ISCTE IUL

Instituto Universitário de Lisboa

The Adoption Intention of Travel-Related App: A Framework Integrating Perceived Characteristics of Innovation and Software Quality

WANG Ruping

Thesis submitted as partial requirement for the conferral of

Doctor of Management

Supervisor:

Prof. Bráulio Alturas, Assistant Professor, ISCTE University Institute of Lisbon

Co-Supervisor:

Prof. FANG Jiaming, Associate Professor, The University of Electronic Science and Technology of China

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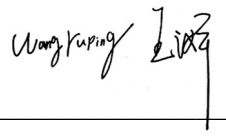
Signed 

Abstract

This thesis aims to analyze the views of customers who have great appetite for tourism on the tourism application. According to the perception characteristics of technology acceptance model, innovation diffusion theory and software quality model, the thesis sets up the research model and puts forward the corresponding research hypothesis on the combination of current research results.

In the manner of questionnaire design and collection and data processing, data analysis and hypothesis verification will be conducted by the use of structural equation model. The research result implies that application design attributes and application performance features are key to promote the adoption of mobile travel application.

In addition, this research broadens our horizons on the accidental impact of application attributes on adoption behavior through adding user gender as a variable to the model, and increases an awesome theoretical basis for future research in this field.

Keywords: Mobile Travel App; Adoption Intention; Perceived Characteristics of Innovation (PCI); Software Quality

JEL: M15; Z32

Resumo

Esta tese tem como objetivo analisar as visões de potenciais turistas com grande interesse por aplicações turísticas. De acordo com as características de percepção do modelo de aceitação de tecnologia, teoria da difusão da inovação e modelo de qualidade de software, a tese estabelece o modelo de investigação e propõe hipóteses de investigação correspondentes, sobre a combinação de resultados da pesquisa atual.

Uma vez realizado o desenho do questionário e feita a recolha e processamento de dados, a análise de dados e a verificação de hipóteses foram conduzidas pelo uso do modelo de equações estruturais. O resultado da pesquisa implica que os atributos de design do aplicativo e os recursos de desempenho do aplicativo são fundamentais para promover a adoção do aplicativo móvel de viagem.

Além disso, esta pesquisa amplia os horizontes sobre o impacto acidental de atributos de aplicação no comportamento de adoção, adicionando o gênero do usuário como uma variável ao modelo, e aumenta uma importante base teórica para pesquisas futuras neste campo.

Palavras-chave: App para viagens; Intenção de adoção; Características Percebidas da Inovação (PCI); Qualidade de Software

JEL: M15; Z32

摘要

本论文通过对旅游有兴趣的用户访问调查，来研究他们对旅游应用程序的看法。我们围绕技术接受模型、创新扩散理论和软件质量模型的感知特征，提出了本文的研究模型，并结合现有的研究成果，提出了相应的研究假设。

通过问卷设计、收集以及数据处理，并利用结构方程模型进行数据分析和假设验证。研究结果表明，应用设计属性和应用性能属性是推动移动旅行应用程序采用的重要影响因素。

此外，本研究还通过将用户性别作为调节变量加入模型，丰富了我们关于应用属性对采纳行为的偶然影响的了解，为今后在这个领域的研究提供了一个良好的理论基础。

关键词：旅游服务 App；采纳意愿；感知创新特征(PCI)；软件质量

JEL: M15; Z32

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Chapter 1: Introduction

1.1 Research background

Travelling is an indispensable relaxation lifestyle for people. Whether it is a group organization travel or a small-scale travel between family and friends, whether it is going abroad to experience exotic customs or enjoying a rare leisure time at some resort in China, it reflects the increasingly diversified modes of travel in all aspects. In the past, people tended to follow the travel agency, which mastered adequate travel information to help tourists work out more reasonable travel plans to avoid unnecessary trouble and save travel cost. An enhancing development of information technology has conduced more websites to providing customers one-stop travel service. They not only have a detailed introduction to the scenic spots in the world, but also provide visitors with more personalized services, such as planning of the itinerary, accommodation in nearby hotels, recommendations for local cuisine, and even sharing travel experiences platform for tourists. Through these websites, people can also have enough travel information and make travel plans for themselves according to their own preferences. Therefore, self-service travel has become a popular choice for current travel.

Nowadays, as wireless communication technology advances, a smartphone with a powerful multimedia entertainment function, supporting for online services, and basic functions on a personal mobile phone (PDA) has gradually replaced the traditional ones, so that people can be able to search the Internet easily when they are travelling. Furthermore, the smartphone with Android system has occupied most of the mobile phone market, and the travel information search software of mobile mobile client is more popular. Therefore, the development of an application system based on mobile phone travel services (app), not only can provide great convenience for users in the travel. It also enables visitors to view their scheduled itineraries on the smartphone anytime and anywhere and use the GPS function of the mobile phone to search for nearby attractions, food and hotels, and even “shake out”

unexpected gains through the function of “shake it”. These are features that are not available on the PC website.

A turbocharged growth of smartphone mobile Internet applications and the continuous penetration of tourism have generated an increasing proportion of mobile travel applications. As of 2014, the scale of the Internet tourism market reached 140.6 billion yuan, accounting for 44.6% of mobile-end, annual proportion growth of 40.4% and 34%, respectively in the next two years. Back in 2017, the market scale reached 738.41 billion yuan, registered 76.5% of mobile-end. (Source: Prospective Industry Research Institute). According to the financial statements published by a variety of online travel service companies, Crip’s net revenue in 2017 was RMB 26.78 billion yuan, a year-on-year increase of 39%. Comparing to the gross profit in the same 2017 was 2.2 billion yuan, it realized a year-on-year increase of 54%; The total revenue of Tuniu in 2107 was 2.2 billion yuan, an increase of 53.3%, whose gross profit in 2017 referred to 1.2 billion yuan, an increase of 80.9%. It can be seen that the profitability of OTA is improving, and the competition between various travel apps is also intensifying.

We have known that the seven sections of information collection, travel booking, hotel accommodation, transportation, food and beverage, photography editing and travel sharing have consisted of the ecological chain of tourism, and while the profit points are mainly concentrated in the pre-trip preparation stage, which is the most competitive part for various apps. Information collection is an indispensable preparation before going travelling. Ctrip app is the top one in this section, while in terms of travelling abroad, Mafengwo app is the second-in-command aiming at the foreign tourism. The itinerary booking is mainly the reservation of attraction tickets. In addition to Ctrip and Where to go apps, Taobao shows its popularity with the advantageous edge of huge flow of views. Especially in its overseas travel schedule, it ranks second behind Ctrip app. Hotel accommodation represents a part and parcel of tourism, and it is also a section of the competition of various businesses. Among others, Ctrip and where to go apps share the half markets together, and other businesses occupy the other half market shares. In the light of transportation, the railway is monopolized by the official channels of the railway operation company, and the aviation is led by various

platforms. The food and beverage is highlighted by Dazhongdianping app with the limited information of foreign delicious food. As for photographing and landscaping, they are presented by other types of apps. And tourism sharing is mainly reflected in the way of write a tourism strategy for travel platform and issue photos for social platform.

In view of this, whether it is from the perspective of the needs of travellers, the developers' thinking in designing and developing the travel mobile application, and the competition demands of the mobile travel service app market, the research on the intention of tourists to adopt the travel application has become an pressing real needs. At present, the market is mainly monopolized by several companies. Although new entrants to the tourism service market have invested a lot of money and energy in the development of the app, how to promote consumers to adopt their app has become a research topic with great theoretical and practical value. Therefore, this study has certain practical guidance and theoretical research significance for small and medium-sized enterprises and individual developers, as well as new mobile travel service app.

1.2 Research problem

Today, with the popularity of Internet applications and access to information and ralated services through the Internet, how we live and our behaviors have undergrone tremendous changes, bringing new opportunities and innovative models for the development of all walks of life. The tourism industry has also been affected by the impact of Internet applications, and it has also ushered in a booming opportunity. The travel service application software has penetrated all aspects of tourism consumption, especially the mobile travel service app on the mobile phone side, which has become an indispensable travel assistant tool for traveler travel. In recent years, a large number of research scholars have conducted research on tourism service apps. For example, Li and Zhang (2015) introduced the two factors of self-efficacy and perceived risk by using the “Technology Acceptance Model” as the research basis to study the influencing elements of the download of tourism service app users. The results show

that perceived ease of use and perceived usefulness are important factors affecting download behavior, and perceived ease of use is the biggest influencing factor, but perceived risk is not the influencing factor of user download behavior. For example, Lu et al. (2015) integrated the Technology Acceptance Model (TAM), the Innovation Diffusion Model (IDT), and the Social Cognition Theory (SCT) to establish user acceptance model of traveler on tourism app. The results showed that perceived usefulness, perceived ease of use and compatibility are three most important influencing factors. Self-efficiency can affect user's intention through expected outcomes, while social norms are not the influencing factors on it. Most of the hypotheses were verified.

At the same time, due to fierce competition in the travel app market, such as: travel integrated service provider like Ctrip and Where to go, travel guide service providers such as Horse cell, travel community service provider like Tripadvisor, folk service provider like Airbnb. How the newly developed app enhances the user's acceptance behavior has been of an urgent and realistic research significance. There has been a lot of research on this important issue, such as using the innovative features of perception to explain the acceptance behavior of consumers in many fields such as e-commerce tourism. Amaro and Duarte (2015) explored the factors that affect consumers' purchase of online travel. Agag and El-Masry (2016) investigated consumers' intention to participate in online travel communities and to purchase travel products online. Jensen (2009) investigated the willingness of travelers to buy online tourism products. Lee et al. (2011) added IDT to the Technology Acceptance Model in 2011. Kang et al. (2015) investigated the willingness to download and use retail applications based on mobile location. It can be seen that the innovative features of perception have been applied to the survey of consumers' intention to adopt in the context of tourism applications. However, the current research on the willingness to accept travel app from the perspective of app product attributes is extremely scarce, although previous research results show that app product attributes have an important influence on whether visitors will accept a certain mobile app.

The goal of this thesis is to study the personal information technology acceptance model

(TRA, TAM, TAM2, TPB, UTAUT), the organization-based information technology acceptance model (IDT, TOE), the software quality model (ISO / IEC 9126, ISO / IEC 25010, CISQ), involvement theory and research on mobile applications and tourism-related applications, which are the basis of these theoretical foundations, so the author selects the relative advantages, compatibility and complexity of innovation characteristics in the innovation diffusion model, and increases two influencing factors-social interaction and UI experience originating from software quality model, to build a model of user acceptance model of tourism app. In a result, the model of the users' willingness to use tourism app will be constructed and the research hypothesis will be put forward. The questionnaire survey and data collection are designed to analyze the reliability and validity of the questionnaire data, and the author will know about the path coefficient among all variables to verify the research hypothesis. The thesis will explain the influencing factors of app users' intention to use and find out the key influencing factors and the main influencing factors, finally to provide guidelines for developers and operators of tourism app.

1.3 Research significance

1.3.1 Theoretical significance

1) The influencing mechanism model of mobile travel app's willingness to use is put forward. The effect in different perspectives of tourism app products on users 'attitudes and willingness to use is verified, supplementing the current vacancies in research on the willingness of travel app users;

2) The mediating effect about attitudes and involvement on the relationships between perceived characteristics of innovation factors and software quality factors on users' willingness is discussed, additionally, analyzing and explaining the mechanism of this effect;

3) The study firstly applies the software quality factors such as social interaction, UI experience, and the transferability to the users' willingness model of mobile app in this research, which can widen the research dimensions of studies in related fields;

4) The perceived characteristics of innovation such as relative advantage, compatibility and complexity are also firstly applied in the users' willingness model of mobile app in this research.

5）This thesis also delves deeply into the effect of demographic variables on the model. In addition, it explicates clearly the mediation efficacy of attitude and involvement between application features and user's willingness to harness. What's more, this research broadens our horizons on the accidental impact of application attributes on adoption behavior through adding user gender as a variable to the model, and increases an awesome theoretical basis for future research in this field.

1.3.2 Practical significance

1) The results of this research can provide practical enlightenment for the development and design of tourism app. The results indicate that factors such as comparative advantages, compatibility, complexity, time convenience, social interaction, UI experience, transferability can directly have an effect on the users' involvement, and finally affect users' attitudes and willingness to use. Therefore, the app developers should give priority to the improvement of relative advantages, compatibility, time convenience, social interaction, portability and involvement, optimizing the user interface of app, reducing the complexity of app, and thinking about how to improve these attributes. In this way, the user's user involvement can be better improved, thereby improving the user's attitude and willingness to use by increasing the degree of involvement.

2) This study considers the characteristics of innovation perception and software quality factors into the model at the same time. The research finds that they have significant influence on the degree of involvement, attitude and willingness to adopt. Therefore, in practice, we should pay attention to the innovative perception characteristics and software quality factor of app.Innovation-aware characteristics and software quality factors play a very significant role in the user, which directly affects whether the user adopts the installed software. Therefore, the software product manager, software designer and software developer of app company

should merit close attention to it.

3) User involvement is an intermediary mechanism in this research model. The impact on users' attitudes and willingness is significant and direct. Therefore, in addition to considering the innovative perception characteristics and software quality factors in the model, we should also consider what other aspects should be considered to improve the user's involvement in the app, and should put the user's involvement in the important consideration at the moment of enhancing and optimizing the app.

1.4 Research content and methods

Tourism app is a new emerging technology recently as the mobile internet develops, and there is a few domestic research on the users' willingness of tourism app. Based on the previous research results, a combination of the technology acceptance model and innovation diffusion model is conducted to do the further study of travellers' intention on tourism service app. The data of this study were derived from the written survey visit statistics of travelers, and the structural equation modeling method was used to perform hypothesis verification.With 803 questionnaire survey sample, the study makes an analysis of the reliability and validity of sample data to verify the research hypothesis. The main goal is to investigate the opinions of consumers on tourism applications. The target population include the consumers who are interested in travelling, users of online traveling community, and the members who prefer to use tourism app to search travel information by using questionnaire survey and empirical methods to collect data in this research.

The research model is based on Technology Acceptance Model (TAM), the Innovation Diffusion Model and Software Quality Model. The questionnaire survey includes two parts, one is the basic information, the other is conceptual measurement. The basic information part is about the characteristics of the targeted groups, containing their gender, age, education, occupation, travel frequency, travel budget, frequency to use the tourism applications, purchase experience in the tourism application, frequency to search information by use of

tourism application, and type of mobile operating system. There are ten concepts in the research model, namely, relative advantage, compactivity, complexity, time convenience, social interaction, UI appearance, portability, attitude, involvement and utilization. Due to the comparative advantages, consistency, complexity, time convenience, social interaction, UI aesthetics, portability, attitude, involvement and use of many studies verified in different contexts, the latent variables measured in this study are derived from previous mature literature. The variables in this study were measured from previous studies and then appropriately adjusted to suit the context of the user using the Travel app.

1.5 Research schedule and content outline

1.5.1 Research schedule

Starting from the project background, the thesis first defines the research issue of the project and finds the source of the problem and the research problem. Secondly, a large amount of literature reading is carried out, and then research hypotheses are proposed, determining research models and research methods. Next, the author will start to make the field research and do data pre-processing and data analysis. Finally the research results of the topic is summarized.

1.5.2 Content outline

The thesis consists of six chapters with the following details.

The Chapter one mainly illustrates the background, problems, significance, contents and methods of the research, as well as the research process and arrangement of the whole thesis.

The Chapter two includes two sections, the first part is the simple overview of the industry of research problem, from the industry development and its business model; the other aspect is a comprehensive introduction to the theory used in the thesis and a review of the main theoretical models.

In terms of the third chapter, the research model of the thesis is put forward according to

the existing model. Secondly, the thesis's requirements are analyzed in detail from the aspects of user's functional requirements and non-functional requirements, and the research hypothesis are put forward.

As to the fourth chapter, it mainly illustrates the the design of the questionnaire, the determination of the measurement title, the recovery of the questionnaire and the data pre-processing.

In the fifth chapter, the modeling and data analysis of the model are mainly presented. Through the descriptive statistical analysis of each variable, the research hypothesis is tested, and the influence on the results is studied by adding demographic variables.

The sixth chapter summarizes the conclusions of this study, mainly from two aspects, one is the theoretical contribution, the other is the management contribution, and the future research direction is prospected.

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Chapter 2: Theory and Literature Review

2.1 App operating system

2.1.1 Mobile terminal operating system

As the core control software of the computer system, the operating system is claimed to be the interface program module between the computer user and the computer hardware, which plays a role of managing and controlling the computer hardware and software resources. With the soaring development of mobile communication technology and the popularity of mobile Internet, while mobile phone, looked upon as an inevitable mobile communication tool, has morphed into a mobile personal information collection and processing terminal with a great number of intelligent characteristics from a simple communication. Thanks to the operating system and the abundant apps, the smart phone is prominently a mobile terminal.

The operating system of the mobile terminal, to put it simply, is the intelligent mobile phone operating system. It is developed into a kind of operating system especially applied for the forward mobile progress on the basis of an embedded operating system. Namely, the emerging mobile terminal operating system not only provides a unified interface and a good interaction interface for the user to use the mobile phone, but also generates a platform for the extension of mobile phone function and the installation and operation of third-party software. The available mobile operating system on smart phone is roughly classified into the following categories: Google's Android, Apple's iOS, Microsoft's windows phone, Nokia's Symbian, BlackBerry's BlackBerry OS, web OS. On the front of the openness of source code, kernel and application environment, smart phone operating system can be deliberately divided into an open platform (based on Linux kernel) and an closed platform (based on UNIX and Windows kernel).

In addition to the functions of the embedded operating system (such as process

management, file system, network protocol), the mobile terminal operating system also has set up other applications, for example, a power management section for the battery power supply system, an input/output section interacting with the user, an embedded graphical user interface with an accessible interface for the upper layer application, services including encode and decode for the bottom layer, a Java operating environment, a wireless communication core function aiming at the mobile communication service and an upper layer application of the smart phone for the multimedia application.

In November 1996, Microsoft released the Windows CE operating system, and then it began to step into the threshold of the mobile phone operating system. In June 2001, the Italian Symbian company launched the Symbian S60 operating system, which improved the concept of smart phones as the debut of the S60. While in June 2007. The apple Company made its voice of releasing the IOS operating system, in which the operation of finger touch began to influence people's life, innovately integrating the functions of mobile phone, touch screen, web browsing, mobile phone game and cell phone map into a whole. As it moved forwards September 2008, Google's research and development team unveiled the Android OS operating system, whose good user experience and open source design allowed Android OS to quickly grasp the smart phone market. In response of the fierce market competition and the choice of users, Android OS and IOS systems uphold a compelling advantage in smart phone market. Such being the case, Microsoft's official website announced that its Windows 10mobile phone operating system will no longer provide download updates by the end of 2019, which means that the mobile phone system will completely exit the stage of history.

2.1.2 IOS operating system

IOS is a mobile terminal operating system developed by the US apple Inc., which was founded by Steve Jobs, Steve Wozniak, and Rowan (Ron Wayne) on April 1, 1976 and named apple Computer Inc. On January 9, 2007, it was renamed apple Inc. headquartered in Cupertino, California. The apple Inc. is committed to designing, developing and selling consumer electronics, computer software, online services and personal computers. Its

developed apple II embarked on a personal computer revolution in the 1970 s, followed by the Macintosh since 1980. The company's hardware product is mainly the Mac series, the iPod media player, the iPhone smart phone and the iPad tablet; the online services include iCloud, iTunes Store and app Store; the consumer software is full of the OS X and IOS operating systems, the iTunes multimedia browser, the Safari web browser, iLife and iWork ideas and production sets. Apple unveiled the system at the Macworld conference on January 9, 2007, and it was a Unix-like commercial operating system on the basis of Darwin (it is an open source operating system for apple computers). According to the data released by NetMarkShare, the global market share of the IOS operating system was 29 percent in 2018. apple's intraday market capitalization exceeded $1 trillion for the first time on the evening of Aug. 2, 2018, a record high of $203.57 in history.

Taken together, the iOS operating system is featured with the following characteristics:

(1) User interface with artistic visual effect. IOS's innovative Multi-Touch interface is designed for fingers.

(2) Optimal combination of hardware and software collocation. The operating system of hardware, applied in the iPad, the iPhone, and the iPod Touch, are both IOS highly integrating to make the App application take full advantage of the Retina screen's display technology, the Multi-Touch (multi-touch screen technology) interface, the acceleration sensor, the three-axis gyroscope, the acceleration graphics capability, and the more hardware features. Face Time (video call software is an excellent example, using front and rear cameras, display screens, microphones and WLAN network connection, making IOS the best optimized and fastest mobile operating system.

(3) Safe and reliable design. The designs of low-level hardware and firmware functions are designed to prevent malicious software and viruses; and the function of high-level OS progress contributes to ensure security when accessing personal information and enterprise data.

(4) Multilingual support. iOS devices can use more than 30 languages and switch

between any two languages. The inserted dictionary is able to speak over 50 languages, VoiceOver (speech Auxiliary Program) can read the screen content of more than 35 languages, and the speech control function can understand more than 20 languages.

(5) Light vision and rich colors to present fashionable trend of new UI. The introduction of Control Center makes the control easier, and the flattened design can reduce the pressure of cross-platform application design to some extent.

2.1.3 Android operating system

Android operating system is a mobile terminal operating system developed by Android, which originally means "robot" in English. Android Company was founded by Andy Rubin in the United States in 2003 and acquired by Google in 2005. its main business is mobile software and mobile operating system. Android OS is an open source mobile operating system based on Linux, developed by Google (Google) in partnership with more than 30 technology and wireless applications, including China Mobile, Motorola, Qualcomm, HTC and T-Mobile. The Android operating system was officially launched in November 2007. It is the first open-source mobile phone operating system based on the Linux 2.6 standard kernel. The platform consists of operating system, middleware, user interface and application software. It is billed with the first genuine open and comprehensive mobile software built for mobile terminal.

The greatest edge of Android operating system is labeled with convergence, that is, permitting ant mobile terminal manufacturer, user and application developer to join the Android alliance and develop their own application products with respective features. An broad, extensive and open development environment supported by the platform for third-party developers gives rise to a tremendous variety of rich, practical, novel and unique applications full of touch screen, advanced graphic display, Internet access and comfortable interface, thus is announced to be a web application platform.

After Google acquired Android, it made continuous progress of Android system. Going forward, it adopted software stack (also known as software stack) architecture,

mainly divided into three parts: the bottom layer is underpinned by Linux kernel work, developed by C language, and with basic functions; the middle layer is composed of Library and Virtual Machine, explored by C++; as to the top layer, it is all kinds of application software, including call program and SMS program, these parts are expedited by each company, with the participation of Java in the program.

At the same time, through deep partnerships with software and hardware developers, equipment manufacturers, telecom operators and other interested parties, Google aspires to formulate an open ecosystem in the mobile industry via the establishment of a standardized, open mobile phone software platform. Android, as an indispensable section of Google's corporate strategy, will make vigorous efforts to advance the realization of the enterprise goal of "providing information to everyone anytime, anywhere". Given that a tremendous number of mobile phone users around the world are using a variety of Android-based phones, Google aims to unleash mobile communication devices from equipment even platform. Out of the realization of this goal, Android will replenish but not replace the long-time pursuit of mobile development strategy by Google, interpreting that develop useful and attractive mobile services and promote these products by partnering with mobile phone manufacturers and mobile operators around the world.

The Android operating system has the following characteristics outperforming other systems:

(1) Openness

Out of the comprehensive openness, any mobile terminal vendor is allowed to join the Android alliance. On the front of Android's prospect, openness is conducive to the increase of users, including consumers and manufacturers, as to the consumers, a plenty of software resources can meet their various needs. A large number of software developers in a short span will gravitate to the open platform, and they will squeeze intelligence to provide various kinds of application software for the platform so as to build an ecosystem of platform application software, which gathers more and more users to the platform, and the convergence of consumers in return stimulate software developers to develop more

high-quality software, thus forming a cross-edge forward network effect. That being said, the open platform will continuously improve itself through fierce competitions. Seeing the benefits of openness, consumers have the chance to purchase their favorable smart phones at a lower price.

(2) Get rid of the bondage of operators

Over the past period in Europe and the United States, the function of mobile phone applications and mobile phone network access are nearly in the charge of operators. With the launch of iPhone on the market, the users are freely to connect network with less constraints by operators. In the current times of the gradual transition and promotion of EDGE, HSDPA, WCDMA, TDLTE, FDDLTE and other mobile networks from 2G to 4G, the 5G (the 5th generation mobile communication system) is around the corner, so the random access of mobile phone to the network is no longer a joke of the operator.

(3) Rich choice of hardware

Although Android is an open platform, the creations with multiple unique functions designed by many manufacturers list large choices for users without impacting data synchronization or even software compatibility. For example, if you replace the phone from Samsung to Huawei, there is no obstacle to download the application software which you used on Samsung phone before on Huawei smart phone, and it is convenient to transfer contacts, address book and other information through professional apps. In other words, users using Android platform can have more choice in the process of hardware selection, and can enjoy the same software services on different hardware.

(4) Closely knitted with Google apps

The services provided by Google from the search giant to comprehensive extension of the Internet, such as map, e-mail and search, have been an important bond to connecting users and the Internet, while the phones in Android system enable to ingeniously interface with Google’s application and its services.

Google’s mobile map service is a case in point. The user can harness the client end to

query the information, location and road situation of a city, and then see precise position with the help of GPS or Internet and obtain relevant location information. Google's mobile map service provides map search and scaling map services to the world with vector maps, satellite maps and hybrid maps, allowing users around the world to experience a new map service model. In order to make Google Maps service more widely used, in June 2005, Google provided an open map service application interface GooleMap API for secondary development, enabling people interested in Google Maps to develop Google Map service. In the next year, Google designed a map service for mobile platforms, which meant that the map data was directly transmitted to the mobile phone platform through a wireless connection, and the user could obtain the map service by surfing the Internet through the mobile phone. The innovation and openness of Google Maps Services has made it a great success on the Internet.

The birth of Google Maps marks the rise of online map services and has also attracted the attention of the Chinese market. Well-known Chinese websites, such as Sohu, Baidu, Tencent, and Gaode, have launched their own map services, whose functions are more local and more practical than Google Maps. However, these services generally do not provide an open API interface, nor can they provide high-resolution satellite maps.

2.1.4 Other operating systems based on Android

(1) Emotion UI system

Emotion UI (Emui for short) is an emotional operating system developed by Huawei in China based on Android. Huawei Technology Co., Ltd. is a private communications technology company in China, which produces and sells communication equipment. It was founded in 1987 and is headquartered in Shenzhen, Guangdong Province, China. Huawei is the world’s leading provider of information and communication technology (ICT) solutions, mainly engaging in ICT sector. It has established end-to-end solution edge in telecom carriers, enterprises, terminals and cloud computing, providing competitive ICT solutions, products and services to carrier customers, enterprise customers and consumers, and striving to realize the future information society and build a better-connected world.

In July 2018, Fortune magazine released the latest list of the world's top 500, and Huawei ranked 72nd. In 2018, Huawei ranked sixth in the "China's 500 Most Valuable Brands". In December 2018, the "2018 World Brand Top 500" which was compiled by the World Brand Lab announced Huawei 58th rank.

