國立臺灣大學管理學院資訊管理學研究所

碩士論文

Graduate Institute of Information Management

College of Management

National Taiwan University

Master Thesis

行動應用程式使用者轉移使用延伸應用程式影響因素之研究

Factors of Mobile Application User Transferring to

Use Extended Application

謝慈恩

Tzu-En Hsieh

指導教授：曹承礎 博士

Advisor: Seng-Cho T. Chou, Ph.D.

中華民國 102 年 7 月

July, 2013

誌謝

本論文的育成要感謝很多人的幫助，首先要感謝我的指導教授　曹承礎博士。若不是曹老師在我研究過程中適時地提供其獨到創新的見解，並勉勵我在研究中應突破窠臼、創造亮點，及教導我要有所取捨，我想我的研究終究也只會被侷限在我最初單純的研究動機以及研究的框架之下，而無法取得現有的成果。

由衷感謝口試委員　王貞雅老師在我撰寫論文的過程中，不厭其煩地幫我解惑及不斷地為我打氣，並細心地審閱論文後加以指正，使我能順利地完成研究並通過論文考試。並特別感謝口試委員　陳文國老師以其專業領域之知識提出諸多寶貴的建議，並在考試的過程中始終對我的研究方向表達支持，對我來說是很大的鼓勵。

感謝所有同甘共苦的實驗室夥伴：陳陳、aiko、容萱、小腹、小力與美欣。那些日子裡一起蹲實驗室寫論文、有疑難一起找尋解決辦法、有困惑一起分享情報、有食物一起分享、有壓力一起抒發，口試時也一起面對、互助合作，我想我們真的不愧是感人溫馨的 KMLab。

謝謝所有同樣身為碩二，互相加油打氣、從大學一路走來的好同學們、陪我度過很多美好時光的籃球球友們，我的碩士時光因你們而美好；以及所有幫助我完成問卷，認識與不認識的人們，沒有你們我就無法順利完成我的論文。特別要感謝陪我度過編寫論文初稿及論文口試階段的工友，謝謝妳的包容與無微不至的照顧。

最後我要感謝我的家人，我的爸爸、媽媽與姐姐。沒有你們的鞭策、鼓勵、期望與傾聽，我沒有辦法熬過一些艱難的時刻，謝謝你們。

中文摘要

　　在行動應用程式市場的競爭持續白熱化之下，行動應用程式供應商的生存也越來越艱難。一旦一個行動應用程式爬上了熱門排行榜的頂端，幾天後它可能就掉出排行榜，而它所累積的人氣與使用者也因為沒有善加利用在推廣同供應商的下一個行動應用程式產品而淪為無用。為了幫助這些行動應用程式供應商能抓住行動應用程式市場所提供的大好機會，本研究致力於理解哪些因素能有助於原行動應用程式的使用者增加採用同供應商開發的新應用程式的意圖。

　　研究發放的網路問卷根據分類理論及與影響行動應用程式採用因素相關的前人研究所設計，使用行動通訊應用程式作為親代行動應用程式，行動照相應用程式及行動遊戲應用程式作為延伸行動應用程式。總共回收了 253 份有效問卷，這些問卷提供了 506 個樣本以供分析。

　　分析結果顯示不只親代行動應用程式的知覺品質，連親代行動應用程式的知覺有用性也可被移轉至延伸行動應用程式上。甚至，親代行動應用程式及延伸行動應用程式之間的知覺配適度也對知覺品質及知覺有用性的移轉有顯著且正面的影響。

　　本研究進一步地驗證了分類理論在研究行動應用程式方面的應用，並且對使用者在同一行動程式供應商所提供的應用程式之間的知覺行為有更深的認識。除此之外，根據研究結果也建議在實務上更重視知覺有用性在知覺意圖移轉上的重要性。


關鍵詞：行動應用程式；分類理論；知覺移轉；知覺有用性；知覺品質；知覺配適度

ABSTRACT

As the competition in the mobile app market continues to rise, the survival of the developers became harder. Once an app climbs up to the top of the leaderboard, it came down really quickly, and the popularity it once owns is hard to generate value for the next released app provided by the same developer. To help the developer seize the promising opportunity of the mobile app market, this research aims at realizing what kind of factors will influence the user of the original mobile app intending to adopt the new extended app.

An online survey based on the previous studies using categorization theory and technology acceptance model was conducted using a messenger app as the parent app and a camera app and gaming app as the extended apps. A total of 253 validate respondents was received, which yielded 506 samples to analysis.

The results indicate that not only perceived quality but also perceived usefulness of the parent app can be transferred to its extensions. Furthermore, the perceived fit between the parent app and the extended apps has significant positive influence on perceived quality and perceived usefulness of the extensions.

This study further confirms the application of categorization theory in the context of mobile app and improves deeper understanding of the user behavior between mobile

apps provided by the same developer. In addition, findings of the research suggest the

importance of perceived usefulness in usage intention transfer in practical use.
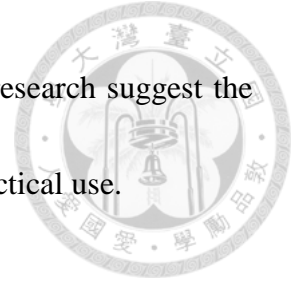
Keywords: Mobile app; Categorization theory; Perception transfer; Perceived usefulness; Perceived quality; Perceived fit

CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1　Introduction

1.1　Background and Motivation

As the user number of smartphone and smart device constantly rises up, the number of mobile application provider and mobile application (app) in different categories has also risen up tremendously. In the report of Mary Meeker and Liang Wu, 2012 KPCB Internet Trends Year-End Update and KPCB Internet Trends 2013, pointed out the following statistics of smart phone and smart device. Up to 2013 May, the number of global smartphone subscriber has grown to 1.5 billion with growth rate at 31%, and only accounts 21% of global mobile phone subscriber. There was 29% of adults in USA owns tablet/eReader until 2012, while there was less than 2% in 2009. The global mobile traffic has grown to 15% of global internet traffic in 2013, growing 1.5 times per year, whereas the global mobile traffic was only 1% of global internet traffic in 2009. In India, the mobile traffic has surpassed traditional computer traffic in the second half of 2009. The amount of global mobile device, including smart phone and tablet, will surpass the amount of traditional computer, including desktop computer and notebook, in the second quarter of 2013. The revenue produced by global mobile App, including charge app and advertising revenue, has grown from 700 million USD in 2008 to 19 billion USD in 2012 (Mary Meeker & Liang Wu,
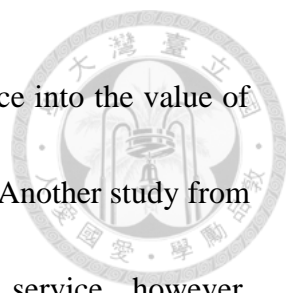
2012, 2013). According to the news from emgadget.com, the amount of mobile app of the top two popular mobile app platforms, Google play, used to call Android market, and App store had reached 700,000 in October 2012 and 900,000 in June 2013 separately, and both platforms are considered to hit 1 million apps in 2013, despite the fact that both platforms were established in less than 5 years ago (Steve Dent, 2012; Sharif Sakr, 2013; McCarra, 2013).

Although the above data shows that developing mobile app is promising, however, among the successful minority of all mobile apps, which attract vast amount of mobile users, many often get to the top in just one night, and then fall to the bottom the next morning. For example, the entertainment app, Draw Something, once had 1.2 million downloads in 10 days, 12 million downloads in 1 month, 20million downloads in 5 weeks, 100 million draws and 15 million active user per day in just few month, and 250 thousand USD revenue per day when there was a fever for it in first half of 2012, but then a year passed and the fever was gone, even if Draw Something 2 was released, the team of Draw Something was still dismissed (Sean Hollister, 2013; 夔蒽, 2013). Yet in another different example, the team manages to keep their popularity. Angry Birds, an entertainment app launched in 2010 by Finland developer, Rovio, and its team continues to release its serial app, Bad Piggies, Angry

Birds: Star Wars and the upcoming new app, Angry Birds Go!(Francisco & London, 2013; "Angry Birds Go," 2013). They success in maintaining their popularity and preserve their achievement in the initial Angry Birds app, which is seldom seen in the mobile app market. Generally, mobile app users won't remember the mobile app provider and only have some vague impression of the content and the name of the mobile app, and when the mobile app provider launch a new mobile app with a new look, they have to make the users rediscover the app without effectively using the good image they already built or the familiar users they already have in their original mobile app. So even if the original app was a great success with a lot of users, it may not drive the user number of the newly developed app.

In the related field of academic research, there has been a lot of studies focus on the adoption or continuous use of mobile service, and also on the user readopt or rebuy intention in the context of e-commerce or m-commerce (Table 1-1). In spite of the immense interest in the mobile device research field, few studies have aimed at discussing the transfer of existing achievement of original mobile app to the next mobile app. One of the unique studies is the work of Wang and Li (2012), which explore mobile services adoption from a brand-equity perspective. In the studies, they concentrated on the factors which can improve the brand-equity of the mobile service,

because they believe that to transform the value of the mobile service into the value of the brand can make consumers buy things from the brand next time. Another study from Song, Zhang, Xu and Huang (2010) in the context of web service, however, concentrated on the factors that influence the transfer of the value from parent brand to its extension, but there are several differences between conventional web service and mobile service. According to some researches, mobile service has certain distinctive characteristic, which can derive value like ubiquity, personalization, flexibility, dissemination, usability, identifiability, and perceived enjoyment, and those value are not available in traditional wired e-commerce (Wei-Tsong Wang & Hui-Min Li, 2012; Yi-Shun Wang, Hsin-Hui Lin, & Pin Luarn, 2006; Scharl, Dickinger, & Murphy, 2005a; Mahatanankoon, Wen, & Lim, 2005; Siau, Lim, & Shen, 2001). And another major difference is that adopting a mobile app unlike adopting a web service because the former might require user to consider whether the space of their smartphone is enough for the app to occupy or whether the transmission quantity required for downloading the app surpass the user's remain amount of their limit transmission quantity, according to their contract with their telecom provider. Since people may make different judgment in such different contexts, mobile and conventional web environment, this research examines the model proposed by Song, Zhang, Xu and Huang in mobile environment

and makes changes if necessary.

Theoretical base	Key construct	Adoption measure	Research context	Representative literature
TAM	Perceived usefulness; perceived ease of use; subjective norm; self-efficacy; enjoyment; network externality	Behavioral intention; adoption intention; intention to use; actual use behavior	Mobile-technology-enabled tasks; mobile data services; mobile shopping services; mobile short message services; mobile payment services; mobile healthcare services	Fang et al., 2005-2006; Hong and Tam, 2006; Li and Yeh, 2010; Liu et al., 2010; Lu and Su, 2009; Ko et al., 2009; Scharl et al., 2005; Schierz et al., 2010; Shin, 2009; Thong et al., 2006; Wang et al., 2006; Wu et al., 2011
ISSM	System quality/ease of use; information/content quality; service quality; trust	Satisfaction; actual use behavior	Mobile shopping services; mobile banking services; ubiquitous computing services	Kim et al., 2009a; Lee and Chung, 2009; Wang and Liao, 2007
EDM	Confirmation	Satisfaction; continued usage intention	Mobile internet services	Thong et al., 2006
Trust-related theories	Dimensions of trust; innovation measures; perceived value	Adoption intention; usage intention; mobile trust	Mobile shopping services; mobile banking services	Kim et al., 2009b; Li and Yeh, 2010; Lin, 2011
Culture-related theories	Cultural characteristics/ dimensions	Satisfaction; continued usage intention	Mobile internet services	Kao, 2009; Lee et al., 2007
Service quality perspective	Perceived value; trust service quality; enjoyment; risk; personalization	Adoption intention; purchase intention; post-purchase intention	Mobile value-added services; mobile shopping services; loyalty	Kuo et al., 2009; Lin and Wang, 2006; Xu et al., 2011

Table 1-1 Summary of existing studies of m-service adoption (W.-T. Wang & Li, 2012)

To make the mobile app providers to survive or even strengthen their competitiveness in a market environment so full of opportunity yet having intense competition, this

research aims at studying the factors which may increase the transfer of good image and

users from original mobile app to newly developed mobile app, helping the app

provider to get competitive advantage in developing new apps.

