile applications to make their websites compatible with mobile devices but also enrich their mobile applications by using various technologies to carry out basic promotional and marketing activities and achieve sustainable competitive advantage. Mobile applications are used by hotel chains worldwide, especially thanks to their high marketing budgets (Ribeiro et al., 2018). Mobile tourism applications give tourists permission to reach and receive up-to-date information about tourist places and activities in the relevant destination during/before their travel, without time and place limits. In this respect, it is stated that mobile applications have an effect on tourist satisfaction. (Erdem, Kayran, & Şeker, 2020). Besides, the transmission and storage of digital data generated by the use of mobile devices goes beyond standardised experimental research and reveals new methods of observing tourist behaviour. (Reif & Schmücker, 2020). These data, which are directly obtained from the target audience, provide tourism managers with valuable information for the personalisation of the service, which is especially important in mobile apps (Zhang, Omran, & Cobanoglu, 2017). As a result, it's vital to scrutinise the components affecting user behaviour. On the other hand, while the mobile evolution, in general, has contributed to enhancing the travel experience drastically, tackling the reasons for using tourism mobile apps is still lacking. Within the scope of the research, the main determinants of tourism mobile apps usage were examined. In the tourism industry, mobile applications help consumers identify and understand more about travel information, products, and services; and developers often use them to build marketing strategies. Mobile apps bring enormous benefits to users. However, there has been limited research on what factors may affect the use of tourism mobile apps. Even though several researchers have studied mobile apps in terms of convenience (Medeiros et al., 2022), time-saving (Xu, Huang, & Li, 2019), and financial advantage (Bhagyasree and Venugopal, 2021), in addition to these advantages provided by the applications, technological self-efficacy of the individuals has been largely ignored. Considering the gaps within the literature, the purpose of this study is to determine the key factors affecting the behaviour of using tourism mobile apps. It differs from previous studies because it highlights the key factors by evaluating the perceived advantages (convenience, time, and money) and technological self-efficacy together.

## 2. Theoretical framework and hypotheses development

Put forward by Davis (1989), the Technology Acceptance Model (TAM) links technology user acceptance with user behaviour. According to the model, the use of a technology-based product

rests on the intention to purchase through applications that depend on customers' attitudes toward the new technology. This demeanor is chiefly developed by an inspection of the perceived advantages of technology. Technology Acceptance theory can be broadened to diverse sorts of technology (Natarajan et al., 2017; Venkatesh & Davis, 2000) and be related to "behaviour intent attitude belief" to define technology acceptance among possible users (Gillenson & Sherrell, 2002). According to the theory, perceived advantages (convenience, time-saving and financial advantage) are one of the most important factors affecting the use of technology-based products in service industries (Mohamad, Radzi, & Hanafiah, 2021). Therewithal, when the literature on the mobile application context is examined, it has been determined that technological self-efficacy (Ursavaş, Şahin, & McLroy, 2014) also comes to the fore (Kibe, Ogutu, & Ojwach, 2019). These variables, which are included in the proposed model of the study, which was created based on the existing literature, constitute the theoretical framework of this research.

### 2.1 Technological self-efficacy

Technology has become an indispensable element for today's societies and people manage all processes in their daily lives, from the simplest to the most complex, via mobile devices. For example, the rate of people who check their phone before washing their face in the morning has increased to 28%, and it is stated that people stare at their phone screen every 13 minutes during the day (Deloitte, 2021). Also, with the change in tourists' travel habits, the rate of mobile application usage and the popularity of the online travel market is increasing day by day (Jia, Li, & He, 2016). In particular, the ability of smartphones to be connected at any time to communicate with the world has made it easier for individuals to share with others while on the go and has made their travels more enjoyable through location-based services (Dickinson et al., 2018). For this reason, it is essential to explore the reasons for the use of technological applications.