Emotion UI has presented customers a simplified user interface, new gesture navigation and HIVision “AI” function already, and the new system has been updated to the most phone models in China in a natural and simple design. As to the 9.1 version, users can have an enabling interactive experience with the benefits of 10% simplified procedure, overall unified design, the convenient one-hand operation and creative gesture navigation; the new UX mixes the sound, color, light and shadow of nature, forming the immersive design of nature. It presents the following features:

- Integrating screen

The Home button that combines the screen and the main menu reduces the step of navigation and improves ease of use for introductory users. Me Widget integrates the information and functions of the media class and the AC class together.

- Scenario mode

With the permission of the user, the mobile phone can use its own sensors and related technologies to locate, track time and other information. Such being the case, when users are in the gym, driving, or in a meeting, the phone can intelligently choose the scenario mode that best suits the current situation.

- Intelligent guidance

Considering the challenge that not all users have a composite understanding of the functions and operations of the smart phone, even some of the most basic operations, a comprehensive guidance system is provided to enable fresh users to be familiar with the operations as soon as possible.

- Voice assistant

Voice assistants can be used for phone calls, texting, real-time navigation, switching scenario modes. Whether you're driving or just sitting leisurely, voice assistants will make your life more convenient.

- Individualized theme

The operations of switching the theme, replacing the wallpaper, and changing the font, five-set presets and a large number of downloaded themes conduce users to showoff their individualized design.

(2) Xiaomi MIUI system

The MIUI is a third-party mobile phone operating system based on the depth optimization, customization and development of the Android system of the Chinese Xiaomi Company. Founded on March 3, 2010, Xiaomi Technology is a mobile Internet company specializing in the development of smart hardware and electronics, as well as an innovative technology company committed to high-end smart phones, Internet television and smart home ecological chain construction. The company has created an operating system for developing smart phone in the Internet mode with the participation of Electronic enthusiasts. On July 9, 2018, Xiaomi MIUI officially landed on the main board of the Hong Kong Stock Exchange. In 2018, it shipped more than 120 million units, accounting for 8.7%, ranking fourth in the world and second among Chinese manufacturers.

Since the release of the maiden beta version on August 16,2010, MIUI has been followed by 100 million big fans at home and abroad, spreading China, UK, Germany, Spain, Italy, Australia, USA, Russia, Netherlands, Switzerland and Brazil. MIUI, a deeply customized Android mobile operating system based on CyanogenMod, dramatically modifies Android's local user interface and removes its application drawer, as well as adds a large number of design elements from apple's iOS, which have also led to comparisons with apple's iOS in public.The MIUI system also uses different system applications from the original Android, replacing the original music program, calling program, photo album program, camera program and notification bar, and adding some new functions. Because

MIUI remakes some of the system database tables of Android and modifies the native system application program, the data of MIUI is incompatible with the data of Android, and the direct consequence may be the incompatibility of the application program.

On balance, the main features of Xiaomi MIUI are as follows:

- Green and simple

MIUI provides green and clean ROM space without integrating other cumbersome third-party applications.

- Unique user experience design

The MIUI, taking into consideration Chinese user habits, has originally invented a full set of user experience design systems to get closer to the user's use habit and psychology, and create simpler and more considerate operation.

- Individualized operation interface experience

MIUI pioneered the functions of "Multiple themes" and "Changeable lock screen" in the world, which brings more gorgeous and glamouring individualized sensory experience of the mobile phone operation interface.

- Better SMS experience

MIUI, starting with the phone, SMS and other functions, provides the best phone and SMS experience for users in the smart phone with nearly 100 in-depth optimization and mirco-innovation on the Android native system. MIUI team developer and users unite together into a user honor development team, empowering the system function options to users. Going ahead, the MIUI system will upgrade and update every Friday on the basis of user comments and suggestions.

- Dual versions co-existence

The MIUI sets up a unique co-existence mode with a test version and a stable version to meet the needs of different users; the former focuses on developing new functions and respective fast upgrade on the extension of original modes; the latter emphasizes stability

with longer update cycle, about one to two months.

(3) Blur system

Blur operating system is an application interface developed by Motorola based on Google Android platform. In addition to the basic Android features, the most prominent feature of Blur is the key on network social functions. Blur has integrated many components of well-known foreign social networks, including Facebook, Twitter, Gmail, MySpace, Yahoo, Picasa and. As long as users bind Email to social network accounts, information from these social networks will be automatically pushed to mobile phones.

2.2 Mobile phone App

Mobile app means software applications that run on mobile devices such as tablet computers and smartphones (Ackerman, 2006). At the same time, mobile apps tend to contrast with computer desktop applications and web applications running on mobile web browsers (not running directly on mobile devices). Data show that people spend time in apps growing by 63 percent on Android phones from 2014 to 2015, and the data indicate that American downloading in app stores are expected to reach 284.3 billion in 2020, increasing to 284.3 billion in 2020 of app downloads from app stores worldwide against 111.2 billion in 2015 (Takahashi, 2016). Mobile app also bears the function for being the main carrier of mobile Internet content. The population of smart mobile phone and spread application of 4G communication network have conduced the mobile app not only to replace the various life-oriented application of PC Internet, but also to be the main tool fully filled with people's life and work. Mobile app covers people's entertainment aspects, such as shopping, booking a ticket and a hotel for tourism, taking photos, listening to music, reading a book, playing games and watching video and, on the other side, mobile app also deals with work affairs, for example, document processing, drawing icons, and painting, as well as mobile attendance management for staff outside. In other words, mobile app at present is full of our daily life.

In the mobile app industry, due to the maturity of the operating system and the rapid advancement of the industry, the existing functions can basically meet the daily needs of users,

but if there are new expectations in the process for users, mobile app designer will in such update the system. To cite an example, if the user has the consciousness of the new function requirement in the using process, the mobile app developer will upgrade the software and add the new function to meet the further requirement of the user. At the same time, in order to operate smoothly and experience well for mobile app, the designer will have an initiate to upgrade the version. For example, when it comes to the operation and interconnectivity, it entails to adjust the underlying database of the software in order to improve the response speed of mobile app; it is necessary to design an interface icon in line with the taste of the users in order to enhance the aesthetic characteristics of the user interface. Arguably, some mobile app developers make attempts to modify the logic of software interaction. Such as, there is a tradition virtually that the return button of a software in the left corner of the interface, while the return button has been changed to the right corner of the interface to collaborate the user's habit after the research of user's usage. Barring of that, the modification of interconnectivity lofic will be simplified in the manner of two steps transformed from the three original steps.

2.3 Emergence of Travel App

The rapid development of China's economy has triggered a higher and better living standard of people and a tendency to travel. Some of them are prediposed to go travel by participating into the travel agency, others love travelling, to be free. With the rapid development of the mobile Internet, the integration of various industries and mobile Internet has been recognized highly by the society, thus emerging a travel app. In this connection, the development of travel app software holds the key to open up new markets for tourism, not only provides tourists with the convenience of travel on the one hand, but also becomes a crucial platform for travel attractions to show themselves and enhance their popularity. Travel app is such a software for mobile marketing of tourist attractions. Nowadays, a unique and intriguing travel way embedded into the development of Travel app receives more applause among people. After experiencing various tour modes such as group tour, self-driving and self-tour, young people are in the quest for a more personalized travel app.

The app has revolutionized the travel industry as visitors use their smartphones to make travel plans, book and track all travel related issues. The data shows that the travel app ranks 7th in the app store's app downloads ranking and 9th in the Google app downloads (2016, July, 12).

Karanasios et al. (2012) proposed two categories of mobile travel programs: destination guide classes and travel tools. At the same time, they also distinguish between downloadable applications and mobile web applications. Kennedy-Eden and Gretzel (2012) put forward to classify travel-related apps from a value chain perspective: map navigation, mobile marketing, social applications, security emergencies, entertainment, transactions, and information. Navigation apps can help visitors find routes, such as the Global Positioning System (GPS). Social apps have the functions of sharing, communication, and cooperation. The social category also contains methods of communication, such as texting. Mobile marketing apps are designed to receive marketing messages, such as text messages for contests, coupons. Security and emergency apps contain emergency locator services, weather warnings, health monitoring. Transactional apps include a transaction of some sorts such as auctions, tickets/reservations, financial/banking, and shopping. Entertainment apps provide entertainment choices like movies, e-readers, games. The information classification involves a vast array of information sources, from a general information search to self-guided tours without global positioning system (GPS), translator/conversion apps, event schedules.

2.4 Main functions of Travel App

Travel app can effectively connect the market and tourism resources through the Internet. Empowered by the Internet, links will automatically generate so as to promote the process of Internet tourism. When people have an intention to go travel, Travel app can work out a tailored and optimized tourism route that spends less time and money and provides considerate services. That means that Travel app will determine the order of cities in which tourists want to travel in light of the flexible factors such as the traffic conditions between cities, instant transportation expenses and generate the final price for tourists to confirm. And

what tourists need to do is to confirm the payment and enjoy a specially prepared trip for themselves.

With the continuous optimization and upgrade of Travel apps in recent years, the main features are as follows:

Travel reminder: various special services. For example, Travel app will give its suggestion to tourists based on their travel destination and real-time weather conditions, including wearings, transportation and reminding of your own items.

Scenic spots: there are a variety of introductions of special and fun attractions and the preferential activities of all scenic spots will be launched in holidays. The user can look through the specific introduction of the scenic spots only by clicking the spots in the Travel app, including the fun items of the attractions, the opening time, the ticket information, the recommended open time and the arrival methods.

Hotel recommendation: all specialized hotels will be provided. For instance, the user can reserve a hotel on the Travel app through a quick order. After the user inputs the selected conditions, like distance, spots genre and travelling time, Travel app will provide the most suitable and rapid choice of attractions automatically according to these conditions. In such, the users can book the ticket of the tour destination, hotel and restaurant without too many procedures through Travel app.

LBS location: the scenic spots will be located through LBS. For example, the scenic spots around the users will be automatically located and listed in a certain order. And users are allowed to enter or select addresses manually.

VIP service: Travel app has a VIP membership service. In addition to membership discount, membership points can also be converted for products.

One-click sharing: users can share tourist attractions information to friends through the app, and present their travel information on social platforms so as to increase the interconnection with friends.

Preferential activity: Travel app has various preferential activities, such as users take part in the online activity, new user can sign up for gifts, other events like exclusive shopping activities and discount again on the basis of the first discount will also be presented.

User comments: After the trip, tourists can write down their own evaluation of the scenic spot or provide travel strategy for other tourists according to their own experience of sightseeing, so that other users can refer to it.

2.5 Prominent Travel App Service Provider

2.5.1 Qunar.com

Qunar Travel app, whose headquarter is in Beijing, is not only China's leading travel search engine, but also the current world's largest Chinese online travel platform. Launched in February 2005, it set up its headquarter in Beijing, and was listed on NASDAQ on November 2, 2013. Qunar.com provides the consumer with the real-time research of air ticket, the hotel, the meeting place and the holiday product, on the other hand, offers the services of group purchase of the tour product and other tourism information services, and the online technology and the mobile technical solution for the tourism industry partners as well. In June 2011, Qunar.com received a strategic investment of $306 million from Baidu. On December 25, 2014, it announced its investment in travel Pepsi, a national tourism chain. Ctrip and Qunar announced a merger in October 2015, and Ctrip will have 45 percent of the voting rights after the merger.

2.5.2 Ctrip

Ctrip is an online ticketing service company, established in October 1999 and listed on NASDAQ in December 2003. Its headquarter is set up in Shanghai, China. Ctrip is the top leading hotel reservation service center in China with more than 600,000 member hotels available for booking at home and abroad. Ctrip has set up branches in 17 cities including Beijing, Tianjin, Guangzhou, Shenzhen, Chengdu, Hangzhou, Xiamen, Qingdao, Shenyang, Nanjing, Wuhan, Nantong and Sanya, with more than 25,000 employees. In December 2003,

Ctrip.com successfully listed on NASDAQ. On August 3, 2017, the "Top 100 Chinese Internet Companies" list was released in 2017, with the rank of ninth.On March 21, 2018, Ctrip released a custom-certification system, releasing the first domestic customized badge. In October 2018, Fortune's top 50 companies were released, and Ctrip ranked fourth.

2.5.3 Tuniu.com

Tuniu is a professional leisure travel booking platform in China. It provides travel and holiday booking services for more than 100 cities nationwide, including group travel, self-help, air ticket purchase, self-driving, tickets, hotels and company's travel reservation. Tuniu, setting up its headquarter in Nanjing, was initiated in October 2006, and listed in NASDAQ on May 9, 2014. Tuniu Travel app promotes enormous travel services, including hotel booking, ticket purchase of scenic spots, group tours and other services, plus high-quality travel and one-stop service. It is featured with leisure vacation travel service, cheap price and simple-operation of app interface.

With the mission of "making tourism simpler", Tuniu Tourism provides consumers with travel product reservation services from 64 cities including Beijing, Tianjin, Shanghai, Guangzhou, Shenzhen and Nanjing, and offers more than 80,000 kinds of tourism products for consumers to choose from, including group, self-assistance, self-driving, cruise, hotel, visa, scenic spot tickets and company travel. It has successfully served more than 4 million people. In December 2014, Tuniu Travel announced an equity subscription agreement with Hony Capital, JD.com, Ctrip's subsidiary Ctrip Investment, and Tuniu CEO and COO. According to the agreement, Tuniu will sell the newly issued shares of USD 148 million to the above investors. On November 24, 2015, Tuniu Travel and HNA Tourism Group jointly announced a strategic alliance. HNA invested 500 million US dollars to Tuniu to carry out in-depth cooperation in many other fields, such as online tourism, aviation, hotel services by harnessing their respective premium and high-quality resources.

2.5.4 Fliggy

“Fliggy”is affiliated with Alibaba, the largest e-commerce company in China. As a comprehensive travel network trading platform, it mainly deals with the following services: provide the selection of air tickets, hotels, travel routes and other products for Taobao members.it was named as “Ali Travel”, now is renamed into “Fliggy Travel”. Fliggy is a comprehensive travel network trading service platform, with the functions such as selected introduction, travel insurance, strong data and resources and multiple preferential. “Fliggy” is a leisure and holiday brand for young consumers. Together with Ali Business Travel for Corporate Travel Service, it forms the travel business unit of Alibaba, giving consumers a more free and imaginative journey. It is characterized by convenient ticket purchasing and considerate service, there is no need more fee to purchase ticket.

2.5.5 Travel Go

Travel Go is China’s leading provider for leisure travel by offering a host of services such as scenic spot ticket, outbound tour, domestic travel, peripheral tour, cruise, air ticket, visa, hotel, train ticket reservation. It was founded in 2004 and listed on the Hong Kong Stock Exchange on November, 26 2018 with its headquarter in Suzhou, China.The high-growth and innovative business model of Travel Go has won the favor of capital market and the strong upholding of the industry, successively winning hundreds of million yuan of investment from Yuanhe Holdings, Tencent Technology, Boyu Capital and Wanda Group; In April 2014, Travel Go obtained more than US$200 million in strategic investment from Ctrip. In addition, Travel Go is a high-tech enterprise in China and the first batch of e-commerce demonstration enterprises in the Ministry of Commerce of China. It has been selected as the "Top 20 China Tourism Group" for three years in a row, ranking 9th in 2014 and 8th in 2015. Travel Go is now one of the three major enterprise groups in China's online tourism industry.

With the overarching goal of “becoming the top one of leisure tourism”, Travel Go picks the scenic spot ticker as the entrance, vigorously arranges the business sectors including peripheral tour, the long-term tour, and cruise tour. The branches Travel Go network and Travel Go Mobile Client served nearly 30 million tourists in 2014, with an average annual

growth rte of 100%, exceeding 100 million population, a year-on-year increase of 200% in 2015. Making more people enjoy the fun of travel and feel the beauty of life is the long-term goal upheld by Travel Go. In December 2015, Wu Zhixiang, CEO of Travel Go, presented the function of “My Travel Consultant” of Travel Go app at the “National Outbound - 2016 Travel Go Strategy Launch” to provide tailored consumer scene solutions for each user. On December 29, 2017, the Travel Network Group's Travel Network and Elong Travel Network announced the formal merger into a new company “Travel Elong”. Travel Go has a full range of travel products, booking tickets for popular shows around the world, and a number of special value-added services. It is characterized by convenient purchase, and sending a message to the consumer if there is any change of the ticket.

2.5.6 Lvmama.com

Lvmama.com is a kind of new B2C tourism e-commerce website, which provides tourists with scenic tickets, free travel, holiday hotels, air tickets, domestic travel, outbound travel and other one-stop travel services. It was established in 2008 and listed in Beijing Stock Exchange Center on December 22, 2015, with a headquarter in Beijing, China. Lvmama is a tourism e-commerce website, scenic hotel designated service providers, often introduce preferential activities, for example, enjoy RMB 100 discount with the full sum over 199, peripheral group tour, purchase one for free one, and obtain membership privileges on every membership day.

In 2015, Lvmama successfully won the online self-help market in China, with a market share of 30.7%. In the 5A and 4A scenic market share, Lvmama ranked first in the industry with 23.8% and 24% market share. In June 2016, Lvmama Travel Network and Fudan University jointly sponsored the “China Tourism Electronic Ticket Research Center”, which was jointly participated by Huangshan Tourism, Oriental Pearl Tower, Guangzhou Tower, Qingcheng Mountain Dujiangyan, Beijing happy Valley and other scenic spots, and announced the first research report. This is the first research-based center in China that is based on travel e-tickets and is jointly participated by enterprises, universities and scenic spots. As the first OTA to launch online ticket bookings, Lvmama has been working with the

scenic spots to create festivals for a long time. The kite festival and the color festival have attracted tens of thousands of visitors. Lvmama has embarked on various festival marketing activities, such as Wuhan happy Valley Fluorescent Run, Xiangshan Seaside Carnival Seafood Festival, Wanshan Self-driving Tour Huangshan, Tent Camping Festival. Lvmama's major business is to provide consumers with differentiated products through in-depth interaction with scenic spots, product innovation, joint festivals, industry-university integration, and to divert and enhance the brand influence of the scenic spots.

2.5.7 Elong Travel

Elong is one of the leading online travel service providers in China. It provides customers with hotel, air ticket and holiday booking services. It was founded in Delaware in May 1999 and listed on NASDAQ in October 2004. As a professional hotel subscription app with more than 750,000 hotels to choose from, Elong Travel app services include train tickets, ticket booking, and special ticket reservation and ticket package preferential.It can be operated with map search, 360-degree panorama of hotel, guidance of domestic and international hot spot destination, and user’s real comment online services, so that users can make travel decisions on the basis of obtaining a wide range of information.

Elong Travel provides customers with reservations for hotels, airline tickets and group purchases through the website, 24-hour reservation hotline and mobile e-commerce, eLong iPhone and Andriod wireless client platforms. Elong Travel Network consists of powerful map search, 360-degree panoramic display of hotels, domestic and international hot destination guides and user real-time reviews. It enables users to make travel decisions based on extensive information and start a relaxing journey.

2.5.8 Mafengwo Travel

Mafengwo is not only a leading free travel service platform in China, but also a innovative free travel service platform for making tourism exchanges and big data of travel. It was founded in 2006 and started its business officially in 2010, whose headquarter is in Beijing, China. You can enjoy different themes of free travel such as preferential island

tourism, honeymoon vacations and parent-child travel as well as super preferential travel package. It is an inevitable app of travel strategy that can be found enormous information on it. And it is a free trade and service platform based on personalized travel strategy information, gaining wide applause for the younger generation in China.

Mafengwo's attractions, restaurants, hotels and other information, collecting from the real sharing of hundreds of millions of users, help hundreds of millions of travelers each year to develop a free travel program. Mafengwo is a travel website widely aspired by the younger generation in China and is flattered as the travel Bible of China. At the beginning of 2015, after the company released its free-travel strategy, it gradually explored a business model that is completely different from the traditional OTA (Online Travel Agency) a free-form trading and service platform based on individualized travel strategy information. With the core of “free travel”, Mafengwo provides travel guides, travel questions and answers, travel reviews and more for more than 60,000 destinations around the world, as well as free travel products and services such as hotels, transportation and local tours.

2.5.9 Umetrip

Umetrip is a trip app launched by China Civil Aviation Information Network Co., Ltd. (CAAC) in 2012, which provides passengers with complete information services from travel preparation to arrival destination only through the mobile phone. It is possible for users to query the flight dynamics and the delay information in real time through this app. If the flight is delayed, Umetrip will pay for you. In addition to have a quick search for the domestic flight information push and flight dynamics, the users have an option to check in and select seat. Umetrip also launched the "virtual cabin" function, which is a new feature that is being tested on some routes. It does not display the individual identity information. The avatar, nickname, label. are all editable information, the label is added by the user, and the heat map is blurred.

2.5.10 Airbnb

“Airbnb” is the acronym for AirBed and Breakfast ("Air-b-n-b"). Airbnb is a service website for travelers and homeowners who rent their free rooms. It provides users with a

variety of accommodation information. It was founded in August 2008 and is headquartered in San Francisco, California. Airbnb is a subversive traditional rental app. It means that the user can rent from the individuals or anywhere around the world covering 4 million-odd houses in more than 191 countries and regions. It gives a chance to know more like-minded fellows. It is diversified international platform. Whether it's an apartment, a villa, a castle or a treehouse, Airbnb is called “EBay in housing”. However, some rental house is largely different from the pictures.

In February 2015, Airbnb's valuation reached $20 billion, and Airbnb planned to raise $1 billion from some investors including Fidelity, TPG, T. Rowe Price, Dragoneer, Founders Fund, Sequoia Capital and Russian DST. In November 2016, foreign media reported that Airbnb told Chinese users that the company would store their personal data locally. In January 2017, Airbnb made its first profit with the turnover increasing by more than 80%. In December 2018, the World Brand Lab released the “Top 20 of the 2018 World Brands” list, and Airbnb ranked 425.

2.6 Travel-related App’s business models

2.6.1 In-App advertising

In the in-app advertising business model, users can download apps for free. When accumulating a sizeable users base and collecting information on the apps, developers can obtain revenue via advertising (Munir, 2014). Facebook is a good example of an app that does this well. Facebook utilizes a vast amount of their data to sell highly targeted advertisements, but users of Facebook do not directly pay Facebook anything to download. Jinritoutiao app is a case in point. They will push users news in terms of their tastes based on the access information they leave behind, and then embed advertisements in their news content. When the user is looking at the news they are interested in, they will not ignore the embedded ads. The same is also for the game software. It is free for games, but the ads will be interconnected in the game interface. For example, a large number of chess mobile games will be bonded with ads almost for every company, and the users can download these games for

entertainment free of charge. When the user opens the app, the ads will show up in the non-main screen, and the embedded ad will pop-up in every pass of games, even there will have mandatory settings that only after watching the ads can users enter the next game.

2.6.2 Freemium

Freemium, a combination of “free” and “premium”, has become the primary business model among smartphone app developers and internet start-ups. Users get fundamental features at no cost and can access to richer functionality for a subscription fee (Kumar, 2014). Among others, the freemium model is widely applied in travel-related apps such as Tom Tom Go Mobile. TomTom Go Mobile is designed for the iPhone and can be downloaded on the app Store for free. This app is free in the first 50 miles of navigation and traffic information service every month, but after that, users will need to pay for the continued use of the app (Driks, 2016).

Free anti-virus software industry is also a good case. Antivirus software originally applies for the business model of software charge. As to enterprises or group customers, it is inevitable to purchase the antivirus software in order to protect the network and computer security. While for a large number of Chinese individual users, spending money on an antivirus app seems to be an extra expense. At this point, Qihoo Company, a Chinese software manufacturer, has innovatively proposed a “free software” business model, which taps “free” as an entrance to attract user traffic, and then charges through value-added services. Soon later, Qihoo’s 360 free antivirus software received good fame from users, and the number of installations surged quickly and steadily. In this connection, Qihoo Company once became one of the giants of China’s Internet traffic import. Later there happened to the famous “3Q War” (360 and QQ) in the history of Chinese Internet. Qihoo, a “free” business model, contributed Qihoo to defeat many domestic and foreign antivirus software companies and changed the business model of antivirus software industry. Later, QQ security steward, Jinshanduba and other software also adopted this model, which advances the innovation of the business model of the software industry.

2.6.3 Charge apps

Charge apps imply that apps are not free to be downloaded. If the consumers want to use the app, they must first purchase it (Munir, 2014). The key to the success of this model is that users can be aware that the app is different from the value of a free app. In other words, high-yield paid apps tend to be unique in marketing their unique features. For example, Calendars 5 is a paid app that costs $4.99 in the apple app store. When users view the iTunes list of Calendars 5, the app will immediately appear as a “smart calendar”, providing personalized human language, task reminders, and a simple and colorful page layout. Within a few seconds, the app can make a compelling case that it is better than apple's default calendar, thus, it deserves the monetary investment. In addition, Samsung’s charging theme interface of mobile phone is involved. The users t has to pay for a more cool, flashy and interesting phone interface. There are many other charge models, such as charge for music, e-book, document editing model and Q&A.

2.6.4 In-app purchases

A profitable strategy for an in-app purchase model involves selling real or virtual goods within an app and then earning revenue. In-app purchases involve a wide variety of consumer products, such as accessories and clothing. At the same time, in-app purchases can also be virtual goods, such as extra hit points or coins. A lot of game software developers will set up the mode of purchasing game equipment in the game, users will have to pay for it if they want to get good equipment when they play games. They as usual buy the game currency first, then exchange the game currency for the corresponding game equipment. MeetMe is a creative example of incorporating in-app purchases into social apps. That being said, users can purchase credit to increase awareness and gain new ways to interact with other consumers.

Another incarnational case illustrates firmly. Tencent, as one of China’s largest integrated Internet service providers and one of the country’s largest Internet companies with service users, has set up the biggest Internet communications and social platforms: WeChat and QQ. The prominent features of Tencent’s business model is the purchasing mode embedded in the WeChat and QQ software. That is to say, empowered by strong user entrance and sticky

advantage, Tencent has embedded micro-business shopping and virtual goods trade in the mobile app.

2.6.5 Subscriptions

The subscription model first allows users to browse a certain amount of content for free, then induces users to register for payment, and pays to subscribe to more content or features (Munir, 2014). Umano is an app that applies this business model. Umano only allows users to listen to a limited number of stories unless they register for paid subscriptions.

The similar case is video app. Users have limited access to free films or TV dramas, which are already on view for a long time either, or not popular. If they want to see the latest film or classic blockbuster, they have to pay for it. The watching model the company used is to let the user to watch the film for free for a few minutes before deciding whether to pay for them. And there are usually two ways to pay for watching, one for a single movie and one for a monthly, quarterly or annual subscription. Users usually choose to subscribe for a preferential cost. Many film apps such as Kumao, iqiyi, Taijie, Tencent, Huashu and adopt this subscription model.

2.6.6 Sponsorships

Sponsorships entail companion with advertisers, who provide users with awards for accomplishing certain in-app actions (Munir, 2014). In this model, brands and agencies pay to be portions of an incentive system. The apps earn money by taking a share of revenue from redeemed rewards. An early adopter of this app business model is RunKeeper. RunKeeper employs incentivized advertising to stimulate its users to track their running activity with the app to unlock exclusive awards and promotions.

When it comes to variety show app, it also takes use of the sponsor model. They will invite popular stars to attend an interesting show so as to get a large audience to watch or participate in the program’s interaction. In such, the variety shows can create tremendous commercial value, and producers will seek sponsors to make money at this time.