1.2 Research Purpose and Scope

Based on the motivation mentioned before, this research aims at realizing what kind

of perception factor between the original and new mobile app, which both come from

the same mobile app provider, will influence the user of the original mobile app to adopt

the new mobile app. It should be noted that this research mainly focus on preserving the

good achievement from the original mobile app and transferring it to the new app, but

not reversing or reducing any negative impression of original mobile app so that the

new app can get better popularity or more downloads.

It is to be expected that this research can contribute to both industry and academic

world. For the mobile application industry, if the mobile app provider could grasp and

employ the factor that can successfully transfer the user of the original mobile app to the

new one, then maybe it can ensure the basic market share of the new mobile app

without having to spend extra cost to popularize the app to the user they already knew,

and reach the goal of saving marketing cost, increasing profit, and becoming more

sustainable in this world where users like the new and hate the old, and from the

perspective of the mobile app user, they can adapt to the new mobile app faster and reduce the search cost for the mobile app they might like, so it is a win-win situation. Academically, this research can further expand the not yet fully develop field of user behavior toward mobile app. The related system usage research started to became primary in IS research in 1970s and has been developing till now, but only few has consider different products as interrelated bundle, which because that the adoption of one product may rely on the adoption or user experience of another (Song, Zhang, Xu, & Huang, 2010), and this study can provide yet another complement to this area. Overall, this research can give a different perspective to the use of user assets, hoping to improve the development of related academic and industries.

1.3   Research Process

As shown in Figure 1-1, the first step of this research is to collect and review literature and current status related to mobile user behavior and mobile app market, for determining the research model and data source, and designing effective questionnaire scale to disseminate to the object. Finally, collect the questionnaire results and analysis it with structural equation modeling (SEM) to get research result.
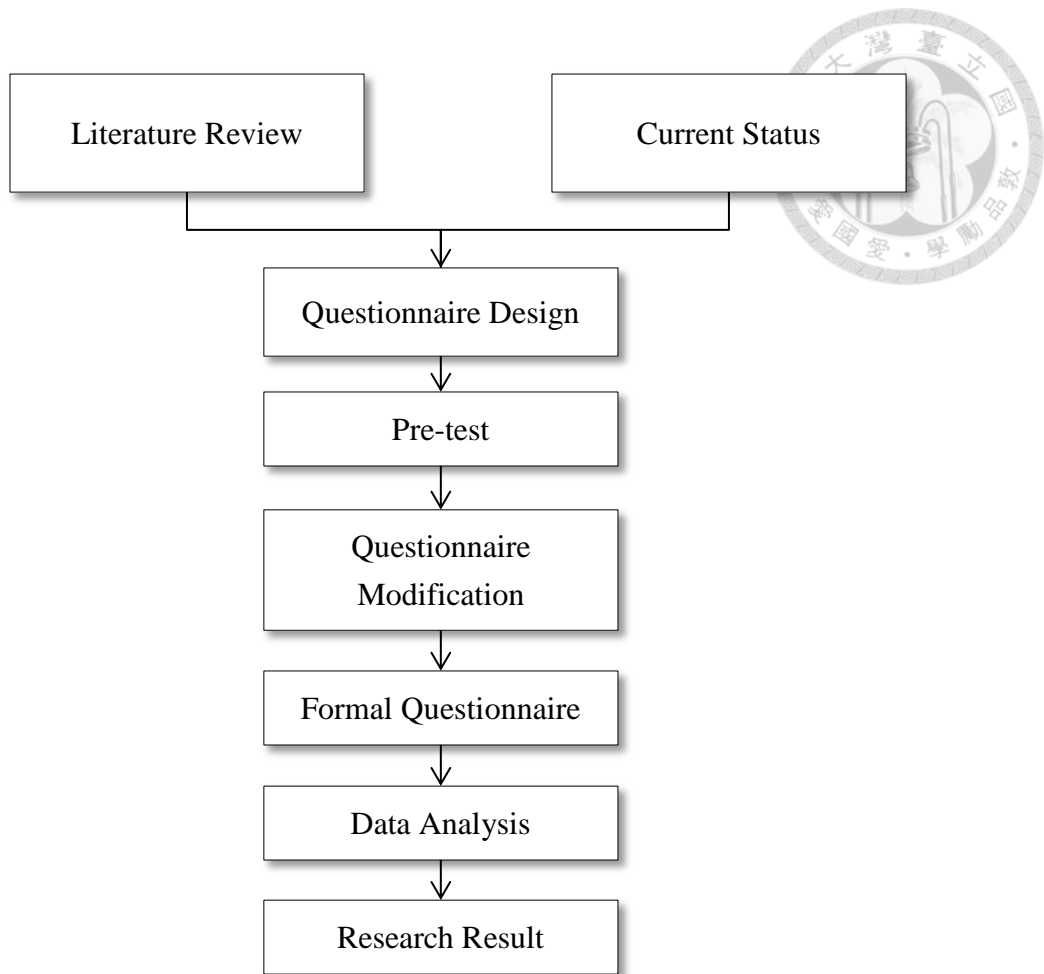
Figure 1-1 Research process

1. Literature Review and Current Status

This research starts from collecting literature related to mobile user behavior and investigate current status of mobile app market. Related literature includes papers which studies m-commerce, e-commerce and system usage and technique related to questionnaire scale design. Current status includes the development, app categories and number, popularity, etc. of the market.
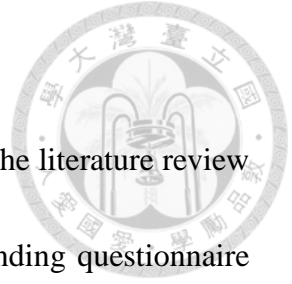
2.   Questionnaire

Following the first step, according to the factor construct from the literature review

to build the research model and hypothesizes, and design corresponding questionnaire

from the questionnaire items collected from the literature review. After pre-test, which

includes item analysis and reliability analysis, the questionnaire was modified and the

formal survey was conducted.

