

Adoption of E-hailing Applications: A Comparative Study between Female and Male Users in Thailand

Athapol Ruangkanjanases and Chayanee Techapoolphol
Chulalongkorn Business School, Chulalongkorn University
athapol@cbs.chula.ac.th

Abstract—E-hailing, a process of ordering a taxi via mobile devices, has become popular in Thailand recently. This study focuses on applying Diffusion of Innovations Theory and Technology Acceptance Model in examining the factors affecting adoption of e-hailing applications in Thailand. The objective of this comparative study is to find significant factors influencing female and male users to adopt E-hailing applications. The hypotheses are constructed to test the influence of five factors on consumers' attitude. This study uses a survey to collect data from 200 female and 200 male users who have experienced using e-hailing applications. The results indicate that the relative advantages and ease of use have an influence towards the adoption of e-hailing applications in both genders. Interestingly, social influence and physical security influence the adoption of e-hailing applications for among male users only.

Index Terms— Mobile; E-hailing; Application; Diffusion of Innovations Theory; Technology Acceptance Model; Thailand

I. INTRODUCTION

In the past, the only way to use a taxi was to catch one from the street. Then, it evolved into the call-centre taxi service. Now, in the digital evolution era, consumers rely heavily on their smartphones for a variety of needs. So, the idea of using applications to locate a taxi is a smooth transition.

E-hailing applications are accessible via phone applications. It is available both for Android and iOS. It is becoming more popular in Thailand due to the factors that taxi drivers linked to the e-hailing application are more committed than typical taxi drivers who tend to decline passengers during rush hours or sometimes quote for unfair fixed rate fare.

This study hopes to gain more understanding of factors affecting the adoption of e-hailing applications and to benefit application developers in giving recommendations for further research on how to develop better e-hailing applications. The researchers would like to examine at what level female and male users are expected to adopt e-calling applications into an everyday life where the factors affecting application adoptions would be measured based on attributes in the Diffusion of Innovation Theory and Technology Acceptance Model.

II. LITERATURE REVIEW

A. Introduction to e-Hailing Application

With the increasing demand for transportation, the choices of ground transportation alternatives have grown; bicycle, personal vehicle, bus, taxi, and metro transit among others. Taxis are an important part of mobility in the transportation system compared to the other types of public transportation

[1]. The advantages of taxis are speediness, privacy, door-to-door service, free of parking fee and 24-hour service [1].

Advance technology helps to improve the efficiency of overall taxi system and enable the idea of using applications to locate a taxi [2]. This research will specify the name of the applications for ordering a taxi via mobile devices as 'e-hailing applications'. The mobile device includes mobile PCs, smartphones and tablets. E-hailing application is a software program on smartphones which performs one or more of the following functions; 1) allow passengers to identify the locations of available taxis; 2) allow drivers to identify passengers who are ready to travel; 3) allow passengers to hail a taxi via mobile applications; 4) allow drivers to receive hail requests; and 5) E-payment [3].

E-hailing applications are normally available on mobile devices such as smartphones and tablets. The use of mobile devices has been increasing rapidly. Study of Ericsson predicted that mobile devices subscription are expected to grow to 5.4 billion in 2018 with the majority are in 4.5 billion smartphones [4].

With the proliferation of mobile devices, the mobile device-based e-hailing applications such as Uber, Lyft, GrabTaxi, Didi Dache and Kuaidi Dache are experiencing fast growth worldwide. According to Google play store, the number of registered users of Uber and GrabTaxi all together are 55 million users, and a number of registered users of Lyft are 5 million as of October 2015 [5].

In the recent years, the public transportation industry has drastically changed when the application-based taxi-hailing service has been introduced to the market. These application-based taxi hailing services have changed the traditional way of hailing a taxi. Previously, individuals needed to hail one from the street or reserve a ride by calling for local service from the taxi call-centre. Now, the system enables individuals to secure a taxi or reserve a ride only by a tap from their mobile devices from anywhere and at any time [6].

B. Location Based Service Techniques

Location-based service (LBS) is information service accessible with mobile devices through the mobile network and utilising the ability to make use of the location of the mobile devices [7]. Generally, it is a service of utilising geographical location of the mobile device and identify where such mobile device is.

Currently, there are several LBS techniques used [8]. Each technique has a different level of accuracy and ease of location information retrieving such as indoor localisation techniques, mobile phone network localisation techniques and global positioning system (GPS).

