Key Indicators of UI/ UX Research on Mobile Tourism Application (MTA) Using UTAUT 2 Model

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Abstract:

Purpose: The advent of mobile tourism applications (MTA) has revolutionised the planning and experience of tourism among travellers. With the proliferation of mobile technologies, travel applications have become indispensable tools for travellers who are searching for seamless and enriching experiences. However, the success of MTA is dependent on its user-friendly and intuitive interface. This study tries to present the key indicators using the UTAUT-2 model for user interface (UI) and user experience (UX) research on MTA in India.

Methodology, Design, and Approach: A qualitative research method was deployed in the study, which included an online survey with the Indian travellers to capture their insights, expectations, and challenges while using MTA. For the data analysis, the confirmatory factor analysis (CFA) method will be used.

Findings: The results shed light on various factors that contribute to positive or negative user interactions, such as intuitive navigation, visual aesthetics, information presentation, personalisation, language localization, and responsiveness.

Practical Implications: This research not only contributes to the growing body of knowledge on UI/UX in MTA but also offers practical recommendations for developers, designers, and stakeholders to enhance user satisfaction and engagement.

Future Research and Implications: The outcomes of this study provide a valuable foundation for future UI/UX research in the field of MTA, both in India and beyond. By incorporating the identified usability constructs and indicators into the development process, stakeholders can strive to create intuitive, engaging, and culturally sensitive applications that cater to the specific needs and preferences of Indian travellers, thereby enhancing their overall tourism experience.

Originality and Value: By integrating these usability constructs and indicators into the design process, MTA can be better equipped to cater to the diverse needs and preferences of Indian travellers, ultimately fostering more enriching and enjoyable tourism experiences.

Keywords: UTAUT2 model, user interface, user experience, mobile tourism application, UI/UX research, key indicators, Indian travellers

Introduction and Literature Review

The ubiquitousness of smartphone usage among tourists and travellers is experiencing swift and notable growth (Hübler & Hartje 2016). According to the Ministry of Tourism, data shows that international tourist arrivals in India were 3.31 million in the first quarter of the calendar year. While travelling to different states or different nations, tourists and travellers are unable to access different unfamiliar environments; thus, they can get access from their smartphones or mobile devices to take the guidance and explore through the digital lens. Instead of the array of smartphone applications available on the market, they still have certain common attributes.

User Interface and Mobile Application

The term UX was originated by Donald Norman as "User Experience". This states all the communication that is communicated by the company to its users about the services and products offered by them. Donald Norman defined this term after considering that company communication with the users in terms of the human interface and their usability has become attenuated.

UTAUT-2 and tourism applications

The study has adopted the UTAUT-2 model to understand the technological acceptance among the users for their destination searches and how UI and UX are also helpful with the other components of UTAUT (Venkatesh, 2000). The study has adopted the UTAUT model for the technology acceptance of the users through different models such as TAM and UTAUT. The model selection is guided by the development of digital tourism and related applications through mobile phones. These applications use geolocation in different tourist places to influence tourists to visit (Rasinger et al., 2009; Höpken et al., 2010; Fuchs, Höpken, & Lexhagen, 2014). Chopdar et al. (2018) found that the previous studies on the adoption of the UTAUT model did not consider studying UI and UX as major factors while studying the technological adoption of mobile applications. Existing studies have applied the UTAUT-2 (Venkatesh et al., 2012) model with the UI and UX interface in mobile tourism applications. The study proposes a model to examine the intended use of mobile tourism applications (MTA) on the basis of different constructs of the UTAUT-2 model, such as performance expectation, effort expectation, social influence and facilitating conditions, hedonic motivation, user experience, and user interaction with mobile tourism applications, as application quality constructs included in the design quality as proposed by Al-Qeisi & Hegazy (2015). Magrath & McCormick (2013) state that user experience is a component that defines the user experience when they are using the mobile tourism application while interacting with the application with its technological assistance to accept the technology (Al-Qeisi et al., 2014

Research Model and Hypothesis Development Performance Expectancy

From the previous literature, it can be inferred that users who use technology for their own benefits have favourable results that are expected by consumers (Compeau & Higgins, 1995). It can also be identified that customers have a pragmatic relationship between the performance of the application as performance expectancy and their behavioural intentions in the framework of online purchase intention (Escobar-Rodríguez & Carvajal-Trujillo, 2014; Ponte, Carvajal-Trujillo & Escobar-Rodríguez, 2015; Slade et al., 2015; Oliveira et al., 2016; Engotoit et al., 2016). With the use of UX and UI interfaces that allow users to use their creativity and leverage their experience through personalisation and customization (Gharaibeh et al., 2021), we hypothesise as follows:

H1: Performance expectancy has a positive relationship with the tourist users' behavioural intention to use mobile tourism applications.

