

CONFIRMATORY FACTOR ANALYSIS OF TAXI DRIVERS' ATTITUDES TOWARDS USING TAXI CALLING APPLICATION

Wimon Laphrom¹ and Suthatip Pueboobpaphan^{2,*}

Received: November 30, 2020; Revised: August 31, 2021; Accepted: September 10, 2021

Abstract

The objective of this study is to analyze for confirmatory factors in accordance with the Technology Organization Environment (TOE) involved with the taxi driver's attitudes towards making decision to use taxi calling application. The empirical data were obtained from collecting questionnaires using purposive sampling method. The sample group was 387 respondents who were taxi drivers used to provide passenger transportation in Bangkok and its vicinities through taxi calling applications. The study results found that the confirmatory factors are statistically consistent with the empirical data at the level of 0.01 significance. Therefore, it can be concluded that the taxi drivers decision to apply taxi application may be measured from 6 factors including Relative Advantage, Complexity, Driver's Knowledge, Coercive Pressures, Mimetic Pressures, and Normative Pressures. The research results will be appropriately used for analyzing for factors affecting the attitudes towards using the application

Keywords: Confirmatory factor analysis, Taxi calling application, Taxi driver, TOE

Introduction

The progressive development of information and communication technology has led to change in almost perspectives of global society. In the business of public transport services such as taxi service which passengers, in the past, had to wave down by the roadsides or call through the taxi centers, E-Hailing Apps have been developed to meet the needs of customers who conveniently call them through an application on a smartphone which has been well accepted, especially among new Thai generation. Ongkittikul (2014) said that the availability of taxi calling application allows

users to have a better alternative service, promotes more effective taxi service, and sometimes reduces the users' feeling of waiting. Furthermore, the taxi calling application provides quality service information by showing the driver performance evaluation. The rating system will provide passengers with a positive effect on the manners and taxi drivers' service mind as well as the confidence in using the service (Thammarak, 2015). As the taxi passengers' behavior in the past has changed to calling taxi through the application on the smartphone instead, taxi drivers need to adjust

¹ School of Transportation Engineering, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand.

² Lecturer in Transportation Engineering, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand. E-mail: suthatip@sut.ac.th

* Corresponding author Ramli Siti Aishah

themselves according to market conditions to potentially compete with others. This is considered a challenge which is not easy to change the familiarity of taxi drivers who are accustomed to drive patrols to turn to use a smartphone for taxi calling application (Jarunansiri, 2014). However, the apps can help taxi drivers know the passengers' needs. The decrease in travel distance seeking for passengers helps reduce operating costs as well as increase revenue (Keong, 2015; Contreras and Paz, 2018).

However, taxi calling applications lead to many controversial issues and challenges such as confidentiality and personal data protection, financial transaction data, rules and regulations involved with multiple stakeholder groups, especially, the diverse taxi drivers' responses, both positive and negative (GSB Research Center, 2019). Thus, some taxi drivers are hesitant or are still against using the taxi calling application. In addition, one of the problems that taxi drivers face is the problem of accessing smart phones and internet fees which make them unable to adjust the service model according to the trend and Mimetic Pressures (Bangkokbiznews, 2018; Center for Economic and Business Forecasting, 2018). Workpoint TODAY (2020) also identifies that nowadays, there are only ten thousand taxi drivers or 12.5% of all taxi drivers provide passenger transportation via the application.

Therefore, this research aims to conduct Confirmatory Factor Analysis under the framework of the Technology Organization Environment (TOE) of taxi drivers in Bangkok and its vicinity, and subsequently test the consistency measurement model in making decision on taking application to use. The results of confirmatory factor analysis from the study will be used to furtherly analyze for factors affecting the taxi drivers' attitudes to use the application.

Materials and Methods

Technology - Organization - Environment Framework: (TOE)

The TOE concept framework was developed based on the principles of Tornatzky and Fleischer (1990) which was described as a decision-making process for applying technology. The process in which the organization decides to accept or bring technological innovations into practice is influenced by 3 contexts comprising

Technology Context

is the consideration of the internal and external technology, both currently used and not used within

the organization but available in the market (Raksakaew, 2016). as well as the operational process consideration, operation or practice. The significant factors to be obligatorily considered for technology taken into the organization are technological compatibility and the current possession of available equipment and tools (Distanont and Pongphanich, 2017). Keong (2015); Maduku *et al.* (2016) studies indicated that Technological factors affecting technology decisions or acceptance can be measured by Complexity and Relative Advantage of that technology usage.

Organization Context

is the consideration of the organizational characteristics, resources, sizes, degrees of centralization, degrees of formalization, managerial structures, human resources, applicable resources, and the coordination among employees in the organization.