C. Location-based service in various business

Nowadays, in the world that mobile phones and internet have revolutionised both in communication and lifestyle, increasing the number of smartphones that allow people access to the internet from anywhere at any time. From the internet, people are able to obtain the information they need at hand. Reichenbacher states that there are five elementary mobile actions with users' needs on geographic information as follows [9];

- 1) Locating: to locate somebody or something
- 2) Navigating: to find the way to a destination
- 3) Searching: to search for people and objects meeting with the search criteria.
- 4) Identification: to identify where the properties are
- 5) Checking: to know what is currently happening or checking for events

This condition is when the location-based service becomes useful. Many business use LBS to provide value-added service to serve the requirement of mobile users.

D. Theoretical Foundations

In order to examine the factors influencing user's intention to adopt new technologies, many theories have been developed and proposed to the public. Researchers would like to refer to Diffusion of Innovations Theory and Technology Acceptance Model (TAM) as foundations of the study.

1) Diffusion of Innovations Theory

Diffusion of Innovations Theory was introduced by Everett M. Rogers in 1962. It is the theory explaining what factors would influence individuals to adopt new innovations. Rogers has done many studies in various fields such as marketing, public health, and communication technologies and has concluded that it should not be assumed that all innovations are equivalent units of analysis [10]. Rogers also identified five characteristics of innovations that influence the rate of innovation adoptions. The five characteristics are; Relative advantages, Compatibility, Complexity, Trialability, and Observability.

In summary, diffusion of innovations is the process which innovations are communicated through specific channels over time among the member of a social system [10]. Combining all the characteristics, innovations that are perceived with greater relative advantages, compatibility, trialability, observability and less complexity are more likely to be adopted faster.

2) Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is an information technology model which was developed to study individual's acceptance of the technology. Individual may take into his or her account that such technology has ease of use and usefulness to himself or herself before accept the technology [11].

TAM assumed that acceptance of information system is determined based on two major variables which are; perceived usefulness and perceived ease of use [12]. The author explained that perceived usefulness and perceived ease of use have effect to the individuals' attitude towards using technology. It means that if individuals perceived the usefulness and ease of use of any technology, that individuals would have right attitude towards using such technology

which could develop behavioral intentions to use and finally create actual system usage [12].

There are several types of research which proved that the Diffusion of Innovations Theory and Technology Acceptance Model could be used to explore the influence towards technology acceptance. The previous study of Lee suggested that usefulness, ease of use and word of mouth are significant on intention to initial adoption of mobile technology [13]. The previous study of Pavlou also suggested that trust was the direct variable while perceiving usefulness and perceived ease of use were the indirect variables of intention to transact e-commerce [14].

III. HYPOTHESES DEVELOPMENT AND CONCEPTUAL MODEL

A. Relative Advantages

Relative advantages are the degree to which an innovation is perceived as better than the ideas it supersedes [10]. There are many types of services offered on mobile devices. E-hailing service can be done either by call centres or by specific e-hailing applications. The e-hailing applications have the advantage of mobility. It also allows users to identify the vacant taxis near the location of the user. This advantage can influence the intention to adopt cab-calling applications. Therefore, this research study hypothesised that:

H1a: Relative advantages of e-hailing application have an effect on the adoption of e-hailing applications by female users.

H1b: Relative advantages of e-hailing application have an effect on the adoption of e-hailing applications by male users.

B. Ease of Use

Ease of use is the degree to which an individual perceived the asserted effort in using the application [10]. The previous study of Leong et al. [15] suggested that perceived ease of use has the highest influence on the adoption of Near Field Communication (NFC)-enabled mobile credit card. Researchers would also like to examine whether this factor influence to the adoption of cab-calling applications. Therefore, this research study hypothesised that:

H2a: Ease of use of e-hailing application has an effect on the adoption of e-hailing applications by female users.

H2b: Ease of use of e-hailing application has an effect on the adoption of e-hailing applications by male users.

C. Trialability

Trialability is the degree which innovations may be experienced prior to the technology launching or prior to the adoption of users [10]. In the previous study of Chong et al. [16], suggested that trialability did not have a significant relationship with consumer intention to adopt technology since users already had an understanding of what the technology can offer. However, researchers believe that if potential users have a chance to use or experience the technology as a trial, it could create familiarity and be persuasive enough in drawing targeted groups to adopt the technology especially with the technology that users have to pay for. Therefore, the hypotheses are:

H3a: Trialability of the e-hailing application has an effect on the adoption of e-hailing applications by female users.

H3b: Trialability of the e-hailing application has an effect on the adoption of e-hailing applications by male users.