Effort Expectancy

Effort expectancy can be defined as "the extent to which the user can connect to the technology and the ease of using the technology" (Davis, Bagozzi, & Warshaw, 1989; Venkatesh et al., 2003; Richards, 2011). The effort expectancy can also be explained as a degree to which it becomes easier for the users to accept the technology and

understand it; they need less effort towards it. With this, user acceptance can be increased while using the mobile tourism application. Thus, we hypothesised that:

H2a: Effort expectancy has a positive relationship with the UI and UX interface while using the Mobile Tourism Application (MTA).

H2b: Effort expectancy has a significant relationship with the performance expectancy of mobile tourism applications (MTA).

H2c: Effort expectancy has a significant relationship with the user's intention towards using the Mobile Tourism Application (MTA).

Hedonic Motivation

Hedonic motivation can be defined as "the pleasure and enjoyment that the user derives while using the technology" (Brown & Venkatesh, 2005). According to Van der Heijden (2004), hedonic motivation is similar to perceived enjoyment. It is also found that perceived enjoyment or hedonic motivation plays a significant role while using the technology and applications that are characterised by UI and UX interfaces while using the tourism mobile applications (Zhou, Song, & Zhou, 2022). Therefore, we hypothesise as follows:

H3a: Hedonic motivation has a positive relationship with the UI and UX interface while using the Mobile Tourism Application (MTA).

H3b: Effort expectancy has a significant relationship with the user's intention towards using the Mobile Tourism Application (MTA).

Facilitating Condition

Facilitating conditions can be defined as "the extent to which a user assumes that mobile application and technological acceptance will accept the use of the system and technology" (Venkatesh et al., 2003). In the context of mobile applications, this establishes a need for acceptance towards the use of technical frameworks that are still not acceptable from the user's perspective (Zhou et al., 2010; Gupta et al., 2018; Farah et al., 2018; Lunardi et al., 2022). The travellers who are searching for their desired places and their related things on mobile applications need to have the latest technology, which enables them to adopt that

application more profoundly. Therefore, we hypothesise as follows:

H4a: Facilitating conditions have a positive impact on tourist behaviour and intention to use UI and UX for the mobile tourism application.

H4b: Facilitating conditions have a positive impact on tourists' use behaviour of mobile tourism applications.

Social Influence

As per Ajzen (1991), if the individual thinks that his or her behaviour is not accepted by his peer or group, he or she will not opt for the given behaviour. Therefore, from the literature, it can be ascertained that social influence is a strong indicator of the behavioural intentions of the users (Chong & Ngai, 2013). Social influence can include different factors such as social value, innovativeness, and application use (Sufian & Kamarudin, 2016). Social influence can also be defined as an individual's belief, attitude towards the services, behavioural intention, and opinions that they accept from others, which influence their individual behaviour and practices (Venkatesh et al., 2012). The influence of peers, relatives, and family can affect an individual's decision towards mobile tourism applications (Omonedo & Bocij, 2017; Moorthy et al., 2017; Tan et al., 2017). Therefore, we hypothesised as follows:

H5a: Social influence has a positive impact on users' behaviour and intention to use the UI and UX for the mobile tourism application.

H5b: Social influence has a positive impact on users' use behaviour towards the mobile tourism application.

H5c: Social influence has a positive impact on users' behaviour and intention to use the UI and UX for the mobile tourism application.

Habit

Habit can be defined as the "sharing of experiences by the tourist through the website or mobile application (Herrero & San Martín, 2017). It is also identified that habit is found to be a significant predictor of behavioural intention towards purchasing the product or services. It is also identified that habits also have a significant impact on the behavioural intentions of users and their actual usage (Rodríguez & Trujillo, 2013; Hsiao et al., 2016; Järvinen et

al., 2016; Chen et al., 2021). Thus, we hypothesised that:

H6a: Habit has a positive relationship with the use of UI and UX when using a mobile tourism application (MTA).

