



Research article

A plenary free individual traveler life cycle for assessment of adoption intelligent travel assistant



Noppadol Phaosathianphan, Adisorn Leelasantitham*

Technology of Information System Management Division, Faculty of Engineering, Mahidol University, Nakhon Pathom, Thailand

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ABSTRACT

This study aims to investigate antecedent variables and IT Processes being suitable factors for ultimately measuring and assessing feature values of an Intelligent Travel Assistant (ITA) related to the actual use of the Free Individual Traveler (FIT). Accordingly, the technology acceptance model (TAM) is extended with the essential factors of travel and tourism (i.e., Quality and Safety), and a plenary FIT life cycle (i.e., Pre-Trip, On-Route, On-Site, and Post-Trip). The data collection is gathered from 382 FITs in Thailand by the online questionnaire through famous social media, i.e., Facebook and Line. Hence, the collected data are analyzed statistically by PASW Statistics and SmartPLS. Therefore, the distinguished finding of this study is obtained from the useful assessment model, which is decided to usage for FITs and investment of ITA operators for travel and tourism firms.

1. Introduction

The situation of the world tourism industry has been very significant for a long time. It would be increasing more importance in the future because there is the growth of worldwide tourism throughout the eight years ago (UNWTO, 2018). Particularly, Thailand was 29.10 million tourists per year (9th in the tourist number of the world) and there were travel expenditure total 44.40 billion dollars per year (3rd in the travel expenditure of the world) (UNWTO/GTERC, 2017). Normally, Thai tourists favorably travel both domestic and outbound but all of them almost prefer to travel on a private tour without any tour guides as the Free Individual Travelers (FIT). For example, 73.82% of Thai tourists have preferred the use of Information Communication Technology (ICT) during their trip with the travel assistant applications e.g. google maps (Kasikorn Research Center, 2018). Therefore, they have the strengths of several experiences for the journey using the Intelligent Travel Assistant (ITA). In this point, it was a reason and motivation to study in this research.

Consequently, United Nation World Tourism Organization (UNWTO) and Global Tourism Economy Research Centre (GTERC) stated in their annual report in 2017 that tourists were changing their travel behavior toward using the ICT according to Tourist's Life Cycle, i.e., Pre-Trip, During Trip, and Post-Trip by their smartphones, tablets, and personal

computers in order to search tourism information, plan a trip, buy a ticket, book an accommodation, navigate to the destination, find restaurants and shopping centers, and share photo and story into their social media via several intelligent travel applications such as Skyscanner, Agoda, Grab, Uber, Airbnb, Eatigo and so on. In particular, the Intelligent Personal Assistants (IPA), i.e., Google Assistant, Apple Siri, Windows Cortana, and Amazon Alexa that were widely used to be the ITA for world travelers (UNWTO/GTERC, 2017) since it has a lot of sufficient and suitable features to aid the tourists in many activities of the Tourist's Life Cycle (Reis et al., 2017).

Meanwhile, there are previous studies which attempted to study the technology acceptance within Tourist's Life Cycle domain such as hotel guest's social media acceptance in luxury hotels during Pre-Trip, On-Site, and Post-Trip (tom Dieck et al., 2017), tourist adoption of mapping application during On-Route and On-Site (Gupta and Dogra, 2017) and understanding the adoption factors influence on the use of ITA for Eco-Tourist's Life Cycle (Phaosathianphan and Leelasantitham, 2019). Unfortunately, entire studies could not analyze and describe which antecedent variables had signification (i.e., positive and negative) or rejection relationship to which phase in Tourist's Life Cycle because of their conceptual model has not been integrated IT Process such as Tourist's Life Cycle, the result of their study would be an overview of the technology acceptance instead of explicitly understand which antecedent

* Corresponding author.

E-mail address: adisorn.lee@mahidol.ac.th (A. Leelasantitham).

variables influence which phases of Tourist's Life Cycle and also which phase of Tourist's Life Cycle influence user acceptance.

As a result of the diversity of ITA, it is necessary to study antecedent factors influencing the IT Process according to FIT's behavior. This cause was to confuse and to hesitate against the FITs in order to a selection of ITA. It also will be difficult for travel and tourism firms to decide investment with ITA operators in the future. However, this study investigated essential antecedent variables are suitable for ITA features and IT Process which are related to the actual use of FIT in order to decide a usage for FITs and investment with ITA operators for the travel and tourism firms. Hence, this study initialized with the formulation of a conceptual model by literature review within theories and researches about travel and tourism, and related technologies acceptance which related IPA, e.g., ICT, Internet, PDAs, Smartphone, VPA, IPA, AI, IoT, Mapping Application, Social Media and E-Commerce. Afterwards, it is created and promoted the online questionnaire through favorite social media, i.e., Facebook and Line with who is greater than 18 years old, which prefer to travel on private tours by using IPA. Besides, the data analysis consists of the Descriptive Statistics (i.e., Mean, S.D.) by PASW Statistics v.18.0.0 and the Inferential Statistics (i.e., Measurement Model and Structural Model) by SmartPLS v.3.2.8.

2. Literature review and research hypotheses

2.1. Technology acceptance theory

The technology acceptance theory was initialized since the rise of the computer era in 1962 by Everett Rogers, a professor of communication studies. He declared the diffusion of innovation theory (DIT) and social change theory. Thus, that would be the cause of either acceptance or denial toward innovation. In 1985, Fred Davis brought the concept of DIT to formulate the Technology Acceptance Model (TAM) is consisted of independent factors and dependent factors (Davis, 1985). Hence, dependent factors include external variables (i.e., system features, user characteristics, and ultimate behavior) and independent factors include belief variables (i.e., Perceived Usefulness and Perceived Ease of Use), attitude toward using, behavioral intention to use and actual system use (Davis et al., 1989), as shown in Figure 1.

TAM was brought to study user acceptance toward several technologies because that could conveniently explain which factors had influenced user acceptance, both innovation and present technology. Nonetheless, that would highly obtain an effective result when using to study in technology which is used specific job and situation such as working with large-sized machine or software computer which was stationary working and having limited functions in spite of present machines becomes the mobile ability, and current application has multi-function to use such as smartphone, smartwatch, and internet of things (IoT) then it also affected to the user behavior within travel and tourism technologies that are increasing more advantage of using.

Consequently, the most previous studies concentrated on investigating and understanding of the antecedent variables within the proposed model whereas there are few studies attempted to modification of TAM with adjusted "attitude toward using" become either IT process or

innovation life cycle such as the researchers replace the attitude variable with marketing-related mobile activity, i.e., providing information, sharing content, and accessing content in order to obviously study factors influenced with technology acceptance of mobile marketing in smart-phone era among teenagers in the United States of America and Pakistan (Sultan et al., 2009). Moreover, the TAM could also be applied to assess and explain the antecedent factors (i.e., Usefulness, Ease of Use, Impression of Hiring Organization and Impressions of Website) influencing applicant's behavioral intentions to apply for jobs online (Kashi and Zheng, 2013).

Besides, technology acceptance theory was developed towards several social psychological theories and technology acceptance models. Therefore, most of them would adhere to the concept of TAM that could be consisted of four variable types, i.e., external factors, belief factors, psychological factors, and the process of information technology (Dillon and Morris, 1996), as shown in Table 1. According to the related literature review of this study, there are previous studies that used TAM as a base model. Hence, they could be divided into two groups, consisted of technology user acceptance, i.e., the intelligent virtual agent (Serenko, 2005; Chao et al., 2016), smartwatch (Kim and Shin, 2015), electronic payment (Dastan and Gürlür, 2016), and information system in a mobile phone (Koç et al., 2016), and technology user acceptance of travel and tourism, i.e., includes portable electronic navigator technology (Peres et al., 2011), the virtual agent in restaurant website (Reza, 2014), and social media with luxury hotels (tom Dieck et al., 2017). Therefore, the external variables and belief variables are favorably most studied, following as behavioral intention to use (BI), attitude toward using (attitude), and actual system use (AU), respectively. Unfortunately, all of them lack the application and integration of the IT process, e.g., the phase of using technology into their proposed model, as shown in Table 2.