D. Social Influence

Social influence is the degree to which an individual perceived the importance of using the innovation through the belief of others [17]. A related study of Chong et al. [16] suggested that social influence play a significant role in M-commerce adoption. Therefore, the hypotheses are:

H4a: Social influence of e-hailing application has an effect on the adoption of e-hailing applications by female users.

H4b: Social influence of e-hailing application has an effect on the adoption of e-hailing applications by male users.

E. Trust

Trust can be described as the belief that the other parties would behave in a socially responsible manner and fulfil one’s expectation without taking advantages of one’s vulnerabilities [18],[19]. Travelling by taxi with unknown drivers gives passengers some uncertainty about their safety. Most of the cab-calling applications provide drivers’ information such as names, phone numbers, photos and plate numbers. Researchers are interested in examining whether physical security influences with the intention to adopt cab-calling applications. Therefore, the hypotheses are:

H5a: Physical security of e-hailing application has an effect on the adoption of e-hailing applications by female users.

H5b: Physical security of e-hailing application has an effect on the adoption of e-hailing applications by male users.

The conceptual model of this study consists of five independent variables and one dependent variable as shown in Figure 1.

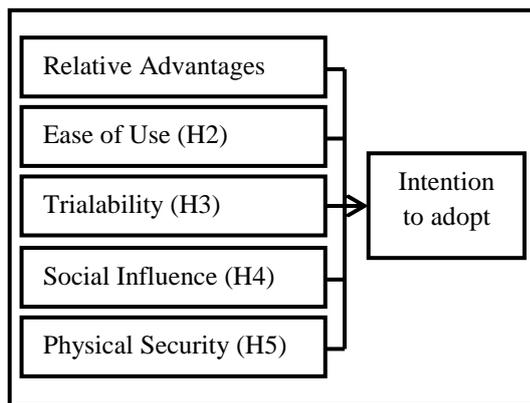


Figure 1: Conceptual model

IV. METHODOLOGY

A. Samples and Data Collection

The number of registered users of Uber and GrabTaxi together sum up to 55 million users around the world. Researchers have estimated that some users in Thailand are more than 0.2 % of 55 million which means more than 110,000 users. Using 95 percent confidence level with a sampling error of 5 percent based on Yamane [20], a sample size of respondents is 400. The researchers used quota

sampling technique for data collection; half of the samples are female, and the rest of samples are male. An online and paper-based survey questionnaire was developed to test hypotheses in this study. Questionnaires were distributed during January to March 2016. Total of 400 completed questionnaires, 200 from female and 200 from a male, were returned.

B. Research Instrument and Variable Measurement

Twenty questions were used to measure the five independent variables, and five questions were used to measure a dependent variable. Besides demographic profiles, all items are measured on a five-point Likert Scale ranging from 1 (strongly disagree) to 5 (strongly agree). The sample of the questionnaire is in Appendix A.

C. Reliability

The reliability of the questionnaire was tested by using Cronbach's alpha [21]. Table 1 shows that the reliability coefficients (α) of all independent variables are above 0.7. Therefore, the questions used in the questionnaire are reliable [22].

Table 1
Reliability Analysis

Variable	Cronbach's alpha
Relative advantages	0.853
Ease of use	0.914
Trialability	0.823
Social influence	0.661
Physical security	0.891

D. Validity

Factor analysis with varimax rotation is applied to test the validity of the constructs. Factor loading of 0.50 is used as a cut-off point as suggested by Hair et al. [22]. The results in Table 2 confirm the existence of 5 factors with eigenvalues greater than 1.0 and all items have a factor loading of more than 0.50. These results confirm that each of these constructs is unidimensional and factorially distinct and that all items used to operationalise the particular construct are loaded onto a single factor [23].

Table 2
Factor Analysis

Construct	No. of Items	Factor Loading	Eigen values	Percentage of Variance
Relative advantages	6	0.581-0.727	3.391	16.957
Ease of use	5	0.731-0.806	3.842	19.211
Trialability	3	0.658-0.852	2.325	11.624
Social influence	3	0.603-0.873	1.943	9.717
Physical security	3	0.648-0.803	2.456	12.28

V. DATA ANALYSIS

Statistical Package for Social Sciences (SPSS) is used to analyse primary data collected from questionnaires in this study.

A. Descriptive Statistics

Descriptive statistics of samples on demographic data are shown in Table 3. The largest group of respondents is in the age range of 15 to 34. Most of the respondents have a bachelor’s degree followed by a graduate degree.

