DETERMINING THE DIMENSIONS OF MOBILE APP USABILITY IN THE CONTEXT OF VIETNAM'S TOURISM: A THEORETICAL APPROACH

Tran Thi Thu Dung[1], Le Van Huy[1]*, Nguyen Huu Thai Thinh[2]

[1]The University of Danang - University of Economics
[2]University of Khanh Hoa

*Corresponding author: levanhuy@due.edu.vn

(Received: September 26, 2022; Accepted: November 17, 2022)

Abstract - Nowadays, along with the popularity of mobile devices, mobile apps gradually become an essential part of users. To improve competitiveness and recover from the Covid-19 pandemic, tourism businesses need to know how to take advantage of the power of mobile technology, especially mobile apps. Therefore, this study concentrates on identifying and explaining the dimensions that comprise mobile app usability in the tourism sector. For this purpose, the authors have used a qualitative method of an in-depth interviews technique. The results indicated that there are 7 dimensions of mobile tourism app usability, including App design; App utility; Interface graphic; Interface input; Interface output; Interface structure; and App dependability. The findings have provided tourism managers with useful knowledge to improve the usability of tourism apps to attract more users.

Key words - App usability; Mobile app; Tourism sector; Covid-19; App interface

1. Introduction

Nowadays, with the popularity of mobile devices, mobile apps have become a vital part of users all over the world. Among the factors that make a good mobile app for users, app usability is considered as an important quality aspect. Mobile app usability is the extent to which a mobile app can be used by particular users to help them achieve specific purposes with efficiency, effectiveness, and satisfaction in specific contexts [1]. This factor not only assesses the user interface's ease of use, but also plays a significant role in the success of a mobile app [2]. Unlike the function of apps, it focuses only on researching the product and what the product can do. App usability concentrates on whether users can easily understand the app and have it perform the functions it can do. These issues are commonly expressed via the app's interface [2], [3]. According to Hussain & Omar [4] mobile app usability is confirmed to be the key to the success of app development.

However, when researching the dimensions that make up the usability of mobile apps, in different countries and different fields, these dimensions have some modifications. Besides, the dimensions of mobile app usability also change over time in the increasingly powerful development of information technologies. Research theories and models on mobile app usability are primarily based on theories of software and website contexts [5]. Most studies consider usability as an overall factor. Only some of these studies shed light on the fundamental dimensions of this research concept [3], [6]. However, mobile tourism apps are distinct from mobile apps in general in terms of features, functions, and design because of their attachment to the occasional users' needs [7].

In the tourism context, mobile apps are often associated with smart tourism destinations [8], so it is an effective tool for promoting destinations [9] and creating tourist attachment to destinations [10]. Moreover, in Vietnam's tourism after Covid-19, in particular, mobile apps are one of the effective tools for supporting tourism recovery. Therefore, understanding the dimensions that comprise the mobile app usability in the tourism sector plays a critical role for tourism managers and researchers. This study contributes to the mobile app usability literature by extending the scope of research concept "mobile app usability" to the tourism sector. Previously, this concept was only mentioned in the field of information systems (IS) [1]. In addition, the study also identified and confirmed the dimensions constituting mobile app usability from users' views in the context of Vietnam's tourism.

2. Theoretical background

2.1. Mobile tourism app usability

User-perceived usability is the perception related to aspects of user interface design, ease of use, visual appeal, user-friendliness, and convenience in providing services [11]. Based on the previous definitions, in this study, mobile tourism app usability is the extent to which the tourism app can be used, which helps travelers achieve their tourism purpose in a genuine, accurate, efficient, and satisfying way.

2.2. Research models of mobile app usability

2.2.1. mGQM Model

Hussain et al [12] developed the mobile Goal Question Metric model (mGQM) to measure the usability of mobile apps. It has 14 items and the following 6 dimensions:

- Simplicity: The degree of comfort that users find a way to perform tasks.
- Accuracy: The accuracy in which users complete tasks.
- Time: Time spent on tasks or parts of tasks.
- Featur es: Proper features available on the app.
- Safety: Users should be saved and secured while using the app.
- Attractiveness: Attractive level of the user interface.

2.2.2. PACMAD Model

Harrison et al [13] developed the model of People At the Centre of Mobile App Development (PACMAD). The model identified 7 dimensions of mobile app usability, including:

- Effectiveness: The ability of a user to complete a task in a specified context.

- Efficiency: The ability of the user to complete their task with speed and accuracy.

- Satisfaction: The perceived level of comfort and pleasantness afforded to the user through the use of the software.