2.2. Travel information factors of the journey and transit trip planners

Travel information should be planned for the journey and transit trip to understand important factors. Particularly, preliminary factors of travellers should be considered in terms of the information during travel or On-Route. Suitable information was necessary to evaluate the measurement of multimodal journey planners. Integrated multimodal traveller information (IMTI) was potential to contribute a modal change (Kenyon and Lyons, 2003), and to investigate or to inquire anxiety during travel of travellers by travel styles, e.g., car, bus, train, duration, expenditure, convenience and so on. Thus, it found that there were two factors influencing to request travel information of travellers, i.e., Trip Type and Attitude. Trip Type consists of two variables, i.e., Habitual/nonhabitual and Trip Characteristics; whilst Attitude consists of two variables, i.e., Reasoned and Subjective.

Moreover, an analysis of variables was an assessment in terms of values of travel information by the multimodal journey planners (Esztergár-Kiss and Csiszár, 2012, 2015). Hence, features of function, operation and visualization had been basic criteria to analyze and to select evaluated variables consisting of five variables, i.e., Handling Dynamic Data, Offering Location-based Services, Multimodality, Proposing

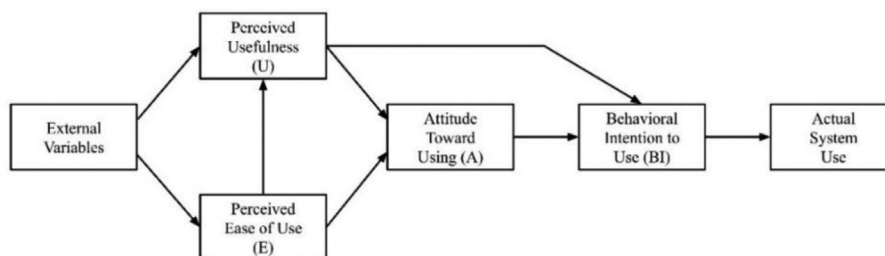


Figure 1. Technology acceptance model (TAM) (Davis et al., 1989).

Table 1. Fundamental theories of technology acceptance and the component variables by chronology.

Year	Theory	Author	Factor Group			
			External	Belief	Psychology	IT Process
1962	Diffusion of Innovation Theory (DIT)	Rogers	✓	-	-	-
1975	Theory of Reasoned Action (TRA)	Fishbein and Ajzen	-	-	✓	-
1986	Social Cognitive Theory (SCT)	Bandura	-	-	✓	-
1989	Technology Acceptance Model (TAM)	Davis et al.	✓	✓	✓	-
1991	Theory of Planned Behavior (TPB)	Ajzen	-	-	✓	-
1991	Model of PC Utilization (MPCU)	Thompson et al.	✓	✓	-	-
1992	Motivational Model (MM)	Davis et al.	-	-	✓	-
1995	Combined-TAM-TPB (C-TAM-TPB)	Taylor and Todd	-	✓	✓	-
1995	Task-Technology Fit (TTF)	Goodhue and Thompson	✓	-	-	-
2003	Unified Theory of Acceptance and Use of Technology (UTAUT)	Venkatesh et al.	✓	✓	✓	-

Table 2. Comparison TAM with related literature in the scope of the study.

Group	TAM Research	Constructs System				
		External	Belief	Attitude	BI	AU
Technology User Acceptance	Serenko (2005)	✓	✓	✓	✓	✓
	Kim and Shin (2015)	✓	✓	✓	✓	-
	Chao et al. (2016)	✓	✓	-	✓	-
	Dastan and Gürler (2016)	✓	✓	✓	✓	-
	Koç et al. (2016)	✓	✓	-	✓	-
Technology User Acceptance of Travel and Tourism	Peres et al. (2011)	✓	✓	✓	✓	-
	Reza (2014)	✓	✓	-	✓	-
	tom Dieck et al. (2017)	✓	✓	✓	-	✓

Personalized Recommendations for all Transport Modes and Real-Time Data.

As a development of transportation and new technology, travel information had been more increasing, diversifying and always updating. This point had become the limitation into an individual assessment of

travel information value for trip planners. Thus, suggestions of an individual utility-based path in transit trip planners (Nuzzolo and Comi, 2016) were investigating new methods and generating path advice in transit trip planners. However, personalized recommendations were proposed by all transport modes to the travellers including a prototype

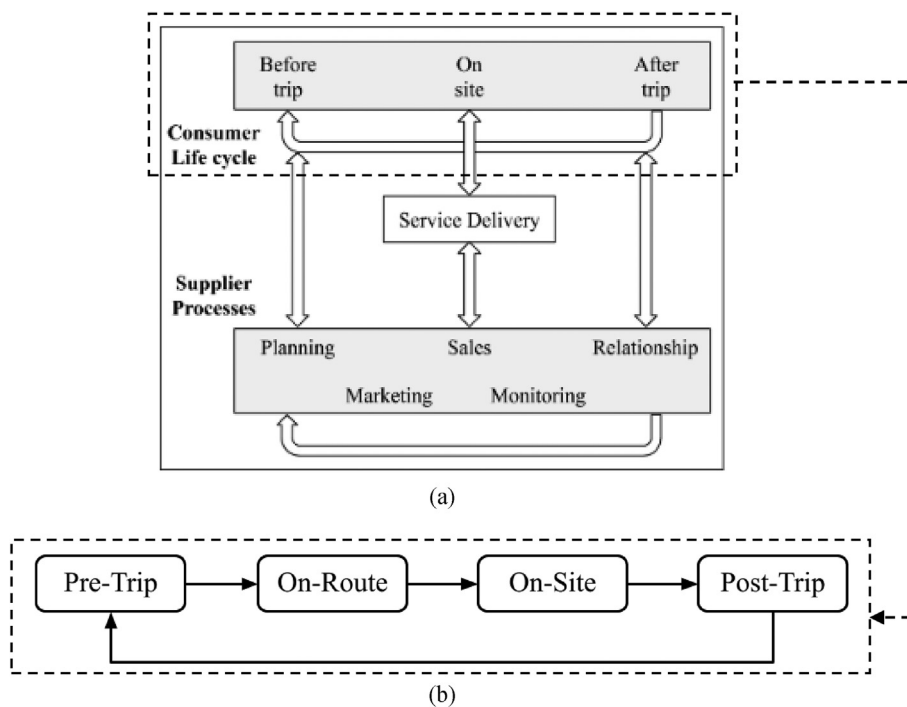
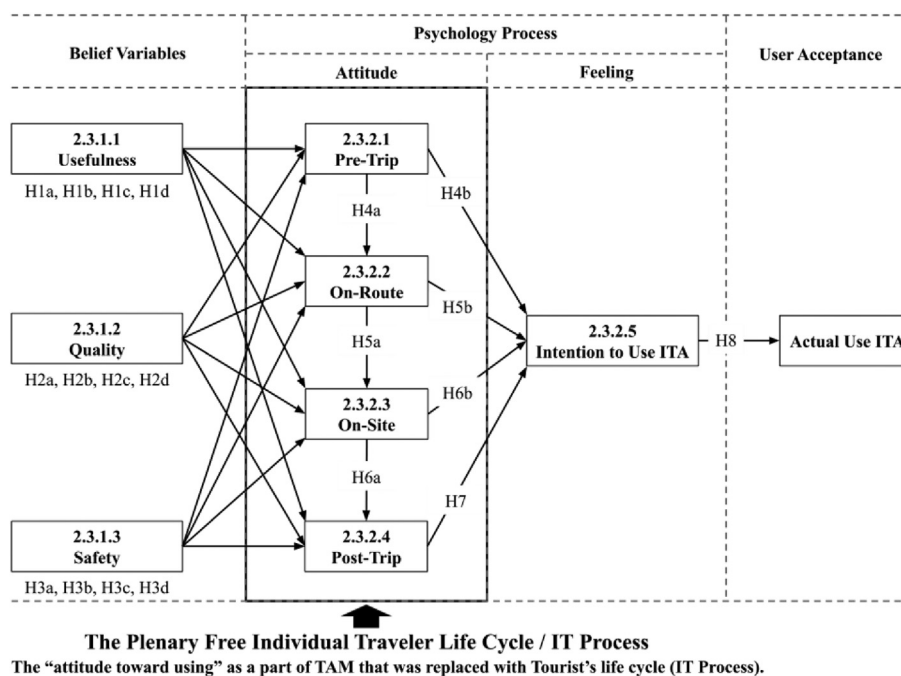