According to the literature, one of these reasons is technological self-efficacy. Technological self-efficacy belief is developed based on competency, knowledge, and skillfulness regarding using technology. Hasan (2006) pointed out that technological self-efficacy was a potent determinant of behavioural intention to use information systems. Rahman et al. (2016) indicated that technological self-efficacy had a positive impact on the demeanour of health technologies usage. As stated in Latikka, Turja, and Oksanen's (2019) empirical study, self-efficacy was linked with the acceptance to use robots. The findings of Wilkowska, Heek, and Zieffle (2021) showed that technological self-efficacy significantly affected the user acceptance of lifelogging technologies. Jokisch et al. (2021) found that technological self-efficacy was a major factor in older adults' Internet use. Accordingly, the hypothesis relating to technological self-efficacy is as follows:

**Hypothesis 1 (H1).** Technological self-efficacy positively influences the behaviour of using tourism mobile apps.



## 2.2 Convenience

Formerly, a variety of researchers handled the importance of convenience in technology usage (Lai, 2014). For example, Kim and Kim (2004) suggested that the key element for online reservation intention was convenience. Increasingly, online buyers are those who seek convenience compared to conventional consumers (Korgaonkar et al., 2014). Raman (2019) found that there was a significant impact of convenience on female customers' intention to buy online. The results of the study by Bi and Kim (2020) revealed that convenience positively influences satisfaction. Khadir, Ravindranath, and Sen (2021) designed a study to comprehend the elements which affect users in selecting and persisting to use mobile applications. They detected that when an application is convenient and easy to use, users tend to rely more on it. The study of Ozturk et al. (2021) also revealed that users' ongoing usage manners were positively influenced by performance expectancy. Medeiros et al. (2022) analyzed the factors influencing travelers' intention to share their travel-related information on travel-tracking mobile apps. In this context, it has been determined that users' performance expectation has a positive effect on their intention to share travel-related information through the relevant mobile applications. Hew et al. (2015) reported that performance expectancy significantly relates to behavioural intention to use mobile applications, too. Tak and Gupta (2021), in their study on travel applications, examined the role of mobile application features in influencing users. The findings obtained by the researchers show that visual, information, and collaboration features affect users' interaction with the travel application. On the other hand, Hatamifar, Ghaderi, and Nikjoo (2021) found a positive relationship between the usefulness of mobile applications and purchase intention. In accordance with the relevant literature, the undermentioned hypothesis can be derived:

**Hypothesis 2 (H2).** Convenience positively influences the behaviour of using tourism mobile apps.

## 2.3 Time-saving

The rapid progress of mobile internet technology in the hectic human life has introduced the concept of "time pressure" to consumers (Alreck & Settle, 2002). The impact of time pressure on consumer behaviour was frequently studied in behavioural science literature (Dhar & Nowlis, 1999). According to the study by Jacoby et al. (1976) for any human being; time is finite so it has worth, time is a fundamental notional resource and its utilization might be obtained through substituting another resource like money or struggle, and in behavioural science, time could be inquired as an antecedent or consequence. Limayem, Khalifa, and Frinin (2000) aimed to analyse the factors influencing online shopping. The findings uncovered that time-saving was a critical perceived outcome of online shopping. Udo and Marquis (2002) revealed that time-saving was the prominent element in the effectiveness of a website. Christou

and Kassianidis (2002) affirmed that saving time positively influenced customers' intention to adopt online travel purchases. Similarly, Internet usage for time-saving was determined as one of the main causes for travellers to make a reservation in Heung's (2003) research. Wong and Law (2005) analysed elements affecting travellers' buying intention on websites of hotels and revealed that saving time was an important determinant of purchase intention. Xu, Huang and Li (2019) approved that time-saving had an influence on the intention to use tourism mobile applications. The hypothesis relating to time-saving to be evaluated in the research is hence as follows:

**Hypothesis 3 (H3).** Time-saving positively influences the behaviour of using tourism mobile apps.

## 2.4 Financial advantage

Lastly, the perceived financial benefit has been recognized as a crucial element among people to accept the technology-related product's usage since the Internet facilitates price comparison, and online shoppers can reach the lowest price for a product without the high search cost of multiple options (Brashear et al., 2009). Duarte and Amaro (2018) demonstrated that financial advantage positively affected the intention to buy travel online. According to Gupta, Dogra, and George's (2018) study, price saving is one of the most significant predictors of smartphone app usage intention. Portz et al. (2019) aimed to explore the usage behaviour of a patient application among elderly people and they found that one of the reasons for using the online patient portal was to save money. Bhagyasree and Venugopal (2021) stated that financial advantage was one of the main reasons for online shopping. Thus, the following hypothesis is developed:

**Hypothesis 4 (H4).** Financial advantage positively influences the behaviour of using tourism mobile apps.

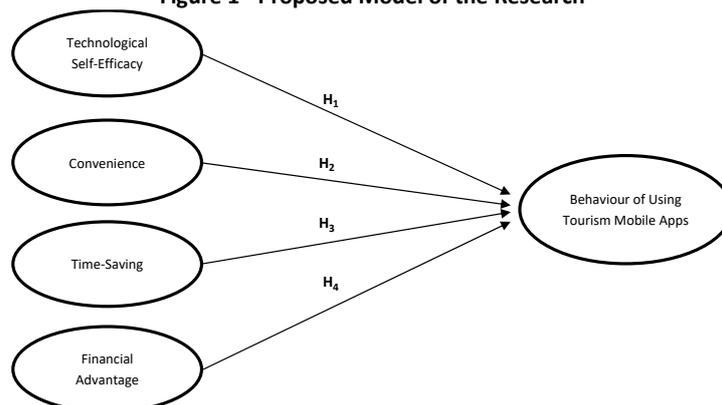
## 3. Methodology

Rested on the literature review, 4 hypotheses are established. Figure 1 shows the conceptual model developed for this research. In order to empirically measure the relations in the model, measurement items were adjusted from the existing studies and included in a survey. To measure three dimensions of perceived advantage (time-saving, financial advantage, and convenience) 9 items were adapted from Xu, Huang, and Li, (2019) as well as 3 items to measure the behaviour of using tourism mobile apps.

Technological self-efficacy was measured using 3 items adapted from Ursavaş, Şahin, and McLroy (2014). All the items were rated using a 5-point Likert scale (1 – strongly disagree to 5 – strongly agree). In addition, the survey includes questions (7 items) regarding the demographic characteristics of the participants.



Figure 1 - Proposed Model of the Research



This study employs a quantitative method and a self-administered survey to collect data. The population of the research consists of people who actively use tourism mobile applications in Türkiye. Since the total number is not known exactly convenience sampling, one of the non-probability sampling methods, was used in the research. Data were collected from individuals who agreed to participate in the research and preferred mobile applications for restaurant, hotel, and travel reservations. The survey was prepared online and the data were collected via Google Forms between March-April 2021. The prepared questionnaire was shared on various Instagram accounts related to travel and tourism. As a result of the sharing, a total of 300 surveys were distributed and 213 usable surveys were returned, 62.4% of which were completed by males. More than half (56%) of the sample were graduated from a university and 46.9% of the sample were between 28-38 ages. The sample size is greater than 100 and has more than 10 observations for each variable, so the sample has a sufficient size for the PLS technique (Barrett, 2007). Even, the sample size is greater than many studies that have been used (Hair et al., 2012). In order to assess overall measurement quality and test the hypothesized

relationships, a two-step approach (Anderson and Gerbing, 1988) was applied. In the first step, confirmatory factor analysis (CFA) was employed to test the validity of the measurement scales. Then, the data were analysed using partial least squares structural equation modelling (PLS-SEM) to examine the relationships hypothesized in the conceptual model.

4. Results

The reliability of the scales was evaluated by Cronbach’s Alpha and Composite Reliability (CR). As described in Table 1, all Cronbach’s Alpha values are greater than 0.7 and all CR values are greater than 0.60, so it is said to demonstrate reliability (Nunnally, 1970). The validity of the scales was assessed with two methods as convergent validity and discriminant validity by investigating the AVE (Average Variance Extracted) of each construct. All AVEs are greater than the 0.50 standard for all of the constructs proposed so the convergent validity of the structure is considered sufficient (Fornell and Larcker, 1981). Also, the factor loadings of all measures were significant at the  $p < .001$  level and above 0.70. The results are presented in Table 1.