2.6.7 Blended Models

Blended model is a new business model based on the increasing complexity of mobile app functions. Payment models, in-app purchase models, freemium models, and subscription models (excluding sponsorship). Among others, advertising is the most popular app profit strategy, and subscriptions are the most profitable (Munir, 2014). Therefore, as the app functionality becomes more sophisticated, the business of apps tends to blended models. For example, developers can start with the "In-app advertising" model and then offer users a paid upgrade to the advertisement-free version, which is a "freemium" way.

For instance, payment-based mobile app is like Alipay. It is China's largest mobile payment company, featuring with the largest settlement transaction payment volume, and it is also the largest user entrance for daily service. Alipay integrates mobile app, owned by Alibaba and invested by Alibaba, into Alipay's app. Through Alipay's powerful traffic entrance, one advantage of which is to bring about the convenience to of the united entrance of Alibaba's mobile app for users, the other is to create enormous user's entrance for the integrated mobile app. The integrated mobile app has a variety of business models, which make Alipay not only a mobile app with payment function, but also a comprehensive living service app based on mobile payment.

2.7 Information technology adoption behavior based on individual level

2.7.1 Theory of Reasoned Action (TRA)

Theory of Reasoned Action (TRA) regards a consumer's behavior as determined by the consumer's behavioral intention, where behavioral intention is a capability of 'attitude towards the behavior' and 'subjective norm' (Fishbein & Ajzen, 1975; Chang, 1998). An individual's attitude towards a behavior has personal characteristics and captures people's positive or negative evaluation of performing the behavior (Fishbein & Ajzen, 1975). Subjective norms are often described as measuring directly by asking respondents to indicate whether "important others" would approve or disapprove of a particular behavior (Ajzen,

1991).

In the context of tourism, there are numerous studies which have applied Theory of Reasoned Action (TRA) to explain consumer acceptance of a new technology. For example, Kim, Kim, and Goh (2011) provide an integrated way to understand the effect of food tourists' behavior based on perceived value and satisfaction. Lepp (2007) investigates residents' attitudes towards tourism in Bigodi using Theory of Reasoned Action (TRA), and the result shows that residents have consistently positive attitudes towards tourism. Paul, Modi, and Patel (2016) aim to validate the Theory of Planned Behavior (TPB) and the Theory of Reasoned Action (TRA) to predict Indian consumers' purchase intention to green product.

2.7.2 Technology Acceptance Model (TAM)

Technology acceptance model (TAM), proposed by Davis and Bagozzi, is regarded as the most influential and widely applied theory to explain individuals' acceptance and use of information systems (Lee, Kozar, & Larsen, 2003). This model hypothesizes that system use is directly determined by behavioral intention to use, which is affected by users' attitudes towards using the system and the perceived usefulness of the system in turn (Nunkoo, Juwaheer, & Rambhunjun, 2013). In addition, perceived ease of use is also influencing perceived usefulness and attitude. In the model, perceived usefulness is described as the degree to which individuals believe that using the system will improve people's job performance (Davis, 1989). Perceived ease of use is defined as the degree to which a person believes that using the system will be free of effort (Davis, 1989). "Attitude towards using" has been described as that "the degree of evaluative affect that an individual associate with using the target system in his or her job" (Davis, 1993). A person's attitude refers to ''represents a summary evaluation of a psychological object captured in such attribute dimensions as good–bad, harmful–beneficial, pleasant–unpleasant, and likable–dislikable'' (Davis, 1993).

There are numerous studies which have applied TAM to explain consumer acceptance of new technology. For example, Amaro and Duarte (2015) propose and empirically test an integrated model to explore which factors affect intentions to purchase travel online. The

empirical results indicate that consumers' intention to purchase travel online are mostly determined by attitude, perceived risk and compatibility. Lee (2009) explores and integrates various advantages of online banking to form a positive factor named perceived benefit, and as well as integrates with the TAM to propose a theoretical model to illustrate customers' intention to use online banking. Phatthana (2011) examines three factors (perceived ease of use, perceived usefulness and image) that predict electronic purchase intention of health tourism based on the TAM theory.

2.7.3 Technology Acceptance Model 2 (TAM2)

In the process of extensive discussion and application of the technology acceptance model, the flaws of the model have been pointed out by scholars. Venkatesh and Davis (2000) proposes a theoretical extension of the technology acceptance model (TMA2) by using collected longitudinal data regarding to four different systems at four organizations.

TAM2 comprises additional theoretical and constructs spanning cognitive instrumental processes and social influence processes (Venkatesh & Davis, 2000). The cognitive instrumental processes contain job relevance, output quality, result demonstrability, and perceived ease of use (Venkatesh & Davis, 2000). Output quality refers to the matching degree of the system performs tasks over and above considerations of what tasks a system is capable of performing and the degree to which those tasks match their job objectives. Result demonstrability, defined by Moore and Benbasat (1991) refers to "tangibility of the results of using the innovation", directly affecting perceived usefulness. Meanwhile, TAM2 retains perceived ease of use and variable of perceived usefulness in TAM. Furthermore, the social influence process includes subjective norm, spontaneity, and image. Subjective norm, consistent with TRA, is defined as a "person's perception that most people who are important to him think he approves or deny their bahavior" (Fishbein & Ajzen, 1975). The spontaneity as a regulatory variable reflects the extent to which potential adopters believe that accepting the technical system decision is non-mandatory (Moore & Benbasat, 1991; Hartwick & Barki, 1994; Agarwal & Prasad, 1998). Moore and Benbasat (1991) argue that image refers to the extent to which an innovative technology can be used to enhance a person's social status.

This model has been also widely applied in the field of acceptance and use of information technology. For example, Nunkoo et al. (2013) seek to establish the relationships among travelers' attitude, perceived usefulness, trust, perceived ease of use, perceived risk and travel related products as well as online purchase intention of tourism by using an extended technology acceptance model. Bhatti (2015) presents an extended technology acceptance model that integrates innovation diffusion theory to investigate what determines user mobile commerce acceptance. Cheung and Vogel (2013) enhance the technology acceptance model to illustrate the factors that affect the acceptance of google applications for collaborative learning. In addition, the subjective norm represented by peers is considered to significantly moderate the relationship between tachnology adoption and attitudes.

2.7.4 The Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) is an extension of the Theory of Reasoned Action (Fishbein & Ajzen, 1975). When dealing with behaviors over which people have incomplete volitional control, the original model has certain limitations on the study of technology adoption willingness. The difference between planned behavior theory and rational behavior theory is that it increases the "behavioral control cognition" variable. Attitude, subjective norms, and behavioral control cognition affect behavioral intentions and in turn affect individual behavior. Attitude refers to an individual's consistent positive or negative feelings about certain behaviors; subjective norms refer to the degree to which individual decision-making behaviors are influenced by groups' common beliefs, attitudes, and choices; behavioral control cognition is a measure of people's behavioral perception control on difficulty.

Substantial empirical researches have utilized the TPB to explain the consumer acceptance behavior in many fields. Quintal (2010) studies the differential impacts risk and uncertainty on travel decision-making and the constructs' influencing on the antecedents of intentions to visit Australia by using the Theory of Planned Behavior. Jalilvand and Samiei (2012) investigate the impact of electronic word of mouth on a tourism destination choice.

2.7.5 The Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) represents a more comprehensive theoretical framework than the TAM and TPB models. The UTAUT identifies four key drivers of the adoption of information systems: effort expectancy, performance expectancy, social influence and facilitating conditions. Venkatesh et al. (2003) define performance expectancy as the extent to which an individual through using the system will help him or her enhance the performance of a task or work. Therefore, this variable is close to concepts such as perceived use (TAM & TPB). In turn, the effort expectancy is conceived as the degree of ease correlative with the use of the system (Venkatesh et al., 2003). The social influence refers to the degree to which an individual perceives that he or she should employ the system (Venkatesh et al., 2003). It embodies a normative character in line with variables such as the subjective norm. Finally, the facilitating conditions factor is defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system (Venkatesh et al., 2003). Therefore, this variable captures the concepts of perceived behavioral control (TPB).

In the context of the consumer acceptance behavior, the UTAUT has been widely used in this field. For example, San Martín and Herrero (2012) explore the process of adoption of new information technologies by the users of rural tourism services. Maillet, Mathieu, and Sicotte, (2015) reveal the relationship between the acceptance and actual use of an electronic patient record and nurses' satisfaction. Parameswaran, Kishore, and Li (2015) assess within-study invariance of key UTAUT scales considering a total of six respondent group characteristics: five variables pertaining to users' two technology engagement facets and one variable pertaining to their gender. The results indicate that the UTAUT instrument shows full or partial invariance for respondents' technology usage pattern and gender.

2.8 Organizational information technology adoption behavior

2.8.1 Innovation Diffusion Theory (IDT)

According to the viewpoint of Rogers, innovation is “a novel idea, practice, or object that is perceived represented by an individual or another unit of adoption” (Rogers, 1995). Meanwhile, diffusion is “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995). Innovation Diffusion Theory (IDT) is about persuading people accepting new ideas, new things and new products through the media (Rogers, 1995). The theory has been proposed by Rogers in 1960s. Perceived characteristics of innovation (PCI) are portions of IDT, including relative advantage, compatibility, complexity, trialability and observability (Rogers, 1995). Relative advantage stands for the benefits the company (Rogers, 1995). Compatibility is the degree of fitness of a certain technology to the company’s existing procedures and processes through its experience (Rogers, 1995). Complexity refers to perceived hardness of learning to use and understand a new system or technology (Rogers, 1995). Trialability means the ease of experimenting with an innovation (Sonnenwald, Maglaughlin, & Whitton, 2001). Observability represents the degree to which the results of the innovation easily be seen and understood (Sonnenwald et al., 2001). These factors will affect consumer’s intention to adopt new technologies. Among these factors, relative advantage and compatibility have provided the most constant explanation for consumer intention to adapt new technologies (Lu, Cao, Wang, & Yang, 2011). Agag and El-Masry (2015) suggest relative advantage and compatibility positively impact involvement. Kang, Mun, and Johnson (2015) test relative advantage, compatibility and complexity. Therefore, our study focuses on examining the influence of perceived relative advantages, compatibility and on consumer adoption intentions towards travel apps.

As a result, PCI indicates that “potential users adopt or reject an innovative technology based on beliefs in innovation” (Agarwal, 2000). Consumers’ adoption intention towards an innovative technology always means the change of consumer behavior. For instance, the emergency of online travel agencies has changed the way to buy air tickets.

Substantial empirical researches have utilized PCI to explain the consumer acceptance behavior in many fields, such as the electronic commerce tourism. Amaro and Duarte (2015) explore the factors which have an influence on consumer intentions to purchase travel products online. Agag and El-Masry (2016) investigate the consumer intention to participate in online travel community and purchase travel online. Jensen (2009) investigates travelers' intentions to purchase travel products online. Lee et al. (2011) add the IDT to the technology acceptance model in 2011. Kang et al. (2015) investigate the downloading and usage intention towards mobile location-based retail apps. Therefore, the PCI has been applied to investigate the antecedents of consumer adoption intention in the context of travel apps.

2.8.2 The Technical Organization Environment (TOE)

The Technical Organization Environment (TOE) framework was proposed by Tornatzky, Fleischer, and Chakrabarti (1990) to describe the impact of the corporate environment on the adoption and implementation of innovative technologies. The framework is an organizational-level theory that describes the three factors that influence the adoption of technology and technological innovation in the corporate environment, namely the technical background, organizational environment and environmental context.

The technological context includes all the technologies relevant to the firm. A firm's existing technologies are crucial to the adoption process of innovative technology because they set a broad limit on the scope and pace of technological change that a firm can undertake (Collins, Hage, & Hull, 1988). The organizational context refers to the features and resources of the firm, including linking structures between employees, firm size, intra-firm communication processes, and the amount of idle resources (Galbraith, 1973; Tushman & Nadler, 1986). The environmental context contains the structure of industry, regulatory environment and the existence of technology service providers (Mansfield, 1968; Mansfield, 1977).

This framework also has been widely applied in the adoption and use of information technology. For example, Ramanathan, Chen, and Ramanathan (2016) explores the reason that hotels adopt mobile reservation systems. Based on a TOE framework, nine factors are

hypothesized to illustrate hotels' adoption of mobile hotel reservation systems. Song, Kim, Tang, and Bosselman (2015) develop and test a conceptual model by strategically combining TOE framework and an expectation confirmation model (ECM). Yang, Zhang, and Wang (2015) propose a tripod model of SaaS Readiness. The result suggests that organizational users need to get prepared from technological, organizational and environmental aspects for the adoption of SaaS.

2.9 Involvement Theory

Involvement is defined as ‘‘a person’s perceived relevance of the object based on inherent needs, values and interests’’ (Zaichkowsky, 1985). Meanwhile, involvement is recognized as the perceived importance of the stimulus (Zaichkowsky, 1985). The involvement construct has been investigated in numerous consumer behavior and marketing literature. Involvement can be divided into two categories including cognitive involvement and affective involvement, which have been implemented in the opinion of Zaichkowsky (1994). Associated with travel apps, affective involvement with travel apps is an individual’s perceived emotional feelings or the relevance and it is made up of value-expressive or hedonic motives. For instance, if a consumer is affectively involved with travel apps, he/she may feel that it is exciting, appealing, and interesting to use these travel apps.

Kang et al. (2015) demonstrate that affective involvement with a mobile location service (LBS) retail apps affects the downloading and usage intention towards mobile LBS relation apps. Jiang, Chan, Tan, and Chua (2010) find that involvement on the website is an antecedent of favorable attitude and purchase intention using the website. Huang, Chou, and Lin (2010) provide insights into the structural relationship among travel bloggers’ involvement level, travel bloggers’ intention to purchase travel products and the advertising effect from blog messages.

2.10 Software Quality Model

Software products are showing a rapid development trend and are widely used in people's lives. Therefore, it is critical to effectively measure and evaluate software quality. Software quality refers to the extent to which a system or component meets a user's specific needs or expectations (Miguel, Mauricio, & Rodríguez, 2014). This article reviews some software quality models such as ISO/IES 9126, ISO/IEC 25010, and IT Software Quality Alliance.

2.10.1 ISO/IEC 9126

The International Organization for Standardization (ISO) was established in 1946 to promote international coordination by providing a set of standards recognized by all parties (Chua & Dyson, 2004). The ISO/IEC 9126 model has undergone a 10-year revision to provide a complete software quality assessment framework It has displayed six product feature variables: efficiency, maintainability, portability, functionality, reliability, and ease of use.

These six features are further subdivided into multiple sub-features. For example, the efficiency characteristic is subdivided into two subsystems: reaction time and resource utilization. The characteristics of response time mainly evaluates how fast the response speed of the system is, and the features of resource utilization are to test whether the system can use resource effectively. Maintainability is subdivided into analyzability, variability, stability and testability. Analyzabilityis used to evaluate whether the fault is easy to diagnose, variability is utilized to evaluate whether the software can be easily modified, stability means to evaluate whether the software can continue to run if the changes are made, and testability is taken use of to evaluate whether software can be easily tested. Portability is subdivided into subsystems such as adaptability, ease of installation, consistency and substitution. The adaptive subfeature is to evaluate whether the software can be moved to other environments, and the easy-to-fit subfeature is harnessed to evaluate whether the software is easy to install. The consistency subfeature is made use of to evaluate whether the software meets the portable criteria, and the replacement subfeature is used to evaluate whether the software can be easily replaced with

other software. Functional features are subdivided into applicability, accuracy, interoperability, security. The applicability subfeature is used to evaluate whether the software can perform the required tasks, the accuracy subfeature is used to evaluate whether the software results meet expectations, and the interoperability subfeature is used to evaluate whether the software can interact with another software. The security subfeature is used to evaluate whether the software prevents unauthorized access. Reliability features are subdivided into subsystems such as maturity, error tolerance, recoverability. Maturity subcharacteristics are used to assess whether most faults in software are eliminated over time, Error tolerance subfeature is used to evaluate whether the software can handle errors, and recoverability is used to evaluate whether the software can resume normal work and recover data after failure. Usability features are subdivided into subsystems such as comprehensibility, learnability, maneuverability and attractiveness. Comprehensibility aims to assess whether the software can be easily understood and used by the user, the purpose of learnability is to assess whether the software can be easily learned and used by the user, maneuverability is to evaluate whether the software can be easily operated by users, as to attractiveness, the function of it is to evaluate whether the software interface is attractive to users.

Meanwhile, functionality is described as the ability of the software to supply functions which meet the stated and implied needs of users under the specified circumstances of usage (Fahmy, Haslinda, Roslina, & Fariha, 2012). Reliability is the ability of a software product to maintain a specified level of performance under certain circumstances (Fahmy et al., 2012). Usability refers to the ability of a software product to be easily understood, used, manipulated and attractive to the user when used under specified conditions (Fahmy et al., 2012). Efficiency is the ability of the software product to provide proper performance, relative to the amount of resources used under stated conditions (Fahmy et al., 2012). Maintainability is the ability of the software product to be predicted and modified (Fahmy et al., 2012). Portability refers to the ability of the software product to be transferred from one circumstance to another (Fahmy et al., 2012).

ISO/IEC 9126 has been widely applied in both online and offline environments. For example, Kanellopoulos et al. (2010) propose a methodology for source code quality and

static behavior evaluation of a software system, based on the ISO/IEC 9126 standard. Carvallo and Franch (2006) propose an extension of the ISO/IEC 91261 catalogue with non-technical factors. Quirchmayr, Funilkul, and Chutimaskul (2007) address the quality model of e-Government services by employing the ISO/IEC 9126 standard.

2.10.2 ISO/IEC 25010

ISO 25010 sets up a quality model for software products and software-intensive systems that guides the formulation of quality requirements and metrics to measure their satisfaction (Paredis et al., 2013). This standard is a revision of ISO/IEC 9126 (Alves, Silva, & Dias, 2014). Meanwhile, this standard describes eight main characteristics (functionality, suitability, reliability, usability, performance efficiency, maintainability, portability, compatibility and security), and the eight main characteristics also are divided into several sub-characteristics. The model is graphically presented in Figure 2-1 (Alves et al., 2014).

Compared to ISO/IEC 9126, ISO/IEC 25010 defines eight product characteristics, adding two characteristic variables of consistency and safety. Compatibility Consistency refers to the ability to perform the required functions in other products or systems while sharing the same software and hardware environment. Security refers to the extent to which a product or system protects information and data to provide access for operations of the appropriate type and authorization level. Security is divided into integrity, confidentiality, non-repudiation, responsibility and authenticity (Alves et al., 2014).

At the same time, ISO/IEC 25010 also adds in-use software quality to describe the specific product's ability to achieve specific goals in a given environment for effectiveness, efficiency, satisfaction, risk and context coverage, including five features, including efficiency. , validity, satisfaction, context coverage, degree of freedom risk, and further subdivided into sub-features that can be measured (Olsina, Lew, Dieser, & Rivera, 2012). During the use of the product the user has a perspective of the quality of the software. According to ISO 9126-1, this model is called quality model for Qquality in Use. Quality in Use defines software quality from the user's point of view (Barreto & Alturas, 2018). Similarly, ISO/IEC 25010 has been widely applied in online and offline environments. Sivaji

et al. (2014) use ISO/IEC 25010 as a guideline to measure the availability and user experience of local work portals for user experience issues in the registration process. Acharya and Sinha (2013) followed ISO/IEC 25010 to propose a set of indicators for measuring the characteristics of mobile learning systems.

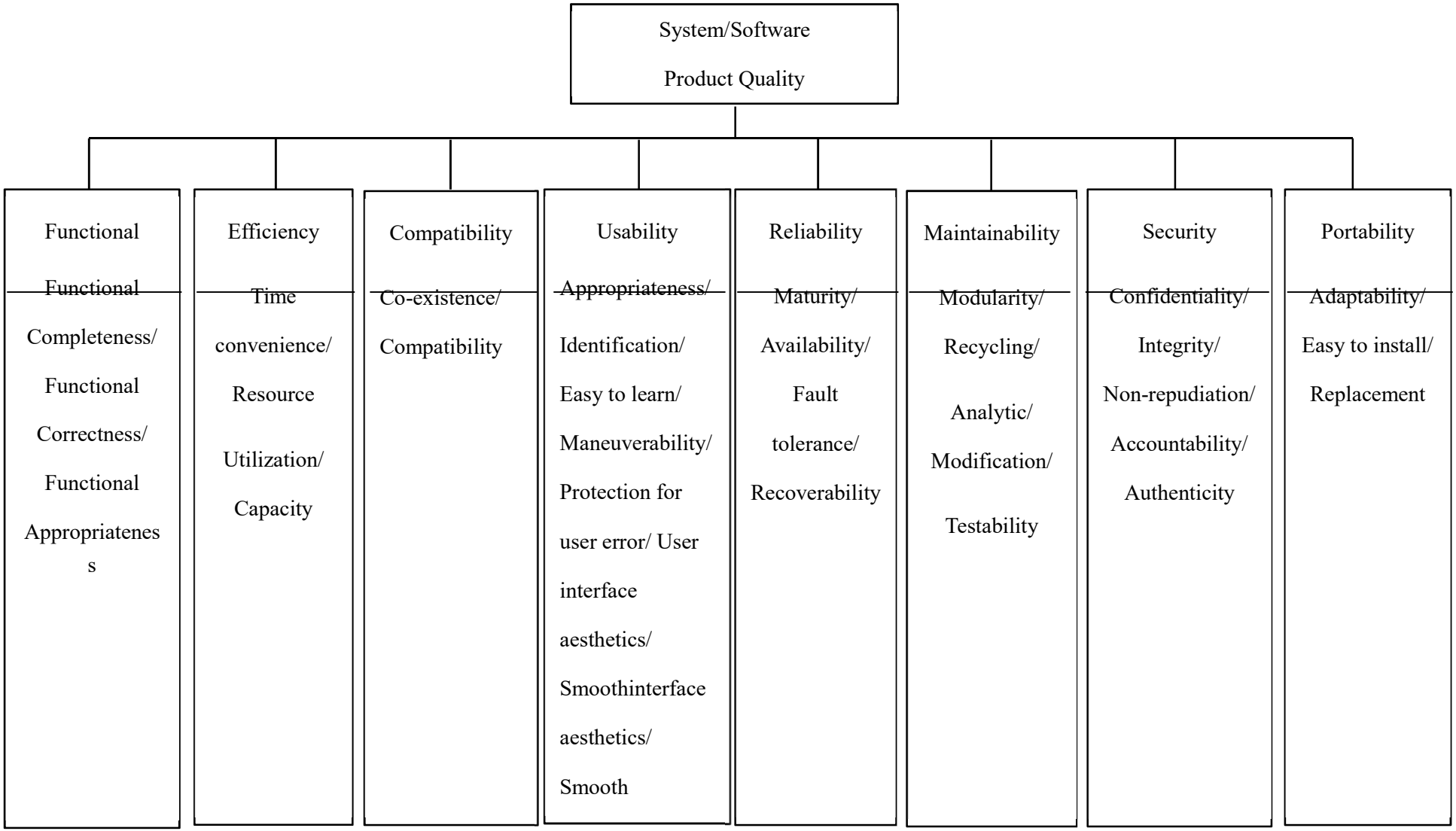

Figure 2-1 Eight product characteristics of the ISO/IEC 25010

2.10.3 CISQ

The Consortium for IT Software Quality (CISQ) was co-founded by the Carnegie Mellon University Software Engineering Institute (SEI) and the Object Management Group (OMG) to become a neutral forum. Among them, customers and suppliers of IT applications can develop industry-wide schedules to measure and improve the quality of IT software. CISQ represents a consortium of end-user and supplier organizations working together under the Object Management Group (OMG) process to generate standards for measuring and reporting software quality (Soley & Curtis, 2010). In addition, CISQ is a leading organization in the IT industry, including 2,000 IT executives, system integrators, outsourced service providers and software technology providers worldwide, working to improve the quality of IT applications. CISQ has organized three executive forums in the fall of 2009: Fall 2009, Frankfurt, Germany; Fall 2009, Arlington, USA; June 2009, Bangalore, India. Participants highlighted four initial goals for the IT Software Quality Alliance, Namely: maintainability, reliability, performance efficiency and security. Maintainability is the factor that affects maintenance cost, energy and duration; reliability is the element that affects operation availability and recoverability; performance efficiency is the factor that has an influence to user's response ability; security is a measure of vulnerability and takes advantage of existing work in the security community.

Quality characteristics of CISQ: Reliability, performance efficiency, safety and maintainability are consistent with the ISO/IEC 25010 definition. Schuerz and Koerner (2015) provide a tool for automated measurement of the maintainability-related measures of the IT-CISQ standard, and then evaluate five Java open source projects through the IT-CISQ quality model. Braeuer, Ploesch, and Saft (2015) followed a comprehensive measurement and evaluation process for validating IT-CISQ.

Another topic that can also be analyzed (although we will not do it in this study) is the quality of the data. ISO 25012: 2008 can be used to establish requirements for data quality, to define metrics, or to plan and perform data quality performance assessments (Tavares & Alturas, 2018).

2.11 Summary

This chapter mainly introduces the tourism-related app and its business model in detail and makes theoretical reviews of the personal information technology acceptance model

(TRA, TAM, TAM2, TPB, and UTAUT), organization-based information technology acceptance model (IDT, TOE), software quality model (ISO / IEC 9126, ISO / IEC 25010, CISQ) and the theory of involvement. At the same time, this chapter also reviews mobile applications and travel-related applications. These theories and models will be used in the study of consumer travel app adoption behavior formation mechanisms.

Starting from the concept of mobile app, this chapter introduces tourism-related app, and sorts out the current mainstream business model of tourism-related app, which has reference significance for subsequent research.

In the next, this chapter combine the research on information technology adoption behavior at the organizational level and the individual level. At the individual level, two theoretical systems are combined. One is the rational behavior theory and the planned behavior theory based on it. The second is the technology acceptance model and the extended model of the technology acceptance model. On this basis, the integrated technology receiving model is combed. It is found that the integrated technology acceptance model is widely used in the field of consumer acceptance behavior. In terms of the organizational level, it mainly reviews the theory of innovation diffusion and the theory of technical organization context, and summarizes the influence of perceived comparative advantage, consistency and complexity on the intention to adopt tourism app and points out that organizational users need to adopt SaaS from the technical, organizational and environmental levels. Existing research on individual and organizational adoption behavior provides a theoretical basis for subsequent research in this thesis. At the same time, this thesis sorts out the theory of involvement, and explains the relationship between cognitive involvement and emotional involvement and app in the theory.

Finally, the thesis lists the software quality evaluation standards of the International Organization for Standardization (ISO) and the IT Software Quality Alliance (CISQ), which will serve as an aid to the research on the formation mechanism of consumer travel app adoption behavior.

Chapter 3: Research Methodology and Hypothesis

3.1 Research model

The author presents our research model in Figure 3-1 in terms of the overarching research goal, and the proposed relationships among the constructs in the model will be elucidated in the hypotheses section.