Table 3
Demographic Profile

Demographic profile	Number	Percentage
<i>Gender</i>		
Female	200	50
Male	200	50
<i>Age</i>		
Less than 15	2	1
15-34	342	85
35-50	51	13
More than 50	5	1
<i>Highest education level</i>		
Diploma or less Degree	32	8
Bachelor Degree	229	57
Graduate Degree	139	35

B. Correlation Analysis

The correlation of means of the variables is conducted to determine the variability of the factors as shown in Table 4 and Table 5. For intention to adopt cab-calling application for female users, the factors that have the strongest relationship are Relative advantages ($r = 0.72$) followed by Ease of use ($r = 0.58$). For intention to adopt cab-calling application for male users, the factors that have the strongest relationship are also Relative advantages ($r = 0.71$) followed by Ease of use ($r = 0.63$) and Physical security ($r = 0.60$).

Table 4
Correlation among Variables for Female Users

Variables	RA	EU	TA	SI	PS	ID
Relative advantages	1.00	0.69	0.47	0.18	0.58	0.72
Ease of use		1.00	0.54	0.15	0.59	0.58
Trialability			1.00	0.25	0.57	0.40
Social influence				1.00	0.23	0.13
Physical security					1.00	0.49
Intention to adopt						1.00

Table 5
Correlation among Variables for Male Users

Variables	RA	EU	TA	SI	PS	ID
Relative advantages	1.00	0.66	0.49	0.32	0.56	0.71
Ease of use		1.00	0.48	0.35	0.54	0.63
Trialability			1.00	0.45	0.54	0.52
Social influence				1.00	0.38	0.48
Physical security					1.00	0.60
Intention to adopt						1.00

C. Collinearity Diagnostics Tests

The collinearity diagnostics tests are performed to validate the variables and detect any multicollinearity problem. According to O'Brien, a tolerance value of higher than 0.20 or a VIF lower than 5 does not possess a threat of having multicollinearity [24]. The results of collinearity diagnostics test are displayed in Table 6.

None of the variables possesses a threat of multicollinearity problem because the tolerances of all variables for female respondents are in the range of 0.53 to 0.96 and the tolerances of all variables for male respondents are in the range of 0.57 to 0.90. Therefore, the results validate all variables for both female and male samples.

D. Stepwise Multiple Regression and Hypothesis Test

According to Table 7, two variables have a significant impact on the intention to adopt e-hailing applications for female users. The first variable is Relative Advantages ($\beta = 0.61$, p -value = 0.00) and the second is Ease of Use ($\beta = 0.16$, p -value = 0.02). The adjusted R^2 is 0.53, which means that the two independent variables could explain 53% of the

variance of the dependent variable (Intention to Adopt). In summary, factors influencing the intention to adopt cab-calling application of female users are shown in Figure 2.

Table 6:
Collinearity Diagnostics of Female and Male users

Variables	Collinearity Statistics			
	Female users		Male users	
	Tolerance	VIF	Tolerance	VIF
Relative advantages	0.53	1.89	0.69	1.45
Ease of use	0.53	1.89	0.57	1.77
Trialability	0.78	1.28	0.76	1.31
Social influence	0.96	1.03	0.90	1.11
Physical security	0.66	1.51	0.69	1.45

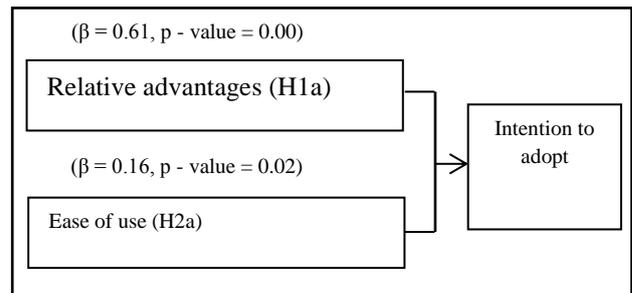


Figure 2: Multiple regression of female users

According to Table 8, four variables have a significant impact to intention to adopt cab-calling application for male users, which are Relative Advantages ($\beta = 0.43$, p -value = 0.00), Ease of Use ($\beta = 0.19$, p -value = 0.03), Social Influence ($\beta = 0.17$, p -value = 0.01) and Physical Security ($\beta = 0.20$, p -value = 0.01). The adjusted R^2 is 0.61, which means that the four independent variables could explain 61% of the variance of the dependent variable (intention to adopt). In conclusion, factors influencing the intention to adopt cab-calling application of male users are shown in Figure 3.

The results from the multiple regression in Table 7 and Table 8 show that hypotheses H1a, H1b, H2a, H2b, H4b and H5b are supported, but hypotheses H3a, H3b, H4a and H5a are not supported.