3.   Data Analysis and Result

Next, collect the results of distributed questionnaire, and analysis the data collected

with SPSS 16 and with SmartPLS 2.0 using PLS-SEM technique to test the research

hypothesizes. Finally, organize the analysis results and reach the purpose of this

research.

Chapter 2 Literature review

In the following sections of literature review will discussed the context of this research, i.e. mobile application, and the main theory used in this research, i.e. categorization theory, and extracted mobile app adoption related factors from existing researches in sequence.

2.1 Mobile Application

Mobile application (app)-refers to software application which runs on mobile device including smartphone, tablet PC, iTouch, etc. Usually distribute by application platforms like App Store and Google Play, on which full of mobile app providers who develop the apps and release them on the platform. For applying the mobile app, user has to download it from the platforms, some of which are chargeable while others are free and only has the user bear the transmission fee ("Mobile app," 2013). There are all sorts of mobile app available now, categorizing from Business, Education, Entertainment, Family & Kids, Finance, Food & Drink, Games and Health & Fitness to Lifestyle, Music, Mews, Photo & Video, Productivity, Social Networking, Sports and Travel("Apple-iPhone 5 - Learn about apps from the App Store.," 2013).
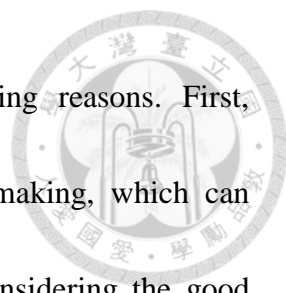
Since 1999 when mobile phone first provides the function of internet access, the ecosystem of mobile service has been continuing in developing. Before the smart phone appears on the market, the old type of mobile phone acquire users to join in an

m-service group (e.g. i-Mode) supported by a telecommunication company to access

variety of m-service, including email, music, animation, shopping, news, game, stock

market, ticket, fortune-telling, personals, book, auction, m-banking, etc. (Yi-Shun Wang

et al., 2006). And then, the first app was added to the App Store in 2008. The initial

purpose of mobile apps was general productivity and information retrieval, such as

email, calendar, contacts, stock market information and weather information, but as the

public demand rise, plus the availability of the development tool for app, the categories

grown to the scale mentioned in previous paragraph. Because of the number and

categories of mobile app has rapidly expanded, causing trouble for users to search

required app, multi-type of media have offer the service of commenting the mobile app

("Mobile app," 2013).

2.2   Categorization Theory
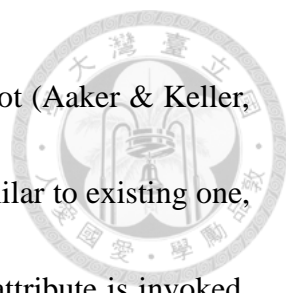
Categorization is the process by which object is recognized, differentiated, and

understood by our mind. To handle the explosion of information confronted every day,

people cluster things and objects, which share some perceived similarity, into categories

to simplify the complex world, so the people can function more effectively (Ozanne,

Brucks, & Grewal, 1992; Rosch, 1975; Song et al., 2010). This research uses the theory

of categorization to try to understand whether the achievement of original mobile app

can be transfer to its extension app somehow for the following reasons. First, categorization is fundamental in human inference and decision making, which can explain the situation when user adopts the extend mobile app considering the good experience or impression with its parent app (Song et al., 2010). Second, the extension mobile app can be assumed as a new instance which has some similarity with the parent app and awaits the process of categorization. Last but not least, the mobile app provider often use the parent app as a promotion platform for the extended app, like advertising for extended app, providing download link and discount, and designing all sorts of interaction between parent app and extended app which can benefit the users. And from the perspective of users, the more the interaction between the apps, the more likely they will assume the apps are associated with each other.

2.2.1 Evaluation of extended product based on Categorization Theory

The earliest concept of categorization can be traced back to the work of Greek philosophers, Plato and Aristotle, who introduces the approach of grouping objects based on their similar properties and further explore and systemized the approach ("Categorization," 2013). In modern times, this concept has been developed to explain how people evaluate extended product initially. Researches indicate that evaluation toward extended product can be formed in at least two ways, according to whether the

extended product is perceived as similar to the existing product or not (Aaker & Keller,

1990; Boush & Loken, 1991). If the extension is perceived as dissimilar to existing one,

then an evaluation based on a function composed of some specific attribute is invoked,

which termed "analytical," "piecemeal," or "computational." On the other hand, if

perceived as similar, a categorization process is invoked, that is, the extension is viewed

as belonging to the category which includes the existing product, and the evaluation

related to the category can be transferred to the extension (Boush & Loken, 1991; Song

et al., 2010). And there are two different two-step evaluation process are proposed by

previous research. One of them is proposed by (Fiske, S. T. & Pavelchak, M. A., 1986),

in which the first step is to match the new object with existing category, if there is a

match, then a categorization process is launched, otherwise a piecemeal process is

launched. Another one, proposed by (Smith, Shoben, & Rips, 1974), is that the first step

is also doing match. When a clear match or clear mismatch is made, a categorization

process is launched, but if some of the feature match and some do not, a second stage of

evaluation is invoked and a piecemeal process is launched, but a more careful

comparison to the existing category is also launched. With a mention, research shows

that a more category based evaluation process is faster than a more piecemeal based

evaluation process, and the second process indicate that the reason why it is faster is

because a more piecemeal based process involves two stages of evaluation(Ozanne et al.,

1992; Sujan, 1985).

2.2.2   Application of Categorization Theory

There has been a long history of the development and application of categorization

theory. A lot of empirical research in the social psychology (Fiske, S. T. & Pavelchak, M.