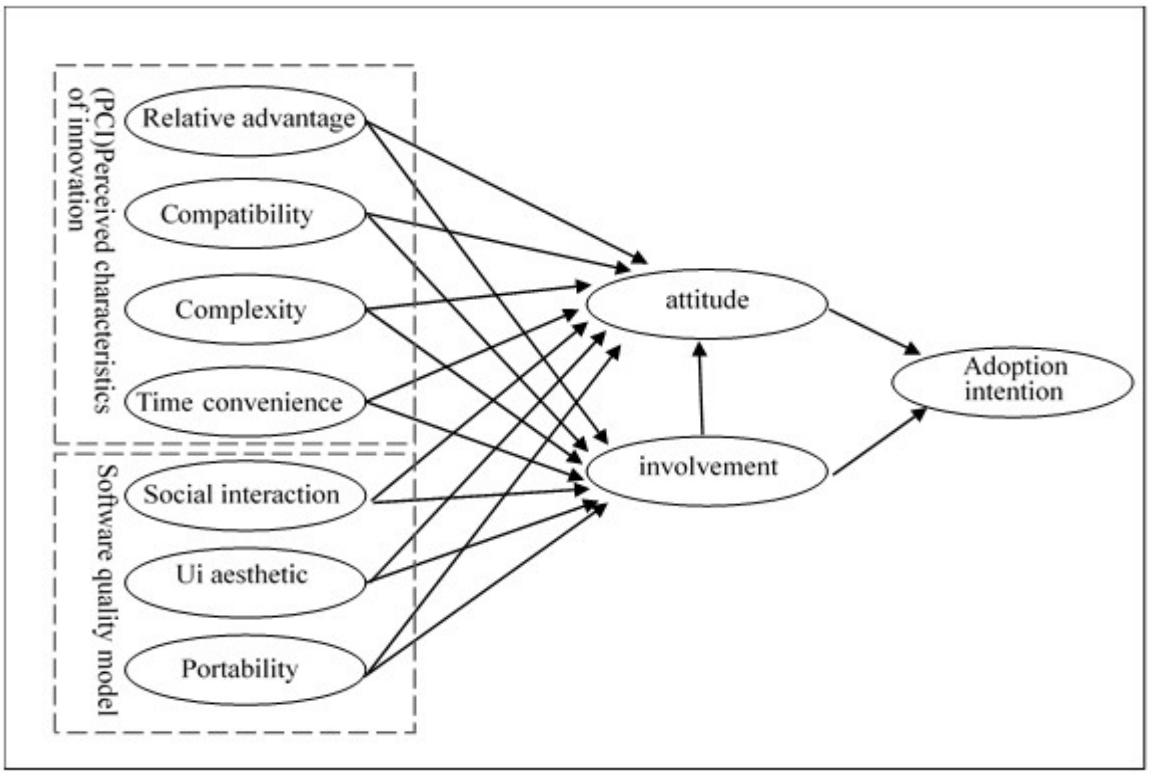

Figure 3-1 The framework of this research

3.2 Relationships among the constructs

The main purpose of this study was to investigate consumer perceptions of travel applications. The target population for the study included consumers who are interested in

tourism, and members of the online travel community who use the Internet or travel applications to search for travel information. This study used questionnaires to collect data and conducted empirical research.

The research model is based on the Technology Acceptance Model (TAM), the Innovation Diffusion Theory, and the Software Quality Model. The questionnaire survey is divided into two parts, one is the basic information part, and the second is the construct measurement part.

The basic information section is to understand the characteristics of the target group. The basic information section includes gender, age, education, occupation, travel frequency, travel budget, frequency of using the travel app, purchase experience in the travel app, frequency of searching for information using the travel app, and type of mobile operating system. The research model has ten constructs, namely, comparative advantage, consistency, complexity, time convenience, social interaction, UI aesthetics, portability, attitude, involvement and willingness to adopt. Due to the comparative advantages, consistency, complexity, time convenience, social interaction, UI aesthetics, portability, attitude, involvement and willingness of many studies in different environments, the results of the latent variables in this study are derived from the literature on mature measurement scales of previous studies.The variables in this study were measured from previous studies and then appropriately adjusted to suit the situation of users using the Travel Services app. First, according to the research background of this research, the original document items are translated into Chinese. In order to ensure the validity of the measurement, the Chinese project was translated into English and the English version was compared with the Chinese version. Next, for the target group, modifying the words makes it suitable for this research background and is easy to understand. A pilot test was conducted on a group of 15-year-old respondents to assess the effectiveness of the content, in which some simple expressions are used, rather than proper nouns that are difficult for the public to understand. The questionnaire contains 10 potential variables. All of these structural projects are measured using a seven-point Likert-type scale, ranging from 1 to 7 for “strongly disagree”, “disagree”, “some disagree”, “unsure”, “some agree”, “agree” and “strongly agree”.

3.3 Research hypothesis

3.3.1 Relative advantage and user's attitude

Relative advantages, compatibility, and complexity are three factors underpinning the Innovation Diffusion Theory (Roger, 2003). Relative advantage describes the degree to which an innovation is perceived as being better than the previous ways of performing the same task (Roger, 2003). Relative advantage is one of essence constructs of the PCI and it presents the degree to which a potential adopter views the innovation as offering an advantage over previous ways of performing the same task (Liao & Lu, 2008). Relative advantage includes tangible and intangible benefits (e.g. convenience, lower price, time saving, profitability and relations between people with common interests) (Agag & El-Masry, 2016). In the field of mobile apps, relative advantage describes the degree that users regard the current travel app to be greater than the others from the aspects that the benefits and values the apps provide, such as the running speed, the stability and the entertainment.

In terms of tourism, relative advantage is considered a prerequisite for positive attitude and involvement. Amaro and Duarte (2015) suggest that relative advantage positively influences consumers'intention to purchase travel online. Zendehdel and Paim (2013) show that relative advantage is an important factor that is significantly associated to attitude toward online shopping. According to this, consumers usually evaluate the relative advantages of online shopping before the behavior of purchasing online. Perceived value has been related to positive outcomes, such as the user satisfaction and loyalty (Hsu & Lin, 2015). Perceived value is also found to be the determinants of customer loyalty in mobile contexts (Cyr et al., 2006). Perceived advantages mean the superiority over the other mobile travel apps. Because of the achievement of users'expectation, users can be joyful while browsing the website with large amounts information. Therefore, we draw the following hypothesis:

H1a: The relative advantages of mobile travel applications have a positive impact on user attitudes.

3.3.2 Relative advantage and user's involvement

In the light of all these studies, the relative advantages of the mobile travel app are expected to provide users with useful information about travel destinations (such as good accommodation, places of interest, authentic folk snacks and travel advice) and user

interaction. And user interaction allows users to fully understand the destination. All the relative advantages of a travel app and a comprehensive understanding of the attractions can increase user confidence, experience and satisfaction with the application. Therefore, potential customers who recognize the relative advantages of the travel app may recognize that using the travel app is convenient, beneficial and enjoyable, which will be more likely to bring positive attitudes to the user, such as satisfaction and loyalty. In view of this, we propose the following hypothesis:

The degree of relative advantage often companies with economic profitability and social prestige (Rogers, 2003). In the field of mobile location-based retail apps, a significant and positive relationship between relative advantage and involvement is confirmed (Kang et al., 2015). From the facet of consumer, involvement behaviors can be motivated by bringing perceived benefits to them. The perceived perception of innovation indicates a significant correlation between comparative advantage and acceptability (Zolkepli & Kamarulzaman, 2015), so the user's high degree of involvement is present. The more personalized features a product or service a consumer provides, the higher the involvement. If consumers believe that certain products or services are helpful to their lives or work, they will voluntarily devote more time and energy. For example, the time-convenient characteristic and benefits of the mobile LBS retail application can spur consumer emotions and desires by making users aware that mobile LBS retail applications are fun and important (Kang et al., 2015). Gatignon and Roberetson (1989) argue that the perceived advantages of a new technology can provide tremendous energy for the application of this technology in a highly competitive market. Therefore, the relative advantages of a new technology may be a meaningful factor affecting the application of the technology. What is more, if users recognize their needs can be fully satisfied by certain products, service or technology, the perceived benefits will bring a large number of repeat customers. For instance, an American Hospital supply system attempts to establish electronic links with other hospitals when they realize the remarkable benefits from the electronically linking to one hospital (Vitale, 1985).

Potential customers who perceive the relative advantages of travel apps are more likely to have cognitive involvement physically and psychologically with the pleasant and relax feelings of the travel apps. (e.g. perceived lower ticket price, acquainting traffic route, and authentic folk snacks). In addition, the relative advantages of some mobile travel applications can significantly increase the level of behavioral involvement. For example, the relative advantage can enhance the user's recognition of the application, and the increasing online

interaction can also improve hotel reservations, revisiting and emotional involvement, which have a higher status in the user's mind. Therefore, it is reasonable to assume that when users recognize the relative advantages of mobile travel applications, they will have a high degree of involvement in the travel application. Therefore, we draw the following hypothesis:

H1b: Relative advantage of a mobile travel app has a positive influence on users' involvement.

3.3.3 Compatibility and user's attitude

Perceived compatibility is a construct borrowed from the PCI. Rogers defined compatibility as "the degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters" (Rogers, 1995). Compatibility describes the extent to which users regard using a mobile travel app as fitting in with their traveling needs and preferences (Kang et al., 2015). If a product or service is more compatible and less uncertain to the prospective users, it will fit more closely with the individual's situation (Zolkepli & Kamarulzaman, 2015). For the aim of this study, we define the compatibility as the extent to which consumers believe that using travel apps will match their traveling needs, lifestyle, and travel preference. Therefore, compatibility captures the consistency between an innovation and the potential adopters' existing values, current needs, and present lifestyle. The importance of compatibility shows that the adoption of an innovation can be influenced by the compatibility of an innovation with a preceding idea.

In the field of e-commerce, a positive and significant relationship between compatibility and attitude toward online shopping has been addressed by Amaro and Duarte (2015) and Vijayasarathy (2004). If a product or service is compatible, users may have a certainty use, which can enhance the confidence of using and comfort users' suspicion, leading to a positive attitude with the certain product, service or technology. Incompatible innovation with cultural values can deter adoption, and on the basis of the familiarity, consumers can utilize the innovation correctly (Zolkepli & Kamarulzaman, 2015). Seeing from this, compatibility means consistency and can attenuate the uncertainty. Lin and Chen (2012) argue that the relevance of perceived value and demand plays an important role in the intent of IT professionals to adopt cloud computing. Compatibility is an indispensable concern when considering a product or service. When consumers recognize the consistency of a technology, product or service, it means that they believe that the technology, product or service can meet their needs, and is consistent with past behaviors and more convenient to use. Therefore,

perceived benefits can bring a relaxed atmosphere and a positive attitude when using it. Chen, Yen, and Chen (2009) showed that consistency has a direct impact on the positive attitude of using smartphones and the perceived usefulness of smartphones. Compatible innovations match the user's needs, preferences, and behavioral habits to provide a valuable reference when users evaluate value. The positive relationship between consistency and adoption can reflect potential positive intentions and attitudes. Thus, we develop the following hypothesis:

H2a: Compatibility of a mobile travel app has a positive influence on users' attitude.

3.3.4 Compatibility and user's involvement

The travel app can provide information about travel destinations, such as historical descriptions of attractions and local customs, travel routes and accommodation information. Therefore, the travel app meets the needs and lifestyles of consumers. Kang et al. (2015) found that consistency is a determining factor in consumer emotional and cognitive involvement. Compatibility is also related to consumer readiness to use and try out self-service technology (Meuter et al., 2005). Compatibility is inversely related to conversion costs, reducing potential risks and helping to get involved (Huang & Hsieh, 2012). Highly familiar and consistent consistency reduces the cost of repeat learning and saves time, making users more willing to accept a product, technology or service and potentially increasing emotional involvement. It is expected that consumers will increase their emotional or utilitarian motivation when they become aware of the relevance of travel applications. Yaacob and Yusoff (2014) explored the consistency revealed by two sets of positive relationships based on computer training. Compatible products or services that meet consumer needs, lifestyles, and existing values can drive greater satisfaction among users and partners, and ultimately increase cognitive engagement. In addition, perceptual compatibility can also be involved in enhanced behavior through frequent repeated access. Conversely, dissimilarity may encounter many resistances from individuals, as new products, technologies, or services cannot adapt to their work or living habits, perceived value, and thus lead to an adaptation period for a new work environment.

For example, potential users of travel-loving travel apps are passionate about travel and usually have travel plans in their spare time. They are happy to share travel photos, travel stories and travel experiences on social platforms or online travel communities. Compared with traditional tourism, they like self-travel and like to travel with friends. The travel app can provide information about destinations, such as historical descriptions of attractions and local

customs, travel routes and accommodation information. Therefore, the mobile travel app meets the needs and lifestyles of consumers. Perceived compatibility and familiarity and consistency of certain mobile travel applications can lead to perceived usefulness, readiness and interaction. Based on all of these findings, prospective customers who are expected to perceive the relevance of travel applications may show a high level of emotional or cognitive involvement in travel applications. Hence, the following hypothesis is proposed:

H2b: Compatibility of a mobile travel app has a positive influence on users' involvement.

3.3.5 Complexity and user's attitude

Complexity is also an indispensible aspect of PCI. Perceived complexity reflects the degree of difficulty to understand, reflecting the extent of use. (Rogers, 1995). In the context of mobile LBS retail apps, the complexity reflects consumers concern about the difficulty of using the app (Kang et al., 2015). In the field of purchasing travel online, complexity is defined as the degree of purchasing travel online which is perceived to be difficult (Amaro & Duarte, 2015). For the purpose of this study, complexity is defined as the degree of difficulty to understand the various features of travel app, and use them successfully. It can be expected that when technology is perceived easily to understand and use, it will increase the adoption intention.

Complexity means the difficulty of using the program, increasing the user's learning cost and time cost. In addition, it increases the user's perceived uncertainty and risk, which may lead to anxiety and negative attitudes when users are using. In addition, ease of use as part of the TAM model is likely to be a resolution and measurement tool for complexity. They all recognize the extent to which potential users think it is easier to use a target system. The important and positive relationship between perceived ease of use and attitude has been supported by many studies (eg, Nysveenet et al., 2005; Akman & Mishra, 2015; Agag & El-Masry, 2016). The ease of use of perceived mobile sites is positively correlated with perceived usefulness and perceived pleasure (Cyr et al., 2006), which is described as a hedonic component and reflects the positive attitude of online shopping. In the context of the mobile space, complexity has a negative impact on the use of mobile innovation. If some mobile travel applications are considered to be complex, users will first create psychological conflicts with the mobile travel application. In addition, complexity may also increase learning and time costs, which may lead to negative attitudes of users. Such being the case, it

is expected that the complexity of mobile travel applications may lead to a negative attitude towards user adoption intentions. When consumers think that travel apps are not difficult to use, they will take a positive attitude towards the travel app. For these reasons, we propose the following assumptions:

H3a: Complexity of a mobile travel app has a negative influence on users' attitude.

3.3.6 Complexity and user's involvement

Complexity can lead to an unclear understanding of a product or service, and even the certain product is perceived helpful, the difficulty of use can attenuate the usage intention. Huang and Hsieh (2012) suggest the difficulty of understanding and use of the product will lead consumers to rely on existing providers which increase the obstacle of use. For example, if users perceive that a product is difficult to use, there is a psychological barrier before using the product. Besides, the hostility emotion may reduce the possibility of adopting the certain product and even lose the interest to use it. High levels of involvements will be motivated if consumers perceive that mobile LBS retail apps are easy to use (Kang et al., 2015), which can significantly influence users' involvement. Complexity requires more attention and knowledge as well as additional time to learn how to use the products, which increases user's costs (e.g. time cost, learning cost) and the product or service will be accepted and used hardly when it is perceived to be difficult to understand and use. Thus, there will be a barrier in the involvement of the product. If users are able to harness m-BI features, they will feel in control and have a sense of freedom, which can increase emotion engagement (Rozendaal, 2007). Premkumar (2015) demonstrate that complexity of a certain product, technology or service can inhibit the intension to adapt it. With the rapid development of the technology, simple operation step is required, consumers are more likely to adopt a product or service without additional costs, so complexity violates consumers' intention to use.

Complexity of the mobile travel app requires more learning and time costs, as well as the ability to overcome the psychological barriers. Thus, new product with large amounts of complexity means decreased competitiveness in the fierce competition market, the difficulty of using in psychology and behavior aspects obstacle the involvement. Therefore, it is reasonable to suggest that if users perceive that a mobile travel app is complex to use, they will be more likely to have high level of involvement. Hence, we develop the following hypothesis:

H3b: Complexity of a mobile travel app has a negative influence on users' involvement.

3.3.7 Time convenience, and user's attitude

Time convenience enable consumers to use services anytime and anywhere, which can improve time efficiency significantly. Previous studies suggest that time represents consumers' most precious and important asset in time-sensitive market, and mobile service value can derive from time savings. Kleijnen, De Ruyter, and Wetzels (2007) argue that time convenience and user control are seen as two advantages of representing the relative advantages of mobile transaction services. In the retail industry, the benefits of consumer perceived time convenience significantly impact service quality. Kang et al. (2015) regard the time convenience of mobile applications as an access service that consumers need whenever and wherever they need it. Hourahine and Howard (2004) show that time convenience is particularly relevant to time-sensitive services, such as time-limited travel quotes and last-minute bookings, which see time as one of the most important factors in market competition. Furthermore, time convenience is positively correlated with the perceived value of mobile channel usage (Kleijnen et al., 2007). Time convenience is more likely to leave a huge impression of a positive correlation with consumer attitudes. Previous research has explored that time is an intangible commodity that can be obtained by trading another resource with limited value (Becker, 1965; Jacoby, Szybillo, & Berning, 1976).

From that point on, we can conclude that time convenience is important in economics and business activities, and time is always considered an indispensable consideration. More importantly, with time as a scarce resource, consumers often plan their time carefully and always avoid wasting time (Jacoby et al., 1976). Under the premise of the importance of time, consumers will increasingly cherish time, and there is a tendency to use it, which is considered a potential factor for service convenience (Berry, Seiders, & Grewal, 2002). Therefore, time convenience is more likely to be associated with quality of service, which is significantly related to consumer attitudes toward a certain product or service. Convenient service time can stimulate consumers' emotions and utilitarian enthusiasm and provide a better user experience in today's fast-paced life, thereby enhancing consumers' habits and making consumers feel interesting and attractive, and leading to a positive attitude towards certain products. Consumers with time-awareness often view time as a scarce resource, so lack of time convenience can lead to negative attitudes and loss of market competitiveness. With the focus of all these studies, it is expected that the time convenience of mobile travel

applications can save consumers a lot of time, which can provide consumers with a high degree of confidence, a good feeling and satisfaction with the use of mobile travel applications. Potential consumers think that time is convenient and can have a pleasant and convenient feeling, which will be more likely to have a positive attitude. In view of this, we propose the following hypothesis:

H4a: Time convenience of a mobile travel app has a positive influence on users' attitude.

3.3.8 Time convenience and user's involvement

Kang et al. (2015) suggest that time convenience is positively associated with consumers' affective and cognitive involvement with mobile LBS retail apps. Kleijnen et al. (2007) assert that time convenience represents the relative advantages of mobile transaction services. Previous study concludes that time convenience mediates the effect of service and value (Tojib & Tsarenko, 2012), which can infer the fact that time convenience plays an irreplaceable role in contemporary business activities. Thus, time convenience can increase the perceived value, which is positively related to consumer involvement with the certain product or service. Tojib and Tsarenko (2012) identify that time convenience plays a vital role in improving experiential value, which can positively impact consumer satisfaction and increase the degree of emotional involvement significantly. Furthermore, it is believed that consumers derive great value from efficient and timely service delivery in fast-paced life environment (Childers, Carr, Peck, & Carson, 2001). Kleijnen et al. (2007) believe that greater perceived time convenience can significantly influence perceived value of mobile channel usage. Thus, time convenience of a new service or technology can be a great factor that influences the adoption. In addition, the satisfaction with time convenience of the certain technology can enhance the probability of repeat consumers. For example, if consumers recognize the time convenience of a mobile app, he or she will use it more frequently, even recommend it to others, which can decrease the advertising cost at the same time.

Prospective customers who are aware of the time convenience of a certain travel app are more likely to have cognitive involvement psychologically and have a pleasant impression. In addition, the level of behavior involvement can also be increased by the perceived value of time convenience, which can be in line with consumers' needs and lifestyle and lead to perceived readiness and helpfulness. On the foundation of all this research findings, it is reasonable to infer that prospective consumers who perceive that the time convenience of the certain travel app may show high level of involvement with the app. Hence, the following

hypothesis is proposed:

H4b: Time convenience of a mobile travel app has positive influence on users' involvement.

3.3.9 Social interaction and user's attitude

Interaction refers to the ability of a computer communication system that allows roles to be exchanged between a sender and a receiver in real-time or delay time so that the communicator can have more control over the speed, structure, and content of the communication.Perceptual interaction describes "the experience of what happens when a user interacts with a website or other computer-mediated communication entity" (Mollen & Wilson, 2010). Previous research has shown that interaction can be summarized in three areas: technology, information exchange, and user experience (Zhao & Lu, 2012; Ariel & Avidar, 2015).

Recently, it can illustrate the communication, exchange, sharing and modification of content (eg, product or service information, entertainment, ideas) and the process or state of the media through media (eg, computers, mobile phones) to help communicators and viewers (Macias, 2010). Liao and Keng (2013) describe interaction as the interaction of a machine or system and compare it to the interpersonal interactions between users of the online platform.

As we enter the "always on" society, people can interact anytime, anywhere, and interest in the concept of "interaction" increases. Social interaction has greatly changed people's lives. With mobile devices, business entities can also access customers anytime, anywhere. Individuals can connect with others anytime, anywhere, breaking through time and space constraints. Previous studies have shown that e-learner interaction is an important factor in virtual learning, and it affects attitudes through e-learning experience (Rodriguezardura & Meseguerartola, 2015). If e-learners do not interact online, they will fall into the unhelpful dilemma during the learning process, which is a lack of fun learning process. Oh and Sundar (2015) found that as the site's interaction increases, the site information will be more convincing, which will improve the authenticity and practicability of the information with a positive attitude. Interaction is a prime part of a successful travel website (González & Cavia, 2015). High levels of website interaction experience are significantly related to user emotional response, loyalty, satisfaction, and overall attitude to the site (Ku & Chen, 2015).

Strong interaction allows users to clearly and comprehensively recognize products, while

also significantly improving the user experience, and more likely to have a positive impact on users' perceptions and attitudes. The interactive nature of the mobile travel app provides users with a wealth of useful information, from convenient travel routes to high-quality accommodation, from beautiful historical attractions to special folk snacks. All interaction can enhance presence, recognition, and loyalty, which is positively correlated with positive attitudes toward certain mobile travel applications. Based on all of these studies, we can expect that when potential visitors perceive the social interaction of the travel app, they will spend more time on the travel app and be happy about it. Therefore, we propose the following assumptions:

H5a: Social interaction of a mobile travel app has a positive influence on users' attitude.

3.3.10 Social interaction and user's involvement

The role of social interaction has been especially obvious in travel service. Travelers can consult travel apps to seek information when they are in trouble, and they can also share interests, values and travel experience on the basis of social interaction. Lsabel (2015) and josé (2015) analyses the relational nature of official destination websites with interaction. Ayeh et al. (2013) indicate that social interaction had become an integral part of the online travel community. Interaction among communities is an indispensable role that can expend the level of user activity, it is also a judgment standard for the success of one community. Interaction can deepen the positive emotional experience and weaken the negative experience. Besides, interaction can also find problems to enhance the advantages significantly suggest that interaction among users can provide information to each one and allow users to be involved in conversations. Social interaction gives an assistance to optimize user website experience, decrease users' time cost to find information that they need on a website, and facilitate communication. Previous studies show that interaction of system-related dimensions and human interaction have a positive influence on consumer psychological engagement (Mpinganjira, 2016). Interaction can be defined as the indispensable features that affect consumers' participation and usage (Hu et al., 2016), and the perceived relationship can be a bonding contact with each other closely. Interaction can collect the feedback of others, which is helpful for the new users to have a latest and comprehensive grasp of the search object.

Social interaction has greatly changed people's lives. The role of social interaction has featured prominently in travel service. Interaction gives a chance that users can ask for assistance anytime and anywhere without time and space limitation. Besides, information and

emotion exchange also cultivate the habit of the mobile travel app using and enhance the user stickiness, which can increase the involvement significantly. Thus, it is expected that when users recognize the interaction of a mobile travel app, they will have high level of involvement to the travel app. Therefore, the following hypotheses are developed:

H5b: Social interaction of a mobile travel app has a positive influence on users' involvement.

3.3.11 User interface and user's attitude

User interface is the exchange media between the system and user interaction and information exchange. As an important aspect of software quality model, the user interface is the design of operating logic and user interface aesthetic. In the context of the M-learning application, different features, such as ease of use, user satisfaction, attractiveness and learn ability, should be inserted in the user interface (Sarrab, Elbasir, & Alnaeli, 2016). UI design is an important part of user interface design. UI attractiveness refers to one's perception of aesthetic attractiveness of a mobile travel app derived from UI design factors such as color schemes, spatial layout details and shape selection. Users prefer systems with a visually appealing UI, and touch-screen-based visuals are even more attractive for mobile users (Peters et al., 2016).

Previous studies revealed that an interesting website could motivate consumers to conduct the online shopping activities (Ganesh, Reynolds, Luckett, & Pomirleanu, 2010). Today, the interface of an app is no longer used for utilitarian purpose to look for helpful information, it is significantly becoming a place for entertainment experience (Hartman et al., 2006; Ganesh et al., 2010; Childers et al., 2001). A friendly interactive interface design can not only increase the aesthetic perception, but the simple and convenient design helps users find the information needed easily. A good user interface makes the operation of the software more comfortable and simple, which will reduce the difficulties of consumer cognitive. An artistically beautiful user interface can please users' eyes and create a deeper inquiry into the hedonic needs (Wang et al., 2011). Visual interfaces have a significant influence on users' visual impression and decision making in many aspects such as economic, psychology and physic (Hartmann, Sutcliffe, & De Angeli, 2008). Today, the product and service are no longer made for the practicality, it should become user-centric, providing a good user experience, and give users a relaxed and comfortable searching or purchasing experience. A good user interface of the travel app can attenuate the feeling of tedious task and create a comfortable

environment from the design of color schemes to spatial layout. Besides, the good online surfing environment can make users feel relaxed and have a positive feeling and attitude. In the field of mobile app design, superior UI design supports not only the aesthetic appeal of the product but also can distinguish a product from its competitors, which can leave a positive influence on the users as well as a positive attitude to the products quality (Bloch, 1995; Lee et al., 2011). Visual design of mobile users interface is a important part of environment quality, which is positively associated with users' satisfaction with the mobile service. When a consumer utilizes a mobile travel app at the first time, a beautiful aesthetic design will provide a great impression on the certain app, which can have a relaxed positively attitude. Besides, a clear web navigation can let users feel it is easy to handle the app and search the expected information. The simple operation of a certain mobile travel app represents significantly reduce of the time and learning cost as well as the high improvement of the efficiency. Base on these studies, it infers that attractive user interface of the mobile travel app can improve users attitude strongly. Thus, the following hypothesis is proposed:

H6a: Good user interface of a mobile travel app has a positive influence on users' attitude.

