

Effects of Mobile Design Quality and Innovation Characteristics on Intention to Use Mobile Tourism Guide

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Abstract—This study investigates theoretical model of tourist intention in the context of mobile tourism guide. The research model consists of three constructs: mobile design quality, innovation characteristics, and intention to use mobile tourism guide. In order to investigate the effects of determinants and examine the relationships, partial least squares is employed for data analysis and research model development. The results show that mobile design quality and innovation quality significantly impact on tourists' intention to use mobile tourism guide. Furthermore, mobile design quality has a strong influence on innovation characteristics, and cannot be the moderator on the relationship between innovation characteristics and tourists' intention to use mobile tourism guide. Our findings propose theoretical model for mobile research and provide an important guideline for developing mobile application.

Keywords—Design quality, Innovation characteristics, Intention, Mobile tourism guide.

I. INTRODUCTION

NOWADAYS mobile applications are growing rapidly in a variety of contexts, due to an advantage of mobile phone is mobility that can gain information anywhere and anytime. Mobile applications in tourism industry also are possibly emphasized by international tourists because they are mobility and supporting tourists' travel. The mobile tourism guide (MTG) can help travelers to access information on their smart phones such as understanding the geography, sharing their experience, gathering information and learning something more about the places they are visiting. However, mobile application development is not easy based on user satisfaction, budget, developed time, and the efficiency of mobile phone. Therefore, in order for MTG to be used effectively in tourism, we need a better understanding of which factors influence a successful implementation. Intention to use technology is commonly acknowledge as one of the useful proxy measures of mobile system success [1]-[3]. Therefore, we address the concern of effective mobile MTG design by empirical validation of tourists' intention to use MTG.

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Even though most literature on modern mobile-based focus on the innovation characteristics as determinants of intention to use technology, their innovation characteristics are different based on context and technology such as mobile internet [4], [5], mobile library [6], mobile learning [1], mobile health [2], and mobile payment [7], [8]. Consequently, it needs the understanding characteristics of MTG that affect on the tourists' intention. In addition, we found that the several previous studies also have emphasized to mobile design quality because of the mobile limitations: small screen, limited memory, processing capacity, low-resolution displays, and data transfer speed [9]-[11]. Therefore, we purposed and examined the theoretical model in order to understanding tourists' intention to use MTG in terms of mobile design quality and innovation characteristics.

The next section proceeds with the literature review and hypotheses, methodology, data analysis and results, and discussion. Finally, the paper provided the concluding remarks and suggesting future work at the last section.

II. LITERATURE REVIEWS AND HYPOTHESES

A. Intention of Technology

Most prior researches on technology adoption have mainly focused on intention to use technology and user satisfaction. Investigating determinants of users' intention also has been emphasized by mobile-based researchers [7], [12], [13]. In addition, several previous studies found the significant relationship between users' satisfaction and user intention [13], [14]. Thus, intention to use MTG is identified to be the dependent variable of this study.

B. Innovation Characteristics

There are the different characteristics of innovation in each technology, thus the previous studies which studied in different technologies proposed dissimilar innovation characteristics in their model. For instance, in a survey done by [1] which studied intention to use m-learning, proposed usefulness, ease-of-use, compatibility, trialability, observability as determinants of users' intention; while [8] proposed security, compatibility, usefulness, ease-of-use and mobility in intention to use mobile payment model. In addition, in the research being done by [4] found relative advantage and communicability of mobile internet offers were significantly positively, and trialability was a negative impact on mobile internet acceptance.

From considering of tourists' interview results, previous

reviews and the features of MTG, we proposed the five characteristics as the following:

1. Relative advantage refers to the degree to which an innovation is perceived as being more advantageous than its precursor [15].
2. Compatibility refers to the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters [15].
3. Lack of complexity refers to the degree which innovation is perceived as relatively easy to understand and use [15].
4. Trialability refers to the degree to which individuals think that they have the opportunity to experiment with and innovative offering on a limited basis before users decide about their commitment to adopt the novelty [15].
5. Mobility refers to the degree of ability to move around while still being quite free to perform task and interact the instant access to information at any time and any place [16].

Furthermore, diffusion innovation of theory [15] also stated that innovation characteristics influence on user adoption and intention to use technology. Likewise, most prior studies found a significant relationship between innovation characteristics and intention to use technology [8], [17]-[19]. Thus, the first hypothesis proposed as the following:

H1. Innovation characteristics positively affect on tourists' intention to use MTG.