Environmental Context

is the consideration of competitiveness and legal requirements, policies, or regulations (Distanont and Pongphanich, 2017). all of which are external factors regarding stakeholders such as customers, competitors, or regulatory authorities of the organization affecting the decision on bringing new technology into practice in the organization. Institutional theory is a concept that focuses on studying the external pressures occurring within the organization. The results showed that such pressures cause changes leading to acceptance of innovations and their implementation (Scott and Christensen, 1995). DiMaggio and Powell (1983) stated that there are 3 types of environmental pressures occurring within an organization: Coercive Pressures, Mimetic Pressures, and Normative Pressures.

Chiu *et al.* (2017) studied about mobile application in organization and found that the Relative advantage, Complexity, and employees Knowledge are important components for the organization in deciding to adopt innovation or new technology. Gibbs and Kraemer (2004) studied factors affecting the decision to buy goods in E-commerce market. It was reported that all three factors of TOE are significant at explaining E-commerce adoption. The research of Wang *et al.* (2017) which studied about the use of e-Government cloud in government agencies, found that Knowledge about technology of employees in the organization is one of the factors that influence the organization decision whether or not to adopt the technology. The study of Teo *et al.* (2003) about external factors that affect the decision to use

financial information sharing technology between organizations also showed that the Coercive, Mimetic, and Normative pressures are external factors that affect the decision to use technology as well. Based on the findings above, it can be concluded that these six factors are the key components according to the Technology-Organization-Environment (TOE) framework. Therefore, this paper applies the above-mentioned TOE framework and the modified framework from Keong (2015) in the confirmatory factor analysis to measure the attitude of taxi drivers towards adoption of taxi calling application as shown in Figure 1.

Data Collections

The sample group in this research is taxi drivers in Bangkok and its vicinities including Nakhon Pathom, Samut Prakan, Nonthaburi, Pathum Thani and Samut Sakhon who had experience in picking up and dropping passengers via taxi calling application. The period of data collection was from August to October 2019. The purposive random sampling method was adopted. The appropriate sample size for factor

analysis was based on the concepts of Hair *et al.* (2010) in which the ratio between the sample and the number of parameters or variables should not be less than 10 to 1. In this research, there are 24 observed variables, therefore 240 samples were needed. The researcher distributed 400 questionnaires, which is much more than 240, just in case there might be some incomplete responses. However, after screening out, there are in total 387 complete responses, which will be used further for data analysis.

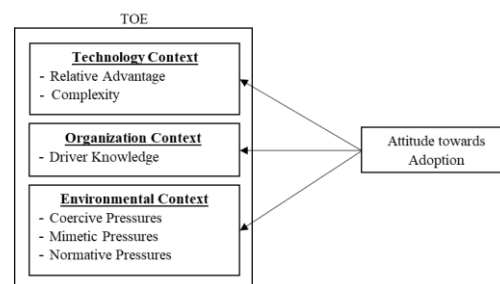


Figure 1. Research Framework

Table 1. Shows Skewedness and Kurtosis analysis of observed variables

Indicators	Skewness (SE = 0.124)	Kurtosis (SE = 0.247)
Relative Advantage: 5 items		
RA1 Adopting mobile taxi booking apps allows me to get more passengers.*	0.213	-0.232
RA2 Adopting mobile taxi booking apps allows me to save cost of fuel.*	0.167	-0.480
RA3 Adopting mobile taxi booking apps allows me to save waiting time at the taxi stand.*	-0.072	-0.274
RA4 Adopting mobile taxi booking apps creates easy communication with customers.*	-0.009	-0.348
RA5 Adopting mobile taxi booking apps can access present passengers.**	-0.342	-0.903
Complexity: 3 items		
C1 The use of mobile taxi booking apps requires a lot of mental effort.*	0.263	-0.127
C2 Mobile taxi booking apps are complex for my business operations.*	0.379	0.272
C3 The use of mobile taxi booking apps is frustrating.*	0.545	0.737
Driver Knowledge: 4 items		
DR1 I know how mobile taxi booking apps can be used to support my services.*	0.382	-0.335
DR2 I have necessary technical and other skills to operate mobile taxi booking apps.*	0.375	0.396
DR3 I have a good understanding of mobile taxi booking apps can be used in my services.*	-0.140	-0.024
DR4 The overall level of knowledge for adopting and using mobile taxi booking apps is high.*	-0.331	-0.035
Coercive Pressures - Passengers: 5 items		
CP1 Many of my passengers expect I use mobile taxi booking apps.*	-0.046	-0.109
CP2 Many of my passengers encourage us to use mobile taxi booking apps.*	-0.112	-0.205
CP3 I may not retain our important passengers without mobile taxi booking apps.*	-0.110	-0.326
CP4 I agree that most passengers turn to use a taxi through the application.**	-0.256	-0.320
CP5 I think that in the near future most passengers are more likely to use a taxi through the application.**	-0.030	-0.958
Mimetic Pressures – Competitors: 4 items		
MP1 Many of our competitors are currently adopting mobile taxi booking apps.*	0.194	-0.712
MP2 Many of our competitors will be adopting mobile taxi booking apps in the near future.*	0.140	-0.186
MP3 Many of our competitors that adopt mobile taxi booking apps are benefiting greatly.*	0.007	-0.233
MP4 Many of our competitors that adopt mobile taxi booking apps are perceived favourably by their customers.*	-0.050	-0.458
Normative Pressures – Trade Association: 3 items		
NP1 Large pressure is placed on our firm to adopt mobile apps by industry sources (e.g., industry or trade associations)*	0.055	-0.298
NP2 I am actively participate in industry, trade, or professional associations that promote mobile taxi booking apps adoption.*	-0.122	-0.951
NP3 I often receive information regarding mobile apps from external sources (such as industry associations, professional associations, or trade newsletters)*	0.181	-0.666