- Learnability: The ease with which a user can gain proficiency with an app.

- Memorability: The ability of a user to retain how to use an app effectively.

- Errors: Reflect how well the user can complete the desired tasks without errors, which inferred the simplicity of a system.

- Cognitive load: Refer to the amount of cognitive processing required by the user to use the app.

2.2.3. MAU Model

The conceptualization and instrument of mobile app usability (MAU) of Hoehle & Venkatesh [5] includes 19 items with 6 dimensions.

- App design: The degree to which a user perceives that a mobile app is generally designed well.

- App utility: The degree to which a user perceives a mobile app generally serves its purpose well.

- User interface graphics: The degree to which a user perceives a mobile app's user interface graphics to be effectively designed.

- User interface input: The degree to which a user perceives that a mobile app allows easy input of data.

- User interface output: The degree to which a user perceives that a mobile app presents content effectively.

- User interface structure: The degree to which a user perceives that a mobile app is structured effectively.

2.2.4. UHM Model

The Usability Hierarchical Model (UHM) was developed by Kasali et al [14] including 7 dimensions and 23 sub-dimensions.

- Satisfaction: The perceived level of comfort the user experience through the use of the app.

- Efficiency: Ability of the user to complete their task with speed and accuracy.

- Effectiveness: Ability of a user to complete a task in a specified context

- Learnability: The ease with which a user can learn how to use an app within a sufficient time.

- Operability: The level at which users can easily operate the app.

- Universality: The app's tendency to accommodate various users with different cultural backgrounds.

- User interface aesthetics: The users' satisfaction and pleasure with regard to the mobile app user interfaces aesthetics.

2.2.5. UEM Model

Hussain [4] proposed an Usability Evaluation Model (UEM) to identify the usability dimensions of mobile visually impaired apps. This model includes 6 dimensions below.

- Efficiency: Speed completing a task and achieving goals of the product, with the best productivity by the app after learning it

- Effectiveness: Accuracy and completeness in achieving specific goals by users

- Satisfaction: The level of user pleasure and enjoyment during using the app.

- Understandability: The user's level of understanding of app usage and the possibility of learning it faster.

- Errors: The user faces fewer errors during using the app and can easily recover from them if there are errors, also the app is without catastrophic errors.

- Accessibility: The level of the user's usage regardless of the disabilities and ability to fully perceive the app.

2.3. Summary of previous studies on identifying the dimensions of mobile app usability

The findings of previous studies on measuring mobile app usability show that the dimensions used in the model to evaluate the usability of apps vary across countries and fields. There are certain changes in mobile apps. At the same time, the evaluation usability model of mobile apps also changes over time in the increasingly extensive development of technology and the needs of technology users. Table 1 provides a summary of previous studies related to the dimensions of mobile app usability in different context to provide a better understanding of those dimensions.

Table 1. *Previous studies related to the dimensions of mobile app usability*

Article references	Research field – Country	mGQM						PACMAD, UHM, UEM							MAU						UHM, UEM		
		Simplicity	Accuracy	Time	Features	Safety	Attractiveness	Effectiveness	Efficiency	Satisfaction	Learnability	Memorability	Errors	Cognitive load	App design	App Utility	User Interface Graphics	User Interface Input	User Interface Output	User Interface Structure	Operability	Universality	Accessibility
[16]	Tourism - Egypt							+	+	+													
[17]	Tourism - Switzerland		+			+																	
[18]	Tourism - Different countries	+	+							+	+							+					+
[19]	Health care education -Norway									+	+												
[20]	Education - Saudi Arabia							+	+	+	+	+	+	+									
[21]	Different context							+	+	+	+	+	+	+									
[3]	Disaster - New Zealand														+	+	+	+	+	+			
[14]	mHealth - Nigeria							+	+	+	+						+				+	+	
[22]	M-commerce - Indonesia										+						+				+		
[23]	Mobile social media - US, Germany, China, India														+	+	+	+	+	+			
[12]	SatNav apps - United Kingdom	+	+	+	+	+	+																
[24]	Mobile apps - different context									+	+				+		+						

3. The necessity of determining a research model on mobile app usability in the tourism sector

3.1. Limitations of existing usability models

3.1.1. Limitations of mGQM Model

This model has three main limitations. First, the model was only evaluated through usability testing and a tutorial using four different mobile apps. Therefore, the mGQM model may be effectively applied to some mobile apps due to the differences in features and functions. Second, this model is quite comprehensive because they created it for research on mobile apps in general. Therefore, it lacks adequate explanations of how to select appropriate usability metrics for a particular mobile app [12], [15].