Table 1 - Reliability and Convergent Validity of the Scales

Constructs and scale items	Standardized Loadings*	AVE	CR	Cronbach’s Alpha
<i>Technological Self-Efficacy</i>		0.709	0.880	0.798
I have the knowledge and skills to use technological devices.	0.817			
I am confident in the use of technological devices.	0.888			
I can use new technological devices if shown how they are used.	0.820			
<i>Convenience</i>		0.636	0.840	0.715
Using these apps to book tickets, restaurant and hotel services can free me from the constraint of business opening hours.	0.814			
The payment procedure of using these apps to book tickets, restaurant and hotel services is relatively simple.	0.783			
Using these apps to book tickets, restaurant and hotel services is not restricted by location.	0.795			
<i>Time-Saving</i>		0.636	0.840	0.714
Using these apps to book tickets, restaurant and hotel services can make me save time.	0.777			
Using these apps to book tickets, restaurant and hotel services is less time consuming than booking in a store.	0.793			
Using these apps to book tickets, restaurant and hotel services can save me time to get discount information.	0.822			
<i>Financial Advantage</i>		0.739	0.894	0.824
Booking tickets, restaurant and hotel services through these apps can save money.	0.881			
Booking tickets, restaurant and hotel services through these apps can get more discounts than offline purchases.	0.811			
Generally, the price is relatively low when booking tickets, restaurant and hotel services through these apps.	0.884			
<i>Behaviour of Using Tourism Mobile Apps</i>		0.739	0.894	0.823
I often use these apps.	0.856			
I often use one app repeatedly.	0.888			
I often recommend these apps to other people.	0.834			

Note: \*All factor loadings are significant at the 0,001 level, N=213



The values of the square roots of AVEs compared with inter-construct correlation. Correlation between constructs should be lower than the square roots of the AVE value for each

construct (Fornell & Larcker, 1981). As shown in Table 2, all correlations between pairs of constructs were less than the corresponding square roots of AVEs.

**Table 2 - Discriminant Validity (Fornell-Larcker Criterion)**

		1	2	3	4	5
1	Behaviour	<b>0.860</b>				
2	Convenience	0.645	<b>0.798</b>			
3	Self-Efficacy	0.478	0.383	<b>0.842</b>		
4	Financial Advantage	0.516	0.658	0.232	<b>0.860</b>	
5	Time-Saving	0.651	0.607	0.419	0.497	<b>0.798</b>

**Note:** The square roots of all constructs' AVEs are in bold along the diagonal. Lower diagonal values indicate factor correlations.

So as to secure discriminant validity, the Heterotrait-Monotrait Ratio of Correlations (HTMT) approach was used. If the HTMT value is higher than 0.90, there is an issue of discriminant

validity (Henseler, Ringle, & Sarstedt, 2015). As demonstrated in Table 3, all HTMT values are greater than the value of 0.90.

**Table 3 - Discriminant Validity (HTMT Criterion)**

		1	2	3	4	5
1	Behaviour					
2	Convenience	0.836				
3	Self-Efficacy	0.571	0.494			
4	Financial Advantage	0.617	0.859	0.281		
5	Time-Saving	0.843	0.845	0.537	0.642	

Consequently, all findings confirm that the measurement model represents adequate validity (convergent, discriminant) and reliability. After confirmatory factor analysis (CFA), in the second step, due to the small sample (N=213), the PLS-SEM

method was used to test the four hypotheses. The conceptual model developed for the research affirmed significant relations among variables except for H4. Table 4 shows the outcomes of testing the hypotheses.