Source : * Ref. (Keong, 2015), ** from Researcher

Research Instrument

The instrument used in this research was a questionnaire inquiring taxi drivers' opinions and attitudes towards bringing the taxi calling application into practice. The questionnaire is designed in format of 5 rating scales which are very strongly agree, strongly agree, moderately agree, slightly agree and very slightly agree in 6 contexts, 24 question items as shown in Table 1. When considering the skewness of the distribution in the overall picture, from Table 1, it was found that the variables in the model are distributed in the left skewed distribution (Negative skewness value). This indicates that most variable data have higher scores than average with the skewness between -0.342 to 0.545. In addition, when considering the Kurtosis values, the variables contained in the model have negative values or lower than the kurtosis of the normal curve with the kurtosis values between -0.951 to 0.737. However, when considering skewness and kurtosis values, it was found that they are slightly different from zero but are considered close to zero. It can be assumed that the variable has a normal curve distribution. Therefore, it is appropriate to conduct confirmatory factor analysis.

Quality of Research Instrument Validation

The researcher checked the content validity by using the Index of objective congruence (IOC) of questions and objectives. The obtained value is between 0.66-1.00 which is considered acceptable (Rovinelli and Hambleton, 1976). For testing the questionnaire reliability with 30 samples before the actual practice, the Cronbach's alpha coefficient value is 0.835 (George and Mallery, 2010).

Results and Discussion

For the confirmatory analysis results with Mplus program shown in Figure 2, the researcher has taken the factors and the indicators to test the consistency with empirical data by using confirmatory factor analysis as shown in Table 2. The result of model consistency measurement by measuring the drivers' attitudes towards their use of application with the empirical data in Goodness-of-Fit index, it was found that the $\chi^2/df=719$, $TLI=0.946$, $RMSEA=0.043$, $SRMR=0.040$. As for the CFI comparison group, 0.957 (Bentler, 1990; Hair *et al.*, 1998; Loo and Thorpe, 2000), the measurement model can explain the taxi driver's attitude toward bringing the application to use. The following attitude measurement model consists of 6 factors including Relative advantage, Complexity, Driver knowledge, Coercive pressures, Mimetic pressures,

and Normative pressures. However, it was found that the 6 confirmatory factors derived from this data on taxi drivers' attitudes in Thailand were similar to the confirmatory factors derived from Malaysian taxi drivers (Keong, 2015). The Confirmatory factor analysis results are shown in Table 2.

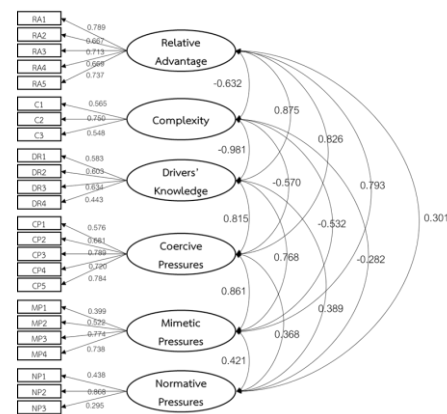


Figure 2. The first-order confirmatory factor analysis model

Table 2. Goodness-of-Fit Index

Goodness-of-Fit Index	Criteria for Consideration*		Statistical value	Interpretive result*
	Acceptable	Good		
χ^2/df	2-3	<2	1.719	Good
P-value		>0.05	0.000	Acceptable
CFI	0.70-0.90	>0.95	0.957	Good
TLI	0.70-0.90	>0.95	0.946	Good
SRMR	0.05-0.10	<0.05	0.040	Good
RMSEA	0.05-0.10	<0.05	0.043	Good

Relative Advantage consists of 5 variables with factor loadings between 0.667 and 0.789 and every variable is statistically significant at the 0.01 level. The variable having the highest factor loading (0.789) is Adopting mobile taxi booking apps allows me to get more passengers (RA1). This result implies that, from the taxi drivers' perception, adoption of taxi application would result in increasing the number of customer and income.