A., 1986; Smith et al., 1974) and marketing discipline (Boush & Loken, 1991; Sujan &

Dekleva, 1987; Sujan, 1985) has been established, and hence the validity of the

categorization theory has been empirically confirmed in various marketing contexts

(Song et al., 2010). Some of the research in marketing discipline has applied

categorization theory in examining consumers' attitudes toward brand extensions

(Aaker & Keller, 1990; Boush & Loken, 1991; Song et al., 2010).
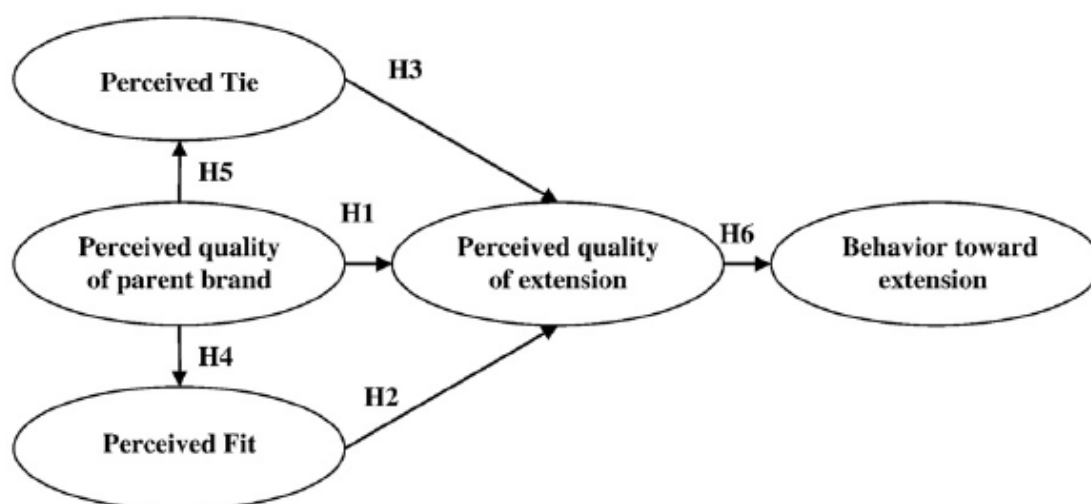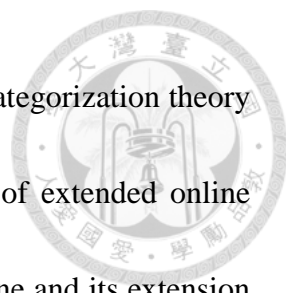
Figure 2-1 Model proposed by (Song et al., 2010)

(Song et al., 2010) proposed a model (Figure 2-1) to understand the brand

14

extension in the traditional online context. Their research employs categorization theory and attempt to realize the factors which determine the popularity of extended online product. The model was examined in the context of web search engine and its extension to a virtual community service and online news service. The result of the research shows that perceived quality of a parent brand can be transferred to its extensions, and perceived fit and perceived tie between the parent brand and extension have a positive influence on the perceived quality of the extension. The present study will validate this model in a mobile app context and modify the model if there's a chance that can make the model more fit in this specific context of mobile app.

2.3   Factors Related with Mobile App Adoption

The extended mobile app can be viewed as a new information service to the parent app users. According to Technology Acceptance Model (TAM) (Davis, 1989), user's behavioral intention toward use will eventually lead to actual system usage, and because of the differences of people, mission, system and organization in different technology or information system, the factors which influence the intention could change in different contexts, so it is important to figure what factors might influence the adoption of mobile app extension in order to modify the categorization theory-based model so it can be more fit in current research context.

Table 2-1 Existing studies of perceived usefulness as factor of m-service adoption

Adoption measure	Research context	Representative literature
Intention to use; repurchase intention	General mobile app	Chen, 2012; Tai-Li Ho, Huei-Hsia Hsu, & Chia-Cheng Chang, 2012
Intention to use	M-service group (ex. i-mode)	Yi-Shun Wang et al., 2006
Intended use	General handheld device services	Fang et al., 2006
Behavioral intention	Mobile data services (MDS)	Hong & Tam, 2006
Usage behavior; attention/ intention/ behavior; continued usage intention	Mobile communication services	Lu et al. 2010; Scharl et al., 2005b; Thong et al., 2006
Adoption intention; m-trust; purchase intention	Mobile commerce	Ko et al., 2009; Li & Yeh, 2010; H.-P. Lu & Su, 2009
Intention to use; use behavior	Mobile payment services	Schierz et al., 2010; Shin, 2009
Behavioral Intention	mobile healthcare	Wu et al., 2011

As the competition of mobile app market becomes more intense, the research associated to adoption of mobile services has continuous in thriving regardless of frontiers. Mentioned in the categorization based model proposed by (Song et al., 2010), perceived quality is a crucial factor in transferring the achievement of parent product to the extended product, likewise, it is also an important factor in a TAM based model. In the research of (Wei-Tsong Wang & Hui-Min Li, 2012), perceived quality is confirmed to have significance positive influence on purchase intention in the context of mobile

value-added service consumption. However, perceived usefulness has also been

confirmed to have significance in explaining users' adoption or re-adoption behavioral

intention in diverse type of mobile related service (

Adoption measure	Research context	Representative literature
Intention to use; repurchase intention	General mobile app	Chen, 2012; Tai-Li Ho, Huei-Hsia Hsu, & Chia-Cheng Chang, 2012
Intention to use	M-service group (ex. i-mode)	Yi-Shun Wang et al., 2006
Intended use	General handheld device services	Fang et al., 2006
Behavioral intention	Mobile data services (MDS)	Hong & Tam, 2006
Usage behavior; attention/ intention/ behavior; continued usage intention	Mobile communication services	Lu et al. 2010; Scharl et al., 2005b; Thong et al., 2006
Adoption intention; m-trust; purchase intention	Mobile commerce	Ko et al., 2009; Li & Yeh, 2010; H.-P. Lu & Su, 2009
Intention to use; use behavior	Mobile payment services	Schierz et al., 2010; Shin, 2009
Behavioral Intention	mobile healthcare	Wu et al., 2011

Table 2-1). Therefore in current research perceived usefulness will be added to the

model considering its influence on mobile service related adoption. On the other hand,

according to (Fang et al., 2006), another factor in classic TAM, perceived ease of use,

remains controversial to its relationship with users' behavioral intention toward

information system, since some of the researches report that perceived ease of use has

directly influence on intention of information system use while some of researches do

not. Likewise, although some of the researches indicate that perceived enjoyment or

perceived playfulness to be a factor which influences mobile app adoption, but it mainly

affect the gaming type of mobile app. And because of the trend of free app, free trial app

or limit free app in App Store and Google Play, and the nature of mobile app which lack

of binding contract, price related factors, such as perceived price, perceived credibility

are not suitable in the study context of mobile app. Thence in current study these factors,

perceived ease of use, perceived enjoyment and perceived price, won't present in the

model.