3.3.12 User interface and user's involvement

User interface is the first contact with users, who may not continue their surfing behavior if they do not like the interface, bacause the first impression of the app plays an important role in the usage process. Wang et al (2011) found that aesthetic interface could indirectly increase the propensity to re-visit a website. Thus, the interface of the app is associated to the involvement of the app using. An appealing UI of a mobile business intelligence system is significantly related to the level of users' psychological engagement (Peter et al. 2016). An appealing user interface design can make a good impression of high quality and trustworthy corporate image on users when they visit it the first time, which can lead to re-visit behavior frequently. Previous studies suggest that aesthetic interface can significantly influence the overall atmospherics on consumers' shopping behavior and impact consumers' psychological and behavioral reactions (Donovan et al., 1994; Hui, Dube, & Chebat 1997; Eroglu, Machleit, & Davis 2001). A clear navigation design and relaxed interface design is an enjoyment, a corporate image, as well as a signal of high quality of the product or service. Cyr et al. (2006) found that perceived aesthetics played an important role in the perceived ease of use. Kim et al. (2016) explored that different ATM touch screen layouts could lead to significant

differences in users' reaction time. Lowry et al. (2012) explored that end users have noticed and process UIs systematically, if they are involved or they think users interface interaction is part of their work; however, if the end users perceive that they do not get into involved or have no particular purpose, they will process UIs systematically. User interface has a direct effect on cognitive processing and subsequent behavior (Vance et al., 2015).

A good interface of a mobile app can increase confidence and trust to the service provided by the company, which can comfort consumers' psychological behavior and influence the decision making in information searching process. Besides, the attractive interface of the app can also satisfy users' hedonic needs, which can increase the re-visit propensity. Meanwhile, it will make consumer feel happy and develop affective involvement and positive attitude. Therefore, the following hypotheses are developed:

H6b: Good user interface of a mobile travel app has a positive influence on users' involvement.

3.3.13 Portability and user's attitude

Mobile app portability is defined as an application's ability to be executed on different mobile operating system (OS), such as Android, iOS, and Windows Mobile. Previous study has meant that entertainment and portability needs will significantly influence young adults' adoption of mobile TV behavior (Lee et al., 2011). It is believed that the ubiquity and portability of mobile apps is closely related to consumers' consumption behavior, which is important in marketing activities. Furthermore, portability is regarded as an important factor for mobile TV services that require entertainment (Lee et al., 2011).

Previous study has shown that mobile number portability is an essential influencing factor for consumers not changing the existing access providers on account of the changing cost especially for commercial users (Singh & Sirohi, 2015), which may not satisfy the consumers. With the rapid development of mobile smartphone, there is more likely for consumers to have more than one mobile device. In this situation, mobile app portability is becoming increasingly important and can enhance the sense of profession and convenience for the certain mobile app, which can significantly improve consumer satisfaction and positively influence consumers' attitudes. Ida (2012) implies that lace of service portability can increase changing costs and get into passive in effective competition, which can not only lead to negative attitudes. Previous studies have conducted conjoint analysis to discuss the

willingness to pay for e-mail address portability. In addition, previous study has supported that consumers prefer diverse services that are perceived free portability and increase of mobile service portability with reasonable costs is positively related to consumer welfare (Ida, 2012). On the foundation of all these findings, portability can be considered as an irreplaceable factor for mobile service, which can make consumers have a sense of convenience and helpfulness as well as leave a great impression on the certain product or service. In the context of mobile travel app filed, portability can give great convenience for consumers execute the certain app service at different device anytime and anywhere without cumbersome operation. What' more, portability of mobile app service can achieve large range of consumers and platforms? If a mobile travel app is lack of the service of portability, consumers will have to find traveling information only in one specific device, which may lead to negative attitude towards the certain product, on the other hand, consumer may even ask for another similar product to replace it. Thus, potential consumers obtaining the portability of the certain travel app may view that the using experience is convenient, readiness and beneficial, which will be more likely to have positive attitudes such as satisfaction and loyalty. Hence, the following hypothesis is proposed:

H7a: Portability of a mobile travel app has a positive influence on users' attitude.

3.3.14 Portability and user's involvement

In Japan's mobile phone market, the average consumers are pleased to pay more money to increase mobile service portability (Ida, 2012). Mobile app portability can make sure that consumers use the app in different operation system, for example, consumers can continue find information in his or her iPad if his or her Android smartphone is not at hand. The portability of mobile app can not only seize the market share but also cultivate consumers' habit of re-visit. From this point, mobile app portability can significantly improve consumers' behavior involvement. If mobile app portability is lost, providers will lose market share, which means profit reduction and a lack of competitiveness. Besides, consumers will have a sense of inconvenience and may look for alternatives, thus, consumers' loyalty may decrease at the same time. Mobile app portability can give consumers great convenience among the using process, which can leave positive impressions and improve consumer satisfactions. If the service or product meets the consumer's needs, living habits, and the existing value, it will prompt users and partners to be more satisfied, and ultimately improve cognitive involvement.

In the current society, individuals often try to find information from travel applications,

such as travel destinations, travel routes and accommodation information. In addition, consumers are happy to post and share their travel activities. If they have the equipment at hand, portability can provide consumers with the possibility to search for information anytime, anywhere. The perceived portability of some mobile travel applications is consistent with consistency and habits, which helps to increase consumer loyalty. Based on the results of all these studies, if consumers consider mobile travel applications to be portable, they will be more likely to have high levels of cognitive and behavioral involvement. Hence, we develop the following hypothesis:

H7b: Portability of a mobile travel app has a positive influence on users' involvement.

3.3.15 Involvement and user's attitude

Involvement refers to the perceived relationship of a product or service. The term "Engagement" is similar to the definition and assessment criteria of "involvement" and describes the level of cognition, emotion and behavior of a person (Chan et al., 2014). Consumer involvement in products is usually associated with their information search process (Chiang & Jackson, 2016). Gummerus et al. (2012) suggested that community and transaction involvement behaviors have a positive influence on user satisfaction and loyalty by the mediate effect caused of perceived benefits. Involved consumers exhibit enhanced consumer loyal, satisfaction, communication, emotional relationship, trust. Satisfaction and perceived benefits can motivate user involvement behaviors from the behaviors, or the emotional bonding supported by the behaviors (Gummerus et al., 2012). Dholakia et al. (2004) explored that involved consumers can gain perceived benefits (e.g. social benefits, information benefits, emotional benefits) from the involvement behaviors with the product or service. Involvement means users have a great sense of identity and belonging, besides, high level involvement represents users can get large amounts of needed information, have entertainment with the members, satisfy their needs and have a great social recognition. Consumer involvement is expected to be associated to the relationship outcomes (e.g. satisfaction, trust, affective commitment, and loyalty) (Brodie et al., 2011). If a consumer is deeply involved with a product or community, they can not only find the material value, satisfying their needs and realizing their target, but also meet spiritual requirements, such as a high level of knowledge recognition, credibility and social media status. Thus, consumers will have a sense of achievement, which is significantly associated with positive attitude towards the certain product or community. High level involvement can enhance the inherent relationship between

users and product, in which the emotional bonding is helpful to improve the satisfaction and loyalty. Besides, the inherent relationship can also decrease the perceived risk, which can lower the marketing costs. In the context of travel apps, travelers and prospective travels perceived high involvement usually means they feel that using travel app is needed and means a lot to them or they have positive feelings with travel apps. Based on these studies, it is reasonable to infer that the enhanced involvement with the mobile travel app can improve positive attitude significantly. Thus, the following hypothesis formulated:

H8: Involvement with a mobile travel app has a positive influence on users' attitude.

3.3.16 User's involvement and user's intention to use

Involvement describes the individual's perceived consistence and relation of extrinsic things on the foundation of inherent values, needs (Aaichkowsky, 1985). Involvement is influenced by the situation and self- relevance, which has an effect on consumers' attention and comprehension efforts (Celsi & Olson, 1988; Hoffman & Novak, 1996) Involvement with the mobile travel app is a person's perceived emotional and cognitive relevance that they are related to the app, which can motivate the utilitarian needs, satisfaction and loyalty. For example, if a user feels that all of the needs can be satisfied and thinks that using the app is interesting and appealing, he/she will re-visit the app next time.

Lu (2015) suggests that perceived usefulness, perceived ease of use, and compatibility influencing the involvement significantly are important factors of the intention to use a certain travel app. Previous studies have explored that perceived quality value, emotional value, economic value and social value have a positive influence on users' intention to purchase for paid mobile apps (Hsu & Lin, 2015). Jiang et al. (2010) find that affective involvement with a website has a positive effect on consumers' intention to purchase at this website. If a consumer is highly involved with a product or service, he or she will show great curiosity and enhance sense of identity, which can make a good influence on the adoption. Kang et al. (2015) has demonstrated the significant and positive relationship between involvement and consumers' downloading and usage intention toward mobile LBS retail apps. Previous studies have demonstrated that learners with prior e-learning experiences have great difference from learners without prior e-learning experience (Liao & Lu, 2008). Factors of perceived relative advantages significantly affect consumers' decision to involve in online shopping behavior, which have a strong influence on their intention of adoption (Van Slyke et al., 2004). Moore and Benbasat (1991) have tried to explain the technology adoption behavior in technology

contexts, but the influencing factors are not consistent. Consumers are more likely to adopt recommendations while making decision if they have high involvement with recommendation agents (Wang & Doong, 2010). A high level of involvement often comes with high level of perceived usefulness, entertainment, ease of use and satisfaction, which can give assistance to improve the intention to adopt the product or service. Besides, enhanced involvement and high satisfaction form a positive cycle that promotes the adoption significantly. Based on these studies, it is expected that involvement with the certain mobile travel app is positively associated to the adoption attention. Hence, we draw the following hypothesis:

H9: Involvement with a mobile travel app has a positive influence on adoption intention.

3.3.17 User's attitude and user's willingness to use

Attitude is a core factor that affects the adoption of new ideas (Wang et al., 2011). Previous studies have shown three aspects of the attitudes (Crutschfield & Ballachey, 1968). Cognitive attitudes represent individual's ideas about a certain product, service or things. Affective attitudes describe the emotional recognition (e.g. preference, joy, anxiety). The last one refers to the behavior component, representing individual's action towards a certain object. Attitudes towards adopting a technology refer to the extent that evaluates a certain technology from the interface to the quality negatively or positively from the self-point of view (Venkatesh et al., 2000). Previous studies have suggested attitude can be measured by assessments on an object that can be distinguished as favorable or not (Fleury, 2016). In the field of the mobile app, attitudes towards using a mobile travel app can be regarded as the overall assessment of the app that includes the user needs and perceived entertainment.

Agag and El-Masry (2016) found that attitude positively influence intention to participate in online travel community. Customers' attitude towards adopting a new product plays an important role in the motivation and adoption intention. A positive attitude usually is associated with high levels of satisfaction with meted needs, and it also has a positive effect on consumers emotion while visiting or using the certain product or service. Thus, consumers will have an enhanced intention to adapt it. On the contrary, the negative attitude means the discontent and even the disgust, which will decrease consumers' enthusiasm to use it, let alone the adoption. Previous studies have found the relationship between attitude and intention to adopt M-banking (Deb & Lomo-David, 2014). Bruner and Kumar (2005) suggest that if consumers hold a positive attitude towards a product, they will be more likely to have the intention to adopt the certain product. A positive attitude towards a certain product often

companies with a sense of preference, satisfaction and a positive emotion. If a user has a positive attitude towards the certain mobile travel app, he/she will be more likely to have the inherent preference which can decrease the search cost and increase pleasure during the online surfing process. Besides, the positive attitude often means the satisfaction and loyalty, which is the competitive power among the fierce competitive environment. Consumers along with positive attitude toward travel apps are likely to speed up their adoption intention of travel apps. On the foundation of all these studies, it is possible to infer that users with positive attitude towards a certain mobile travel app, he/she will be more inclined to adopt it. Therefore, we develep the following hypothesis:

H10: Attitude towards a certain mobile travel app has a positive influence on adoption intention.

3.4 Summary of research hypotheses

The 17 research hypotheses were presented.

H1a The relative advantages of mobile travel applications have a positive impact on user attitudes.

H1b The relative advantages of mobile travel applications have a positive impact on user involvement.

H2a The consistency of mobile travel applications has a positive impact on users' attitudes.

H2b The consistency of mobile travel applications has a positive impact on user involvement.

H3a The complexity of mobile travel app programs has a negative impact on user attitudes.

H3b The complexity of mobile travel applications has a negative impact on user involvement.

H4a The time convenience of the mobile travel app has a positive impact on the user’s attitude.

H4b The time convenience of mobile travel applications has a positive impact on user

involvement.

H5a The social interaction of the mobile travel app has a positive impact on the user’s attitude.

H5b The social interaction of mobile travel apps has a positive impact on user involvement.

H6a The good user interface of the mobile travel app has a positive impact on the user’s attitude.

H6b The good user interface for mobile travel apps has a positive impact on user involvement.

H7a The portability of mobile travel applications has a positive impact on user attitudes.

H7b The portability of mobile travel applications has a positive impact on user involvement.

H8 The involvement of mobile travel apps has a positive impact on user attitudes.

H9 The involvement of mobile travel apps has a positive impact on user’s intention to use.

H10 The attitude of the mobile travel app has a positive impact on user’s willingness to use.

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Chapter 4: Research Design and Questionnaire Preprocess

4.1: Research design

4.1.1 Questionnaire design

The main aim of this study is to investigate the consumers' opinions toward travel app. The target population of the study comprises the consumers who are interested in travel and are the members of the online travel communities who used internet or travel app to search information for traveling. This study adopts questionnaire survey of empirical research method to make data collection and analysis.

The research model is based on Technology Acceptance Model (TAM), Innovation Diffusion Theory and Software Quality Model. The questionnaire survey composes of two parts, one is to form the measurement part, and the other is the basic information part.

The basic information part is to understand the characteristics of the target group. The basic information part consists of gender, age, education, occupation, travel frequency, travel budget, the frequency of using travel app, the purchase experience within travel app, the frequency of using instrument for travel information, the frequency of using travel app for travel information and the type of mobile operation system. The constructing measurement part is adopted to measure the mixture. This research model has ten structures, i.e. relative advantage, compatibility, complexity, time convenience, social interaction, UI aesthetic, portability, attitude, involvement and adoption intention. The latent variables measurements of this study were all from previous studies in the literature of the mature scales of measurement because of many researches in different environment of relative advantage, compatibility, complexity, time convenience, social interaction, UI aesthetic, portability, attitude, involvement and adoption. Variables measurements in this study were also from previous study, and then appropriate adjustment was made to fit the situation when users using the travel app. In the first place, the items of the original literature were translated to Chinese based on the research background of this study. In order to ensure the validity of the measurements, the Chinese items were translated into English, and the comparison has been made between the English vision and Chinese vision. Then, the modification of words was

adapted to make them applicable and easy to understand to this study context for the target group. A pilot test is conducted in a group of fifteen to assess the content validity. Some plain expressions have been used instead of the proper nouns, which increase the difficulty of understanding for general people. The questionnaire contained ten latent variables. All the items of the structure are measured using a seven-point Likert-type scale, with anchors ranging from disagree 1 to strongly agree 7. From 1 to 7 stands for “strongly disagree”, “disargee”, “disagree somewhat”, “undecided”, “agree somewhat”, “agree” and “strongly agree” respectively.

4.1.2 Definition of variables measurement

The comparative advantage in this study refers to the advantages of an innovation relative to the original method it replaces. The comparative advantage measurement topics are from the scales studied by Huang and Hsieh (2012) and Jung et al. (2012). In the study, the user's use of the travel app was modified. Four items borrowed from previously developed scales were used to measure perceived relative advantages (Huang & Hsieh, 2012, Jung et al, 2012). The items of relative advantages are: (1) This travel app enhances my traveling experience; (2) This travel app makes it easier to understand destinations; (3) This travel app helps me save much time; (4) This travel app makes traveling more effective.

Compatibility in this study refers to the extent to which travel apps are consistent with the adopters' existing values, existing practices, and needs. This consistency reduces uncertainty and increases the chances of potential adopters adopting the innovation. The measurement of compatibility is from the scales used by Huang and Hsieh (2012), Jung et al. (2012), Lu et al. (2015). In the study, the user's use of the travel app was modified. There are three measurement items, namely: (1) This travel app is compatible with my travel prferences; (2) This travel app suits my travel needs; (3) This travel app fits well with my travel needs.

The complexity in this study refers to the degree of understanding and use of an innovation. The simpler the innovative things are, the easier it is to adopt the lower the complexity. This study used the measurement of complexity in Huang and Hsieh (2012) and Jung et al. (2012). In the study, the user's use of the travel app was modified. A total of three measurement topics were selected: (1) This travel app is easy to use; (2) Learning how to use this travel app is easy for me.; (3) I would imagine that most people would learn to use this app very quickly. The measurement of complexity in the study uses a reverse measurement approach.

Social interaction means that users can communicate with other users through the travel app. This study used the measurement of social interaction in the study by Zhou et al. (2014). In the study, the social interaction was modified in combination with the user's use of the travel app. There are three measurement topics for social interaction: (1) I can communicate with strangers who travel together using the travel app; (2) I can meet many friends on this travel app; (3) I can get help from others on this travel app.

UI aesthetics refers to the reasonable layout of the various functional modules of the travel app and the pleasantness of the interface. The measurement of UI aesthetics is based on research by Coursaris and van Osch (2016) and Cyr (2006). The items of UI aesthetic are: (1) The user interface design of this travel app looks clean; (2) The user interface design of this travel app is sophisticated; (3) The user interface design of this travel app is fascinating; (4) The user interface design of this travel app is aesthetically pleasing; (5) The user interface design of this travel app is visually appealing.; (6) The user interface design of this travel app is attractive.

In this study, the degree of involvement refers to the perceived relevance of the user to the travel app based on the inherent needs, values, and interests. The user's measurement of travel app involvement is from the study of Kang et al. (2015) and contains three measurement topics. This study, in conjunction with the user's use of the travel app, has modified the measurement of the degree of involvement. The items of involvement are: (1) Using this travel app is exciting; (2) Using this travel app means a lot to me; (3) Using this travel app is enjoyable to me.

The user's attitude toward travel app in this study was measured by Kwon and Chung (2010) and included five measurement topics. Based on a preliminary experiment, the study changed the 7-point semantic difference scale for attitude measurement in the original document to the 7-point Likert scale. In addition, this study has been modified in conjunction with the user's measurement of the attitude of the travel app. The five measurement topics of attitude are: (1) it is wise to use this travel app; (2) it is attractive to use this app; (3) it is enjoyable to use this app; (4) using this app is fun; (5) Using this app is helpful for me.

Three items borrowed from pervious developed scales were used to measure portability. The items of portability were: (1) This travel app works well on multiple mobile operating systems.; (2) This travel app has a good operating system compatibility; (3) This travel app has a good multiple operating system applicability.

This study believes that the user's willingness to use the travel app includes not only that the user will download the travel app but also that the user will use the travel app for the next period of time. The research has modified the measurement topic of the user's willingness to use in conjunction with the user's use of the travel app. The four measurement topics of the user's willingness to use are: (1) I will download and install this travel app; (2) I expect to continue to use this travel app; (3) I intend to use this travel app service. (4) I will recommend this travel app to colleagues or friends.

Finally, measurements of time convenience were modified from Mathwick (2001). The four measurement topics for users' willingness to use are: (1) using this travel app can make travel time more efficient; (2) using this travel app to help me make travel arrangements; (3) using this travel app can effectively save travel time.

4.1.3 Questionnaire collection

Questionnaires is used to collect data and test hypotheses. The first thing to take into account is the accuracy and stability of the sample, followed by reliability and effectiveness. The questionnaire of this study involves 10 latent variables and 37 measurement items. Real tourist group was chosen in the study. Generally speaking, tourist have great interests in traveling and have deep feelings on many aspects of traveling. They are the potential users of travel app.

In order to ensure reliability and validity of the questionnaire, a preliminary survey was conducted before the final questionnaire. The main purpose of the survey is to examine the validity and reliability of the sample content and the accuracy and effectiveness of questionnaire design. A total of 45 questionnaires were issued and collected after handing out 50 pieces. The survey suggested that the content validity of the questionnaire was good, reliability and validity also met the requirements. Finally, according to the findings of the survey, language and expression were modified to fit the respondent’s cultural background and language habit.

The survey was conducted in the form of thesis questionnaires, and the real tourist were the respondents. This can improve the quality of the questionnaires. We cooperated with a travel company and developed a mobile travel app named PandaTravel. This travel app provides several travel-related functions such as personalized attractions and activities arrangement, tourist attraction guide, context-aware product/service recommendations and

purchase, and social interactions. The data was collected from a convenience sample of tourists traveling in Chengdu, a famous tourist city in China. We first explained the purpose of this study and the confidentiality of the responses. Once the travelers exhibited their willingness to participate, they were first asked to use the travel app on a mobile device we provided to gain an understanding of the app's various features. After that, the participants were required to complete a questionnaire designed to test the proposed research model. To encourage participation, a gift worth 30 ¥ was offered to the respondents who completed the questionnaire. The data collection lasted about eight months from November 2015 to June 2016.

4.2 Data Collection and data pre-process

4.2.1 Questionnaire collection

In the end, the survey collected 1,151 completed questionnaires of handed out 1250 pieces. In addition, since the respondents of the six questionnaires were not tourists, we omitted them during the analysis. Finally, after investigation and recycling, we collected a total of 803 valid questionnaires for further analysis.

4.2.2 Sample description

Table 4-1 Sample characteristics

Variable	Categories	Frequency	Cumulative
age	Average	29.35(mean)	9.27(SD)
System			
	Android	429	53.42%
	Ios	359	98.13%
	other	15	100.00%
gender			
	male	277	34.50%
	female	526	100%
education			
	middle high school and below	10	1.25%
	training school	288	36.74%

	undergraduate	366	82.57%
	master and above	41	87.18%
	others	98	100%
occupation			
	technology	98	12.20%
	marketing	52	18.68%
	sale	129	34.74%
	administration	85	45.33%
	HR	44	50.81%
	finance	45	56.41%
	management	63	64.26%
	student	129	80.32%
	others	158	100%
budget			
	below 1000(¥)	75	9.34%
	between 1000 and 2000(¥)	238	38.98%
	between 2000 and 4000(¥)	265	71.98%
	between 4000 and 5000(¥)	89	83.06%
	between 5000 and 6000(¥)	43	88.41%
	between 6000 and 8000(¥)	43	93.76%
	between 8000 and 10000(¥)	37	98.36%
	above 10000(¥)	13	100%

1. Age

The respondents' ages range from 20 to 38 (mean = 29.35; SD = 9.27) (Table 4-1).

2. Gender

Among these 803 respondents, 526 are females (65.5%) while 285 are males (34.5%) (Table 4-1). The females are approximately twice as many as males. The survey indicates that the female prefers traveling than the male. Probably women have more interest in tourism.

3. Education experience

With regard to the education, nearly 80% of the respondents hold training school degree (35.86%) and undergraduate degree (45.58%) or above. 10 people have high school education

and below, accounting for 1.25%; 288 have training school education experience, accounting for 35.86%; 366 have undergraduate education experience; 41 have master's degree or above (Table 4-1).

4. Occupation

There are 98 technicians, accounting for 12.2%; 52 marketers, 6.48%; sales staff 129, 16.06%; management staff 85, 10.59%; human resources 44, 5.48%; financial 45, 5.6%; 63 in management, 7.85%; 129 students, 16.06%. Students and sale have a high proportion, and the sample covers various positions (Table 4-1).

5. Traveling budget

There are 75 people whose budget cost is less than 1000 ¥, accounting for 9.34 percentage; There are 238 people whose budget cost is between 1000 ¥ and 2000 ¥, accounting for 29.64 percentage; There are 265 people whose budget cost is between 2000 ¥ and 4000 ¥, accounting for 33 percentage; There are 89 people whose budget cost is between 4000 ¥ and 5000 ¥, accounting for 11.08 percentage; There are 43 people whose budget cost is between 5000 ¥ and 6000 ¥, accounting for 5.35 percentage; There are 43 people whose budget cost is between 6000 ¥ and 8000 ¥, accounting for 5.35 percentage; There are 37 people whose budget cost is between 8000 ¥ and 10000 ¥, accounting for 4.61 percentage; There are 13 people whose budget cost is more than 10000 ¥, accounting for 1.62 percentage (Table 4-2). Virtually two-thirds of respondents' tourism expenditures range from 1000 ¥ to 5000 ¥, 1000 ¥ to 2000 ¥ (29.64%) 2000 ¥ to 4000 ¥(33%) and 4000 ¥ to 5000 ¥ (11.08%).

Overall, in the 803 respondents, the tourists are in the age of 20-38, woman have a high proportion, most of whom have training school or above education background, and most of the tourism budget is between 1000 ¥ and 5000 ¥.

This study also investigated user experience of the travel app, including the frequency of travel app use, the frequency of travel product buying, the frequency of information seeking before traveling and the frequency of information seeking in traveling.

We set up five levels: never, rarely, occasionally, often, always. In the app frequency survey, 13 people chose "never", 85 "rare", 169 "occasional", 343 "regular" and 193 "always". In the survey on the frequency of purchase of travel products, 13 people chose "never", 85 "rare", 169 "occasionally", 343 "regular" and 193 "always". In the survey of pre-departure

information search frequency, 13 people chose "never", 85 "rare", 169 "occasional", 343 "regular" and 193 "always". And in the survey of information search frequency on travel, 37 people chose "never", 125 "very little", 234 "occasionally", 301 "regular" and 107 "always".

Typically, the respondents are familiar with travel app, such as ctrip and qunaer. The majority of them have bought travel products，such as air ticket, hotel room reservation and ticket of the scenic area. A large portion of the respondents have used travel apps. The travel apps have been always used by 24.00% of the respondents, often used by 42.79%, used by 21.02%, rarely used by only a small part (10.57%) and never used by 1.62%. During purchasing travel product through the travel apps in the recent 12 months, almost all of the respondents have used travel apps to seek information about the place before traveling. The Majority of them have looked for related information by using travel apps during traveling.

4.2.3 App features importance description

This study investigates the importance of travel app features. Consumers are asked to order the degree of importance of each travel app feature. Table 4-2 shows the frequency of each feature and Table 4-3 shows the percentage. Travel app features in the survey include book air ticket/book room, online review, introduction of the places, travel arrangement, ticket, food recommendation, discount, special local product recommendation, language translation, introduction to place, route guidance of place, voice introduction to place, video introduction to place, playfulness recommendation, food recommendation, transport service delivery, special local product recommendation, know other travelers, nearby place recommendation and transportation guidance. Most of the consumers think these features are important. Except for discount, special local product recommendation, voice introduction to place, video introduction to place, special local product recommendation, know other travelers, over 70 proportion of consumers thought the rest of the features were important. Over 10 proportion of consumers thought voice introduction to place, video introduction to place, special local product recommendation, know other travelers were not important at all.