H6b: Habit has a positive relationship with the behavioural intention while using the Mobile Tourism Application (MTA).

H6c: Habit has a positive relationship with use behaviour while using the Mobile Tourism Application (MTA).

Mobile tourism application user experience and user interface

With the design and functioning of the mobile tourism application, users find it easy to navigate, browse from one location to another, and easily search for their requirements. This can be achieved with the user experience (UX) and user interface (UI) provided by the application (Kuan et al., 2008; Lee & Kozar, 2012; Magrath & McCormick, 2013; Al-Qeisi et al., 2014; Miladinovic & Hong, 2016; Stocchi et al., 2021). Thus, we hypothesise that:

H7a: User experience has a positive impact on users' use behaviour to use mobile tourism applications (MTA).

H7b: The user interface has a positive impact on users' behavioural intention to use mobile tourism applications.

Aesthetic Value of the Application

Aesthetics can be defined as "the appearance of the thing that looks pleasing to the eyes." This results in the emotional status of the users and their experience with the application (Lavie & Tractinsky, 2004). This reduces the time taken by the tourist to create their experience by searching for the right application that helps them easily navigate. Aesthetics can also be explained as the environment that is created by the application and the features that are provided to the users for their participation" (Oh et al., 2007; Pine & Gilmore, 2017). From the previous literature, it can be examined that the aesthetic value of the different determinants, such as credibility with the application, trust in the application, and performance of the application while navigating through the application (Moshagen et al., 2009; Sonderegger & Sauer, 2010), While designing the aesthetic value, developers used it for learning and understanding the application, hence improving the process through the use of technology (Di Serio et al., 2013; Gharaibeh et al., 2021). To develop a possible impact on the users and using the determinants of the UTAUT model framework (performance expectancy, effort expectancy, habit, hedonic motivation, and social influence) to use the mobile tourism application Therefore, we hypothesise that:

H8a: Aesthetic value has a positive impact on users' behaviour and intention to use mobile tourism applications (MTA).

H8b: Aesthetic value has a positive impact on users' use behaviour to use mobile tourism applications (MTA).

H8c: Aesthetic value has a positive impact on performance expectancy while using the Mobile Tourism Application (MTA).

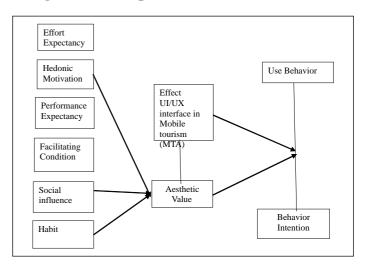
H8d: Aesthetical value has a positive impact on effort expectancy while using the Mobile Tourism Application (MTA).

H8e: Aesthetic value has a positive impact on hedonic motivation while using the Mobile Tourism Application (MTA).

H8f: Aesthetic value has a positive impact on social influence while using the Mobile Tourism Application (MTA).

H8g: Aesthetic value has a positive impact on habits while using the Mobile Tourism Application (MTA).

Figure 1: Conceptual model (source: Author)



Methodology

To intervene with the investigating the validity of the model and to examine and test associated hypothesis with the study. The data was collected through self-administered survey questionnaires developed through google forms and distributed among the respondents aged 18-35 years of age who use smartphones for downloading different tourism applications. The study deployed 500 respondents using the convenience sampling methodology. The survey was conducted in the state of Delhi from May 2023 to September 2023. The questionnaire was divided into two parts. The first part contains the questions related to

demographics such as: age, gender, internet usage, number of time one travel, education level. The second part was divided among the variables related to UTAUT-2 model and UI and UX interface during the usage of mobile tourism application. The questionnaire was distributed among 500 respondents out of which 432 were returned and after removing the duplication, 412 questionnaires can be retrieved, which shows a good response rate (82.4%). Among the respondents 212 respondents were male (54.6%), aged from 18 to 35 years and are using the internet and mobile tourism application in their smartphones. Whereas female respondents comprise of 200 respondents (48.54%). As shown in Table 1

Table 1: Demographic distribution of respondents

Sample n = 412		
Items (characteristics)	Frequency	Percentage (%)
Gender		
Male	212	51.45
Female	200	48.54
Age		
18–23 years old	285	69.17
24–30 years old	85	20.6
31–35 years old	42	10.19
Level of education		
Intermediated	43	10.43
Graduation	185	44.90
Post Graduation	119	28.8
Master/PhD	65	15.77
Apps distribution service (may		
select more than one)		
Apple store	166	40.29
Google play	246	59.7
Mobile Tourism Application usage		
regularly	304	73.78
Often	85	20.6
Rarely	23	5.5