C. Mobile Design Quality

Design quality is important in application development and it is evaluated by various aspects. In the survey done by [20], [21] measured design quality with screen design, terminology, and navigation. Meanwhile in the survey done by [9], [11] assessed quality by contextual quality, connection quality, content quality, and interaction quality. Based on the MTG features, this study evaluated mobile design quality in three aspects: mobile content quality, mobile interaction quality, and mobile appearance quality.

1. Mobile content quality refers to the inherent value and usefulness of the information provided by mobile service [22]. Content quality can be measured by amount of content, timely information, and reliability [9].
2. Mobile interaction quality refers to the level of quality in terms of interaction between application and user over mobile platform [23]. Mobile interaction quality can be measured by structure, navigation, and presentation [9].
3. Mobile appearance quality refers to the level of quality in terms of presentation on mobile phone such as attractive application, organized menu, and appropriate layout [6], [21].

Even though a few previous researches as [21], [24] found the positive relationship between quality and innovation characteristics, it is underlying to study this relationship in MTG domain based on MTG's characteristics. Therefore, we proposed second hypothesis as the following:

H2. Mobile design quality positively affects on innovation characteristics.

Most application development studies found the positive direct and indirect relationship between quality and intention. Reference [20] found technical quality has a significant impact on intention to purchase through web site, while content quality and appearance quality influenced on attitude toward the web site, and attitude also impacted on the intention. In addition, in the survey done by [11] found connection quality, content quality, interaction quality and contextual quality influenced on user satisfaction, and also user satisfaction impacted on intention to use mobile information service. Thus, we propose hypothesis for investigating relationship between mobile design quality and tourists' intention as the following:

H3. Mobile design quality positively affects on tourists' intention to use MTG.

Moderator variable is typically introduced when there is an unexpectedly weak or inconsistent relation between a predictor and a criterion variable [25]. Thus, the relationship between innovation characteristics and intention to use technology should have a moderating variable owing to results from previous studies. For example, in a survey done by [4] did not find the relationship between compatibility and intention to use mobile internet, whereas in a survey done by [2], [8] found compatibility influenced on users' intention.

Therefore, mobile design quality is proposed to be the moderator in this study because of prior researches which found mobile design quality influence on user intention as in [11], [20]. In addition, the increasing design quality possibly increases influence of innovation characteristics on tourists' intention to use MTG. Therefore, the final hypothesis is as the following:

H4. Mobile design quality impacts on the relationship between innovation characteristics and tourists' intention to use MTG.

III. METHODOLOGY

This study uses a survey methodology. The instrument was developed in order to test the hypothesized model and to predict the intention to use MTG among respondents. We design the research methodology as the following:

The population of this study is the international tourists who visited Thailand. According to [26], the population above one million individual users, the minimum sample size of 384 respondents is considered sufficient to test the hypothesis. Sample of this study is international tourists who visited Thailand in May 2012. The total data of study is 708, thus it indicates sufficient data to test hypotheses.

Self-questionnaires were used as the instrument of this survey. All items were adapted from previous studies which the reliability surpass the minimum threshold of 0.70 for Cronbach's alpha value [27]. As presented in Table I, the innovation characteristics' items were adapted from [28], [29] which are widely used to measure the characteristics for a wide variety of technologies. The items for measuring mobile design quality were adapted from [9], [20], [30], [31]. Furthermore, intention's items in the survey were adapted from [3]. All questions are anchored on the 7-point Likert

scale which ranged from 1=strongly disagree to 7=strongly agree.

TABLE I
 CONSTRUCTS AND ITEMS

Construct (Abbreviation)	Item
Mobile design quality (MDQ)	The MTG has sufficient contents that I expect to find information.
	The MTG provides timely information
	The MTG provides accurate information
	The menus of MTG are clearly categorized.
	I can easily recognize where the information I need is located.
	I can easily move back to the page I previously visited.
	The MTG looks attractive.
	The MTG looks organized.
	The layout of MTG is appropriate.
	Innovation characteristics (INC)
Using the MTG will help me to find travel's guide information more quickly	
Using the MTG will be fit into my travel.	
Using the MTG will be fit into my travel style.	
Learning to use the MTG would be easy for me.	
The MTG is easy to use.	
Before deciding to use MTG, I am able to properly try it out.	
Before deciding to use MTG, I am able to use it on a demo version.	
I believe the MTG is independent of time.	
I believe the MTG is independent of place.	
Intention to use MTG (INT)	If I have the MTG, I will use it for planning my trip.
	If I have the MTG, I will use it in during my trip.
	If I have the MTG, I will use it in the next trip.