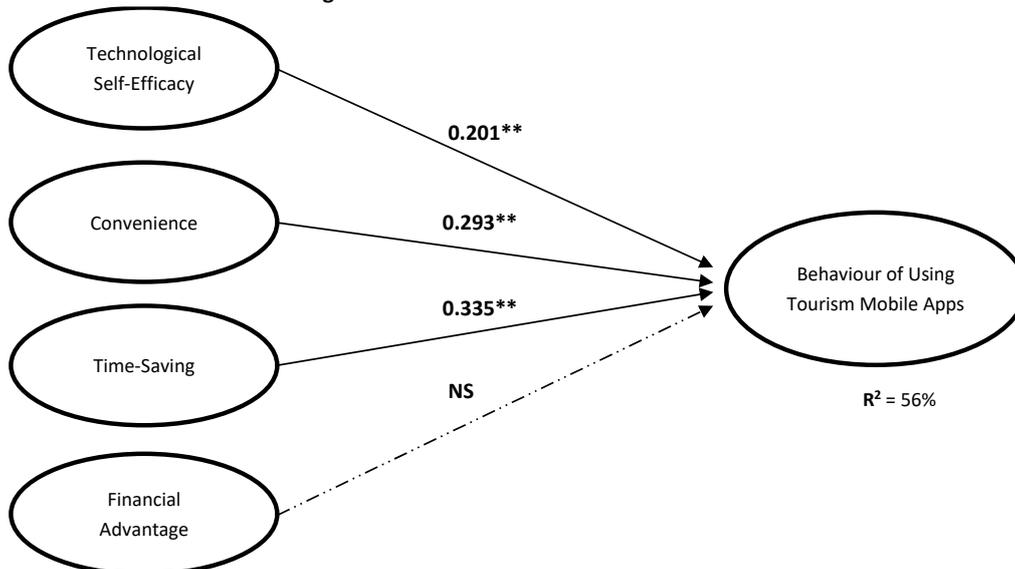
**Table 4 - Hypotheses Test Results**

Hypothesis	Path	Coefficient	t-value	Hypothesis Supported
H <sub>1</sub>	Self-Efficacy → Behaviour	0.201**	3.648	YES
H <sub>2</sub>	Convenience → Behaviour	0.293**	3.621	YES
H <sub>3</sub>	Time-Saving → Behaviour	0.335**	4.138	YES
H <sub>4</sub>	Financial Adv. → Behaviour	0.110 <sup>NS</sup>	1.456	NO

**Note:** \*p<0.01, \*\*p<0.001, NS = non-significant

The PLS structural model along with path coefficients is illustrated in Figure 2.

**Figure 2 - Path Results of Structural Model**



**Note:** \*\*: p<0.001, NS: non-significant.



## 5. Discussion

Studies examining mobile applications are generally based on the adoption and acceptance of this technology. However, in the present study, we tried to determine the key factors affecting tourism mobile app usage. Based on the literature review, four possible factors were determined and the hypotheses were developed. The structural model examined within the scope of the research confirmed the significant relationships between the variables other than "Financial Advantage". Perceived financial advantage does not have a significant effect on the use of tourism mobile applications. Based on the relevant result, it can be explained that users do not use mobile applications to save money. Contrary to this finding, earlier studies (Duarte & Amaro, 2018; Gupta, Dogra, & George, 2018; Portz et al., 2019; Bhagyasree & Venugopal, 2021) have identified a significant effect of saving money. However, according to our study, this situation may be gradually losing its validity. Because the increasing number of online shoppers today seems to have prompted businesses to take action in this regard. As the Internet allows people to compare all prices from where they live, the gap between prices in stores and prices in mobile applications has now closed. Due to this similarity in prices, the price advantage may have been replaced by the advantage of time and place. The results show that time saving has a significant positive effect on behavior. In addition, time-saving is the variable that has the greatest impact on the behavior of using tourism mobile applications. In this context, time-saving is an important determinant of the use of tourism mobile applications. It can be said that people mostly use apps to save time. Mobile tourism applications provide relief from their busy travels, especially for touristic consumers who have time constraints. It can also be considered as a way to reduce the time pressure associated with traditional in-store shopping. In this way, people find the opportunity to spend more time in traditional stores. This finding coincides with the results of Limayem, Khalifa, and Frinin (2000), Alreck and Settle (2002), Heung (2003), Wong and Law (2005), Fong et al. (2017) and Xu, Huang, and Li (2019). In addition, the variables of convenience and technological self-efficacy have a positive effect on the behavior of using tourism applications. The results indicate that the convenience of mobile apps would contribute to tourism mobile app usage due to the ease of ordering and paying. The integration of technology through mobile tourism applications enables companies to provide services that align with customer expectations. For example, mobile apps allow customers to access services from their homes. This finding confirms the current body of knowledge (Kim & Kim, 2004; Lai, 2014; Hew et al., 2015; Kim et al., 2006; Bi & Kim, 2020; Lu et al., 2011; Raman, 2019; Khadir, Ravindranath, & Sen, 2021; Ozturk et al., 2021; Hatamifar, Ghaderi, & Nikjoo, 2021; Tak & Gupta, 2021; Medeiros et al., 2022). In terms of technological self-efficacy, the finding of this paper also supported previous research (Hasan, 2006; Rahman, Ko, Warren, & Carpenter, 2016; Latikka, Turja, & Oksanen, 2019; Wilkowska, Heek, & Ziefle, 2021; and Jokisch et al., 2021). As can be seen, the