Table 4-2 App features importance description of frequency

	not important at all	not important	not very important	neutral	more important	very important	extremely important
Book air ticket/book room	31	21	23	63	202	284	180
Online review	66	38	22	102	229	247	100
Introduction of the places	33	15	14	48	236	313	145
Travel arrangement	66	20	24	118	221	261	94
Ticket	23	14	23	127	224	282	111
Food recommendation	22	17	19	76	239	293	138
Discount	35	26	28	143	216	250	106
Special local product recommendation	35	35	35	181	207	218	93
Language translation	117	31	26	186	149	197	98
Tourist Introduction to place	26	15	18	57	186	350	152
Route guidance of place	23	9	20	54	162	380	156
Voice introduction to place	78	24	31	167	160	281	63
Video introduction to place	84	36	29	174	168	246	67
Playfulness recommendation	44	25	32	87	215	291	110
Food recommendation	33	17	28	72	193	319	142
Transport service delivery	41	17	23	60	167	327	167
Special local product recommendation	82	37	45	165	165	228	82
Know other travelers	102	44	37	216	134	202	69

Nearby place recommendation	81	28	36	98	215	252	94
Transportation guidance	56	19	22	43	162	311	191

Table 4-3 App features importance description of percentage

	not important at all	not important	not very important	neutral	more important	very important	extremely important
Book air ticket/book room	0.04	0.03	0.03	0.08	0.25	0.35	0.22
Online review	0.08	0.05	0.03	0.13	0.28	0.31	0.12
Introduction of the places	0.04	0.02	0.02	0.06	0.29	0.39	0.18
Travel arrangement	0.08	0.02	0.03	0.15	0.27	0.32	0.12
Ticket	0.03	0.02	0.03	0.16	0.28	0.35	0.14
Food recommendation	0.03	0.02	0.02	0.09	0.30	0.36	0.17
Discount	0.04	0.03	0.03	0.18	0.27	0.31	0.13
Special local product recommendation	0.04	0.04	0.04	0.23	0.26	0.27	0.12
Language translation	0.15	0.04	0.03	0.23	0.19	0.25	0.12
Introduction to place	0.03	0.02	0.02	0.07	0.23	0.44	0.19
Route guidance of place	0.03	0.01	0.02	0.07	0.20	0.47	0.19
Voice introduction to place	0.10	0.03	0.04	0.21	0.20	0.35	0.08
Video introduction to place	0.10	0.04	0.04	0.22	0.21	0.31	0.08
Playfulness recommendation	0.05	0.03	0.04	0.11	0.27	0.36	0.14
Food recommendation	0.04	0.02	0.03	0.09	0.24	0.40	0.18

Transport service delivery	0.05	0.02	0.03	0.07	0.21	0.41	0.21
Special local product recommendation	0.10	0.05	0.06	0.21	0.21	0.28	0.10
Know other travelers	0.13	0.05	0.05	0.27	0.17	0.25	0.09
Nearby place recommendation	0.10	0.03	0.04	0.12	0.27	0.31	0.12
Transportation guidance	0.07	0.02	0.03	0.05	0.20	0.39	0.24

4.2.4 Measurement items description

The construction measurement part consists of ten latent constructions such as the relative advantage, compatibility, complexity, social interaction, UI aesthetic, time-convenience, portability, involvement, attitude and adoption intention, a total of 37 items. We took a descriptive analysis of the 803 effective questionnaires. Due to the complexity was the reverse measurement, so the data was reversed when analyzing. Descriptive analysis of the measurement was shown in Table 4-4. Among the 37 items, 30 items the minimum value is 1, 7 items the minimum is 2; 35 items the maximum value is 7, 2 items the maximum is 6. Complexity items value between 2 and 3, with a standard deviation around 1.00. The rest items value between 5 and 6, with a standard deviation around 1.00.

Table 4-4 Measurement items description

variable	Item	Min	Max	Mean	SD
relative advantage					
	question 1	1	7	5.55	0.98
	question 2	1	7	5.63	0.92
	question 3	1	7	5.62	0.91
	question 4	2	7	5.53	0.96
compatibility					
	question 5	1	7	5.40	1.02
	question 6	2	7	5.36	1.00
	question 7	1	7	5.29	1.00
complexity					
	question 8	1	7	2.78	1.02
	question 9	1	6	2.67	0.96
	question 10	1	6	2.55	0.96
social interaction					
	question 11	1	7	5.05	1.29
	question 12	1	7	5.09	1.24
	question 13	1	7	5.23	1.17
UI aesthetic					

	question 14	1	7	5.30	1.07
	question 15	1	7	5.34	1.06
	question 16	1	7	5.42	1.01
	question 17	1	7	5.38	1.06
	question 18	1	7	5.37	1.06
	question 19	1	7	5.42	1.05
time convenience					
	question 20	2	7	5.42	1.02
	question 21	2	7	5.49	1.00
	question 22	1	7	5.52	0.99
portability					
	question 23	2	7	5.51	0.97
	question 24	1	7	5.47	0.94
	question 25	2	7	5.48	0.94
involvement					
	question 26	1	7	5.01	1.08
	question 27	1	7	5.30	0.96
	question 28	1	7	5.26	1.00
attitude					
	question 29	1	7	5.27	1.07
	question 30	1	7	5.23	1.02
	question 31	1	7	5.35	1.00
	question 32	1	7	5.31	1.00
	question 33	2	7	5.51	0.98
adoption intention					
	question 34	1	7	5.35	1.07
	question 35	1	7	5.24	1.07
	question 36	1	7	5.31	1.03
	question 37	1	7	5.34	1.08

4.2.5 Reliability analysis

For the reason that the complexity measurement items were reverse problem, so the

complexity variable values had been transformed when we conducted the measurement model evaluation and hypotheses test.

We adopt the maximum likelihood method to test the measurement model. The first part in evaluating a research model is to present the measurement model results to examine the reliability and validity of the measures used to represent each construction. Generally, the reliability test investigates the internal consistency within a architecture. To assess the reliability the Cronbach's Alpha (α) is computed. Table 4-5 shows the results of reliability. All of the constructs' value of Cronbach's Alpha uniformly high as the Cronbach's Alpha range from 0.89 to 0.94, thus surpassing the thresholds of o.70. The factor loadings of all items range from 0.80 to 0.92, all items loading are greater than the recommend level of 0.7. All of the above evidences showed that the measurement model had acceptable reliability.

Table 4-5 the factor loading and results of reliability

Construct	Item	Loading	*p*	Cronbach's α	Composite reliability	AVE
adoption intention	INT1	0.83	0.00	0.92	0.92	0.86
	INT2	0.89	0.00			
	INT3	0.90	0.00			
	INT4	0.83	0.00			
attitude	ATT1	0.82	0.00	0.94	0.94	0.87
	ATT2	0.87	0.00			
	ATT3	0.92	0.00			
	ATT4	0.92	0.00			
	ATT5	0.80	0.00			
involvement	INV1	0.86	0.00	0.89	0.89	0.85
	INV2	0.87	0.00			
	INV3	0.83	0.00			
relative advantage	REA1	0.88	0.00	0.93	0.93	0.88
	REA2	0.91	0.00			
	REA3	0.91	0.00			
	REA4	0.82	0.00			
compatibility	COM1	0.89	0.00	0.90	0.90	0.87
	COM2	0.90	0.00			

	COM3	0.82	0.00			
	CEX1	0.84	0.00	0.89	0.90	0.87
complexity	CEX2	0.92	0.00			
	CEX3	0.83	0.00			
	TIM1	0.86	0.00	0.92	0.92	0.89
time-convenience	TIM2	0.92	0.00			
	TIM3	0.90	0.00			
	SIN1	0.91	0.00	0.92	0.92	0.89
social interaction	SIN2	0.91	0.00			
	SIN3	0.85	0.00			
	UI1	0.82	0.00	0.94	0.94	0.85
	UI2	0.87	0.00			
	UI3	0.86	0.00			
UI aesthetic	UI4	0.85	0.00			
	UI5	0.87	0.00			
	UI6	0.83	0.00			
	POR1	0.83	0.00	0.92	0.92	0.89
portability	POR2	0.91	0.00			
	POR3	0.92	0.00			

4.2.6 Validity analysis

Convergent and discriminant validity are considered in the second part. Convergent validity is supported by the following: (1) all the factor loading should be significant ($p<0.001$) (Table 4-5); (2) generally speaking, average variance extracted (AVE) meet the recommended benchmark of 0.5 and the square root of average variance extracted (AVE) surpass the recommended level of 0.7. AVE values of 0.5 and higher imply that the latent construct explains more than half of its indictors' variance (Table 4-5).

Discriminant validity is supported by the two aspects, the measurement items loading should be greater than all of its cross loading, and the square root of the AVE of each latent construct should be higher than the construct's highest correlation with any other latent construct. Table 4-6 presents the correlation matrix of cross loading between measurement items and the constructs. And the cross loading was examined, and each indicator's loadings were found to be greater than all of its cross loading. Table 4-7 shows the correlation matrix

of the structure together with the square root of the AVEs. Each mixture meets this requirement in support of discriminant validity. Thus, a high degree of discriminant validity can be presumed with respect to all the constructs in this study. Therefore, we conclude that measurement model exhibits good convergent validity and discriminant validity and reliability.

Table 4-6 Rotated factor-loading matrix

Variable	Intention	Relative ad	Compa	Time con	Social inter	UI aesthetic	Complexity	Portability
intention1	**0.829**	0.151	0.111	0.067	0.148	0.129	0.077	0.108
intention2	**0.869**	0.093	0.123	0.124	0.117	0.158	0.105	0.049
intention3	**0.866**	0.133	0.083	0.165	0.145	0.111	0.132	0.023
intention4	**0.808**	0.151	0.078	0.164	0.149	0.178	0.067	0.051
relative ad1	0.170	**0.805**	0.154	0.162	0.118	0.213	0.165	0.146
relative ad2	0.152	**0.829**	0.150	0.203	0.078	0.221	0.147	0.156
relative ad3	0.120	**0.839**	0.179	0.181	0.118	0.189	0.123	0.178
relative ad4	0.172	**0.679**	0.336	0.219	0.146	0.207	0.092	0.167
compa1	0.187	0.361	**0.705**	0.250	0.179	0.259	0.115	0.125
compa2	0.183	0.334	**0.730**	0.244	0.177	0.253	0.133	0.121
compa3	0.173	0.258	**0.666**	0.302	0.244	0.256	0.059	0.167
time con1	0.165	0.197	0.260	**0.760**	0.197	0.224	0.092	0.142
time con2	0.212	0.231	0.134	**0.812**	0.222	0.205	0.103	0.139
time con3	0.165	0.251	0.186	**0.809**	0.177	0.169	0.105	0.161
social inter1	0.184	0.101	0.138	0.182	**0.853**	0.227	0.025	0.040
social inter2	0.179	0.072	0.123	0.135	**0.867**	0.240	0.067	0.054
social inter3	0.140	0.189	0.113	0.207	**0.795**	0.251	0.121	0.093
ui aesthetic1	0.131	0.146	0.177	0.098	0.250	**0.751**	0.118	0.134
ui aesthetic2	0.140	0.206	0.162	0.146	0.227	**0.750**	0.200	0.150
ui aesthetic3	0.119	0.242	0.135	0.172	0.203	**0.740**	0.175	0.174
ui aesthetic4	0.132	0.238	0.101	0.157	0.189	**0.781**	0.135	0.108
ui aesthetic5	0.175	0.143	0.137	0.147	0.162	**0.813**	0.139	0.143
ui aesthetic6	0.171	0.145	0.140	0.173	0.170	**0.767**	0.133	0.134
complexity1	0.144	0.095	0.063	0.054	0.066	0.185	**0.852**	0.158

complexity2	0.111	0.147	0.042	0.091	0.104	0.173	**0.866**	0.206
complexity3	0.090	0.180	0.115	0.119	0.023	0.160	**0.804**	0.256
portability1	0.038	0.188	0.102	0.096	0.023	0.123	0.191	**0.847**
portability2	0.070	0.117	0.101	0.117	0.087	0.155	0.175	**0.882**
portability3	0.073	0.169	0.053	0.147	0.060	0.182	0.207	**0.855**

4.2.7 Common Method Variance

Common Method Variance (CMV) is another issue to be considered. When all measurement indicators in a questionnaire are filled in by the same respondent, CMV can appear. In order to test Common Method Variance, Harman's single-factor test is employed to assess the potential for CMV. The test results showed that the explanation rate of the first factor was 44.8%, which did not exceed the upper limit of 50%. More than one factor was extracted by factor analysis, and there was no single dominant factor explaining most of the variance, so there was no significant CMV in our data.

Table 4-7 Correlations of the constructs and the square root of AVE

	1	2	3	4	5	6	7	8	9	10
1.intention	0.927									
2.attitude	0.627	0.933								
3.involvement	0.658	0.901	0.922							
4.relative advantage	0.480	0.653	0.833	0.938						
5.compatibility	0.542	0.700	0.888	0.777	0.933					
6.time comvenience	0.513	0.599	0.781	0.660	0.742	0.943				
7.social interaction	0.468	0.490	0.655	0.472	0.598	0.576	0.943			
8.ui aesthetic	0.488	0.638	0.790	0.637	0.705	0.613	0.609	0.922		
9.complexity	0.365	0.444	0.556	0.476	0.458	0.414	0.325	0.506	0.933	
10.portability	0.277	0.376	0.524	0.491	0.473	0.456	0.299	0.476	0.515	0.943

4.3 Summary

This chapter is designed to collect the opinions of consumers on travelling application through the surveys, the aiming groups including the most interested consumers and members

who used the Internet or travel applications to search for travel information in online travel communities. After the questionnaire was collected, the author conducted statistical analysis on the valid questionnaire (sample feature analysis, user experience frequency analysis, app function importance frequency analysis, confirmatory factor analysis, newness analysis, validity analysis), and obtained the attitude of user's preliminary description and intention to use the travel app.

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Chapter 5: Data Analysis and Results

5.1 Structural equation modeling

Structural equation modeling (SEM) has become a quasi-standard in marketing research (Bagozzi, 1994; Hulland, 1999; Babin et al., 2008). An SEM with latent variables is composed of three sets of simultaneous equations, estimated concurrently: (1) a measurement model (or sub model) for the endogenous (dependent) variables, (2) a measurement (sub)model for the exogenous (independent) variables, and (3) a structural (sub)model, all of which are estimated simultaneously. This full model is seldom applied in practice. SEM with a measurement model and a structural model is known as SEM with latent variables. Alternatively, one can have structural model without any measurement models (SEM with observed variables), or a measurement model alone (confirmatory factor analysis). In general, an SEM can have any number of endogenous and exogenous variables.

As it allows authors to test complete theories and concepts (Rigdon, 1998). Researchers especially appreciate SEM's ability to assess latent variables at the observation level (outer or measurement model) and test relationships between latent variables on the theoretical level (inner or structural model) (Bollen, 1989).When applying SEM, researchers must consider two types of methods: covariance-based techniques and variance-based partial least squares (PLS-SEM; Wold, 1982, 1985; Lohmoller, 1989). Although both methods share the same roots (Joreskog & Wold, 1982), previous marketing research has focused primarily on CB-SEM (e.g., Bagozzi, 1994; Baumgartner & Homburg, 1996; Steenkamp & Baumgartner, 2000). For this study we use the AMOS software.

5.1.1 Covariance-Based Structural Equation Modeling

Structural equation modeling (SEM) is firstly applied by Bollen (1989) and Joreskog in social sciences which is the academic advisor for Herman wolds (1973, 1975), who established LISREL CB-SEM software package as a second-generation multivariate data analysis method. CB-SEM is often used in marketing research because it can test theoretically supported linear and additive causal models. Bollen (1989) proposed that Covariance-Based Structural Equation Modelling was founded on three primary analytical developments: (1)

path analysis, (2) latent variable modeling, and (3) general covariance estimation methods.

Path analysis developed almost exclusively by geneticist Sewall Wright (1923, 1934), introducing three concepts: (1) the first covariance structure equations, (2) the path diagram or causal graph, and (3) decomposition of total effects between any two variables into total, direct and indirect effects. Shipley (2000) describes how and why path analysis was largely ignored in biology, psychology and sociology until the 1960s. Prior to the 1960s, econometricians also pursued the testing of alternative causal relationships through the use of over identifying constraints on partial correlations (Haavelmo, 1943), but for many years economics was also uninformed about the solutions inherent in path analysis (Shipley, 2000). During the 1960s and early 1970s, sociologists in particular led by Blalock (1961), Boudon (1965), and Duncan (1966) discovered the potential of path analysis and related partial correlation methods. Path analysis was then superseded by CB-SEM, in which general covariance structure equations specified how alternative chains of effects between variables generate correlation patterns. CB-SEM still relies on path diagrams to express what the modeler postulates about the causal relationships that generate the correlations among variables.

The development of models in which inferences about latent variables could be derived from covariances among observed variables (indicators) that was pursued in sociology during the 1960s. These latent variable models contributed significantly to the development of CB-SEM by demonstrating how measurement errors (errors-in-variables) can be separated from specification errors (errors-in-equations). A seminal contribution was that of Blalock (1963).

CB-SEM has been widely applied in the field of social science during the past several decades and is still the preferred data analysis method today for confirming or rejecting theories through testing of hypothesis, particularly when the sample size is large, the data is normally distributed, and most importantly, the model is correctly specified. That is, the appropriate variables are chosen and linked together in the process of converting a theory into a structural equation model (Reinartz, Haenlein, & Henseler, 2009; Hwang et al., 2010; Hair, Ringle, & Smarted, 2011). However, many industry practitioners and researchers have noted that, in reality, it is often difficult to find a data set that meets these requirements. Furthermore, the research objective may be exploratory, in which we know little about the relationships that exist among the variables. In this case, marketers can consider PLS.

5.1.2 Variance-based partial least squares

Wold (1975) originally developed PLS-SEM under the name NIPALS (nonlinear iterative partial least squares), and Lohmoller (1989) extended it. PLS-SEM was developed as an alternative to CB-SEM that would emphasize prediction while simultaneously relaxing the demands on data and specification of relationships (e.g., Joreskog & Wold, 1982; Dijkstra, 2010). CB-SEM estimates model parameters so that the discrepancy between the estimated and sample covariance matrices is minimized. In contrast, PLS-SEM maximizes the explained variance of the endogenous latent variables by estimating partial model relationships in an iterative sequence of ordinary least squares (OLS) regressions. An important characteristic of PLS-SEM is that it estimates latent variable scores as exact linear combinations of their associated manifest variables (Fornell & Bookstein 1982) and treats them as perfect substitutes for the manifest variables. The scores thus capture the variance that is useful for explaining the endogenous latent variable(s). Estimating models via a series of OLS regressions implies that PLSSEM relaxes the assumption of multivariate normality needed for maximum likelihood–based SEM estimations (Fornell & Bookstein, 1982; Wold, 1982; Lohmoller, 1989; Hwang et al., 2010; for a discussion, see Dijkstra, 2010). In this context, Lohmoller (1989, p. 64) notes that "it is not the concepts, the models nor the estimation techniques which are 'soft,' only the distributional assumptions." Furthermore, since PLS-SEM is based on a series of OLS regressions, it has minimum demands regarding sample size and generally achieves high levels of statistical power (Reinartz et al., 2009). Conversely, CB-SEM involves constraints regarding the number of observations and small sample sizes, often leading to biased test statistics (e.g., Hu & Bentler, 1995), inadmissible solutions (e.g., Heywood cases), and identification problems—especially in complex model set-ups (e.g., Chin & Newsted, 1999). Thus, PLS-SEM is suitable for applications where strong assumptions cannot be fully met and is often referred to as a distribution-free "soft modeling approach."

Consideration of formative and reflective outer model modes is an important issue for SEM (e.g., Diamantopoulos & Winklhofer, 2001; Jarvis et al., 2003). While CB-SEM is applicable for formative outer model specifications only under certain conditions (e.g., Bollen & Davies, 2009; Diamantopoulos and Riefler, 2011), PLS-SEM can almost unrestrictedly handle both reflective and formative measures (e.g., Chin, 1998). Furthermore, PLS-SEM is not constrained by identification concerns, even if models become complex, a situation that typically restricts CB-SEM usage (Hair et al., 2011). Thus, PLS-SEM becomes a good

alternative to CB-SEM when the following situations are encountered (Bacon, 1999; Hwang et al., 2010; Wong, 2010): Sample size is small, applications have little available theory, predictive accuracy is paramount and correct model specification cannot be ensured.

These advantages must be considered, however, in light of several disadvantages. For example, the absence of a global optimization criterion implies a lack of measures for overall model fit. This issue limits PLS-SEM's usefulness for theory testing and for comparing alternative model structures. As PLS-SEM also does not impose any distributional assumptions, researchers cannot rely on the classic inferential framework and thus have to revert to prediction-oriented, non-parametric evaluation criteria as well as resampling procedures to evaluate the partial model structures' adequacy. A further concern is that PLS-SEM parameter estimates are not optimal regarding bias and consistency (Reinartz et al., 2009) a characteristic frequently referred to as PLS-SEM bias. This bias is more severe in very complex models, since least squares estimators do not control the contingent and chained effects of one part of the model's errors to another. Only when the number of observations and the number of indicators per latent variable increase to infinity do the latent variable scores (and therefore the parameter estimates) approach the true values. Thus, estimation are asymptotically correct in the qualified sense of consistency at large (Joreskog & Wold, 1982; Wold, 1982; Lohmoller, 1989).

5.2 Results of hypothesis testing

5.2.1 Demographics

Table 5-1 presents the profile of the sample respondents. Of these 803 respondents, 526 were females (65.50%) and 277 were males (34.50%), and the females were approximately twice than that of males. The survey indicated that the females prefer traveling than the males. The respondents' ages ranged from 16 to 70 (mean = 29.35; SD = 9.27). With regard to the education, about 80% of the respondents held training school degree (35.86%) and undergraduate degree (45.58%) or above. Nearly two-thirds respondents' tourism expenditure ranged from 1000 to 5000, 1000 to 2000 (29.63%) 2000 to 4000 (33%) and 4000 to 5000 (11.08%). Only a small percentage of the respondents chose traditional way to travel,63.64% of the respondents travel along with their friends, 15.94% of the respondents travel alone and only 9.46% of the respondents chose a package tour.

Typically, the respondents were familiar with travel app, such as Ctrip and Qunaer, the majority bought tourism products，such as purchasing air ticket booking hotel room and buying ticket of the scenic area. A large portion of the respondents used travel app, 16.29 % of the respondents always used travel app, 26.12% of the respondents often used travel app, 29.6% of the respondents made use of travel app occasionally, and only a small part used travel app rarely (23.88 %).

Table 5-1 Sample characteristics

Variable	Categories	Frequency	Percept
age	average	29(mean)	
system			
	andriod	429	53.42
	ios	359	44.70
	other	15	1.87
gender			
	male	277	34.50
	female	526	65.50
education			
	junior high school	4	0.50
	middle high school	6	0.75
	training school	288	35.87
	undergraduate	366	45.58
	master	38	4.70
	phd	3	0.37
	others	98	12.20
budget			
	<1000	75	9.33
	1000—2000	238	29.63
	2000—4000	265	33.00
	4000—5000	89	11.08
	5000—6000	43	5.35
	6000—8000	43	5.35
	8000—10000	37	4.60

>10000	13	1.62
travel means		
Along with friends	511	63.64
alone	128	15.94
Package tour	76	9.46
Along with other unfamiliar travelers	58	7.22
others	30	3.74
travel frequency		
never	0	0.00
rarely	116	14.46
occasionally	398	49.63
often	258	32.17
always	30	3.74
travel app view		
never	33	4.10
rarely	192	23.88
occasionally	238	29.60
often	210	26.12
always	131	16.29
Travel app buy		
never	92	11.43
rarely	173	21.49
occasionally	261	32.42
often	147	18.26
always	132	16.40
App query before traveling		
never	21	2.61
rarely	93	11.57
occasionally	178	22.14
often	320	39.80
always	192	23.88
App view in traveling		
never	44	5.48

rarely	131	16.31
occasionally	240	29.89
often	279	34.74
always	109	13.57

The second part of the questionnaire is construct measurement. We conducted descriptive analysis by using the 803 effective questionnaires. Table 5-2 shows the results of descriptive analysis. The minimal value of all the items were 1 or 2, and the maximum value of all the items were 6 or7.

Table 5-2 Descriptive analysis of measurement items

Variable	Obs	Mean	Std. Dev.	Min	Max
intention1	803	5.35	1.08	1	7
intention2	803	5.25	1.07	1	7
intention3	803	5.31	1.03	1	7
intention4	803	5.34	1.07	1	7
attitude1	803	5.25	1.09	1	7
attitude2	803	5.23	1.02	1	7
attitude3	803	5.33	1.01	1	7
attitude4	803	5.31	1.01	1	7
attitude5	803	5.51	0.98	2	7
involvement1	803	5.00	1.10	1	7
involvement2	803	5.28	0.99	1	7
involvement3	803	5.24	1.02	1	7
relative advantage1	803	5.55	0.99	1	7
relative advantage2	803	5.61	0.91	1	7
relative advantage3	803	5.60	0.92	1	7
relative advantage4	803	5.52	0.98	2	7
compatibility1	803	5.37	1.05	1	7
compatibility2	803	5.34	1.02	2	7
compatibility3	803	5.27	1.02	1	7
complexity1	803	5.17	1.05	1	7
complexity2	803	5.28	0.98	1	7
complexity3	803	5.39	0.99	1	7

time comvenience1	803	5.41	1.02	1	7
time comvenience2	803	5.47	1.00	2	7
time comvenience3	803	5.51	1.00	1	7
social interaction1	803	5.03	1.29	1	7
social interaction2	803	5.08	1.24	1	7
social interaction3	803	5.22	1.18	1	7
ui aesthetic1	803	5.28	1.08	1	7
ui aesthetic2	803	5.31	1.08	1	7
ui aesthetic3	803	5.38	1.04	1	7
ui aesthetic4	803	5.35	1.08	1	7
ui aesthetic5	803	5.34	1.07	1	7
ui aesthetic6	803	5.39	1.08	1	7
portability1	803	5.47	1.01	1	7
portability2	803	5.43	0.96	1	7
portability3	803	5.44	0.97	2	7

5.2.2 Results of hypothesis testing

The path of the structural model is assessed. Each path (Fig. 1) corresponds to a hypothesis. Each hypothesis has been tested by check-ing the sign, size, and statistical significance of the path coefficients between each latent variable and the dependent variable. The higher the path coefficient is, the stronger the effect of a predictor latent variable on the dependent variable will be. The result of this structure model is shown in Table 5-3.