Trust and security, for instance, are crucial characteristics in the case of m-banking apps. However, these features have not been adequately discussed in this model. Thirdly, the structure of the model is developed based on goal question metrics [12]. As a result, questions about specific app usability may not be easy to interpret.

3.1.2. Limitations of PACMAD Model

PACMAD was designed to capture the complexities of interacting with apps on mobile devices. The model aims to apply existing usability models to mobile apps, such as by including functionality services during app development. However, the functionality services can be increased the software complexity. Therefore, this makes the user's primary goal becoming difficult to accomplish via the mobile device. Besides, to examine the model's accuracy for mobile apps, PACMAD also lacks guidelines and metrics related to chosen dimension as well as requires evaluation [15].

3.1.3. Limitations of MAU Model

MAU model includes six factors that reflect the mobile app usability which can help guide the development of mobile apps [3]. In particular, in comparison with other usability models, the MAU model shows the specific factors that suggest improving and developing mobile apps in terms of their design or interface [15]. According to [3], one of the limitations of this model is that it has only been applied to the social media context. It is necessary to have an assessment metric to provide a suitable scale to assess the app usability in other research contexts [25].

3.1.4. Limitations of UHM Model

The model was proposed by integrating the Integrated Measurement Model (IMM) and PACMAD model. This overcomes the limitations of the previous research model. However, the survey sample was users in the healthcare sector, specifically MyFitnessPall and GoogleFit apps. Due to the difference in features and functions of different apps in different contexts, this model may not be effective in all research contexts which require further studies [14]. In addition, the model considers all the usability factors together, which generates too many rules [26]. The attributes in the model haven't been ranked and prioritized yet. This is not guaranteed to capture both the subjective and objective attributes simultaneously for reliable and better results.

3.1.5. Limitations of UEM Model

The usability evaluation model is proposed based on the systematic literature review method. The model indicated six dimensions that have a significant impact on users' satisfaction, those who have a moderate and severe visual impairment. It helps mobile app developers and evaluators to evaluate the mobile app for these users. However, the limitation of this model is the scope of the study which can only be proven in the research context of visual impairment. This model still needs to add criteria and metrics to complete the model as well as be evaluated by experts [4].

3.2. Other reasons for forming a new mobile app usability model in the tourism sector

The theories on mobile app usability have been determined based on general research theories in software and website contexts [5]. Some models conceptualize usability in a synthetic way that interprets constituent structures as confusing and even misleading [5], [6]. App usability is a multidimensional concept, defined in various ways by the International Organization for Standardization (ISO) and Nielsen (1994), and in some studies [15], [27]. Many studies have conceptualized and measured mobile app usability without integrating important contextual factors [5]. Generic usability models based on a software or Web site research context may not be sufficient to apply in a mobile app context. Because mobile apps have specific characteristics such as portability mobile and screen size constraints [13]. To overcome this problem, many studies have looked at mobile app-specific usability by combining and extending the usability dimensions. Specifically, this can be proven in the study of [13], [27]. Although mobile app usability studies have consistently used dimensions from the previous research model, there is no consensus on the constituent dimensions. Furthermore, due to the specific characteristics of the tourism sector, it may not be appropriate to use dimensions of mobile app usability developed in other sectors. Or at least it may not capture all subtleties of mobile app usability assessment in the tourism sector. More specifically, the specific characteristics of the tourism sector are that tourism-related needs are often infrequent [7], and users have more mobility between locations.

Based on the above reasons, instead of simply using an existing mobile app usability model like mGQM; PACMAD; or MAU;... then the authors proposed a specific model in the field of tourism. It could identify important factors based on the above models, and develop more relevant attributes to enhance the effectiveness of mobile apps in the tourism sector.

4. Methodology

A critical review of the literature on measuring the mobile tourism app was carried out in accordance with the recommendations of [28]. Seven dimensions of the mobile tourism app usability were identified and defined.

To explore the face validity of these dimensions, 20 individual in-depth interviews were conducted with a

convenience sample. In-depth interviews provided a comprehensive understanding of participants' personal experience with regard to dimensions of mobile tourism app usability, as well as their opinions and preferences, including reasons underlying using behavior. The interviewees were business students and lecturers who frequently used mobile tourism apps to find information or purchase services (see Table 2). Before the survey started, we stated that only people with mobile tourism app experience could participate in the study. To ensure only such individuals would participate, we asked participants to name and detail the mobile tourism apps they had used in the last four months. We automatically excluded from the sample all those who failed to respond to these questions and could not confirm active personal use of a mobile tourism apps.