Figure 2. The free individual traveler (FIT) life cycle creation. (a) Existing Tourist's life cycle and Supplier's process (Staab et al., 2002), and (b) the plenary free individual traveler life cycle.



Accordingly, UNWTO and GTERC's annual report 2017, the FITs had behavior to increase using ICT during on three phases, i.e., Pre-Trip, During Trip, and Post-Trip by smartphones, tablets, and personal computers (UNWTO/GTERC, 2017). Besides, the internet using behavior study in Thailand in 2017 that found increasing in internet usage during the On-Route period, with the growth of 14% in 2016, and 24.1% in 2017; especially in the urban it was more internet usage than the rural area (ETDA, 2017). As a result of the transformation of both technology and FIT's behavior, the researchers have proposed an improvement of the Tourist's Life Cycle from three phases (i.e., Pre-Trip, On-Site, and Post-Trip) becoming four phases (i.e., Pre-Trip, On-Route, On-Site, and Post-Trip) become to the Plenary FIT Life Cycle, as shown in Figure 2 (b) according to interaction evaluation of Norman's Model in Human-Computer Interaction (HCI) theory (Dix et al., 2004) proposed to distinctly measure and assess according to the actual use of technology features.

2.4. Research model and hypothesis

The research model of this study was extended and formulated from TAM after widely and deeply reviewed related literature and theory of IPA technology and, then classification and association whole variables by taxonomy method that is divided into three groups, i.e., Travel and Tourism, Technology User Acceptance of Travel and Tourism, and Technology User Acceptance of related IPA technology.

Accordingly, there is no previous study which integrated the Plenary FIT Life Cycle in the research model within the technology acceptance study, as shown in Table 3. Hence, the Plenary FIT Life Cycle shown in Figure 2 (b) is formulated to the search model and hypothesis of this study aiming to the actual use of FIT that is divided into three parts, i.e., Belief Variables (antecedent variables), Psychology Process (i.e., Attitude and Feeling) and User Acceptance, as shown in Figure 3.

2.4.1. Antecedent variables

The belief variables are antecedent variables that are affected by user perception of several features of using technology and then become to be confident and trust against that technology consisted of three variables as below.

2.4.1.1. Usefulness (PU). This refers to the belief of an individual that the use of technology would enhance the efficiency of his/her work (Davis, 1989). As claimed by reviewing the literature, Usefulness is the most referred factor in the literatures of related user acceptance which are consisted of technology acceptance model (Davis et al., 1989), electronic payment (Dastan and Gürlür, 2016), intelligent virtual agent (Serenko, 2005; Chao et al., 2016), voice recognition (Simon and Paper, 2007), artificial intelligence (Hah, 2010), smartwatch (Kim and Shin, 2015), information system in mobile phones (Koç et al., 2016), and Internet of Things (Shin and Jin Park, 2017). The studies about tourism technology acceptance included the using of information technology on tourism (Usoro et al., 2010; No and Kim, 2014; Trakulmaykee et al., 2018), portable electronic navigator technology (Peres et al., 2011), and social media with luxury hotels (tom Dieck et al., 2017). It was found that Usefulness has a powerful impact on a smartwatch (Kim and Shin, 2015), social media with luxury hotels (tom Dieck et al., 2017), the use of smartphones on tourism (No and Kim, 2014) and adoption factors of using ITA for Eco-Tourists (Phaosathianphan and Leelasantitham, 2019).

- H1a.** Usefulness positively influences Pre-Trip.
- H1b.** Usefulness positively influences On-Route.
- H1c.** Usefulness positively influences On-Site.
- H1d.** Usefulness positively influences Post-Trip.

2.4.1.2. Quality (QU). In this context, it refers to measure the degree of goods or service properties that could serve the customer's needs, including the procedure to deliver the service for the customer. Thus, it is very difficult for measurement and assessment because the aspects of the service are ambiguous, distinctive, and also indistinguishable (Parasuraman et al., 1985). The quality could be divided into three aspects, such as system quality, information quality, and service quality (DeLone and McLean, 2003). Based on a review of the literature, there are theories and researches related to user acceptance, i.e., electronic payment (Jansorn, 2013), and the internet of things (Shin and Jin Park, 2017). The technology acceptance of travel and tourism, i.e., the use of smartphone on tourism (No and Kim, 2014; Trakulmaykee et al., 2018), and virtual agent in restaurant website (Reza, 2014). Travel and tourism theory, i.e., factors associating with capability in the competition and customer's royalty in tourism (Niemczyk, 2014), attracting factors in tourism (Personal, 2013). Therefore, Quality is most influence the user acceptance toward the usage of electronic payment (Jansorn, 2013), portable restaurant information technology (Trakulmaykee et al., 2018), virtual agent in restaurant website (Reza, 2014) and adoption factors of using ITA for Eco-Tourists (Phaosathianphan and Leelasantitham, 2019).

- H2a.** Quality positively influences Pre-Trip.
- H2b.** Quality positively influences On-Route.
- H2c.** Quality positively influences On-Site.
- H2d.** Quality positively influences Post-Trip.

2.4.1.3. Safety (ST). In addition to the personal interest of tourists, Safety is considered to be the main factor in tourist's concern (Personal, 2013). Also, Safety is a criterion factor in evaluating the destination's competitiveness; for example, as political stability, the likelihood of terrorism, crime rate, transport accident statistic, corruption, sanitation, communicable diseases, health care quality, and access to medical treatment (Crofts, 1996). In a literature review, there are related theories and researches about travel and tourism theory that are the pull factors of tourism (Personal, 2013) and adoption factors of using ITA for Eco-Tourists (Phaosathianphan and Leelasantitham, 2019).

- H3a.** Safety positively influences Pre-Trip.
- H3b.** Safety positively influences On-Route.
- H3c.** Safety positively influences On-Site.
- H3d.** Safety positively influences Post-Trip.

2.4.2. Psychological variables

The psychological variables are a principal process of TAM within the technology acceptance theory that probably is influenced either positive or negative relationship from the antecedent variables; thus, this study is divided into two parts, i.e., Attitude and Feeling that are composed of five variables, as shown below.