In order to ensure that the questionnaires of study are effective, questionnaires were distributed to a convenient sample of 30 international tourists for pilot test. Following the pilot test, the completed questionnaires were filled with respondents, who were the international tourists and departed from the Suvarnabhumi Airports of Thailand in May, 2012. Data was collected using questionnaire with convenience sampling technique.

Survey respondents participated in this study voluntarily. Before filling out the survey, participants were given the demonstration of MTG usage and MTG features, and they had a chance to try out the MTG. A total of 708 responses were collected and included in the final analysis. From the demographic data of respondents as shown in Table II, we found that the data is proper for analysis and testing in terms of reliability, validity, and research model.

IV. DATA ANALYSIS AND RESULTS

The study conducts the confirmatory factor analysis to examine the measurement and research model. SmartPLS 2.0 is powerful structural equation modeling software to analyze data, due to the partial least squares (PLS) is a particularly appropriate analysis when raw data is non-normal distribution [32], [33]. We analyzed data in two steps: measurement analysis and model analysis.

TABLE II
 DEMOGRAPHIC DATA OF RESPONDENTS

Item	Frequency	Percentage
Gender		
Male	388	54.5
Female	320	45.2
Age		
Below than 21 years	36	5.1
21-25 years	148	20.9
26-30 years	188	26.6
31-40 years	158	22.3
41-50 years	74	10.5
Above 50 years	104	14.7
Annual Income (USDx1,000)		
Below than \$20,000	176	26.8
\$20,001-\$30,000	122	18.6
\$30,001-\$40,000	76	11.6
\$40,001-\$50,000	74	11.3
Above than \$50,000	208	31.7
Continent		
Asia	284	40.1
Europe	216	30.5
America	60	8.5
Oceania	108	15.3
Africa	16	2.3
Middle East	24	3.4

A. Measurement Analysis

We evaluate and present the measurement analysis in three parts in order to evidence the acceptable measures of study. There are convergent validity, discriminant validity, and reliability.

1. Convergent Validity:

Convergent validity refers to the degree to multiple items to measure the same concept that are in agreement of construct. According to [34], the loading is acceptable when it exceeds the recommended value of 0.6. Likewise, the highest factor loading is higher than cross-loading more than 0.1 [35]. In Table III, the least structure loading values is 0.741 and differ the cross loading more than 0.1, thus the convergent validity of this study is adequate.

TABLE III
 STRUCTURE LOADING AND CROSS LOADING

Item	MDQ	INC	INT
MCQ	0.870	0.722	0.618
MTQ	0.889	0.689	0.538
MAQ	0.854	0.631	0.560
RA	0.664	0.802	0.531
COM	0.624	0.795	0.633
CPX	0.582	0.741	0.504
TRI	0.685	0.900	0.602
MOB	0.685	0.900	0.602
INT1	0.592	0.615	0.884
INT2	0.624	0.629	0.900
INT3	0.548	0.618	0.904

2. Discriminant Validity:

Discriminant validity is assessed by comparing the correlation matrix of the constructs, the diagonal elements which are the square root of average variance extracted (AVE). The AVE value should exceed the inter-construct correlations for adequate discriminant validity [36]. In Table

IV, all correlation values of constructs are significant at the significant level of 0.001. Furthermore, all diagonal elements are larger than their corresponding correlation coefficients. Therefore, our findings indicate the acceptable discriminant validity. We also examined the multicollinearity problem. The results show all variance inflation factors (VIF) are less than the acceptable cut-off points [37]. Thus, the multicollinearity problem is not found in this study.

TABLE IV
 LATENT VARIABLES CORRELATIONS

	VIF	MDQ	INC	INT
MDQ	2.75	0.871		
INC	3.01	0.782	0.830	
INT	2.06	0.656	0.692	0.896

Note: VIF = variance inflation factor, MDQ = mobile design quality, INC = innovation characteristics, INT = intention to use mobile tourism guide

3. Reliability:

Reliability is evaluated by assessing the items' internal consistency of each construct. In PLS analysis, reliability usually is evaluated by three criterions: composite reliability (CR), AVE, and Cronbach's alpha. CR and AVE are calculated by equations as shown in the Table V. The results show CR values of all constructs exceed 0.903, AVE values are at least 0.759, and the Cronbach's alpha are all greater than 0.841. Thus, our findings are higher than the standard 0.7, 0.5, and 0.7 cut-off point of CR, AVE, and Cronbach's alpha, respectively [32], [37]. Hence, the results indicate that the reliability of this study is adequate.