Table 2. *Profile of interviewees*

Participants	Gender	Age (Years)	Academic level	Mobile tourism app
P1	Female	21	Bachelor	Tripadvisor, Airbnb, MAPS.ME, Booking.com
P2	Female	20	Bachelor	mTrip, MeTrip, MAPS.ME, Triip.
P3	Female	20	Bachelor	Traveloka, Tripadvisor, Agoda, Yelp
P4	Male	20	Bachelor	Traveloka, TripCase, MeTrip, MAPS.ME,
P5	Female	21	Bachelor	Traveloka, mTrip, TripCase, Airbnb, MAPS.ME, Yelp
P6	Male	21	Bachelor	Traveloka, Tripadvisor, Agoda, mTrip, Yelp
P7	Male	21	Bachelor	Airbnb, Agoda, mTrip, TripCase,
P8	Male	33	Master	Tripadvisor, Airbnb, TripCase, MeTrip,
P9	Male	25	Master	Traveloka, Booking.com, Agoda
P10	Female	27	Master	Booking.com, Airbnb, TripCase, MAPS.ME
P11	Female	30	Master	Traveloka, Agoda. Booking.com
P12	Male	40	Doctor	Booking.com TripCase, Yelp
P13	Male	45	Doctor	Traveloka, Agoda. MAPS.ME,
P14	Female	42	Master	Traveloka, MAPS.ME,
P15	Male	29	Master	TripCase, MeTrip,
P16	Female	38	Master	MAPS.ME, Yelp
P17	Female	26	Master	Traveloka, MAPS.ME
P18	Female	29	Master	Traveloka, Agoda, mTrip, TripCase,
P19	Male	40	Doctor	Traveloka, MeTrip, MAPS.ME
P20	Female	41	Doctor	Traveloka, Booking.com Agoda. mTrip,

Two researchers conducted the interviews at Danang University of Economics and Khanh Hoa University in May 2020, using a semi-structured protocol. Semi-structured interviews were administered to predetermine questions and further questions on the basis of informants' answers. The interviews continued until no further information was being gained from additional respondents [29]. The interviewees were asked to define mobile tourism app usability and provide examples of its domains. Each interview lasted around 45 min. Three protocols were used to asked the informants, including (1) experience using mobile tourism apps, (2) characteristics of mobile tourism apps that attract customer use, and (3) shortcomings of mobile tourism apps, and participants were instructed to respond to three questions. The interviews were not limited to the prepared protocols because the answer was expanded alongside the issue.

Content analysis was used, and the results suggested that the 7 proposed dimensions sufficiently represented customer perceived mobile tourism app usability.

5. Research results and discussion

The results show that mobile tourism app usability is a multidimensional structure consisting of 7 dimensions: app design, app utility, interface graphics, interface structure; interface input, interface output and app dependability (see Table 3).

The results of this study are consistent with studies by [3], [5]. Specifically, Hoehle & Venkatesh [5] researched and identified the dimensions of mobile app usability including app design, app utility, interface graphics, interface structure; interface input and interface output. In addition, the study of Tan et al [3] has demonstrated and added to the app dependability as an important dimension constituting the mobile app usability.

App design is the ability to preserve data that user enters well, not having to enter the same data twice [3]; The ability to be ready for action immediately after being powered on, and information to be displayed efficiently, regardless of whether the mobile device is held horizontally or vertically [30]; Subtle branding efforts which means that the app doesn't force users to watch advertisement, quietly reminds user of the brand that runs the app, and uses brand colors or images in a refined [3], [5].

App utility is the extent to which users perceive that a mobile app well serves the specific purposes and functions it can provide [5]. A mobile app with good utility is focused on the content that is most relevant to the user and the main purposes an app provides are emphasized [31], [32]. Another important thing about app utility is that users can easily find information and navigate through the toolbar on the app [32].

Interface structure is the degree to which users perceive an effectively structured mobile app [5]. This means that the app arranges and organizes information in a top to bottom structure [33]. Important information is arranged at the top of the interface and the content is logically organized and easily predictable [33].

Interface graphics are the extent to which users perceive the graphics of an effectively designed app interface [5]. Studies confirm that the user's positive perception of use will be significantly improved if mobile apps incorporate icons and realistic images [34]. Realistic icons will make it easier for users to recognize the core functionality of a given mobile app [35]. Graphics integrated into mobile apps must be aesthetically appealing as it is an important criterion for users to evaluate the effectiveness of the app interface [32], [34].