2.4.2.1. Pre-Trip (PRT). It is a planning and preparation period before travel. The information gathering is done in this period, such as tourist attraction, transportation, accommodation, restaurant shopping center and so on, thus he/she could plan an itinerary consideration, such as tour program and budget. The preparation is proceeding through the plan, such as buying a bus or plane ticket, making a reservation in a hotel, renting a car, etc. As maintained by literature review, related theories and researches are regarding travel and tourism, i.e., intelligent system for tourism (Staab et al., 2002), competing for capability on tourism (Meng, 2006), portable service for tourists (Goh et al., 2010), the factors affecting repeating visit (Niemczyk, 2014), and an annual report of UNWTO/GTERC (UNWTO/GTERC, 2017).

- H4a.** Pre-Trip positively influences On-Route.

H4b. Pre-Trip positively influences Intention to Use ITA.

2.4.2.2. On-Route (OR). It stands for the traveling from one place to the other, which does not mean only between tourist's home to the destination; one could be from one tourist's destination to another one, such as from hotel to restaurant, from restaurant to the shopping center. During an On-Route, the tourist could use applications to search for route direction, flight schedule, or recommended restaurant (UNWTO/GTERC, 2017). According to review literature, there are related theories and researches regarding travel and tourism, i.e., competing capability on tourism (Meng, 2006), portable service for tourist (Goh et al., 2010), and annual report of UNWTO/GTERC (UNWTO/GTERC, 2017).

H5a. On-Route positively influences On-Site.

H5b. On-Route positively influences Intention to Use ITA.

2.4.2.3. On-Site (OS). In this period, the tourist visited a destination or attraction already, and the activities during this period would be looking for a subject he/she is interested and maybe post some of his/her trip photo or story in a social media (UNWTO/GTERC, 2017). The destinations could be separated into six types: attraction, accommodation, activity, transportation, restaurant, and souvenir. Proportional to literature review, there are related theories and researches about travel and tourism, i.e., intelligent system of tourism (Staab et al., 2002), competing of capability on tourism (Meng, 2006), portable service for tourist (Goh et al., 2010), and annual report of UNWTO/GTERC (UNWTO/GTERC, 2017).

H6a. On-Site positively influences Post-Trip.

H6b. On-Site positively influences Intention to Use ITA.

2.4.2.4. Post-Trip (POT). This is the last period of the Tourist's Life Cycle. After the finish of the trip, he/she would return to his/her home. The activities in this period are found to maybe share his/her trip experience through posting photos, videos, and story on the social media, similar to what happened during on-route and on-site; the activities also include going forward to the pre-trip period of the next trip (UNWTO/GTERC, 2017). Dependent on reviewing literature, related theories and researches are found to be about travel and tourism, i.e., intelligent system for tourism (Staab et al., 2002), competing of capability on tourism (Meng, 2006), portable service for tourist (Goh et al., 2010), and annual report of UNWTO/GTERC (UNWTO/GTERC, 2017).

H7. Post-Trip positively influences Intention to Use ITA.

2.4.2.5. Intention to use ITA (IU). This referred to the consent of the individual, which is a part of certain behavior. Intention behavior tends to occur before the behavior itself (Ajzen, 1991); the behavior of use could be significantly affected by the intention to the user and it could be examined by observation (Pavlou and Fygenson, 2006). In proportion to the literature review, there are related theories and researches: 1) related technology acceptance, i.e., technology acceptance model (Davis et al., 1989), electronic payment (Jansorn, 2013; Dastan and Gürler, 2016), intelligent virtual agent (Serenko, 2005; Chao et al., 2016), artificial intelligence (Hah, 2010), voice recognition (Simon and Paper, 2007), smartwatch (Kim and Shin, 2015), the use of information system in mobile phone (Koç et al., 2016) and internet of things (Shin and Jin Park, 2017). 2) technology acceptance of travel and tourism, i.e., electronic tourism (Usono et al., 2010), electronic tour guide technology (Peres et al., 2011), the use of smartphone on tourism (No and Kim, 2014), virtual agent technology in restaurant (Reza, 2014), portable restaurant information technology (Trakulmaykee et al., 2018) and adoption factors of using ITA for Eco-Tourists (Phaosathianphan and Leelasantitham, 2019). 3) travel and tourism theory, i.e., the factors affecting repeating visits (Niemczyk, 2014).

H8. Intention to use ITA positively influences Actual Use ITA.

3. Research methodology

The quantitative research method was used to examining the accuracy and precision of the research model, and the research hypothesis was formulated in the previous section with creating the online questionnaire by Google Form that is 47 questions which include as 3 questions of personal information, 3 questions of the experience of using IPA, 39 questions of the user acceptance factors of ITA which has the answer was ranged as five levels, i.e., 1 (Strongly disagree), 2 (Somewhat disagree), 3 (Neutral), 4 (Somewhat agree), and 5 (Strongly agree), and two open-ended questions (i.e., limitation and suggestion). After complete creating and validation the online questionnaire already, the researchers produced a demonstration video of using ITA followed the phase into the Plenary FIT Life Cycle and pasted it at the beginning of the questionnaire in order to convince the respondents to understand the using IPA for travel and tourism obviously.

Besides, the questionnaire has passed the consideration and verification from the Institutional Review Board (IRB) of Mahidol University, Thailand, according to the certificate number of MU-CIRB 2019/012.2101. Consequently, it was distributed and promoted to the voluntary respondents who are greater than 18 years old at Mahidol University and social media (Facebook and Line) by the following three phases i.e. Pretest, Pilot Testing, and Main Testing. In this study, a barrier of the survey was that no exact number of IPA users was preferred a private tour (FIT) in Thailand, thus the data was collected by a convenience method with random sampling that is a type of non-probability sampling method. The sample was taken from a group of people who were easy to contact or to reach with the sample group being a voluntary respondent (Saunders et al., 2012) via the social media in entire phase. The data collection was terminated when the number was enough to calculate the proof of statistics. In Main Testing phase, there are 401 respondents thus the refusal rate is 4.74% in this study.

Hence, aid to build the attention from the sample group and persuasion the respondent's intention to reply truth answer and did it completely, the questionnaire was promoted by two campaigns; firstly, every suitable response would be received money worth 10 baht to donate at 3 hospitals, consisted of Siriraj hospital, Ramathibodi hospital, and Golden Jubilee medical center, and secondly, random 10 lucky respondents would be obtained from a Starbucks gift card worth 200 baht (this was applied only during the main testing period). Subsequently, the data collection was available until the number of responses gave the best to the statistics outcome. Afterwards, the responses would be cleaned and coded before statistical analysis, i.e., descriptive statistics, inferential statistics, and structural equation modeling (SEM) by PASW Statistics v.18.0.0 and SmartPLS v.3.2.8. Therefore, that is divided and described step by step, following as below.

3.1. Pretest

That was an important process of primarily assesses question items of the questionnaire, which was designed from related researches and reliable literature in order to obtain every question that would not confuse to the respondents and provide the best statistical outcome. Hence, the period of Pretest was from 18th January 2019 to 3rd February 2019 thus the sample group was 51 respondents who were the students, teachers, and alumni of Technology of Information System Management Division, Faculty of Engineering, Mahidol University, Thailand. Therefore, PASW Statistics v.18.0.0 has calculated the result of Cronbach's Alpha of reliability testing from 39 questions about factors affected IPA usage decision was 0.975; thus, it was excellent to higher than the standard, which was 0.70 (Hair et al., 2017). Afterwards, SmartPLS v.3.2.8 has also assessed the reliability testing with an analysis of the responses of the questionnaire with the measurement model; thus, it also had excellent results and then applied forward to the pilot testing.

Table 4. The demographic data of respondents.