Variables and Measurement

The proposed conceptual framework is developed on the basis of the relationship between the six different independent components of UTAUT-2 and three dependent variables. The items that were used in the proposed framework were adopted from the previous literature

related to UTAUT-2 model proposed by Venkatesh et al. (2012) and information system model to incorporate the use of UI and UX design in the application for consumer satisfaction and intuitiveness and visual aesthetics. Then their internal reliability and convergent validity was identified and tested. These items were tested under the

five-point Likert Scale ranging from "strongly disagree" to "strongly agree". The demographic of the respondents like age, gender, qualification and internet usage was assessed using nominal scale.

Data Analysis

A two-stage approach of data analysis was done using Structural Equation Modelling (SEM), which was advocated by Anderson & Gerbing (1988). In the two-stage process, in the first stage study deploys confirmatory factor analysis (CFA). To test the study result fitness and also to examine the reliability and validity of the proposed conceptual framework model. In the second stage structural

model was deployed to test hypothesis of the proposed model (Hair et al., 2014).

Descriptive Analysis

The results of the study were shown in the table II. As per the results all the mean value of the items in the survey questionnaire were considered above the midpoint (3.6). This value indicates that respondents had a pragmatic response towards the UTAUT-2 components and UI and UX items being measured through the survey questionnaire filled. Also, from the result of standard deviation it ranges from 1.01-1.25.

Table II: descriptive statistics of the construct

1		
Construct	Mean	SD
Effort Expectancy	5.10	1.11
Hedonic Motivation	4.98	1.01
Performance Expectancy	3.89	1.11
Facilitating Condition	5.09	1.18
Social Influence	3.78	1.24
Habit	4.87	1.03
Behavioural Intention	3.98	1.02
Use Behaviour	4.65	1.05
Aesthetic Value of the Application	4.23	1.25

Measurement Model analysis: Reliability and Validity model

Confirmatory Factor analysis (CFA) was done using the AMOS 23.0 software to ascertain the relationship between the model items in the proposed model framework (Arbuckle, 2016). The CFA was done to increase the estimation procedure to understand the different parameters. The analysis was conducted on variance-covariance matrices (Hair et al., 2014). Kline (1998) suggested fit indices to assess the goodness of fit. Different indices proposed by Kline (1998) are root mean square residuals (RMSR); root mean square of approximation (RMSEA; comparative fit index (CFI); adjusted goodness of fit index (AGFI); goodness of fit index (GFI) and normed fit index (NFI). Table III shows the acceptance of the fit indices from the gathered data. Fives Items (PE6, FC3, SC2, SC3, BI3) have been deleted from the model during

the booting of the model fit. It can be assessed from the table that all the fit indices were in a required range. This enables the study to examine the valuation of convergent validity, discriminant validity and reliability to classify the psychometric properties of the model are adequately distributed. As per Hair et al (2014) to evaluate the reliability, convergent validity, reliability and discriminant validity, composite reliability (CR) and average variance extracted (AVE) were used. The composite reliability (CR) is considered to be good if it is above 0.7 and average variance extracted should be above 0.5 and composite reliability should be greater than average variance extracted (AVE) to establish convergent validity, where average variance establish (AVE) should be greater than correlation value, so that it can support discriminant validity. The result in the table V shows that the average variance extracted (AVE) were above 0.612 and above 0.822 for CR, and this

suggest that the construct shows adequate reliability and convergent validity. Whereas the square root of AVE is

greater than their correlation values that shows that all the items illustrate that it has adequate discriminant validity.