Table 3. *Summary of qualitative research results exploring the dimensions of mobile tourism app usability*

No	Dimension	Frequency	Reason
1	**App design**	20	(1) The app launches quickly, allows user to instantly start using it; (2) The general psychology of customers often wants everything quickly, saving time; Respond quickly to customer needs; If the access speed is slow, they will leave the app; (3) Content adaptation according to the orientation of the mobile device, so users find it very convenient. The users can read the content regardless of the orientation of their mobile; (4) The good app design saves data automatically, so users can restart where I left and, as a consequence, save a lot of time; (5) The good app design is attracted, retained and stimulated consumers through the provision of valuable; (6) Customers often have many options, they can wait or switch to another app; Create a positive and satisfied customer experience.
2	**App utility**	20	(1) The app has had good usability, which makes customer believe that the app satisfies all users' s needs; (2) The good app utility provides the benefits for customer needs and the accurate information their will get; (3) Promoting the utilitarian value of app; the usability of the app is good; (4) Good users' s experience with app usage is positive; (5) The possibility to share and exchange information with others and to search for information easily; (6) Connection with the users community app utility facilitates a focus on customer needs, active two-way communication and responsiveness to help users in a timely manner; (7) The app utility adds value and encourages return visits of users; (8) The users understand and find the service that suits their needs, so the users have a basis to choose services and make decisions; (9) Allowing users to specify requirements, needs and suppliers will increase the ability to provide personalized service; (10) The supplier will guide and advise the users; Ensure convenience, respond to information for users in the fastest way.
3	**Interface graphics**	18	(1) An app with beautiful graphics and eye-catching colors will make users immediately satisfied, happy and refreshed; (2) The app use unique visuals that fit the app's values and positioning; employing engaging graphics. Hence, the interface graphics affects users experience and make the user experience more enjoyable; (3) Using real-life pictures or icons to illustrate the functionalities, laying out the app in a manner that is easy for travelers to locate the content they need; (4) The app uses rich, beautiful, and engaging graphics that draw user to access the app more, make an impression, and keep it in the user's memory when needed; (5) Contributing to increasing the aesthetics of the app to create enjoyment for users; (6) Attracting users; creating a sense of excitement and sympathy for users, they will be more interested in the app...; (7) Create a relaxing environment for users.
4	**Interface structure**	16	(1) The interface structure is an important factor in creating the effectiveness and reliability of the app; (2) To guarantee convenience for users, the app be designed flexibly and explicitly, allowing them, for example, to search for information and make transactions easily throughout their journey; (3) Listing the most frequently used functions at the very top, hence the layout of the app makes it easy for users to locate the content they need; (4) The app provides users a logical path to follow; (5) There is no direct contact with the supplier, so the information on the app is clear and accurate, which will create trust and strengthen users' confidence in the service and the supplier; (6) Make sure the user's choice on the app is correct with the actual service of the supplier; (7) Navigation makes it easy for customers to go to the links that users need to use, optimizing choices for users.
5	**Interface input**	15	(1) Creating the effectiveness of the app and influencing the consumption behavior of customers; (2) The app has simple search input locations; information is clear and well organized. All these features made users feel positive; (3) The app has the main functions immediately apparent and has fingertip-sized buttons. Hence, the users easy input data, so users feel relaxed, comfortable and manage their time effectively; (4) To allow user to enter their preferences or information easily; (5) The users who find a app easy to navigate and access tend to have positive attitude about using it; (6) Interface input can bring about convenience and speed for users in performing operations on the app; (7) When the app functions exceeds the waiting time, users will redirect to another app or stop using the app; (8) Any delay in transaction or request dealing can frustrate online users and keep them from using the app again; (9) If users find that interface input is difficult to use, or the interface input is complex and unclear, their use intentions will be very low.
6	**Interface output**	15	(1) Presenting the content in a suitable and easy to read format; and using familiar terminology; quickly and effectively meet the needs of users who access and use the app; (2) The organization of information and icons of functions on the app should be simple so that it is easy for users to find what they need; (3) Interface output with timely guidance so user feel this app helpful; (4) Providing complete, accurate and up-to-date information on the app to increase the participation of users; (5) Through interface output, users feel the friendliness of app, and app managers recognize and respond to special needs of the customers in a timely manner; (6) The users can easily access and learn about suppliers; (7) Convenient for use and oriented to serve all types of users; (8) Performing complex app operations will create discomfort for users and they will exit the app; (9) Do not waste users' time when accessing the app.
7	**App dependability**	14	(1) A stable app with a clear policy related to personal information security make users feel more secure to use and continue using it; (2) If an app crashes, the users may lose confidence and get the impression that the app is not reliable, which could prevent them from continuing to use it; (3) Ensuring the app operates stably and smoothly; (4) To avoid any disruption, online service failures; (5) The users are often worried about risks and unexpected problems, which they do not know who is responsible for and about the resolution process; (6) App dependability is an essential dimension of mobile tourism app usability, as it affects customer trust and use intention; (7) If the customer feels unsafe and unreliable, he or she will be disappointed and leave the app; (8) The lack of face-to-face interaction for online service sets higher demand for users to be assured of the privacy and security of their transaction; (9) Dependability is one of the main concerns of users and influences users' decision-making process; (10) Ensure professionalism, reliability and high legitimacy.