Demographics		Total (N = 382)	
		Frequency	Percent (%)
Gender	Male	285	74.61
	Female	97	25.39
Nationality	Thai	382	100.00
Age (years)	18–20	10	2.62
	21–30	117	30.63
	31–40	172	45.03
	41–50	76	19.90
	51–60	6	1.57
	Greater than 60	1	0.26

Table 5. The usage behavior of IPA for travel and tourism.

Behaviours		Total (N = 382)	
		Frequency	Percent (%)
IPA (answer more than one item)	Google Assistant	346	86.50
	Apple Siri	149	37.25
	Microsoft Cortana	16	4.00
	Amazon Alexa	7	1.75
	Samsung Bixby	55	13.75
Experience of using IPA	Less than 1 week	69	18.06
	2–3 weeks	41	10.73
	1 Month	44	11.52
	2–3 Months	53	13.87
	4–6 Months	28	7.33
	7–8 Months	8	2.09
	9–10 Months	5	1.31
	11–12 Months	6	1.57
The Plenary FIT life cycle (answer more than one item)	Greater than 1 Year	128	33.51
	Pre-Trip	310	77.50
	On-Route	350	87.50
	On-Site	215	53.75
	Post-Trip	64	16.00

3.2. Pilot testing

This phase was a confirmation step after the improvement of the questionnaire, which was manipulated in the Pretest; thus, the data collection was gathered from 6th February 2019 to 23rd February 2019. The sample group was 37 respondents of students, teachers, employees, and alumni of Mahidol University, Thailand. Afterwards, PASW Statistics v.18.0.0 was calculated Cronbach's Alpha from 39 questions about factors affecting the IPA usage decision was 0.963, which was higher than the standard, which is 0.70 (Hair et al., 2017). Besides, the responses were also analyzed by factor analysis in SmartPLS v.3.2.8 in order to assess the reliability of the data with the measurement model; thus, the result still excellently passed the standard. Therefore, thereafter both assessments, the researchers had the confidence of using the questionnaire to be a decent tool for data collection of this research.

3.3. Main testing

This phase was the last phase of collecting the data from the real sample group to analyze statistics, discuss the result, and conclude this research. Thus, this phase was followed through from 24th February 2019 to 10th April 2019. Hence, there were 382 respondents who prefer to use IPA during private travel and tourism. The collected data have analyzed

the reliability and validity from 39 questions about factors affected IPA usage decision of the questionnaire, which had a calculation result of Cronbach's Alpha by PASW Statistics v.18.0.0 was 0.971, higher than the standard which is 0.70 (Hair et al., 2017). Afterwards, the responses were also analyzed by factor analysis in SmartPLS v.3.2.8 to assess the reliability and validity of the data with the measurement model; thus, the result excellently passed the acceptance value of the essential standard.

Consequently, the demographic information of the respondents who are FIT, having a total of 382 people, the male is 285 people (74.61%), the female is 97 people (25.39%), and all are Thai is 100%. Meanwhile, they are a span of age in the top three, i.e., 31–40 years is 172 people (45.03%), 21–30 years is 117 people (30.63%) and 41–50 years is 76 people (19.90%), respectively, as shown in Table 4. Besides, the IPA usage behavior for travel and tourism of respondents could be ranked in the top three, i.e., Google Assistant is 346 people (86.50%), Apple Siri is 149 people (37.25%), and Samsung Bixby is 55 people (13.75%), respectively. Furthermore, the duration of using IPA of respondents could be ranked in top five, i.e., greater than a year is 128 persons (33.51%), less than a week is 69 persons (18.06%), 2–3 months is 53 persons (13.87%), one month is 44 persons (11.52%) and 2–3 weeks is 41 persons (10.73%), respectively, and the using of IPA regarding the Tourist's Life Cycle, i.e., On-Route is 87.50%, Pre-Trip is 77.50%, On-Site is 53.75%, and Post-Trip is 16.00%, respectively, as shown in Table 5.

Table 6. Reliability and validity results.

Index	Mean	S.D.	Loadings (>0.70)	VIF (<5.00)
PU1	4.377	0.639	0.842	2.091
PU2	4.448	0.633	0.868	2.363
PU3	4.516	0.618	0.883	2.529
PU4	4.469	0.670	0.833	2.007
QU1	4.251	0.687	0.820	2.718
QU2	4.173	0.704	0.829	2.692
QU3	4.178	0.691	0.855	3.101
QU4	4.230	0.687	0.838	2.741
QU5	4.141	0.729	0.824	2.685
QU6	4.165	0.704	0.850	2.986
QU7	4.272	0.679	0.855	3.095
QU8	4.199	0.708	0.852	3.081
QU9	4.202	0.713	0.860	3.171
ST1	3.856	0.821	0.932	3.335
ST2	3.696	0.932	0.934	3.870
ST3	3.801	0.856	0.942	4.186
PRT1	4.380	0.660	0.903	3.161
PRT2	4.348	0.692	0.874	2.576
PRT3	4.390	0.666	0.914	3.585
PRT4	4.359	0.676	0.917	3.555
OR1	4.272	0.667	0.897	2.938
OR2	4.270	0.674	0.907	3.264
OR3	4.374	0.643	0.884	2.734
OR4	4.306	0.708	0.905	3.158
OS1	4.134	0.746	0.909	3.400
OS2	4.115	0.789	0.915	3.577
OS3	4.157	0.733	0.923	4.048
OS4	4.092	0.783	0.930	4.391
POT1	3.856	0.927	0.946	4.351
POT2	3.801	0.979	0.944	4.006
POT3	3.848	0.952	-	-
POT4	3.814	0.985	0.941	4.261
IU1	4.317	0.744	0.888	2.863
IU2	4.277	0.747	0.914	3.400
IU3	4.264	0.820	0.903	3.100
IU4	4.233	0.774	0.886	2.761
AU1	3.971	0.951	0.892	2.453
AU2	4.165	0.801	0.919	2.764
AU3	4.115	0.868	0.883	2.254

Table 7. Construct reliability and validity.

Constructs	Item Code	Cronbach's Alpha (>0.70)	Composite Reliability (CR) (>0.70)	Average Variance Extracted (AVE) (>0.50)
Usefulness	PU	0.879	0.917	0.734
Quality	QU	0.949	0.957	0.710
Safety	ST	0.929	0.932	0.876
Pre-Trip	PRT	0.924	0.946	0.814
On-Route	OR	0.920	0.943	0.807
On-Site	OS	0.939	0.956	0.846
Post-Trip	POT	0.939	0.961	0.891
Intention to Use ITA	IU	0.920	0.943	0.806
Actual Use ITA	AU	0.880	0.926	0.807

4. Examination of research hypotheses

The data analysis to examine and support the research model by SmartPLS v.3.2.8 which could be divided into two parts, i.e., testing

reliability and validity both the items of the questionnaire and the constructs of research model by a measurement model and assessing the significance of constructs and path coefficient (i.e., Hypothesis Testing and Model Fit) by a structural model, as shown below:

Table 8. Discriminant validity of the measurement model (Fornell-Larcker criterion).