Chapter 3   Research Approach

3.1   Research Model

In last chapter, related literature was reviewed and based on the result of the review, a research model describing parent app transferring positive image to extended app is presented in Figure 3-1.
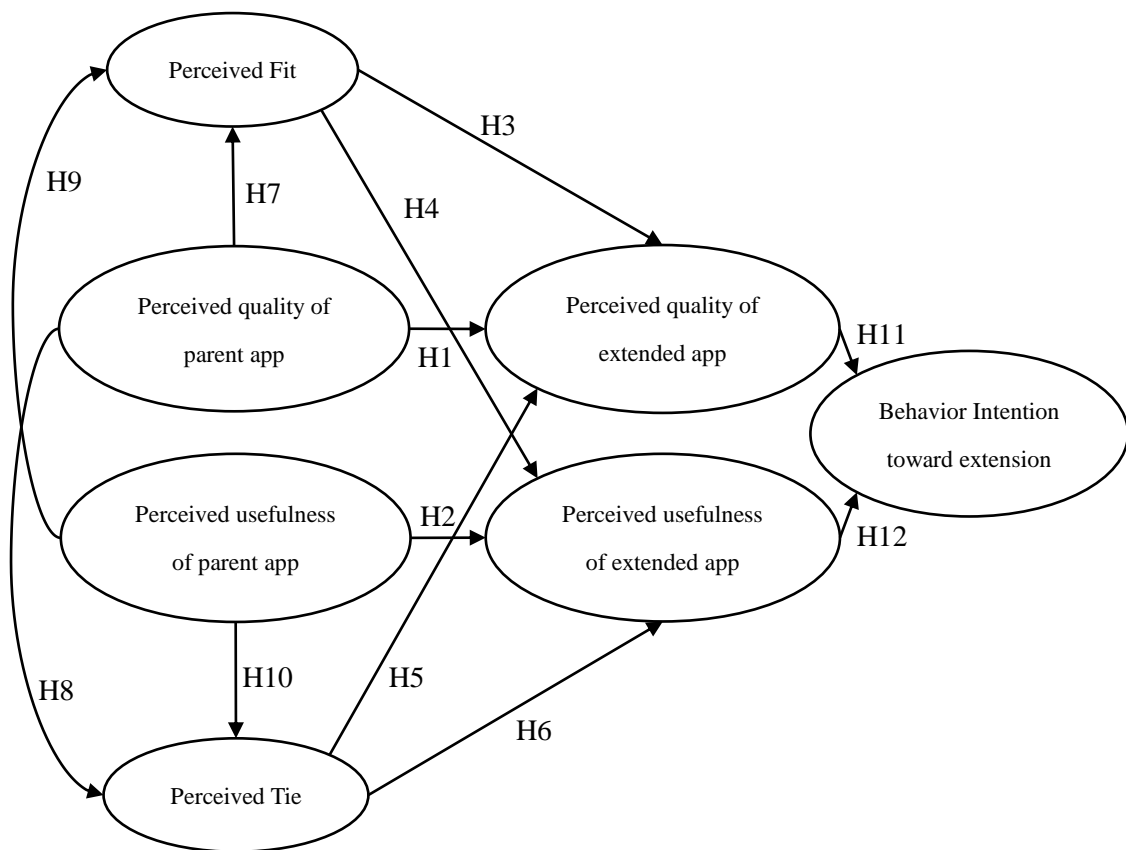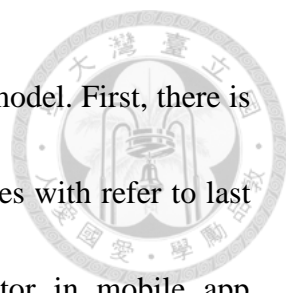
Figure 3-1 Research Model

This model is adapted from the model proposed by (Song et al., 2010) for present study context of mobile app extension, and can be better understood with reference to their simpler single cognitive factor model mentioned in previous sections (Figure 2-1).

Compare to the original model, there are several differences in this model. First, there is

an extra cognitive factor, perceived usefulness, because earlier studies with refer to last

chapter suggested that perceived usefulness is an important factor in mobile app

adoption. Another difference is that this research replaces the original construct,

behavior toward extension, with behavior intention toward extension, and the reason is

that from TAM it can be seen that behavioral intention toward use will eventually lead

to actual system usage. From overall perspective, this model attempts to combine the

research achievements of categorization theory and other existing researches, and to

implement the function, explaining the relationship between two different systems, of

the original model in mobile app context.

3.2　　Variable Definition and Research Hypotheses

3.2.1　Perceived Quality and Perceived Usefulness

Perceived quality has been the basis of global customers' judgment toward all

kinds of products (Hwang & Kim, 2007; Song et al., 2010; Wei-Tsong Wang & Hui-Min

Li, 2012; Zeithaml, 1988). Perceived usefulness in this research, adapted from existing

researches (Davis, Bagozzi, & Warshaw, 1989; Davis, 1989), is the extent to which a

mobile user believes that using a particular app will enhance his or her performance on

specific task. Before the extended app is launched, people probably have had an

evaluation of quality and usefulness toward the parent app. Because of the relationship

between the parent app and extended app, and the unfamiliarity of the extended app

causing by imperfect and asymmetric information, people tended to transfer the already

established evaluation, including perceived quality and usefulness, toward parent app on

to the extended app. While reducing the uncertainty toward the extension, it also

reduces the information cost and risk perception of users, consequently causing better

evaluation toward the extension (Erdem & Swait, 1998). Therefore current research

assumed that the perceived quality and perceived usefulness of the parent app have a

positive influence on the perceived quality and perceived usefulness of the extended app.

The relationship between the perceived quality of parent app and the perceived quality

of the extension has been examined in diverse context (Aaker & Keller, 1990; P.