findings of the study not only support the literature but also add conceptual value with the tested model. Finally, according to the results, it has been determined that more than half (56%) of the use of mobile tourism applications is explained by the variables of technological self-efficacy, convenience, time savings, and perceived financial advantage.

### 5.1 Theoretical implications

In an era of harsh competition such as the present, any marketing activity have to initiate with a good knowledge of which factors affect user behaviour. The findings of this study are notable as they contribute to the mobile application literature in the context of tourism. The research aimed to contribute theoretically to the literature by ascertaining the determinants of tourism mobile applications through perceived advantages and technological self-efficacy. For this, the relevant literature was examined and a conceptual model was created. The model created within the scope of the research was examined with the path analysis created through PLS-SEM. Theoretically, this study attempted to establish an empirical relationship between a Technology Acceptance Model and the use of tourism mobile applications using factors such as technological self-efficacy. To our knowledge, no prior study has included these variables together to understand user behavior. Our model successfully extends the antecedents of tourism mobile app usage. The study contributes to the literature and practice as it provides valuable empirical evidence for both tourism mobile application developers and tourism researchers.

### 5.2 Practical implications

Various instruments created by modern technology have replaced traditional marketing activities. Mobile applications, which occupy an important position among these instruments, provide an effective way to establish loyal relationships between businesses and customers. The present paper offers some practical implications for the industry. The results obtained in the research provide useful information to the experts who develop mobile applications in understanding the factors that affect the impulse buying behavior of tourists. The development of mobile tourism applications is important for a better understanding of tourists. In addition, the introduction and development of appropriate technology play a critical role in responding quickly and strategically to the needs, preferences, and habits of tourists. When the use of tourism mobile applications is the dependent variable, the fact that time-saving has the highest coefficient indicates that the relevant experts should focus on this area. Time-saving is important in terms of some tangible benefits that mobile applications offer to users. According to a study carried out by mathematician Katie Steckles, modern technology saves the average person two weeks each year and consumers have turned to online shopping because they can no longer find time for traditional shopping. Consumers, who do not want to waste time wandering around the store, can immediately get the



products and services they want via their mobile phones with a single click. When the financial advantage variable analyzed within the scope of the research is evaluated specifically for the sample, it has been observed that it does not affect the use of tourism mobile applications. This situation can be interpreted as consumers valuing time more than money. Therefore, tourism mobile application developers should focus on improving the performance of applications. It should also carry out studies to optimize the opening speed of applications. In this sense, financial difficulties may be more important for application developers because application improvement and providing technical support are costly tasks. Another determinant is that tourism mobile applications provide convenience to users. For this reason, technical failures should be minimized as much as possible and necessary updates should be made in order not to disturb the application users and facilitate the processes. Smartphones, tablets, and other digital products that have emerged with the development of technology have made it necessary for society to adapt itself to new developments according to modern technology requirements. Effective use of mobile applications has become important in making these products functional. Now people make online payments, organize virtual events, and also hold online meetings and seminars. In relation to this situation, program developers and designers develop more projects and applications. Evaluation of the effectiveness of the developed applications has become critical. Since there are alternatives to many applications, applications that cannot be developed in a useful way and that are not user-friendly are not used again if they are not found efficient, effective, and satisfactory by the users. A convenient application will continue to exist and grow in the market, in line with environmental, economic, and social factors.

### 5.3 Limitations and future research

The limitations of this study may offer avenues for future research. This research is conducted with 213 participants. In order to allow generalization of the results found, the proposed model should be tested with a larger sample size. Future studies may also include different advantages of applications such as safety (Kim & Kim, 2004) and product diversity (Xu, Huang, & Li, 2019) as independent variables in the model.

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