Constructs	AU	IU	OR	OS	POT	PRT	QU	ST	PU
Actual Use ITA (AU)	0.898								
Intention to Use ITA (IU)	0.777	0.898							
On-Route (OR)	0.654	0.707	0.898						
On-Site (OS)	0.599	0.593	0.709	0.920					
Post-Trip (POT)	0.494	0.428	0.427	0.581	0.944				
Pre-Trip (PRT)	0.575	0.657	0.704	0.489	0.226	0.902			
Quality (QU)	0.612	0.637	0.662	0.568	0.495	0.532	0.843		
Safety (ST)	0.526	0.505	0.458	0.495	0.577	0.342	0.623	0.936	
Usefulness (PU)	0.592	0.591	0.619	0.476	0.323	0.568	0.709	0.479	0.857

4.1. Measurement model

The data were collected in the main testing period, which contained 39 questions that are reflective items type regarding the factors affected the decision on IPA usage for travel and tourism. In preliminary, the responses were processed by PASW Statistics v.18.0.0 in order to approve the reliability of the items by Cronbach's Alpha, which is an acceptable value at higher than 0.70 (Hair et al., 2017) thus the result was obtained at 0.971 that excellently passed the standard value. Afterwards, the responses also were calculated by SmartPLS v.3.2.8, to examine its reliability and validity of items and constructs of the research model with descriptive statistics and inferential statistics.

From the reliability and validity of items in the questionnaire, the descriptive statistic is used to calculate and explain the data reliability. The results show that the mean is approximately 3.696–4.516, whilst the top five highest values consisting of PU3, PU4, PU2, PRT3 and PRT1 are approximately 4.516, 4.469, 4.448, 4.390 and 4.380, respectively. The standard deviation (S.D.) is approximately 0.618–0.985, whilst the top five lowest values consisting of PU3, PU2, PU1, OR3 and PRT1 are approximately 0.618, 0.633, 0.639, 0.643 and 0.660, respectively.

Besides, the inferential statistic is used to calculate and verify the data validity in an item of POT3 that should be removed since it contained Outer VIF at 5.80, exceeding an acceptable value (5.00) (Grewal et al., 2004). Afterward, the entire items are passed the qualified values consisting of the factor loadings being acceptable at higher than 0.70 (Hair et al., 2017) with a range of 0.820–0.946, whilst the top five highest

values consisting of POT1, POT2, ST3, POT4 and ST2 are approximately 0.946, 0.944, 0.942, 0.941 and 0.934, respectively. The Outer VIF being acceptable at lower than 5.00 (Grewal et al., 2004) with a range of 2.007–4.391, whilst the top five lowest values consisting of PU4, PU1, AU3, PU2 and AU1 are approximately 2.007, 2.091, 2.254, 2.363 and 2.453, respectively, as shown in Table 6.

Consequently, the constructed examination of the research model is tested through Cronbach's Alpha being acceptable for values at higher than 0.70 (Hair et al., 2017) with a range of 0.879–0.949, whilst the top five highest values consisting of Quality, On-Site, Post-Trip, Safety, and Pre-Trip are approximately 0.949, 0.939, 0.939, 0.929 and 0.924, respectively. Internal consistency is calculated from Composite Reliability (CR) being adequate values at higher than 0.70 (Hair et al., 2017) with a range of 0.917–0.961, whilst the top five highest values consisting of Post-Trip, Quality, On-Site, Pre-Trip, and On-Route are approximately 0.961, 0.957, 0.956, 0.946 and 0.943, respectively. Convergent validity is calculated from Average Variance Extracted (AVE) being acceptable values at higher than 0.50 (Hair et al., 2017) with a range of 0.710–0.891, whilst the top five highest values consisting of Post-Trip, Safety, On-Site, Pre-Trip, and On-Route are approximately 0.891, 0.876, 0.846, 0.814 and 0.807, respectively, as shown in Table 7.

Table 8 shows the discriminant validity of the standing construct in each measurement model. It can be seen that the elements are measured to a certain measurement model with the assessment through a square root of AVE. Each of the diagonal values should be higher than those of the column values in each construct. It could be considered that the

Table 9. Summary of hypothesis testing results.

Hypothesis	Path	Path Coefficient (>0.10)	t-value (>-1.96)	p-value (<0.05)	Supported
H1a	PU → PRT	0.383	5.356	0.000	Yes
H1b	PU → OR	0.122	1.929	0.054	No
H1c	PU → OS	-0.045	0.843	0.399	No
H1d	PU → POT	-0.140	2.469	0.014	No
H2a	QU → PRT	0.265	3.786	0.000	Yes
H2b	QU → OR	0.295	4.420	0.000	Yes
H2c	QU → OS	0.091	1.423	0.155	No
H2d	QU → POT	0.152	2.139	0.032	Yes
H3a	ST → PRT	-0.007	0.137	0.891	No
H3b	ST → OR	0.060	1.227	0.220	No
H3c	ST → OS	0.189	4.015	0.000	Yes
H3d	ST → POT	0.359	5.763	0.000	Yes
H4a	PRT → OR	0.457	7.807	0.000	Yes
H4b	PRT → IU	0.339	5.320	0.000	Yes
H5a	OR → OS	0.590	11.170	0.000	Yes
H5b	OR → IU	0.329	4.733	0.000	Yes
H6a	OS → POT	0.383	5.867	0.000	Yes
H6b	OS → IU	0.108	1.885	0.059	No
H7	POT → IU	0.148	3.188	0.001	Yes
H8	IU → AU	0.777	31.082	0.000	Yes

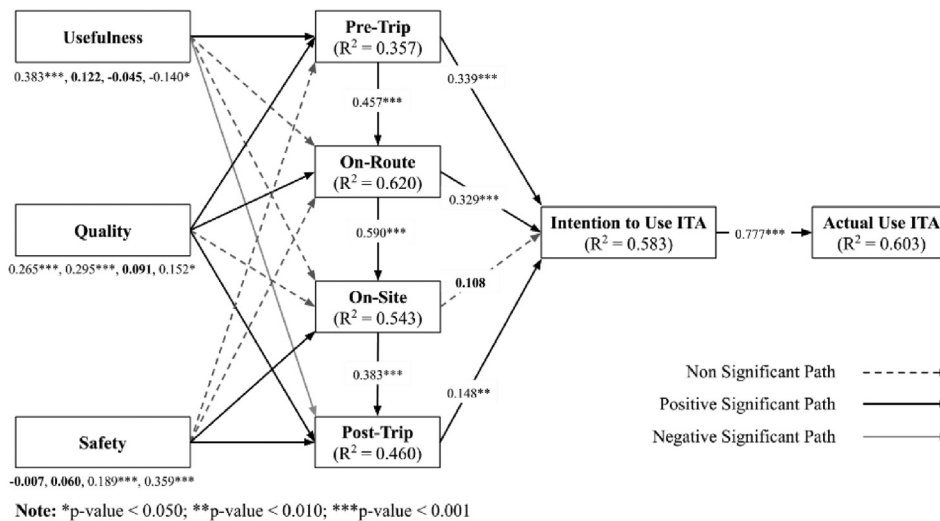


Figure 4. SmartPLS results in the structural model.

weight of all variables in accordance with a criterion is not less than 0.70 (Fornell and Larcker, 1981). For example, in the On-Route (OR) context, the square root of AVE equals 0.898, being higher than the correlation of other constructs, ranged between 0.427 - 0.709. Hence, the research model is an eligible model, and it could be used to analyze the structural model in the next section, as shown in Table 8.

Note that: Table 8 is the discriminant validity, i.e., the equation is $\frac{r_{xy}}{\sqrt{r_{xx} \cdot r_{yy}}}$ where r_{xy} is correlation between x and y, r_{xx} is the reliability of x, and r_{yy} is the reliability of y (Campbell and Fiske, 1959). Therefore, the values of principal diagonal are different from 1.

From the reliability and validity of items of the questionnaire, it can be seen from Table 6 that the results of PU2, PU3, and PRT1 are the best values (i.e., Mean and S.D.), and they also are acceptable for values both factor loadings and Outer VIF. Furthermore, the results of the reliability and validity constructed from the research model in terms of Pre-Trip, On-Site, and Post-Trip are the best values (i.e., Cronbach's Alpha, Composite Reliability, and Average Variance Extracted), and they also are approved by Fornell-Larcker criterion, as shown in Tables 7 and 8.