Bottomley & Holden, 2001; Chowdhury, 2007; Song et al., 2010; Völckner & Sattler,

2006). Although there is no research indicate clear relationship between perceived

usefulness of parent app and the perceived usefulness of the extension, when users

perceived higher usefulness toward the parent app, their needs are satisfied and they are

likely to think that the app provider has the ability to provide extended apps which can

meet their needs especially when the apps are perceived to be in the same category by

the users, wherefore the transfer of usefulness perception between parent app and the

extension is to be tested. In conclusion, the following hypotheses are proposed.

H1. A higher perceived quality of parent app is associated with a higher perceived quality of the extended app.

H2. A higher perceived usefulness of parent app is associated with a higher perceived usefulness of the extended app.

3.2.2 Perceived Fit and Perceived Tie

Perceived fit is defined as the extended app's perceived similarity to the parent app mainly on dimensions like category and attributes (Park, Milberg, & Lawson, 1991; Song et al., 2010). In the memory of users, product categories are conceptualize as cognitive categories(Boush & Loken, 1991), and it is likely that the extended app will be assigned to the same category as the parent app for the reason that they generally have some common attributes. Thus if there is perceived fit between parent app and extended app, a categorization process is probably to follow, and the perceptions toward parent app would be apply to the extended app. Otherwise, a piecemeal process will be launched and the attribute of the extended app will be examined carefully so the user can arrive at a final judgment toward the extension (Sujan, 1985). Furthermore, when the result of perceived fit is low, user may even doubt the provider's capability of developing the extended app and hence causing a poorer evaluation of the extended app

(Czellar, 2003; Park et al., 1991). This leads to the following hypotheses.

H3. The perceived fit between the parent app and the extended app has a positive association with the perceived quality of the extended app.

H4. The perceived fit between the parent app and the extended app has a positive association with the perceived usefulness of the extended app.

In this research, perceived tie is defined as the strength of perceivable interactions between different apps (Song et al., 2010; K. Stewart, 2006). Due to the design of mobile app, which not only provide connectivity through hyperlinks to the extended app, but also provide various interactive ways between parent app and its extension, parent app can act as promoting platform for its extension (Sviokla & Paoni, 2005), and the perceived tie between the parent app and its extension can easily be established by mobile user. If user perceived a strong tie between parent app and its extension, both the apps would be assumed to be a bonded coherent group (K. J. Stewart, 2003; K. Stewart, 2006), and thus more likely to be allocated into the same category. Just as the same situation when perceiving a fit between apps, the categorization process will take place and the evaluation of parent app will be transferred to the extended app. However, if there is no perceived tie or the perceived tie is weak, then the reason why the app provider is launching the extension will be question. Hence the following hypotheses

are proposed.

H5. The perceived tie between the parent app and the extended app has a positive association with the perceived quality of the extended app.

H6. The perceived tie between the parent app and the extended app has a positive association with the perceived usefulness of the extended app.

An overall evaluation of product may be deposited and retrieved apart from specific attribute information in memory, therefore the evaluation of parent app can have impact on perceived fit and perceived tie by the retrieval of memory (Broniarczyk & Alba, 1994; Gwee, Hui, & Chau, 2002). If the perceived quality and the perceived usefulness of the parent app are positive, users will expect the providers to be capable of developing a new app, and causing the perceived fit and perceived tie to be higher. In contrast, if the perceived quality and the perceived usefulness of the parent app are negative, the technique and ability of the provider in developing a new app will be doubt, and result in lower perceived fit and perceived tie. The situation brings about the following hypotheses.

H7. The perceived quality of a parent app has a positive association with the perceived fit.

H8. The perceived quality of a parent app has a positive association with the perceived tie.

H9. The perceived usefulness of a parent app has a positive association with the perceived fit.

H10. The perceived usefulness of a parent app has a positive association with the perceived tie.

3.2.3 Behavior Intention

Perceived quality is a critical determinant of intention (Aaker & Keller, 1990; Jacobson & Aaker, 1987), and many researches have empirically confirmed the positive effect of perceived quality on the user's intention (Baker, Sciglimpaglia, & Saghafi, 2010; Liaogang, Chongyan, & Zi'an, 2007; Tsiotsou, 2006; Zeithaml, Berry, & Parasuraman, 1996). Therefore this study proposes the following hypothesis.

H11. The perceived quality of the extended app is positively associated with the usage behavioral intention toward the extended app.

The primary reason why people adopted an app is that the app provides some specific function which can make people find it helpful. And there is extensive research in related context which has proven the effect of perceived usefulness on usage intention (Chen, 2012; Fang et al., 2006; Hong & Tam, 2006; Ko et al., 2009; Li & Yeh,

2010; H.-P. Lu & Su, 2009; Y. Lu et al., 2010; Scharl et al., 2005b; Schierz et al., 2010; Shin, 2009; Tai-Li Ho et al., 2012; Thong et al., 2006; Wu et al., 2011; Yi-Shun Wang et al., 2006). Hence the following hypothesis will be tested.

H12. The perceived usefulness of the extended app is positively associated with the usage behavioral intention toward the extended app.

3.3 Research Design

3.3.1 Measurement of the constructs

According to (Eagly, 1992), if researchers only adopt the most relevant research, then they will miss the chance to discover potential theoretical ideas and make their research be limited by the constraints of the research paradigm. Therefore the current research will use real mobile app and its extension as research target.

In this research, the free mobile messenger app, LINE, and its extensions were chosen to be the target parent app and extended apps. Launched in June, 2011, LINE has rapidly occupied the communication app market in Taiwan ("LINE," 2013). After that, its provider launched its extensions, LINE camera and LINE POP in April and November next year respectively (Rick Martin, 2012a, 2012b). The recent report indicated that LINE is the top app which has the highest reach rate and its extensions, LINE camera and LINE POP, are also on the popular list during the research period,

November 2012 to January 2013, in Taiwan (InsightXplorer, 2013). There are four reasons why LINE and its extensions are chosen to be the research target. First of all, the popularity of LINE and its extensions, and that the function of them are all major and practical in everyday use, which make it more effective to obtain valid questionnaires and make the research result to be more representative. Secondly, the adoption of the apps selected is usually voluntary, so there is no influence from any coercion to confound user perceptions and intention. Third, according to Taiwan Network Information Center (TWNIC), the apps belong to different categories, which are sociality for LINE messenger, photo editing/ photography for LINE camera and game for LINE POP (TWNIC, 2012a). Therefore LINE camera and LINE POP can be seen as new product category for LINE. Lastly, the launch time of the apps, as mentioned previously, follow the order of parent app and then the extensions.