Complexity consists of 3 variables with factor loadings between 0.548 and 0.750 and every variable is statistically significant at the 0.01 level. The variable having the highest factor loading (0.750) is Mobile taxi booking apps are complex for my business operations (C2). It can be said that most taxi drivers consider Mobile taxi booking apps to be quite difficult to use. This may be one of the key factors that taxi drivers consider when deciding whether to use a taxi calling app or not.

Driver Knowledge consists of 4 variables with factor loadings between 0.443 and 0.634 and every variable is statistically significant at the 0.01 level.

The variable having the highest factor loading (0.634) is I have a good understanding of mobile taxi booking apps can be used in my services (DR3). The above results show that taxi drivers are currently knowledgeable about using a taxi calling application via mobile phone and able to download the application to provide the service.

Coercive Pressure consists of 5 variables with factor loadings between 0.576 and 0.789 and every variable is statistically significant at the 0.01 level. The variable having the highest factor loading (0.789) is I may not retain our important passengers without mobile taxi booking apps (CP3). Such results implies that the pressure on taxi drivers, in the digital age where customers increasingly call for services online, has led taxi drivers to shift from the traditional service of hailing for a taxi to a new one that passengers call for service through the taxi calling application, to keep their passengers and maintain their position in the taxi market.

Mimetic Pressure consists of 4 variables with factor loadings between 0.399 to 0.774 and every variable is statistically significant at the 0.01 level. The variable having the highest factor loading (0.774) is Many of our competitors that adopt mobile taxi booking apps are benefiting greatly (MP3). The fact that taxi drivers saw their fellow taxi drivers earn a lot from serving passengers through a taxi calling app. It will be a driving force that causes taxi drivers who have not yet provided services through a taxi calling application, to adopt using the application to serve their passengers

Normative Pressure consists of 3 variables with factor loadings between 0.295 to 0.868 and every variable is statistically significant at the 0.01 level. The variable having the highest factor loading (0.868) is I am actively participate in industry, trade, or professional associations that promote mobile taxi booking apps adoption (NP2). From this result, taxi drivers want relevant agencies, both public and private sectors, to take part in supporting the taxi service through the application in a systematic way that is good for taxi drivers as well.

Based on the above results, the coefficient values obtained from the first-order confirmatory factor analysis show that most of the observed variables have a factor loading greater than 0.3, which is an acceptable criterion, implying the suitability of the model. It also shows that all 24 observed variables in the model are in accordance with the TOE theoretical framework, and in overall, relate to all 6 components at the significance level of 0.01. Future studies may apply advanced statistical techniques such as structural equation modeling (SEM) to elucidate the factors that affect taxi drivers' attitudes in providing services through taxi calling applications.

In addition, more samples should be collected to obtain a more diverse perspective.

Conclusions

The factors and indicators of attitudes towards taxi drivers' decisions in implementing the application under the concept of technology, organization and environment can be measured from all 6 factors including Relative advantage, Complexity, Drivers' Knowledge, Coercive pressure, Mimetic pressure, and Normative pressure. For parameter values, Relative chi-square (χ^2/df) is 1.719 ($\chi^2/df < 2.00$), the Root Mean Squared Error of Approximation (RMSEA) is 0.043 (RMSEA < 0.05), and the Standardized Root Mean Square Residual (SRMR) is equal to 0.040 (SRMR < 0.05). Therefore, the taxi driver's attitude measurement model about the decision to use taxi calling application is consistent with empirical data. The Comparative-Fit Index (CFI) was 0.957 and the Tucker-Lewis index (TLI) was 0.946. The goodness-of-fit of this model is acceptable for empirical data. The confirmed factors obtained from this study will be used to analyze the factors that influence the attitude of taxi drivers toward adopting the taxi application in future study. The information will be useful to taxi application operators in adjusting their operating strategies, and to the regulatory agencies as a guideline to set policies to promote and encourage taxi drivers to a higher adoption of taxi application. This will result in reduction of the distance the vacant taxi cruising in searching of passengers, reduce air pollution, and better respond to online communities. All of which will make the Taxi Application market to continue growing sustainably.

Acknowledgments

We are grateful to Suranaree University of Technology that funded research. And thanks to all respondents for contributing information for this work.

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