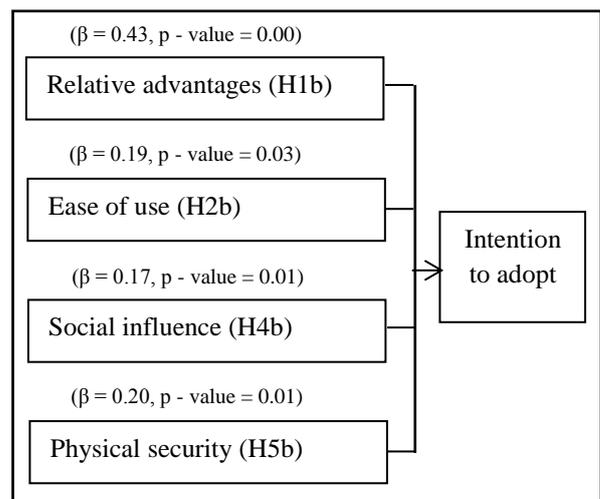


Figure 3: Multiple regression of male users

VI. CONCLUSION

The significant factors which affect intention to adopt cab-calling applications of both female and male users are Relative Advantages and Ease of use. This result is aligned with the study of Lee [13] and Pavlou [14]. This could be interpreted that both female and male users perceived advantages from the applications which could possibly explain that Thai users usually had bad experiences with the services of taxi drivers [25]. Applications are also user-friendly and require few steps to use; they enable more convenient and quicker channels to reach out for nearby transportation.

On the other hand, Social Influence and Physical Security

are factors which affect intention to adopt cab-calling applications only for male users. Although the results are aligned with the study of Chong et al. [16], Gefen [18] and Mayer et al. [19] respectively, the question still remains why these two factors only have an effect for male users in Thailand. Further research on why Social Influence and Physical Security are factors affecting intention to adopt cab-calling applications only in the male users should be conducted.

Another future research may be conducted further to investigate how other external factors such as service quality, pricing, and feeling towards technology which may have an impact towards the adoption of e-hailing applications.

Table 7
Stepwise Multiple Regression for Female Users

	Variables	B	β	t	Sig.	R	R ²	Adj. R ²	Overall F
Criterion:	Intention to adopt					0.73	0.53	0.53	111.56
Predictor:	1. Relative advantages	0.73	0.61	9.19	0.00				
	2. Ease of use	0.16	0.16	2.32	0.02				

Note: Significance at 0.05 level

Table 8
Stepwise Multiple Regression for Male Users

	Variables	B	β	t	Sig.	R	R ²	Adj. R ²	Overall F
Criterion:	Intention to adopt					0.79	0.62	0.61	78.59
Predictor:	1. Relative advantages	0.53	0.43	6.88	0.00				
	2. Ease of use	0.22	0.19	3.02	0.03				
	3. Social influence	0.17	0.17	3.50	0.01				
	4. Physical security	0.24	0.20	3.42	0.01				

Note: Significance at 0.05 level

APPENDIX

A. Questionnaire

Answer the following questions from 1=strongly disagree to 5=strongly agree.

1) Relative advantages

1. E-hailing application is more convenient than other channels to hail taxi.
2. E-hailing application enables me to find nearby available taxi more quickly than hailing from the street.
3. E-hailing application enables me to reach destination faster than hailing from the street.
4. E-hailing application is useful to me.
5. E-hailing application fits well with my needs.
6. E-hailing application is a complementary service to my lifestyle and I don't have to adapt myself.

2) Ease of use

1. I don't need to learn a lot of things before I could use the cab-calling application.
2. Cab-calling application requires little steps.
3. Cab-calling application is user-friendly.
4. Cab-calling application menu is very easy to navigate.
5. The application is easy to use. I can use it without manual or explanation from the service provider.

3) Trialability

1. It is important to my decision to use cab-calling application by being able to try out the service.
2. I use cab-calling application on a trial basis first to see if it serves my needs.
3. Having free access to e-hailing application is important to my decision to use it.

Social influence

1. I use cab-calling application because I've seen advertisement or news from mass media.
2. I use cab-calling application because it is the current trend.
3. Friends and family have influence on my decision to use e-hailing application.

4) Physical security

1. E-hailing application provides me booking transparency information. For example; driver's name, driver's number and plate number.
2. I feel safe when traveling by e-hailing application because historic journeys are recorded systematically.
3. I feel safe when traveling by e-hailing application because I can declare my location via message, e-mail or on social network.

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