TABLE V
 RELIABILITY OF CONSTRUCT

Construct	AVE ^a	CR ^b	Cronbach's Alpha
Mobile Design Quality	0.759	0.904	0.841
Innovation Characteristics	0.689	0.917	0.886
Intention to Use MTG	0.803	0.924	0.877

Note: ^a Average Variance Extracted (AVE) = (summation of the square of the factor loadings) / ((summation of the square of the factor loadings) + (summation of the error variances))

^b Composite Reliability (CR) = (square of the summation of the factor loading) / ((square of the summation of the factor loadings) + (square of the summation of the error variances))

B. Model Analysis

The results of structural model indicate that 61.3% of the variance in the innovation characteristics and 51.5% of the variance of intention to use MTG could be explained by the full model as shown in Fig. 1. The variance explains by this model is substantial, thus the satisfactory fit is obtained [38]. Mobile design quality has a positive influence on innovation characteristics ($\beta = 0.78, p < 0.001$) and intention to use MTG ($\beta = 0.30, p < 0.001$), whereas mobile design quality could not be the moderator on relationship between innovation characteristics and intention to use MTG ($p = 0.34$). In addition, innovation characteristics has a positive impact on intention to use MTG ($\beta = 0.46, p < 0.001$). Thus, the findings of the structural model indicate that H1, H2 and H3 are supported, while H4 is not supported.

In this study, we obtained a global fit measure (GoF) value of 0.651 for complete model, which exceeds the cut-off value of 0.36 for large effect size of R^2 [38], [39]. Thus, our model provides adequate support to validate the PLS globally.

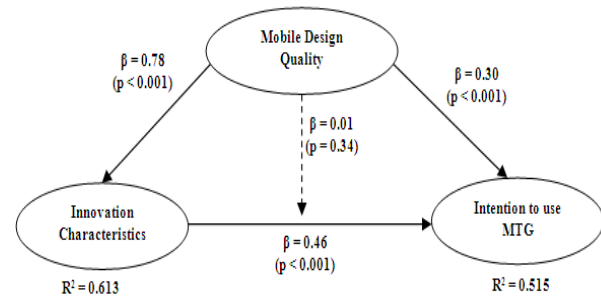


Fig. 1 Results of PLS model

V. DISCUSSIONS

Our results reveal several interested findings. First, mobile design quality is not suitable to be the moderator on the relationship between innovation characteristics and intention to use MTG among international tourist. It should be the antecedent of innovation characteristics and predictor of intention to use MTG. These findings conform to the wide cited article [25] that there should be no relationship between independent variable and moderator. Second, the innovation characteristics are stronger influence than mobile design quality on tourists' intention to use MTG. Third, the mobile design quality highly impacts on innovation characteristics. This result is similar findings as in [11], [20], although they studied in different domain. Hence, our findings clearly understand the influence of mobile design quality which measures by mobile content quality, mobile interaction quality and mobile appearance quality, on tourists' intention to use mobile application. Finally, the findings provide empirical evidence on the positive relationship between innovation characteristics and tourists' intention. The results confirm the IDT [15], even though MTG's characteristics are different from IDT. Because of mobility which is a feature of mobile phone, does not include in the traditional innovation characteristics [15]. This finding suggests that IDT [15] should extend mobility as an innovation characteristic in the context of mobile tourism guide or mobile application.

VI. CONCLUSION AND FUTURE WORKS

Even through extant literatures have identified conceptual linkages of mobile design quality, innovation characteristics and intention to use technology, this study has a new insights of these relationships. Our findings significantly highlight the appropriateness of a mobile design quality role and innovation characteristics influence in predicting tourists' intention to use mobile application. Although our research model proposes in the context of MTG, we hope that this research will be useful for mobile application development in other context.

The propose model would be more valuable if it is the in-depth study. Therefore, we suggest that mobile design quality

and innovation characteristics should be studied in terms of their measures as dimensions in the future work.

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