Table 5-3 Results of structural model (Overall)

	Coef.	z	P>|z|	[95% Conf.	Interval]
Relative advantage->Attitude	-0.302	-3.430	0.001	-0.475	-0.129
Relative advantage->Involvement	1.102	12.050	0.000	0.923	1.281
Compatibility->Attitude	-0.350	-3.470	0.001	-0.548	-0.153
Compatibility->Involvement	1.269	12.770	0.000	1.074	1.464
Complexity ->Attitude	-0.160	-1.690	0.091	-0.347	0.026
Complexity ->Involvement	0.693	6.930	0.000	0.497	0.889
Time convenience->Attitude	-0.335	-2.910	0.004	-0.561	-0.110

Time convenience->Involvement	1.086	9.370	0.000	0.859	1.313
Social interaction->Attitude	-0.433	-2.990	0.003	-0.718	-0.149
Social interaction->Involvement	1.263	9.170	0.000	0.993	1.533
UI aesthetic ->Attitude	-0.210	-1.700	0.088	-0.451	0.031
UI aesthetic ->Involvement	0.991	7.720	0.000	0.740	1.243
Portability ->Attitude	-0.306	-3.290	0.001	-0.488	-0.123
Portability ->Involvement	0.779	8.170	0.000	0.592	0.966
Attitude ->Intention	0.589	13.540	0.000	0.503	0.674
Involvement->Attitude	0.727	17.430	0.000	0.645	0.808
Involvement->Intention	0.150	5.640	0.000	0.098	0.202

H1a is not supported (path coefficient is -0.302 at $p \leq 0.001$), the sign of the path is opposite to our hypothesis. That means the effect of relative advantage on users' attitude is negative. On the other hand, H1b is supported (path coefficient is 1.102 at $p \leq 0.001$), demonstrating that relative advantage has a positive effect on involvement. Similar to relative advantage, the effect of compatibility (path coefficient is -0.350 at $p \leq 0.001$) and portability (path coefficient is -0.306 at $p \leq 0.001$) on attitude is opposite to our hypothesis, the sign shows the negative effect on attitude. Therefore, H2a and H7a are not supported. Meanwhile, the path from compatibility (path coefficient is 1.269 at $p \leq 0.001$) and portability (path coefficient is 0.779 at $p \leq 0.001$) to involvement is significant, so H2b and H7b are verified. H3a and H3b predict a positive effect of complexity to attitude and involvement. The path from complexity to involvement is supported (path coefficient is 0.693 at $p \leq 0.001$). However, the path from complexity to attitude is not supported ($p=0.091 > 0.001$). H4a and H4b postulate a positive effect of time convenience to attitude and involvement. The path from time convenience to involvement is supported (path coefficient is 1.086 at $p \leq 0.001$), and the path from time convenience to attitude is not supported ($p=0.004 > 0.001$). The same goes to the effect of social interaction and UI aesthetic on attitude and involvement. The path from social interaction to attitude ($p=0.003 > 0.001$) and the path from UI aesthetic to attitude ($p=0.088 > 0.001$) are not supported. And the positive effect of social interaction (path coefficient is 1.263 at $p \leq 0.001$) and UI aesthetic (path coefficient is 0.991 at $p \leq 0.001$) on involvement is significant, as a result, H5b and H6b are supported, actually H5a and H6a are not supported. H8 (path coefficient is 0.727 at $p \leq 0.001$) and H9 (path coefficient is 0.150 at $p \leq 0.001$) are

supported, hence, involvement has a positive effect on attitude and intention. The path from attitude to intention conforms to our expected (path coefficient is 0.589 at p≤0.001), then, H10 is supported. The results are summarized in Figure 5-1.

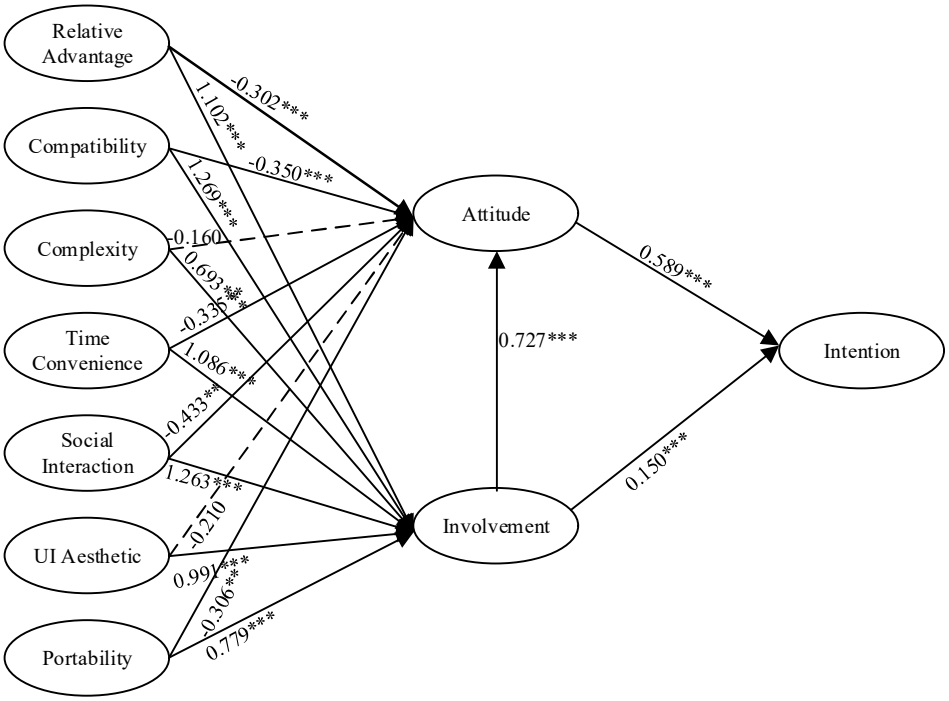

Figure 5-1 The model results

5.2.3 Test of mediation: involvement

We tested the mediation effect by using Baron and Kenny's method. Formula1–3 are used to verify the mediation effect on the relationship between independent variable (IV) and dependent variable (DV). to test the mediation effect of involvement, we first need to test the significance of coefficient c_1 in Formula 1. If c1 is significant, then we need to further test the significance of coefficient a_1 and b_1 in Formula 2 and 3. If a_1 and b_1 are significant, then we must testify the mediating effect according to c_2. If at least one of a_1 and b_1 is not significant, then we must verify the mediating effect through the Sobel test. According to this approach, mediation exists when three things happen: (1) the independent variable (IV) has a significant effect on the dependent variable (DV) when the proposed mediator (M) is not included in the model, (2) IV has a significant effect on M, and (3) when M is included in the model, it has a significant effect on DV, while the relationship IV ➔ DV is either significant (partial mediation) or insignificant (full mediation).

The verification of mediation effect of involvement is illustrated in Table 5-4, Table 5-5 and Table 5-6. Table 5-4 show the test for the effect of independent variable (IV) on the

dependent variable (DV) when the proposed mediator (M) is not included in the mode.

For the mediation effect of involvement on the relationship between relative advantage (IV) and intention (DV), according to Formula1 and Table 5-4, coefficients $c_{1\text{-relative advantage}}$ is significant (coefficient is 0.419 at $p \leq 0.001$). Table 5-5 show the path from IV ➔ M, for the path from relative advantage (IV) to involvement (M), coefficient $a_{1\text{-relative advantage}}$ is 0.658 at $p \leq 0.001$, in other words, relative advantage (IV) have significant effect on involvement(M). Table 5-6 illustrate model 3, in this test, $c_{2\text{-relative advantage}}$ (coefficient is 0.660 at $p \leq 0.001$) and $b_{1\text{-relative advantage}}$ (coefficient is 0.559 at $p \leq 0.001$) is significant. To sum up, involvement has partial mediation effect on the relationship between relative advantage and intention.

Table 5-4 Test for IV ➔ DV without involvement

DV: intention	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage➔Intention	0.419	10.680	0.000	0.342	0.495
Compatibility➔Intention	0.517	11.100	0.000	0.426	0.609
Complexity➔Intention	0.333	8.220	0.000	0.254	0.412
Time convenience➔Intention	0.474	11.550	0.000	0.393	0.554
Social interaction➔Intention	0.588	11.330	0.000	0.486	0.689
UI aesthetic➔Intention	0.450	10.820	0.000	0.369	0.532
Portability➔Intention	0.230	6.080	0.000	0.156	0.305

Table 5-5 Test for IV ➔ involvement

M: Involvement	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage➔Involvement	0.658	14.980	0.000	0.572	0.744
Compatibility➔Involvement	0.696	15.730	0.000	0.609	0.783
Complexity➔Involvement	0.384	9.520	0.000	0.305	0.464
Time convenience➔Involvement	0.540	12.620	0.000	0.456	0.624

Social interaction➔Involvement	0.654	12.790	0.000	0.554	0.754
UI aesthetic➔Involvement	0.566	13.150	0.000	0.481	0.650
Portability➔Involvement	0.310	7.480	0.000	0.229	0.391

Table 5-6 Test for IV ➔ DV with involvement

	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage➔Involvement	0.660	15.540	0.000	0.577	0.743
Involvement➔Intention	0.559	13.220	0.000	0.476	0.642
Compatibility➔Involvement	0.707	15.970	0.000	0.620	0.794
Involvement➔Intention	0.579	13.800	0.000	0.496	0.661
Complexity➔Involvement	0.392	9.990	0.000	0.315	0.469
Involvement➔Intention	0.567	12.810	0.000	0.481	0.654
Time convenience➔Involvement	0.553	13.180	0.000	0.471	0.635
Involvement➔Intention	0.579	14.110	0.000	0.498	0.659
Social interaction➔Involvement	0.672	13.270	0.000	0.572	0.771
Involvement➔Intention	0.589	13.960	0.000	0.506	0.672
UI aesthetic➔Involvement	0.577	13.520	0.000	0.493	0.660
Involvement➔Intention	0.582	13.850	0.000	0.499	0.664
Portability➔Involvement	0.313	7.690	0.000	0.233	0.392
Involvement➔Intention	0.564	12.880	0.000	0.478	0.650

5.2.4 Test of mediation: Attitude

The verification of mediation effect of attitude is shown in Table 5-7, Table 5-8 and Table 5-9. For the mediation effect of attitude on the relationship between relative advantage (IV) and intention (DV), according to Table 5-5, coefficient $a_{1\text{-relative advantage}}$ is 0.658 at $p \leqslant 0.001$, and relative advantage has positive effect on intention when attitude is not included in structure. Table 5-8 show the path from IV to M, for the path from relative advantage (IV) to attitude (M), coefficients $c_{1\text{-relative advantage}}$ is significant (coefficient is 0.597 at $p \leqslant 0.001$), so, relative advantage (IV) has significant effect on attitude (M). Table 5-9 illustrate

model 3, in this test, $c_{2\text{-relative advantage}}$ (coefficient is 0.660 at $p \leqslant 0.001$) and $b_{1\text{-relative advantage}}$ (coefficient is 0.559 at $p \leqslant 0.001$) is significant. To sum up, attitude exerts partial mediation effect on the relationship between relative advantage and intention (Table 5-7). In the same way, the mediation effect of attitude on the relationship between other dependent variable and intention is shown in Table 5-7.

Table 5-7 Test for IV ➔ DV without attention

	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage➔Intention	0.419	10.680	0.000	0.342	0.495
Compatibility➔Intention	0.517	11.100	0.000	0.426	0.609
Complexity➔Intention	0.333	8.220	0.000	0.254	0.412
Time convenience➔Intention	0.474	11.550	0.000	0.393	0.554
Social interaction➔Intention	0.588	11.330	0.000	0.486	0.689
UI aesthetic➔Intention	0.450	10.820	0.000	0.369	0.532
Portability➔Intention	0.230	6.080	0.000	0.156	0.305
Involvement➔Intention	0.562	12.830	0.000	0.476	0.648

Table 5-8 Test for IV ➔ attention

	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage➔Attitude	0.597	14.050	0.000	0.514	0.681
Compatibility➔Attitude	0.690	16.200	0.000	0.606	0.773
Complexity➔Attitude	0.410	8.870	0.000	0.319	0.500
Time convenience➔Attitude	0.556	13.250	0.000	0.473	0.638
Social interaction➔Attitude	0.596	9.870	0.000	0.478	0.714
UI aesthetic➔Attitude	0.606	13.650	0.000	0.519	0.693
Portability➔Attitude	0.337	8.070	0.000	0.255	0.419
Involvement➔Attitude	0.809	19.700	0.000	0.728	0.889

Table 5-9 Test for IV ➔ DV with attention

	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage➔Attitude	0.598	14.680	0.000	0.518	0.678
Attitude➔Intention	0.593	12.840	0.000	0.503	0.684
Compatibility➔Attitude	0.692	16.580	0.000	0.610	0.774
Attitude➔Intention	0.595	13.130	0.000	0.506	0.684
Complexity➔Attitude	0.412	9.040	0.000	0.323	0.501
Attitude➔Intention	0.589	12.970	0.000	0.500	0.679
Time convenience➔Attitude	0.560	13.820	0.000	0.480	0.639
Attitude➔Intention	0.594	13.100	0.000	0.505	0.682
Social interaction➔Attitude	0.604	10.180	0.000	0.488	0.720
Attitude➔Intention	0.594	13.620	0.000	0.508	0.679
UI aesthetic➔Attitude	0.608	13.890	0.000	0.522	0.693
Attitude➔Intention	0.593	13.300	0.000	0.506	0.680
Portability➔Attitude	0.243	6.580	0.000	0.171	0.316
Attitude➔Intention	0.590	13.100	0.000	0.502	0.678
Involvement➔Attitude	0.810	19.940	0.000	0.730	0.889
Attitude➔Intention	0.596	13.260	0.000	0.508	0.684

5.3 The effect of demographic variables

5.3.1 Gender differences

In this part, gender is modeled as a moderator. To compare with the research model across the two gender sub-samples (i.e., female vs. male), male and female are separated to verify the structure model.

Measurement model was evaluated in terms of reliability, convergent validity and discriminant validity of all structures for both the male (N = 277) and female (N = 526) sub-samples, respectively (Table 5-10).

Results of structural model with male and female are shown in Table 5-11, the analysis reveals that male and female are quite different. For female, all paths of independent variable to attitude are not significant ($p > 0.001$). However, for male, relative advantage and compatibility have negative influence on attitude.

5.3.2 Age differences

In this section, we tested the moderate effect of age. Respondents are separated into two part by the median age. We verify the research model across the two age sub-samples, age sub-sample1 include respondents who are more than 27 years old, and age sub-sample2 includes respondents who are 27 years old or below .

Measurement model was evaluated in terms of reliability, convergent validity and discriminant validity of all the constructs for both age sub-sample1 (N = 367) and age sub-sample2 (N = 436) sub-samples, respectively (Table 5-12).

Results of structural model with age sub-sample are shown in Table 5-13. The only difference between this two age sub-samples is the path from time convenience to attitude. For age sub-sample1, time convenience has a negative influence to attitude (coefficient is -0.513 at $p \leqslant 0.001$), but for age sub-sample2, the path from time convenience to attitude is not significant ($p=0.312 \geqslant 0.001$).

5.3.3 Profession differences

To verify the moderate effect of respondent's profession, this thesis divides respondents by their profession type. We put the respondents into three classes according to China Vocation Classification Catalogue. Workers in Class I are fully engaged in mental Labor (i.e., management, civil servant, teacher, designer, financial, lawyer, doctor, nurse, engineer, laboratory.). In addition to do mental work, workers in Class II also do a small amount of manual labor (i.e., tour guide, workshop director, barber, coach, toll collector, individual industrial and commercial households, actor, student.). We put other professions that cannot be classified clearly into Class III (i.e., farming and animal husbandry, navigator, mechanical engineer.).

Measurement model was evaluated in terms of reliability, convergent validity and discriminant validity of all the constructs, for both Class I (N = 323) as well as Class II (N =

356) and Class III (N = 124) sub-samples, respectively. (Table 5-14, Table 5-15, Table 5-16).

Table 5-17 shows the results of structural model with Class I, except for the negative influence of relative advantage, compatibility and portability on attitude become significant, and the structure model of Class I is roughly same with the structure model of Class II (Table 5-18).

5.3.4 Education differences

Education is an important demographic variable which influences users' behavior and psychology. In this part, education is modeled as a moderator. We test reliability, convergent validity and discriminant validity of all the constructs, for both beneath the bachelor-degree (N = 396) as well as bachelor degree or above (N = 407) sub-samples, respectively. (Table 5-17).

In Table 5-18, the research models of the two education sub-samples (i.e., beneath the bachelor-degree vs. bachelor degree or above) were compared. Especially, compared with low education degree, the attitude of the highly-educated user significantly is affected by relative advantage (coefficient is -0.549 at $p \leqslant 0.001$) and compatibility (coefficient is -0.549 at $p \leqslant 0.001$).

5.3.5 Phone system differences

In 2016, a research (Kantar Worldpanel ComTech) shown that the proportion of IOS and Android system account for more than 90% in the smart phone marke. Therefore, in this part, we explored the moderate effect of respondent's phone system (i.e., IOS vs. Android).

The reliability, convergent validity and discriminant validity of all the constructs is shown in Table 5-19. And the results of structural model with IOS and Android are shown in Table 5-20, and especially, for Android users, time convenience (coefficient is -0.542 at $p \leqslant 0.001$), social interaction (coefficient is -0.665 at $p \leqslant 0.001$) and portability(coefficient is -0.548 at $p \leqslant 0.001$) have significant negative influence on attitude. However, for IOS users, paths from time convenience (coefficient is -0.220 at $p=0.151 \geqslant 0.001$), social interaction (coefficient is -0.157 at $p=0.442 \geqslant 0.001$) and portability (coefficient is -0.108 at $p=0.386 \geqslant 0.001$) to attitude are not significant.

Table 5-10 Construct reliability and validity for sub-samples

Male (N = 277), Female (N = 526)

Male (N = 264) Female (N = 526)	Ave	CR	α	1	2	3	4	5	6
1.intention	0.73/0.87	0.92/0.92	0.91/0.92	0.86/0.87					
2.attitude	0.75/0.87	0.94/0.94	0.93/0.94	0.67/0.6	0.86/0.87				
3.involvement	0.76/0.84	0.90/0.88	0.90/0.87	0.73/0.53	0.91/0.80	0.87/0.84			
4.relative advantage	0.76/0.88	0.93/0.94	0.92/0.93	0.56/0.42	0.59/0.69	0.81/0.73	0.87/0.88		
5.compatibility	0.74/0.87	0.90/0.91	0.89/0.90	0.57/0.52	0.58/0.76	0.83/0.77	0.77/0.80	0.86/0.87	
6.time convenience	0.76/0.91	0.90/0.93	0.90/0.93	0.56/0.50	0.56/0.62	0.77/0.63	0.68/0.65	0.77/0.75	0.87/0.9
7.social interaction	0.78/0.89	0.92/0.92	0.92/0.92	0.51/0.45	0.47/0.49	0.66/0.60	0.50/0.43	0.68/0.54	0.65/0.5
8.ui aesthetic	0.71/0.85	0.94/0.94	0.94/0.94	0.53/0.46	0.64/0.64	0.81/0.61	0.68/0.61	0.74/0.68	0.66/0.5
9.complexity	0.76/0.86	0.91/0.90	0.90/0.90	0.42/0.34	0.45/0.44	0.55/0.45	0.47/0.48	0.45/0.44	0.45/0.3
10.portability	0.78/0.89	0.91/0.92	0.91/0.92	0.25/0.28	0.29/0.43	0.42/0.41	0.41/0.55	0.37/0.52	0.40/0.4

Table 5-11 Rotated Results of structural model

Male (N = 277), female (N = 526)

Male (N = 264)/ Female (N = 526)	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage ➔Attitude	-0.557/-0.098	-4.550/-1.060	0.000/0.287	-0.797/0.278	-0.317/0.082
Relative advantage ➔Involvement	1.175/0.980	10.160/9.400	0.000/0.000	0.948/0.775	1.402/1.184
Compatibility ➔Attitude	-0.757/-0.045	-4.980/-0.460	0.000/0.648	-1.055/0.239	-0.459/0.148
Compatibility ➔Involvement	1.383/1.095	9.760/10.400	0.000/0.000	1.105/0.889	1.660/1.302
Complexity ➔Attitude	-0.171/-0.128	-1.150/-1.200	0.252/0.232	-0.463/0.338	0.121/0.082
Complexity ➔Involvement	0.628/0.703	4.430/5.960	0.000/0.000	0.350/0.472	0.906/0.934
Time convenience ➔Attitude	-0.598/-0.150	-3.320/-1.300	0.001/0.195	-0.951/-0.376	-0.244/0.077
Time convenience ➔Involvement	1.206/0.951	6.950/7.490	0.000/0.000	0.866/0.702	1.545/1.200
Social interaction ➔Attitude	-0.614/-0.303	-2.800/-1.880	0.005/0.061	-1.045/-0.619	-0.184/0.013
Social interaction ➔Involvement	1.238/1.225	6.240/7.620	0.000/0.000	0.849/0.910	1.627/1.541
UI aesthetic ➔Attitude	-0.370/-0.056	-1.740/-0.520	0.083/0.603	-0.787/-0.265	0.048/0.154
UI aesthetic ➔Involvement	1.022/0.880	5.150/7.330	0.000/0.000	0.633/0.645	1.411/1.116
Portability ➔Attitude	-0.349/-0.192	-2.660/-1.820	0.008/0.069	-0.605/0.398	-0.092/0.015
Portability ➔Involvement	0.641/0.761	5.040/6.720	0.000/0.000	0.391/0.539	0.890/0.983
Attitude ➔Intention	0.693/0.530	11.000/10.270	0.000/0.000	0.570/0.429	0.817/0.631
Involvement ➔Attitude	0.783/0.685	13.440/13.290	0.000/0.000	0.669/0.584	0.897/0.786
Involvement ➔Intention	0.248/0.114	5.440/3.660	0.000/0.000	0.159/0.053	0.338/0.175

Table 5-12 Construct reliability and validity for sub-samples

More than 27 (N = 367), Less than 27 (N = 436)

Sample1/Sample2	Ave	CR	α	1	2	3	4	5	6	7	8	9	10
1.intention	0.76/0.73	0.93/0.91	0.93/0.91	0.87/0.85									
2.attitude	0.76/0.74	0.94/0.93	0.94/0.93	0.68/0.63	0.87/0.86								
3.involvement	0.73/0.72	0.89/0.89	0.88/0.89	0.58/0.56	0.81/0.82	0.85/0.85							
4.relative advantage	0.80/0.75	0.94/0.92	0.94/0.92	0.43/0.51	0.65/0.67	0.73/0.77	0.89/0.87						
5.compatibility	0.78/0.74	0.91/0.90	0.91/0.89	0.52/0.57	0.72/0.71	0.75/0.80	0.78/0.83	0.88/0.86					
6.time convenience	0.82/0.78	0.93/0.91	0.93/0.91	0.51/0.52	0.62/0.58	0.60/0.67	0.66/0.66	0.74/0.79	0.91/0.88				
7.social interaction	0.75/0.75	0.94/0.90	0.94/0.90	0.46/0.51	0.46/0.51	0.58/0.58	0.38/0.51	0.54/0.65	0.52/0.66	0.92/0.86			
8.ui aesthetic	0.74/0.71	0.94/0.94	0.94/0.94	0.48/0.51	0.62/0.66	0.65/0.63	0.60/0.66	0.68/0.73	0.56/0.66	0.64/0.63	0.86/0.84		
9.complexity	0.77/0.73	0.91/0.89	0.91/0.89	0.36/0.40	0.39/0.53	0.43/0.49	0.43/0.55	0.40/0.50	0.39/0.44	0.32/0.31	0.50/0.57	0.88/0.85	
10.portability	0.84/0.74	0.94/0.90	0.94/0.89	0.29/0.27	0.40/0.39	0.41/0.37	0.53/0.50	0.51/0.44	0.50/0.44	0.32/0.25	0.52/0.46	0.55/0.60	0.9/0.86

Table 5-13 Results of structural model

More than 27 (N = 367), More than 27 (N = 436)

Sample1/Sample2	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage➔Attitude	-0.319/0.212	-2.710/-1.920	0.007/0.055	-0.550/-0.430	-0.088/0.005
Relative advantage➔Involvement	1.192/0.938	9.570/8.700	0.000/0.000	0.948/0.727	1.436/1.150
Compatibility➔Attitude	-0.419/-0.214	-3.100/-1.660	0.002/0.097	-0.685/-0.468	-0.154/0.039
Compatibility➔Involvement	1.420/1.064	9.730/9.030	0.000/0.000	1.134/0.833	1.706/1.296
Complexity➔Attitude	0.000/-0.294	0.000/-2.550	0.998/0.011	-0.252/-0.520	0.252/-0.068
Complexity➔Involvement	0.599/0.760	4.350/6.470	0.000/0.000	0.329/0.530	0.869/0.991
Time convenience➔Attitude	-0.513/-0.133	-3.220/-1.010	0.001/0.312	-0.826/-0.390	-0.201/0.124
Time convenience➔Involvement	1.329/0.820	7.930/6.360	0.000/0.000	1.001/0.568	1.658/1.073
Social interaction➔Attitude	-0.460/-0.440	-2.400/-2.250	0.017/0.024	-0.836/-0.823	-0.084/-0.057
Social interaction➔Involvement	1.353/1.195	6.650/7.630	0.000/0.000	0.955/0.888	1.752/1.502
UI aesthetic ➔Attitude	-0.161/-0.244	-0.840/-1.770	0.403/0.077	-0.540/-0.514	0.217/0.026
UI aesthetic➔Involvement	1.023/0.942	4.900/7.430	0.000/0.000	0.614/0.693	1.433/1.190
Portability➔Attitude	-0.181/-0.386	-1.520/-2.870	0.130/0.004	-0.415/0.650	0.053-0.122
Portability➔Involvement	0.624/0.886	4.940/6.850	0.000/0.000	0.376/0.632	0.871/1.139
Attitude➔Intention	0.586/0.572	9.890/10.510	0.000/0.000	0.470/0.465	0.702/0.679
Involvement➔Attitude	0.705/0.572	14.320/10.510	0.000/0.000	0.609/0.465	0.802/0.679
Involvement➔Intention	0.154/0.157	4.540/4.030	0.000/0.000	0.088/0.081	0.221/0.233

Table 5-14 Construct reliability and validity for sub-samples

Class I (N = 323), Class II (N = 356)

Class I/Class II (N=323)/(N=356)	Ave	CR	α	1	2	3	4	5	6	7	8	9	10
1.intention	0.76/0.72	0.93/0.91	0.93/0.91	0.87/0.85									
2.attitude	0.79/0.74	0.95/0.93	0.95/0.93	0.66/0.61	0.79/0.86								
3.involvement	0.73/0.75	0.89/0.90	0.89/0.90	0.58/0.59	0.84/0.78	0.85/0.86							
4.relative advantage	0.79/0.74	0.94/0.92	0.93/0.92	0.44/0.48	0.61/0.61	0.74/0.74	0.89/0.86						
5.compatibility	0.76/0.75	0.90/0.90	0.90/0.90	0.51/0.54	0.66/0.67	0.74/0.77	0.75/0.76	0.87/0.87					
6.time convenience	0.82/0.76	0.93/0.90	0.93/0.90	0.56/0.47	0.58/0.59	0.64/0.60	0.63/0.62	0.76/0.74	0.91/0.87				
7.social interaction	0.83/0.75	0.94/0.90	0.93/0.90	0.54/0.43	0.45/0.53	0.49/0.61	0.35/0.49	0.53/0.61	0.49/0.63	0.91/0.86			
8.ui aesthetic	0.74/0.70	0.95/0.93	0.95/0.93	0.49/0.49	0.58/0.68	0.59/0.70	0.54/0.67	0.64/0.69	0.61/0.57	0.62/0.62	0.86/0.84		
9.complexity	0.74/0.76	0.90/0.90	0.89/0.90	0.30/0.36	0.42/0.47	0.42/0.47	0.46/0.50	0.42/0.43	0.41/0.39	0.32/0.29	0.48/0.57	0.86/0.87	
10.portability	0.90/0.78	0.93/0.91	0.93/0.91	0.15/0.31	0.30/0.40	0.34/0.36	0.44/0.51	0.42/0.42	0.41/0.44	0.19/0.29	0.38/0.52	0.58/0.56	0.90/0.88

Table 5-15 Construct reliability and validity for sub-samples

Class III (N = 124)

	Ave	CR	α	1	2	3	4	5	6	7	8	9	10
1.intention	0.75	0.92	0.92	0.87									
2.attitude	0.70	0.92	0.92	0.56	0.84								
3.involvement	0.67	0.86	0.85	0.56	0.79	0.82							
4.relative advantage	0.81	0.95	0.94	0.51	0.86	0.76	0.90						
5.compatibility	0.78	0.91	0.91	0.57	0.85	0.75	0.91	0.88					
6.time convenience	0.84	0.94	0.93	0.53	0.70	0.71	0.77	0.80	0.91				
7.social interaction	0.82	0.93	0.93	0.47	0.44	0.67	0.50	0.67	0.69	0.91			
8.ui aesthetic	0.73	0.94	0.94	0.44	0.70	0.62	0.75	0.87	0.72	0.66	0.85		
9.complexity	0.74	0.89	0.89	0.51	0.45	0.45	0.49	0.49	0.46	0.33	0.48	0.86	
10.portability	0.74	0.90	0.89	0.46	0.57	0.54	0.67	0.69	0.64	0.48	0.69	0.56	0.86

5.4 Summary

This chapter mainly analyzes the collected data and constructs a structural equation model to test the research hypothesis and participate in the mediating effect and attitude mediating effect. The results show that participation has a certain mediating effect on the relationship between relative advantage and willingness and attitude has a partial mediating effect on the relationship between relative advantage and willingness. In addition, this chapter also analyzes the impact of demographic variables on the results, mainly from the effects of gender, age, occupation, and education on the results of the adjustment effect, and the impact assessment.