4.2. Structural model

Accordingly, the assessment of items and constructs of the research model are achieved with the measurement model that passed the qualified value (i.e., acceptable, adequate, reliable and valid) already. Hence, it would be well examined for the structural model testing with both hypothesis testing, and Goodness of Fit (GoF) by SmartPLS v.3.2.8.

4.2.1. Hypothesis testing

Hypothesis testing is a verification procedure of the hypothesis which was initiated within the research model. Hence, this study increasingly verify whole the hypothesis by using the Bootstrapping Algorithm, with defining random sample at 5,000 and a significance level at 0.05 (acceptable error at 5%) for calculation of path coefficient (β), t-value, and p-value (the acceptable value is consisted of * t-value at higher than 1.96 at significance level = 5%, ** higher than 2.58 at significance level = 1% and *** 3.29 at significance level = 0.1%) (Hair et al., 2017). Therefore, the results of hypothesis testing show that H1b, H1c, H1d, H2c, H3a, H3b, and H6b are rejected, whilst H1a, H2a, H2b, H2d, H3c, H3d, H4a, H4b, H5a, H5b, H6a, H7, and H8 are supported, as shown in Table 9.

Unfortunately, according to the result of hypothesis testing that is H1d has the significance of path coefficient at p-value < 0.050, but it has a negative significance, thus making it is a rejected hypothesis. Whereas, H7 has significance at p-value < 0.010, and H1a, H2a, H2b, H3c, H3d,

H4a, H4b, H5a, H5b, H6a and H8 have significance at p-value < 0.001. Therefore, the antecedent variables have the significance of path coefficient, i.e., the Usefulness has a positive influence to Pre-Trip at 0.383, the Quality has a positive influence following as Pre-Trip at 0.265, On-Route at 0.295 and Post-Trip at 0.152, the Safety had a positive influence to On-Site at 0.189 and Post-Trip at 0.359. Moreover, the psychological variables have the significance of path coefficient, i.e., the Pre-Trip has a positive influence following as On-Route at 0.457 and Intention to Use ITA at 0.339, the On-Route has a positive influence following as On-Site at 0.590 and Intention to Use ITA at 0.329, On-Site only has a positive influence to Post-Trip at 0.383, and Post-Trip only has a positive influence to Intention to Use ITA at 0.148. Finally, the Intention to Use ITA has a positive influence on Actual Use ITA at 0.777, as shown in Table 9.

4.2.2. Model Fit

It can be seen from Figure 4 that the results are summarized as follows. Usefulness has positive influences on Pre-Trip in the path coefficient at 0.383, whilst it has negative influences on Post-Trip at -0.140. Quality has positive influences on On-Route, Pre-Trip, and Post-Trip being approximately 0.295, 0.265, and 0.152, respectively. Safety has positive influences on Post-Trip and On-Site being approximately 0.359 and 0.189, respectively. Pre-Trip has positive influences on On-Route and Intention to Use ITA being approximately 0.457 and 0.339, respectively. On-Route has positive influences on On-Site and Intention to Use ITA being approximately 0.590 and 0.329, respectively. On-Site has positive influences on Post-Trip at 0.383. Post-Trip has positive influences on Intention to Use ITA at 0.148, and Intention to Use ITA has positive influences on Actual Use ITA at 0.777.

Therefore, there are three essential criteria to measure and assess a Model Fit of the research model consisting of three parts as follows. Firstly, coefficient of determination (R^2) has been unacceptable at lower than 0.19, low level 0.19–0.33, medium level 0.33–0.67, and good level at higher than 0.67 (Chin, 1998), thus all factors have an influence at the medium level. Their results of On-Route, Actual Use of ITA, Intention to Use ITA, On-Site, Post-Trip, and Pre-Trip are approximately 0.620, 0.603, 0.583, 0.543, 0.460, and 0.357, respectively, as shown in Figure 4.

Secondly, Standardized Root Means Square Residual (SRMR) that should be not higher than 0.080 (Hair et al., 2017; Henseler et al., 2016; Hu and Bentler, 1999) thus the calculation result is the acceptable value at 0.038. Thirdly, Goodness of Fit (GoF) that is the square root of multiplication between the mean of the coefficient of determination (R^2) and AVE as shown in Eq. (1); having consideration criteria as no fit at less than 0.10, small level 0.10–0.25, medium level 0.25–0.36 and high level

at higher than 0.36 (Tenenhaus et al., 2005; Wetzels et al., 2009) Thus the GoF is a high level at 0.654.

$$GoF = \sqrt{R^2 \times AVE} = \sqrt{(0.528 \times 0.810)} = \sqrt{0.428} = 0.654 \quad (1)$$

5. Discussion and findings

As mentioned earlier in Section 2.4, research variables involved with the intelligent travel assistant (ITA) are positive or negative significances to the Plenary Free Individual Traveler Life Cycle (i.e., Pre-Trip, On-Route, On-Site, and Post-Trip) consisting of Usefulness, Quality, Safety and Plenary FIT Life Cycle. These factors will be used to study and describe behavior users into three groups from Table 3, i.e., Travel and Tourism (TT), Technology User Acceptance of Travel and Tourism (TUA-TT), and Technology User Acceptance of Related IPA (TUA-IPA). Therefore, the consistency and conflict from the results can be summarized as follows.

(1) Usefulness

It can be seen from Table 3 that Usefulness is related in two groups, i.e., TUA-TT and TUA-IPA. The first group is TUA-TT. It can be described that the dependent variables are divided into four variables consisting of (a) Attitude (Peres et al., 2011; tom Dieck et al., 2017), (b) Intention (No and Kim, 2014; Phaosathianphan and Leelasantitham, 2019; Trakulmaykee et al., 2018; Usoro et al., 2010), (c) Satisfaction (tom Dieck et al., 2017), and (d) Actual Use (Usoro et al., 2010). Therefore, the Usefulness has a significant influence on the entire dependent variables except for the Intention only in a study of mobile food information (Trakulmaykee et al., 2018).

The second group is TUA-IPA. It can be described that the dependent variables also are divided into four variables consisting of (a) Attitude (Dastan and Gürler, 2016; Kim and Shin, 2015), (b) Intention (Chao et al., 2016; Davis et al., 1989; Kim and Shin, 2015; Koç et al., 2016; Serenko, 2005; Shin and Jin Park, 2017; Simon and Paper, 2007), (c) Service Value (Hah, 2010), and (d) Actual Use (Simon and Paper, 2007). Thus, Usefulness has a significant influence on the entire dependent variables except for the study of Smart Watches (Kim and Shin, 2015) and Mobile Information (Koç et al., 2016). In addition, Usefulness of two groups is related to the most dependent variables in the following factors, i.e., Intention, Attitude, Actual Use, Satisfaction, and Service Value; however, there are few studies being not significant on Intention (Kim and Shin, 2015; Koç et al., 2016; Trakulmaykee et al., 2018).