Interface input is the degree to which users perceive that a mobile app allows data to be entered for search [5]. This means that the app has a well-designed data entry method, and the app controls are sized appropriately for the user to easily select the desired functions. In addition, the controls also on the app also need to be clear, intuitive and immediately responsive as users are often not willing to spend a lot of time learning how to use a mobile app [36]. It is important for mobile apps to help minimize user effort when entering data [3], [36].

Interface output is the extent to which a user perceives that a mobile app effectively presents deliverables according to user requirements [5]. Studies have further clarified that the information search provides should contain terms that are easy to understand and familiar to users [34]. Most users prefer to use mobile apps containing standard elements because they feel familiar with these interfaces [36].

App dependability is the degree to which users perceive that the app can operate stably from start to finish during the use of the mobile app [3]. In tourism, a technology that supports before, during and after the trip with high stability plays an equally important role, determining the use behavior of tourists [37].

6. Conclusion

The conceptualisation of the 7 dimensions of mobile tourism app usability was built on the authors' extensive review of relevant literature and qualitative interviews, including assessment of content and face validity. The study used individual in-depth interviews, so many respondents may fully understand the research content. However, the respondents used in this study are not sufficiently representative of the tourism industry and it may limit the generalisation of the results. Therefore, this result needs to be verified in practice with a quantitative method, in order to confirm the accuracy of the dimensions of mobile tourism app usability. Moreover, in the future with the quantitative method, the results will show the importance of each dimension of mobile tourism app usability that this study has not mentioned.

In the context of tourism, mobile apps are increasingly popular because they bring a lot of benefits not only to tourism businesses, tourist destinations but also to travelers. From a business perspective, mobile tourism apps are a valuable tool to help travel suppliers approach potential customers and activate tourists' travel needs. From a tourist perspective, these apps allow them to search for information, find accommodation, transport, flights,... and contribute to enhancing the traveler's experience. App managers can identify the most highly evaluated dimensions of their mobile tourism app usability and may use that information as a basis for an online positioning bases.

REFERENCES

[1] H. Hoehle and V. Venkatesh, ‘Mobile Application Usability: Conceptualization and Instrument Development’, *MIS Q.*, vol. 39, no. 2, pp. 435–472, Feb. 2015, doi: 10.25300/MISQ/2015/39.2.08.

[2] R. Baharuddin, D. Singh, and R. Razali, ‘Usability Dimensions for Mobile Applications-A Review’, *Res. J. Appl. Sci. Eng. Technol.*, vol. 5, no. 6, pp. 2225–2231, 2013.

[3] M. L. Tan, R. Prasanna, K. Stock, E. E. H. Doyle, G. Leonard, and D. Johnston, ‘Usability factors influencing the continuance intention of disaster apps: A mixed-methods study’, *Int. J. Disaster Risk Reduct.*, vol. 50, 2020, doi: 10.1145/1167948.1167972.

[4] A. Hussain and A. M. Omar, ‘Usability Evaluation Model for Mobile Visually Impaired Applications’, *Int. J. Interact. Mob. Technol. IJIM*, vol. 14, no. 05, p. 95, Apr. 2020, doi: 10.3991/ijim.v14i05.13349.

[5] H. Hoehle and V. Venkatesh, ‘Mobile Application Usability: Conceptualization and Instrument Development’, *MIS Q.*, vol. 39, no. 2, pp. 435–472, Feb. 2015, doi: 10.25300/MISQ/2015/39.2.08.

[6] N. Islam, M. Mäntymäki, and B. Anol, ‘Towards a Decomposed Expectation Confirmation Model of IT Continuance: The Role of Usability’, *Commun. Assoc. Inf. Syst.*, vol. 40, pp. 502–523, 2017, doi: 10.17705/1CAIS.04023.