Table 5-16 Results of structural model

Class I (N = 323), Class II (N = 356)

Class I/Class II (N=323)/(N=356)	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage ➔Attitude	-0.465/-0.101	-3.590/-1.180	0.000/0.237	-0.719/-0.268	-0.212/0.066
Relative advantage ➔Involvement	1.240/0.812	9.130/9.980	0.000/0.000	0.974/0.652	1.507/0.971
Compatibility ➔Attitude	-0.533/-0.026	-3.450/-0.300	0.001/0.767	-0.836/-0.195	-0.230/0.144
Compatibility ➔Involvement	1.351/0.843	8.450/9.330	0.000/0.000	1.038/0.666	1.664/1.020
Complexity ➔Attitude	-0.286/0.100	-2.060/0.990	0.040/0.324	-0.559/-0.099	-0.013/0.298
Complexity ➔Involvement	0.762/0.439	4.940/4.610	0.000/0.000	0.460/0.253	1.065/0.626
Time convenience ➔Attitude	-0.553/0.054	-2.700/0.580	0.007/0.563	-0.954/-0.128	-0.151/0.235
Time convenience ➔Involvement	1.313/0.580	6.410/6.310	0.000/0.000	0.911/0.400	1.714/0.760
Social interaction ➔Attitude	-0.396/-0.030	-1.650/-0.280	0.100/0.782	-0.867/-0.242	0.076/0.182
Social interaction ➔Involvement	1.140/0.820	5.070/7.510	0.000/0.000	0.699/0.606	1.581/1.034
UI aesthetic ➔Attitude	-0.327/0.119	-1.520/1.240	0.129/0.214	-0.748/0.069	0.095/0.307
UI aesthetic ➔Involvement	1.012/0.644	4.650/6.430	0.000/0.000	0.586/0.448	1.438/0.840
Portability ➔Attitude	-0.475/0.043	-3.360/0.490	0.001/0.622	-0.753/-0.129	-0.198/0.215
Portability ➔Involvement	0.874/0.396	5.820/4.690	0.000/0.000	0.580/0.230	1.168/0.561
Attitude ➔Intention	0.685/0.550	13.480/8.670	0.000/0.000	0.586/0.426	0.785/0.674
Involvement ➔Attitude	0.755/0.683	12.630/12.510	0.000/0.000	0.638/0.576	0.873/0.791
Involvement ➔Intention	0.138/0.211	3.730/4.280	0.000/0.000	0.065/0.114	0.210/0.307

Table 5-17 Construct reliability and validity for sub-samples

Beneath the bachelor-degree (N = 396), bachelor degree or above (N = 407)

(N = 396)/(N = 407)	Ave	CR	α	1	2	3	4	5	6	7	8	9	10
1.intention	0.74/0.75	0.92/0.92	0.92/0.92	0.86/0.87									
2.attitude	0.71/0.80	0.92/0.95	0.92/0.95	0.62/0.64	0.84/0.90								
3.involvement	0.71/0.74	0.88/0.90	0.88/0.89	0.60/0.56	0.78/0.84	0.84/0.86							
4.relative advantage	0.76/0.79	0.93/0.94	0.92/0.94	0.47/0.47	0.70/0.60	0.73/0.77	0.86/0.89						
5.compatibility	0.74/0.78	0.90/0.91	0.90/0.91	0.56/0.51	0.74/0.65	0.79/0.73	0.82/0.77	0.86/0.88					
6.time convenience	0.79/0.81	0.92/0.93	0.92/0.93	0.57/0.48	0.63/0.57	0.67/0.58	0.72/0.60	0.74/0.80	0.89/0.90				
7.social interaction	0.78/0.80	0.91/0.92	0.91/0.92	0.52/0.45	0.44/0.53	0.58/0.58	0.46/0.42	0.63/0.57	0.57/0.60	0.88/0.90			
8.ui aesthetic	0.68/0.77	0.93/0.95	0.93/0.95	0.54/0.44	0.69/0.60	0.68/0.62	0.69/0.57	0.77/0.65	0.63/0.59	0.64/0.62	0.82/0.88		
9.complexity	0.71/0.79	0.88/0.92	0.88/0.91	0.42/0.33	0.48/0.41	0.48/0.43	0.53/0.44	0.49/0.40	0.50/0.32	0.31/0.31	0.56/0.50	0.84/0.89	
10.portability	0.75/0.82	0.90/0.93	0.90/0.93	0.27/0.27	0.41/0.36	0.42/0.33	0.55/0.46	0.54/0.40	0.53/0.40	0.32/0.25	0.50/0.48	0.59/0.55	0.87/0.91

Table 5-18 Results of structural model

Beneath the bachelor-degree (N = 396), bachelor degree or above (N = 407)

(N = 396)/(N = 407)	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage ➔Attitude	-0.081/-0.549	-0.840/-4.450	0.402/0.000	-0.271/-0.791	0.108/-0.307
Relative advantage ➔Involvement	0.940/1.277	9.230/10.310	0.000/0.000	0.741/1.035	1.140/1.520
Compatibility ➔Attitude	-0.154/-0.549	-1.350/-4.030	0.179/0.000	-0.378/-0.816	0.070/-0.282
Compatibility ➔Involvement	1.200/1.324	10.380/9.970	0.000/0.000	0.973/1.064	1.426/1.585
Complexity ➔Attitude	-0.073/-0.217	-0.780/-1.390	0.438/0.165	-0.257/-0.523	0.111/0.089
Complexity ➔Involvement	0.617/0.722	6.010/4.590	0.000/0.000	0.416/0.414	0.818/1.030
Time convenience ➔Attitude	-0.177/-0.444	-1.440/-2.880	0.149/0.004	-0.418/-0.747	0.064/-0.141
Time convenience ➔Involvement	0.999/1.110	7.930/7.070	0.000/0.000	0.752/0.802	1.246/1.418
Social interaction ➔Attitude	-0.476/-0.303	-2.590/-1.620	0.010/0.106	-0.835/0.670	-0.116/0.064
Social interaction ➔Involvement	1.314/1.124	7.690/6.260	0.000/0.000	0.979/0.772	1.649/1.476
UI aesthetic ➔Attitude	-0.065/-0.329	-0.600/-1.670	0.550/0.096	-0.280/-0.715	0.149/0.058
UI aesthetic ➔Involvement	0.837/1.097	6.940/5.640	0.000/0.000	0.601/0.716	1.074/1.479
Portability ➔Attitude	-0.244/-0.316	-2.330/-2.370	0.020/0.018	-0.449/-0.577	-0.038/-0.055
Portability ➔Involvement	0.764/0.732	6.960/5.320	0.000/0.000	0.549/0.462	0.979/1.001
Attitude ➔Intention	0.551/0.634	9.770/10.160	0.000/0.000	0.441/0.512	0.662/0.757
Involvement ➔Attitude	0.653/0.792	10.840/15.440	0.000/0.000	0.535/0.691	0.771/0.892
Involvement ➔Intention	0.185/0.121	5.290/3.290	0.000/0.001	0.116/0.049	0.253/0.193

Table 5-19 Construct reliability and validity for sub-samples

IOS (N = 351), Android (N = 428)

IOS/Android	Ave	CR	α	1	2	3	4	5	6	7	8	9	10
1.intention	0.78/0.73	0.93/0.92	0.93/0.91	0.88/0.86									
2.attitude	0.76/0.73	0.94/0.94	0.94/0.94	0.56/0.65	0.87/0.87								
3.involvement	0.72/0.72	0.89/0.88	0.88/0.94	0.56/0.62	0.79/0.83	0.85/0.85							
4.relative advantage	0.82/0.74	0.95/0.92	0.94/0.92	0.51/0.50	0.86/0.70	0.76/0.76	0.90/0.87						
5.compatibility	0.77/0.76	0.91/0.91	0.90/0.91	0.57/0.55	0.85/0.72	0.75/0.77	0.91/0.80	0.88/0.87					
6.time convenience	0.81/0.79	0.93/0.92	0.93/0.92	0.53/0.54	0.70/0.57	0.71/0.62	0.77/0.66	0.80/0.75	0.90/0.89				
7.social interaction	0.82/0.78	0.93/0.91	0.93/0.91	0.47/0.52	0.44/0.51	0.67/0.61	0.50/0.51	0.67/0.64	0.69/0.61	0.90/0.88			
8.ui aesthetic	0.73/0.73	0.94/0.94	0.94/0.94	0.44/0.54	0.70/0.71	0.62/0.69	0.75/0.68	0.87/0.74	0.72/0.62	0.66/0.67	0.86/0.85		
9.complexity	0.78/0.74	0.91/0.89	0.91/0.89	0.51/0.38	0.45/0.44	0.45/0.47	0.49/0.56	0.49/0.50	0.46/0.44	0.33/0.32	0.48/0.54	0.88/0.86	
10.portability	0.82/0.76	0.93/0.91	0.93/0.90	0.46/0.29	0.57/0.37	0.54/0.41	0.67/0.53	0.69/0.48	0.64/0.50	0.48/0.39	0.69/0.54	0.56/0.62	0.91/0.87

Table 5-20 Results of structural model

IOS (N = 351), Android (N = 428)

IOS/Android	Coef.	z	P>|z|	[95% Conf. Interval]	
Relative advantage ➔Attitude	-0.326/-0.325	-2.860/-2.640	0.004/0.008	-0.549/-0.566	-0.103/-0.084
Relative advantage ➔Involvement	1.144/1.129	9.760/9.010	0.000/0.000	0.914/0.883	1.374/1.374
Compatibility ➔Attitude	-0.304/-0.423	-2.190/-2.880	0.029/0.004	-0.576/-0.711	-0.032/-0.135
Compatibility ➔Involvement	1.253/1.343	8.990/9.070	0.000/0.000	0.980/1.053	1.526/1.633
Complexity ➔Attitude	0.024/-0.397	0.170/-2.920	0.865/0.004	-0.255/-0.664	0.303/-0.130
Complexity ➔Involvement	0.535/0.924	3.690/6.290	0.000/0.000	0.251/0.636	0.820/1.212
Time convenience ➔Attitude	-0.220/-0.542	-1.440/-3.530	0.151/0.000	-0.521/-0.843	0.080/-0.241
Time convenience ➔Involvement	1.060/1.251	6.980/7.610	0.000/0.000	0.763/0.929	1.358/1.574
Social interaction ➔Attitude	-0.157/-0.665	-0.770/-3.570	0.442/0.000	-0.559/-1.031	0.244/-0.300
Social interaction ➔Involvement	1.029/1.526	5.340/8.250	0.000/0.000	0.651/1.1163	1.406/1.888
UI aesthetic ➔Attitude	-0.227/-0.232	-1.310/-1.500	0.190/0.134	-0.566/-0.536	0.113/0.072
UI aesthetic ➔Involvement	0.945/1.091	5.310/6.690	0.000/0.000	0.596/0.771	1.294/1.410
Portability ➔Attitude	-0.108/-0.548	-0.870/3.750	0.386/0.000	-0.352/-0.835	0.136/-0.262
Portability ➔Involvement	0.631/1.002	4.890/6.700	0.000/0.000	0.378/0.709	0.884/1.295
Attitude ➔Intention	0.525/0.625	8.690/11.490	0.000/0.000	0.406/0.518	0.643/0.731
Involvement ➔Attitude	0.719/0.746	13.070/14.040	0.000/0.000	0.611/0.642	0.826/0.850
Involvement ➔Intention	0.137/0.151	3.730/4.370	0.000/0.000	0.065/0.084	0.208/0.219

Chapter 6: Conclusions and Research Prospects

6.1 Research conclusions

The overarching goal of this research is mainly to investigate consumers perceptions of tourism applications. The target population include consumers who are interested in tourism, online users of tourism community users and members who use tourism applications to search travelling information. Empirical research method is used to collect data and analysis for the questionnaire survey, designed to develop a travel itinerary planning management system that facilitates travel for passengers.

Based on the integration of technology acceptance model, innovation diffusion theory and software quality model, this study proposes a research model, in line with the existing research results, and put forward corresponding hypotheses to make illustrative conclusion from the aspects of comparative advantage, consistency, complexity, time convenience, social interaction, user interface, portability, user involvement and user attitude, user involvement and user willingness. Detailed questionnaires, collection of questionnaires and data preprocession (sample description, app function importance, confirmatory factors, reliability, and validity analysis) is designed on the basis of the above assumptions. As such, the consequence shows that the measurement model, with a high degree of fitness, and the reliability, aggregation validity and differential validity have a good performance. Finally, the structural equation model is used for data analysis and hypothesis verification. The results show that the structural model is highly fitted and most of the hypotheses are verified. The results of the study confirm that application design attributes and application performance attributes are important factors driving the adoption of mobile travel applications. Specifically, relative advantage, consistency, complexity, time convenience, social interaction, UI aesthetics and portability are all important factors influencing the willingness of travel app users. For example, relative advantage, consistency, time convenience, social interaction and portability have a positive effect on involvement and attitude, UI aesthetics exerts positively on involvement, involvement is associated with attitude and user’s intention positively, and attitude is affiliated positively with the willingness of user. It is easier to grasp the conception of complexity affecting involvement negatively. When people use a certain product, if they

feel that the operation is complicated, the experience of the product will be reduced, that is, the user's involvement will decrease as the complexity of the product is increased.

This thesis also delves deeply into the effect of demographic variables on the model. In addition, it explicates clearly the mediation efficacy of attitude and involvement between application features and user's willingness to harness. What's more, this research broadens our horizons on the accidental impact of application attributes on adoption behavior through adding user gender as a variable to the model, and increases an awesome theoretical basis for future research in this field.

6.2 Research contribution

6.2.1 Theoretical contribution

This research is designed to provide theoretical guidance for the development of the travel planning management system software in the actual work to make further improvement in the aspects of function development, business scope, and R&D compared to the past travel information service system software after collecting the data of the tourism target group's perception of the tourism application through questionnaire survey, empirical research and analysis. The theoretical contributions of this study are as follows:

Firstly, the thesis puts forward the initiative a model of the influence mechanism of the mobile-end tourism service app use intention on the basis of its perceptual characteristics after integrating the technology acceptance model, the innovation diffusion theory and the software quality model, and examines the impact of different dimensions of tourism service app products on user attitudes and willingness to use, and fills in the research gaps in this field at home and abroad. The research model has ten constructs: comparative advantage, consistency, complexity, time convenience, social interaction, UI aesthetics, portability, attitude, involvement and willingness to adopt.

Secondly, this study combines the existing research results and proposes 17 research hypotheses: these factors including the relative advantages of mobile travel applications, consistency, complexity, time convenience, social interaction, good user interface, portability and involvement exert a positive impact on user's attitude and user's involvement, respectively. And involvement and attitude have an aggressive effect on the user's intention.

Thirdly, this study theoretically explores the application attributes, attitudes and involvement of mediating innovation perception characteristics and software quality factors on the willingness to use, and analyzes the specific impact mechanism of this effect, explains the mediation influence mechanism of product attributes on the willingness to use, so as to more deeply understand the intrinsic effect of app product attributes on the willingness to accept app products.

Fourth, this study innovates the combination of the novel perception characteristics such as relative advantage, consistency, complexity and other factors, software quality factors and TAM model organic with the mobile phone app use intention. On the other hand, this study also applies software quality factors such as social interaction, UI aesthetics, portability to the willingness model of mobile mobile app, and expands the research dimension of related fields.

The research conclusions of this study provide theoretical guidance for the design developers of the Travel Service app. App design developers can examine the development and design work from the important factors that affect the users' adoption of the travel service app pointed out in this study, and then design a mobile travel service app with higher user involvement.

6.2.2 Managerial contribution

As visitors use smartphones to develop the normality of travel plans, it becomes a habit for visitors to book and track all travel-related issues through the Travel Services app, and the app has revolutionized the travel industry. According to relevant data, the travel app ranked 7th in the app store's app downloads ranking and 9th in the Google app downloads (2016, July, 12). As such, it is urgent to develop a travel service app with a large download volume, high frequency of use, and strong market competitiveness. Among others, whether it can meet the practical needs of travel tourists or it has a good human-computer interaction experience plays a vital role.

This study provides management implications for the design and development of travel service app. The data collection and analysis of this study contains the age, gender, occupation, education, tourism budget of the target population, as well as the frequency of travel service app use, the frequency of purchase of tourism products, the frequency of pre-trip information search, the information search during travel, and the content of the user experience such as the

important function rate of the app. These analytical research results have a significant implementation process and management results for the development of a high-quality travel service app product. From the launch of a travel service app program to every aspect of the development work involved, what should be taken into consideration firstly is the product position of the travel service app, and the reason of developing this app, what problems and pain points it solves, what value it has, who is the target group of the app, and what characteristics these people have, what kind of needs they have, which functional modules can be satisfied by these functional modules, how the functional models are laid out, and what kind of creative design the operating interface uses to have a better user experience. Secondly, in order to complete the above work and carry out product design and development, what kind of organizational structure needs to be set up, which departments and positions are established, how to divide the work department, what responsibilities and rights are defined in the posts, and What the workflows and synergies between each other are , and what the criteria for the quality of work in each sector is. Third, for the plan mentioned above, a clear development time schedule is required. Fourth, how much capital budget is required to complete the above work plan. Through the above management process, developers can not only avoid blind development of tourism service app, but also improve the accuracy of customer requirements, target group positioning, and prevent self-subjectivity of app function settings, module layout, and operation interface design.

This study provides a reference for management quality standards for tourism service app project managers. The research results show that factors such as relative advantage, consistency, complexity, time convenience, social interaction, good user interface, portability, and involvement behavior directly affect the user's involvement and affect the user’s attitude and user’s intention to use through the degree of involvement. Therefore, the development of tourism service app should pay attention to improve the relative advantages, consistency, time convenience, social interaction, portability and involvement behavior of app; optimize the user interface of app, reduce the complexity of app, and think about how to improve these aspects to better enhance the user’s involvement in the app, and thus improve the user’s attitude and their willingness to use. At the same time, this study incorporates innovation perception characteristics and software quality factors into the model considerations. The research finds that they have significant influence on the degree of involvement, attitude and willingness to adopt. In practice, we should also pay attention to the innovative perception characteristics and software quality factors of app; User involvement is an intermediary

mechanism in this research model. The impact on user attitudes and willingness is significant and direct. Therefore, in addition to considering the innovative perception characteristics and software quality factors in the model, we should also consider what other aspects can enhance user's involvement of the travel service app. When improving and optimizing the travel service app, we should put the user's involvement in the important consideration level.

At the same time, on the backdrop of the travel service app products developed by developers based on the research results, it can greatly help travellers to manage the travel itinerary with the hand of information from tourist destinations, ticket reservations, hotel booking, attraction information, scenic spots ticket reservations, nearby destination information, purchase of local products for travel destinations, efficient and convenient services for visitors during the tour.

6.3 Research limitation and prospects

In this study, research still exists some limitations. First of all, the quantity of the sample is a bit of small. The research data collection and research site selected Chengdu, a famous tourist city in China. Although Chengdu has a certain representative representation of tourism cities, there are nearly 20 tourist cities in this category in China, which is a bit small in terms of data collection volume; Secondly, this study only conducted research in the context of China and requires more research in the context of transnational cultural countries. In the selection of scenic spots, this study mainly chooses the traditional Chinese cultural scenic spots in the urban commercial district. It is very different from the scenic spots in the natural scenery, and it also differs from the scenic spots in foreign scenic spots, which presents the landscape of local history and humanities.

In this study, the research model may have missed some important variables. Consumer behavior is ever-changing, affecting consumer behavior due to different scenarios, different factors, cultural factors, personal factors, psychological factors, social factors, political factors.

This thesis has limited in the selection of countries, regions, regions, attractions, cultural characteristics, social factors and political environment, simultaneously, the length of the thesis is not enough, so is the variables of the research model. As such, the author also plans to do further research in the future by rewriting monographs and publications in journals, and

strive to study more variable factors, and strive to make the research conclusions as comprehensive and in-depth as possible.

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Appendix

An Investigation of factors facilitating tourism app adoption

Part I: Basic information

1. Gender

□male □female

2. Which city or place are you from?

_____

3. Please choose the category of your profession

□technology □marketing □sale □administration □HR □finance □student □management □negotiator □others_____

4. Please choose your occupation level

□Middle-level manager □High-level manager □General staff

□Others_____

5. Please choose the category of your industry

□Freelancer □Private Enterprises □Civil servant □Listed company

□Agriculture □catering industry □Hospitality industry

□Public institution □School □Tourism industry

□Other service industry □National enterprise

□Foreign-invested enterprise □Other_____

6. Age _____

7. Please choose your education level

□Training school □undergraduate □master □phD □other_____

8. Please choose your travel frequency

□Never □Rarely □Occasionally □Often □Always

9. Please choose your travel budget

□Below 1000RMB □Between 1000RMB and 2000RMB

□Between 2000RMB and 4000RMB □Between 4000RMB and 5000RMB

□Between 5000RMB and 6000RMB □Between 6000RMB and 8000RMB

□Between 8000RMB and 10000RMB □Above 10000RMB

10. Travel budget proportion:

transportation__% accommodation_% shopping___% food___%

ticket__% entertainment___%

11. Do you often use travel app frequently? (such as qunaer, ctrip, bread travel, mafengwo)

□Never □Rarely □Occasionally □Often □Always

12. Have you bought any travel product in the travel app in the recent 12 months?

□Never □Rarely □Occasionally □Often □Always

13. Do you seek information about the place before traveling?

□Never □Rarely □Occasionally □Often □Always

14. Which of following utilities exist in the tourism apps on market? Please order them according to the importance.

	available ?	Not Important at all	Not important	Not very important	Indifferent	More important	Important	Extremely Important
Book air ticket/book room								
Online review								
Introduction of the places								

Travel arrangement								
Ticket								
Food recommendation								
Discount								
Special local product recommendation								
Language Translation								
Other								

15. Do you look for related information by using this app during traveling?

□Never □Rarely □Occasionally □Often □Always

16. Suppose there will be a new released tourism app, which of following utilities you are expecting:

	Not Important at all	Not important	Not very important	Indifferent	More important	Important	Extremely Important
Introduction to place							
Route guidance of place							
Voice introduction to place							
Video introduction to place							
Playfulness recommendation							
Food recommendation							
Transport service delivery							
Special local product							

recommendation							
Know other travelers							
Nearby place recommendation							
Transportation guidance							
Other							

17. With whom in your last traveling

□Alone

□Along with friends

□Along with other unfamiliar travelers

□Package tour

□Other_____

18. Please choose your mobile operation system

□Android □iOS □Windows Phone □BlackBerry OS □Other_____

Part II: scale

Seven-point Likert scale is used to for the items. 1 denotes strongly disagree, 7 denotes strongly agree

	Strongly disagree	Disagree	Disagree somewhatl	Undecided	Argree somewhat	Agree	Strongly agree
Intention							
I intend to stay on as a member of this travel app.	1	2	3	4	5	6	7
I am willing to actively participate in the activities on this travel app.	1	2	3	4	5	6	7
I am willing to support other members on this travel app.	1	2	3	4	5	6	7
I will recommend this travel app to anyone who seek their advice about mobile travel apps.	1	2	3	4	5	6	7

Attitude							
Using this travel app is a good idea	1	2	3	4	5	6	7
Using this travel app is wise	1	2	3	4	5	6	7
Using this travel app is enjoyable	1	2	3	4	5	6	7
Using this travel app is pleasurable	1	2	3	4	5	6	7
Using this travel app is interesting	1	2	3	4	5	6	7
Using this travel app is favorable	1	2	3	4	5	6	7
Involvement							
Using this travel app is exciting	1	2	3	4	5	6	7
Using this travel app means a lot to me	1	2	3	4	5	6	7
Using this travel app is enjoyable experience.	1	2	3	4	5	6	7
Relative advantage							
This travel app enhances my traveling experience.	1	2	3	4	5	6	7
This travel app makes it easier to understand destinations.	1	2	3	4	5	6	7
This travel app helps me save much time.	1	2	3	4	5	6	7
This travel app makes traveling more effective.	1	2	3	4	5	6	7
Compatible							
This travel app is compatible with my travel preferences.	1	2	3	4	5	6	7
This travel app suits my travel needs.	1	2	3	4	5	6	7
This travel app fits well with my travel needs.	1	2	3	4	5	6	7
UI aesthetic							
The user interface design of	1	2	3	4	5	6	7

this travel app looks clean.							
The user interface design of this travel app is sophisticated.	1	2	3	4	5	6	7
The user interface design of this travel app is fascinating.	1	2	3	4	5	6	7
The user interface design of this travel app is aesthetically pleasing.	1	2	3	4	5	6	7
The user interface design of this travel app is visually appealing.	1	2	3	4	5	6	7
The user interface design of this travel app is attractive.	1	2	3	4	5	6	7
Social interaction							
This travel app makes me able to connect with other travelers.	1	2	3	4	5	6	7
This travel app helps me to become familiar with other travelers.	1	2	3	4	5	6	7
This travel app helps me to perform social activities.	1	2	3	4	5	6	7
User Interface							
The user interface design of this travel app looks clean.	1	2	3	4	5	6	7
The user interface design of this travel app is sophisticated.	1	2	3	4	5	6	7
The user interface design of this travel app is fascinating.	1	2	3	4	5	6	7
The user interface design of this travel app is aesthetically pleasing.	1	2	3	4	5	6	7
The user interface design of this travel app is visually appealing.	1	2	3	4	5	6	7
The user interface design of this travel app is attractive.	1	2	3	4	5	6	7
Complexity							

This travel app is difficult to use	1	2	3	4	5	6	7
This travel app is easy to use	1	2	3	4	5	6	7
Learning how to use this travel app is easy for me.	1	2	3	4	5	6	7
I would imagine that most people would learn to use this app very quickly.	1	2	3	4	5	6	7
Portability							
This travel app works well on multiple mobile operating systems.	1	2	3	4	5	6	7
This travel app has a good operating system compatibility.	1	2	3	4	5	6	7
This travel app has a good multiple operating system applicability.	1	2	3	4	5	6	7