Table III: Model Fit Summary for the structural Model Measurement

Fit Index	Recommended Value	Measurement Model	Structural Model
x^2/df	<5, preferable <3	2.72	2.61
Goodness-of-Fit Index (GFI)	>0.70	0.820	0.522
Adjusted Goodness-of-Fit Index	>0.70	0.825	0.746
Comparative Fit Index (CFI)	>0.80	0.891	0.833
Root Mean Square Residuals (RMSR)	<0.20	0.072	0.067
Root Mean Square Error of Approximation (RMSEA)	< 0.09	0.042	0.050
Normed Fit Index (NFI)	>0.80	0.825	0.917
Parsimony Normed Fit Index (PNFI)	>0.70	0.651	0.723

Table IV: Path coefficients () and statistical significance (t)

Hypothesis	(standard	T statistic	P value	Support
Performance expectancy behavioral i	nte 13.1186io n	4.451	0.000	Yes***
Effort expectancy UI/UX in MTA	0.578	6.389	0.000	Yes***
Effort expectancy Performance exp	ect 0a5fa4cy	2.357	0.000	Yes***
Effort expectancy behavioral inte	n t i 0o203	2.87	0.000	Yes****
Hedonic Motivation UI/UX in MTA	0.103	2.740	0.006	Yes***
Hedonic Motivation behavioral int	ent (0.1647h	2.761	0.006	Yes***
Facilitating Condition UI/UX in MTA	- 0.003	0.087	0.377	Yes***
Facilitating Condition behavioral in	t e n -10.0005 n	2.662	0.008	Yes***
Social Influence behavioral inter	n t i e0n003	6.075	0.344	No
Social Influence use behavior	-0.007	6.067	0.323	No
Social Influence UI/UX in MTA	-0.006	0.863	0.388	No
Habit use behavior	0.139	2.657	0.008	Yes***
Habit behavioral intention	0.81	0.000	0.931	Yes***
Habit UI/UX in MTA	0.091	2.125	0.034	Yes***
UI/UX Use behavior	0.313	2.657	0.183	Yes***
UI/UX behavioral intention	-0.008	2.345	0.163	No
AVA Use behavior	0.124	0.086	0.205	Yes***
AVA Performance expectan	c y 0.512	6.234	0.156	Yes***
AVA habit	0.643	0.044	0.007	No
AVA social influence	0.312	0.456	0.162	No
AVA hedonic motivation	0.213	2.453	0.178	Yes***

Notes For n = 412 subsamples based on distribution t (411) of one-tagged Students: *p < 0.05 (t (0.05, 499) = 1.64791345)
p < 0.01 (t (0.01, 411) = 2.333843952); *p < 0.001 (t (0.001; 411) = 3.106644601)

Discussion and Conclusion

The findings that are obtained from the result analysis are summarised as follows. The study implies the UTAUT- 2 model framework with the use of UI/UX design for the mobile tourism application (MTA). All the item in the model framework are supported except one item of performance expectancy, two items of facilitating conditions and two items of social influence on the behavioural intention and use intention towards UI/UX design in MTA. Also, it can be inferred that behavioural intention and use behaviour have a significant relation with the UTAUT 2 model and use of MTA by the users. The aesthetical value variable has influence on all the components of UTAUT- 2. Moreover, from the study, it can be ascertained that demographic profile of the users also has a positive impact on the user UI/UX design of mobile tourism application (MTA), and this can be examined as an important predictor in the adoption of MTA, as mostly it is found that the younger generation are mostly comprehended towards using the application during their destination visit and also before their visit. The aesthetical value, effort expectancy, performance expectancy is related to mobile travel application have a high level of significance. The use behaviour and user intention have a significant relationship with the UI/UX in the use of mobile tourism application and technological usage. The hypothesis that was not supported is the relation between the facilitation condition and social influence with

behavioural intention and use intention does not have any support for the mobile tourism application (Hew et al., 2015). According to Baptista & Oliveira (2015); Slade et al (2015) and Soares et al (2021) that users while using the mobile application influence with the design quality of the application but does not get influenced by the facilitating condition and social influence while using the mobile tourism application (MTA). These two constructs will not enable the application developer or destination marketing organization (DMO). With the use of Hedonic Motivation component in the UTAUT 2 perspective user can find entertainment and happiness towards using the mobile tourism application as a part of behavioural intention and use behaviour (Chong, 2013; Nair et al., 2015; hew et al., 2015; Wong et al., 2020). Trust is another factor that is incorporated in the model and a component of UTAUT 2, which shows the relationship between the trust among the mobile tourism application and the UI and UX design of the application. This can enable the users to understand the design and interface of the tourism application and further help the developers and destination marketing organization and to understand the behavioural intention and use behaviour of the application (Bankole et al., 2011). The performance expectancy of the mobile tourism application has a behavioural influence and intention to use in the application (Musa et al., 2015). This also shows a positive significant relationship between the performance expectancy and effort expectancy.