[7] D. Wang, Z. Xiang, and D. R. Fesenmaier, ‘Smartphone Use in Everyday Life and Travel’, *J. Travel Res.*, vol. 55, no. 1, pp. 52–63, Jan. 2016, doi: 10.1177/0047287514535847.

[8] C. Lamsfus, D. Martín, A. Alzua-Sorzabal, and E. Torres-Manzanera, ‘Smart Tourism Destinations: An Extended Conception of Smart Cities Focusing on Human Mobility’, in *Information and Communication Technologies in Tourism 2015*, I. Tussyadiah and A. Inversini, Eds. Cham: Springer International Publishing, 2015, pp. 363–375. doi: 10.1007/978-3-319-14343-9_27.

[9] J. Fernández-Cavia, E. Marchiori, C. Haven-Tang, and L. Cantoni, ‘Online communication in Spanish destination marketing organizations: The view of practitioners’, *J. Vacat. Mark.*, vol. 23, no. 3, pp. 264–273, Jul. 2017, doi: 10.1177/1356766716640840.

[10] T.-S. Kuo, K.-C. Huang, T. Quyet Nguyen, and P. Hung Nguyen, ‘Adoption of mobile applications for identifying tourism destinations by travellers: an integrative approach’, *J. Bus. Econ. Manag.*, vol. 20, no. 5, pp. 860–877, 2019, doi: 10.3846/jbem.2019.10448.

[11] S. Lee, B. Shin, B. Shin, H. Lee, and Yonsei University, ‘Understanding Post-adoption Usage of Mobile Data Services: The Role of Supplier-side Variables’, *J. Assoc. Inf. Syst.*, vol. 10, no. 12, pp. 860–888, Dec. 2009, doi: 10.17705/1jais.00217.

[12] A. Hussain and M. Kutar, ‘Usability Evaluation of SatNav Application on Mobile Phone Using mGQM’, *Int. J. Comput. Inf. Syst. Ind. Manag. Appl.*, vol. 4, p. 9, 2012.

[13] R. Harrison, D. Flood, and D. Duce, ‘Usability of mobile applications: literature review and rationale for a new usability model’, *J. Interact. Sci.*, vol. 1, no. 1, p. 1, 2013, doi: 10.1186/2194-0827-1-1.

[14] Kasali, Taiwo, Akinyemi, Alaba, Awodele, and Kuyoro, ‘An Enhanced Usability Model for Mobile Health Application’. International Journal of Computer Science and Information Security (IJCSIS), 2019.

[15] F. Zahra, A. Hussain, and H. Mohd, ‘Usability evaluation of mobile applications; where do we stand?’, presented at the 2nd international conference on applied science and technology 2017 (icast’17), Kedah, Malaysia, 2017, p. 020056. doi: 10.1063/1.5005389.

[16] S. Hussein and E. Ahmed, ‘Mobile Application for Tourism: The Case of Egypt’, *Int. J. Cust. Relatsh. Mark. Manag.*, vol. 13, no. 1, pp. 1–29, Jan. 2022, doi: 10.4018/IJCRMM.290415.

[17] A. Inversini and L. Violi, ‘Tourism Mobile Application Usability: The Case of iTicino’, *Int. J. E-Serv. Mob. Appl.*, vol. 5, no. 2, pp. 54–70, Apr. 2013, doi: 10.4018/jesma.2013040104.

[18] N. A. Ismail, F. Ahmad, N. A. Kamaruddin, and R. Ibrahim, ‘A Review on Usability Issues in Mobile Applications’, *J. Mob. Comput. Appl.*, vol. 3, no. 3, pp. 47–52, 2016.

[19] S. G. Johnson, T. Potrebny, L. Larun, D. Ciliska, and N. R. Olsen, ‘Usability Methods and Attributes Reported in Usability Studies of Mobile Apps for Health Care Education: Protocol for a Scoping Review’, *JMIR Res. Protoc.*, vol. 9, no. 8, p. e19072, 2022, doi: 10.2196/19072.

[20] M. H. Afif, ‘Evaluating PSAU Mobile Application Based on People at the Center of Mobile Application Development (PACMAD) Usability Model: Empirical Investigation’, *J. Comput. Sci.*, vol. 17,

no. 3, pp. 275–283, Mar. 2021, doi: 10.3844/jcssp.2021.275.283.

[21] P. Weichbroth, 'Usability of Mobile Applications: A Systematic Literature Study', *IEEE Access*, vol. 8, pp. 55563–55577, 2020, doi: 10.1109/ACCESS.2020.2981892.