(2) Quality

It can be seen from Table 3 that Quality is related in three groups, i.e., TT, TUA-TT, and TUA-IPA. For the first group of TT, the dependent variables are divided into three variables consisting of (a) Intention, (b) Satisfaction (Niemczyk, 2014), and (c) Travel Motivation (Personal, 2013). Therefore, Quality has a significant influence on entire dependent variables. In the second group of TUA-TT, this group can be separated into two types of dependent variables as follows: (1) an existing dependent variable, i.e., Intention (No and Kim, 2014; Trakulmaykee et al., 2018; Phaosathianphan and Leelasantitham, 2019), and (2) no dependent variable (Reza, 2014). Therefore, Quality has a significant influence on entire dependent variables except for the Intention variable only in a study of the mobile food information (Trakulmaykee et al., 2018). For the last group of TUA-IPA, the dependent variables are divided into two variables consisting of (a) Intention (Shin and Jin Park, 2017) and (b) Actual Use (Jansorn, 2013). Therefore, Quality has a significant influence on entire dependent

variables; whereas, there is a case study being not significant on Intention (Trakulmaykee et al., 2018).

(3) Safety

It can be seen from Table 3 that Safety is related in two groups, i.e., TT and TUA-TT. For the first group of TT, a dependent variable is only Travel Motivation (Personal, 2013). Whilst the second group is TUA-TT, a dependent variable is Safety being not significant on Intention (Phaosathianphan and Leelasantitham, 2019). Therefore, Safety has a significant influence on Travel Motivation; whereas, it is not significant on Intention. Moreover, the analysis of entire dependent variables from three groups, i.e., TT, TUA-TT, and TUA-IPA, found that Intention is the most dependent variable in the following factors, i.e., Attitude, Satisfaction, Actual Use, Service Value, and Travel Motivation. It can be seen that there is an observation of Attitude existing only from four works as follows. Social Media (tom Dieck et al., 2017) and Electronic Tourist Guides (Peres et al., 2011) are included in a group of TUA-TT; whilst, Mobile Payment (Dastan and Gürler, 2016) and Smart Watches (Kim and Shin, 2015) are within a group of TUA-IPA.

From above mentioned in three factors, a possibility of Attitude could not enough to measure and obviously to describe technology acceptance or adoption. It could be manifested in the overview of technology acceptance from only the users; then the most studies of their works are more favoured to the use of other variables such as Intention, Satisfaction, Service Value, Travel Motivation, and Actual Use. However, Attitude is replaced with the plenary free individual traveler life cycle, i.e., Pre-Trip, On-Route, On-Site, and Post-Trip. This could be distinctly measured and assessed in technology acceptance of travel and tourism.

(4) Plenary FIT Life Cycle

It can be seen from Table 3 that Plenary FIT Life Cycle is only within a group of TT. It is used for independent variables not only related to these studies of the models (Goh et al., 2010; Meng, 2006; Niemczyk, 2014) but also explained with the theory and policy of travel and tourism perspective (Personal, 2013; Staab et al., 2002; UNWTO/GTERC, 2017).

6. Conclusion and recommendations

6.1. Conclusion

All respondents from FIT were Thai people by most respondents from males of 31–40 years old. They had an experience greater than one year for using Google Assistant, Apple Siri, and Samsung Bixby. They also had used the IPA following the Plenary FIT Life Cycle, i.e., On-Route, Pre-Trip, On-Site, and Post-Trip. It can be seen that the Usefulness (Davis, 1989; Kim and Shin, 2015; tom Dieck et al., 2017) was the most impact to influence on the Plenary FIT Life Cycle (IT Process) followed in the Quality and the Safety. Consequently, the Usefulness had a negative influence on Post-Trip in spite of a positive influence on On-Site. Besides, the Quality had a positive influence on the highest quantity of the Tourist's Life Cycle, following as Pre-Trip, On-Route, and Post-Trip, respectively, whereas the Safety had a positive influence on On-Site and Post-Trip, respectively. Therefore, there are two distinguished findings in this study as follows. Firstly, antecedent variables (i.e., Usefulness, Quality, and Safety) which are significant to the Plenary FIT Life Cycle (i.e., Pre-Trip, On-Route, On-Site, and Post-Trip). Secondly, the Plenary FIT Life Cycle has the significance with the user acceptance of ITA. Hence, two distinguished findings were initialed the assessment model being suitable to effectively measure and assess the feature value of ITA, which is used to decision and selection both of usage FITs and investing ITA operators for the travel and tourism firms.

Moreover, the analysis of denying and negative path coefficient between the antecedent variables (i.e., Usefulness, Quality, and Safety) and the Plenary FIT Life Cycle (i.e., Pre-Trip, On-Route, On-Site, and Post-Trip) from the open-ended questions, i.e., limitation and suggestion of using IPA for travel and tourism of the questionnaire thus there are some answers that is relationship with these results as follows: 1) the Usefulness has no significance to both On-Route and On-Site; there are some answer of limitations, i.e., it was extremely bad while using a voice control among the noisy area, and some functions were unavailable use in someplace (e.g., the countryside and natural area), and suggestions, i.e., it should be more flexibility determining with route navigation and advice an interesting destination during On-Route. 2) the Usefulness has a negative influence on Post-Trip thus it might be a cause of some features of IPA during Post-Trip remain incomplete development or mismatch with user needs that negatively affects to believe and attitude of the user according to a suggestion that is IPA should regularly collect and show satisfaction evaluation of the destination by previous visitors or travelers. 3) the Quality has no significance on On-Site thus it might be some of the limitations, i.e., a lack of quantitative and qualitative information of the destination, whilst the suggestions, i.e., improvement of the quantity, diversity, and accuracy of the destination's information. 4) the Safety has no significance on Pre-Trip and On-Route thus it probably has some of the limitations, i.e., the use of IPA making a distraction in a case of driving, whilst the suggestions, i.e., need an offline mode, able to download the trip information before having disasters and crime notifications. Therefore, the FIT most had the intention to use ITA on On-Route following as On-Site, Post-Trip, and Pre-Trip, respectively then ITA developers should emphasize to quickly improve usefulness, quality (i.e., system, information, and service) and safety during On-Route and On-Site of the Plenary FIT Life Cycle in order to encourage and increase the using ITA.

6.2. Recommendations

This study attempted to extend TAM (Davis et al., 1989) with the antecedent variables of essential features of ITA and the Plenary FIT Life Cycle toward a suitable assessment model for the complete measurement and assessment the value of ITA, in particular, data collection from the sample group of this study as the FIT is growing and trending becomes the main travelers in the early future. Hence, the benefits of this study are the following. Firstly, understanding the antecedent variables (i.e., Usefulness, Quality, and Safety) for appropriate study with ITA and Secondly, discover a suitable IT Process that is the Plenary FIT Life Cycle (i.e., Pre-Trip, On-Route, On-Site, and Post-Trip) for measurement and assessment the value of using ITA. However, every coin has two sides thus there certainly are the limitations of this study; IPA is an early adoption phase (Rogers, 1962) and it is no specifically developed for travel and tourism thus it maybe has other antecedent variables which should be more investigated in the future, and the data collection of this study that was gathered from FITs in Thailand only and unable to collect data from all kinds of ITA. Therefore, it might be applied and examined with the other sample groups and ITA in the future.

As mentioned earlier in Section 5, there have some barriers in this study, i.e., some antecedent variables and the Plenary FIT Life Cycle being not the significance to the actual use of ITA. If the understanding of antecedent variables affects the Plenary FIT Life Cycle, then the discovery of the Plenary FIT Life Cycle could be used to assess the influence on the actual use of ITA. Therefore, this study still has some contributions as follows. Firstly, FITs could use the result of this study to decide on the selection of using ITA. Secondly, ITA operators, travel, and tourism firms could bring the results from this study to measure and assess the feature value for improving and investing the ITA together. Thirdly, the primary

model is formulated in this study further for the use of ITA such as virtual reality tourism, undersea tourism, universe tourism, time travel, and so on.

Declarations

Author contribution statement

A. Leelasantham and N. Phaosathianphan: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

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