Table V Correlations and AVEs

Effort Expectancy	EE 0.932	HM	PE	FC	SI	HB	BI	UB	AVA
Hedonic Motivation	0.486	0.833							
Performance expectancy	0.485	0.729	0.880						
Facilitating Condition	0.690	0.536	0.589	0.877					
Social influence	0.637	0.589	0.653	0.649	0.875				
Habit	0.435	0.348	0.368	0.465	0.493	0.918			
Behavioral Intention	0.615	0.245	0.244	0.506	0.455	0.408 0.	.926		
Use Behavior	0.255	0.212	0.184	0.247	0.210	0.332 0	367	0.901	
Aesthetic Value of App	0.521	0.488	0.451	0.582	0.566	0.377	0.388	0.183	0.781

Note The bold numbers in the diagonal rows are square roots of the average variance extracted (AVE)

Practical Implications

From the findings of the study, the practical implication can be gained by the developers of Mobile Tourism Application (MTA) and destination marketing organization (DMO) about the users' preferences towards the application and reason which attract them towards using the application. The study also shows that the performance expectancy has a positive significance towards the intention to use and behavioural intention. This helps the stakeholders UI and UX design developers and destination marketing organization (DMO) to develop the strategies to attract and to set the users download more application of MTA. The study confirms that effort expectancy, performance expectancy and habit play a significant role towards the behavioural intention and use behaviour. The hedonic motivation of the users towards the use of application may be used by the markets to use experiential marketing approach to help them connect them with the users' (Zhou et al., 2015; Gupta et al., 2018). It is also suggested from the study that marketers should consider towards improving the interface design of the mobile tourism application and should enjoy using the application (Venkatesh et al., 2012).

Limitation and Future Scope

The limitation of the study can be the population sample selected for the study, that comprises mostly of the youth that is the sample of the age group 18-35 years. The study needs to be conducted with the application developers, to understand their concept and idea towards the development of mobile tourism application (MTA). The study was conducted only in Delhi state, India. The results can be changed as per the socio demographic status and geographical and age distribution also. Most of the application was found to be downloaded mostly through google play rather than IOS. For the future research it is recommended that the study should be conducted on older generation as well and to understand their interest and UI and UX design for the elders to use. Other than developers and marketers also need to be surveyed to understand their perspective towards the UI and UX interface.

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Appendix A: Questionnaire data

EE1	It is easy to understand the information that the mobile tourism applications provides
EE2	The UI/UX in the mobile tourism applications is clear and understandable
EE3	It is easy for me to adopt the UI/UX during the use of tourism mobile applications
HM1	it is easy for me to adopt the UI/UX during the use of tourism mobile applications
PE1	The user experience in Mobile Tourism Applications is an important factor for me
PE2	I like the Design element in using mobile tourism applications
PE3	Mobile Tourism Application are personalised as per my needs
PE4	The use of Localized Language is easy and understandable
PE5	The use of Intuitive Navigation in Mobile Tourism Application is easy to use
PE6	I preferer to travel with mobile tourism applications that have high quality design experience
FC1	I have necessary resources for the use of Mobile Tourism Application
FC2	I am comfortable in using the UI interface of the Mobile Tourism application
FC3	I have necessary knowledge to use Mobile Tourism Application Interface
SI1	I feel like peers who are important to me think that I should use MTA for my Travel usage
SI2	Peers/Friends/Relative who influences my behaviour think that I should use Mobile Travel apps
SI3	Peers/Friends/Relatives whose opinions that I value prefer that I use Mobile Travel apps
HB1	The use of Mobile Travel application has become habit for me while traveling
HB2	I am addicted towards using Mobile Travel Application for travel searches
AV1	Mobile Travel Application understand my needs and personalized them
AV2	Mobile Travel apps can provide me with personalized destination to my activity context
AV3	Mobile Tourism apps can provide me with more relevant information tailored to my preferences or personal interests
BI1	I intend to continue using mobile tourism applications in the future
BI2	I plan to continue to use mobile tourism applications frequently
BI3	I use Mobile Tourism Application on daily basis
UB1	How often do you use mobile tourism applications for location services?
UB2	How often do you use mobile tourism applications for travelling?
UB3	How often do you use mobile tourism applications to advise on travelling?