[22] Y. Yassierli, V. Vinsensius, and M. S. S. Mohamed, 'The Importance of Usability Aspect in M-Commerce Application for Satisfaction and Continuance Intention', *Makara J. Technol.*, vol. 22, no. 3, p. 149, 2018, doi: 10.7454/mst.v22i3.3655.

[23] H. Hoehle, X. Zhang, and V. Venkatesh, 'An espoused cultural perspective to understand continued intention to use mobile applications: a four-country study of mobile social media application usability', *Eur. J. Inf. Syst.*, vol. 24, no. 3, pp. 337–359, May 2015, doi: 10.1057/ejis.2014.43.

[24] B. Biel, T. Grill, and V. Gruhn, 'Exploring the benefits of the combination of a software architecture analysis and a usability evaluation of a mobile application', *J. Syst. Softw.*, vol. 83, no. 11, pp. 2031–2044, Nov. 2010, doi: 10.1016/j.jss.2010.03.079.

[25] N. L. Hashim and A. J. Isse, 'Usability Evaluation Metrics of Tourism Mobile Applications', *J. Softw. Eng. Appl.*, vol. 12, no. 07, pp. 267–277, 2019, doi: 10.4236/jsea.2019.127016.

[26] D. Gupta, A. K. Ahlawat, and K. Sagar, 'Usability Prediction & Ranking of SDLC Models Using Fuzzy Hierarchical Usability Model', *Open Eng.*, vol. 7, no. 1, pp. 161–168, Jun. 2017, doi: 10.1515/eng-2017-0021.

[27] C. K. Coursaris and D. J. Kim, 'A Meta-Analytical Review of Empirical Mobile Usability Studies', *J. Usability Stud.*, vol. 6, no. 3, p. 55, 2011.

[28] G. A. Churchill, 'A Paradigm for Developing Better Measures of Marketing Constructs', *J. Mark. Res.*, p. 10, 1979.

[29] I. Seidman, *Interviewing as qualitative research: a guide for researchers in education and the social sciences*, 3rd ed. New York: Teachers College Press, 2006.

[30] J. O. Wobbrock, B. A. Myers, and H. H. Aung, 'The performance of hand postures in front- and back-of-device interaction for mobile computing', *Int. J. Hum.-Comput. Stud.*, vol. 66, no. 12, pp. 857–875, Dec. 2008, doi: 10.1016/j.ijhcs.2008.03.004.

[31] Venkatesh and Ramesh, 'Web and Wireless Site Usability: Understanding Differences and Modeling Use', *MIS Q.*, vol. 30, no. 1, pp. 181–206, 2006, doi: 10.2307/25148723.

[32] J. D. Wells, W. L. Fuerst, and J. W. Palmer, 'Designing consumer interfaces for experiential tasks: an empirical investigation', *Eur. J. Inf. Syst.*, vol. 14, no. 3, pp. 273–287, Sep. 2005, doi: 10.1057/palgrave.ejis.3000516.

[33] Wells, Valacich, and Hess, 'What Signal Are You Sending? How Website Quality Influences Perceptions of Product Quality and Purchase Intentions', *MIS Q.*, vol. 35, no. 2, p. 373, 2011, doi: 10.2307/23044048.

[34] T. J. Hess, M. A. Fuller, and J. Mathew, 'Involvement and Decision-Making Performance with a Decision Aid: The Influence of Social Multimedia, Gender, and Playfulness', *J. Manag. Inf. Syst.*, vol. 22, no. 3, pp. 15–54, Dec. 2005, doi: 10.2753/MIS0742-1222220302.

[35] C. Flavián, M. Guinalíu, and R. Gurrea, 'The role played by perceived usability, satisfaction and consumer trust on website loyalty', *Inf. Manage.*, vol. 43, no. 1, pp. 1–14, Jan. 2006, doi: 10.1016/j.im.2005.01.002.

[36] T. Jokela, J. Koivumaa, J. Pirkola, P. Salminen, and N. Kantola, 'Methods for quantitative usability requirements: a case study on the development of the user interface of a mobile phone', *Pers. Ubiquitous Comput.*, vol. 10, no. 6, pp. 345–355, Oct. 2006, doi: 10.1007/s00779-005-0050-7.

[37] I. Jeacle and C. Carter, 'In TripAdvisor we trust: Rankings, calculative regimes and abstract systems', *Account. Organ. Soc.*, vol. 36, no. 4–5, pp. 293–309, May 2011, doi: 10.1016/j.aos.2011.04.002.