Validated survey items are adopted from previous research, see Table 3-1. Few changes in the wording have been made so that the items can fit in the research context. Parent app refers to the mobile messenger app, LINE, whose related task is mobile message-sending. Extended app refers to the mobile photographing app, LINE camera, whose related task is photo shooting, and another one refers to the mobile entertainment app, LINE POP, whose related task is game playing. 7-point Likert scales was used,

with anchors ranging from 'strongly disagree' to 'strongly agree' or 'extremely low' to

'extremely high', depending on the type of the question.
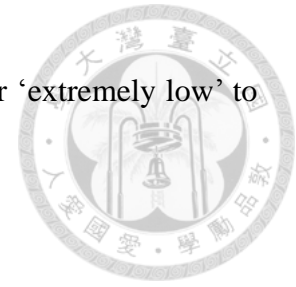
Table 3-1 Survey item design

Construct	Item No.	Item	Citation
Perceived quality of parent app (QUA)	QUA1	The perceived overall quality of the [parent app].	(Aaker & Keller, 1990; Song et al., 2010; Völckner & Sattler, 2006)
	QUA2	The likelihood of using the [parent app] assuming a [related task] behavior was planned.	
perceived usefulness of parent app (PU)	PU1	Using the [parent app] would improve my performance in conducting [related task].	(Davis et al., 1989; Davis, 1989; Y.-S. Wang et al., 2006)
	PU2	Using the [parent app] would make it easier for me to conduct [related task].	
	PU3	I would find the [parent app] useful in conducting [related task].	
Perceived quality of extended app (QUAE)	QUAE1	The perceived overall quality of the [extended app].	(Aaker & Keller, 1990; Song et al., 2010; Völckner & Sattler, 2006)
	QUAE2	The likelihood of trying the [extended app].	
perceived usefulness of extended app (PUE)	PUE1	Using the [extended app] would improve my performance in [related task].	(Davis et al., 1989; Davis, 1989; Y.-S. Wang et al., 2006)
	PUE2	Using the [extended app] would make it easier for me to [related task].	
	PUE3	I would find the [extended app] useful in conducting [related task].	

Perceived Fit (FIT)	FIT1	Global similarity between [parent app] and the [extended app].	(P. A. Bottomley & Doyle, 1996; Song et al., 2010; Völckner & Sattler, 2006)
	FIT2	Would the people, facilities, and skills used in making the [parent app] be helpful if [app provider] were to provide the [extended app]?	
	FIT3	Extent to which [parent app]-specific associations are relevant in the [extended app].	
Perceived Tie (TIE)	TIE1	The [parent app] is not connected to the [extended app]. (Reverse coded)	(Song et al., 2010; K. J. Stewart, 2003; K. Stewart, 2006)
	TIE2	The [parent app] is not likely to recommend the [extended app] to individuals. (Reverse coded)	
	TIE3	The [parent app] and the [extended app] have a business relationship with one another.	
Behavior Intention toward extension (BI)	BI1	Assuming that I have access to the [extended app], I intend to use it.	(Agarwal & Prasad, 1999; Venkatesh & Davis, 1996; Yi-Shun Wang et al., 2006)
	BI2	I intend to increase my use of the [extended app] in the future.	

Before firing the formal questionnaire, pre-test of the measuring items was made by selected mobile app users. Item analysis using critical ratio method, item-to-total correlation coefficient analysis, and Cronbach's alpha coefficient analysis was conducted to examine the quality of the items (Table 3-2). All items' critical ratio is higher than 3.5 (Wang, B.J., 2002), and all items' correlation with construct's total score

is significant and highly relevant. Furthermore, the Cronbach's alpha of all constructs are higher than 0.7 and the Cronbach's alpha if any item was deleted (Anderson & Gerbing, 1988). Therefore, the internal consistency and reliability of the items are verified. However, because the number of pre-test samples was insufficient, the pre-test stage doesn't include factor analysis. The items were modified according to the analysis result and some of the opinions of the subjects. The complete formal questionnaire consists of introduction of the selected apps, measures of the constructs and request for demographic information, which is showed in Appendix A. Questionnaire
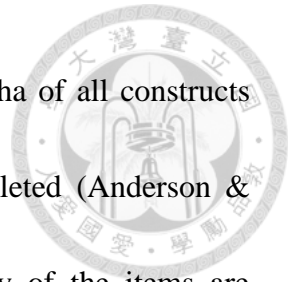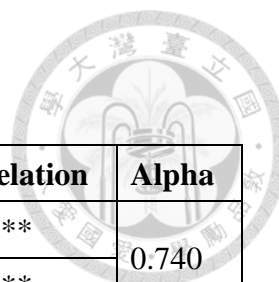
Table 3-2 Pre-test analysis result

Construct	Item No.	CR	Correlation	Alpha
Perceived quality of parent app	QUA1	10.543	0.861**	0.740
	QUA2	8.036	0.939**	
Perceived usefulness of parent app	PU1	15.959	0.893**	0.881
	PU2	9.837	0.924**	
	PU3	12.649	0.889**	
Perceived quality of extended app	QUAE1	9.174	0.921**	0.824
	QUAE2	13.054	0.974**	
Perceived usefulness of extended app	PUE1	11.269	0.945**	0.934
	PUE2	8.504	0.920**	
	PUE3	12.132	0.962**	
Perceived Fit	FIT1	7.734	0.880**	0.836
	FIT2	6.572	0.854**	
	FIT3	6.905	0.874**	
Perceived Tie	TIE1	9.608	0.817**	0.767
	TIE2	8.522	0.875**	
	TIE3	8.851	0.785**	
Behavior Intention toward extension	BI1	11.222	0.959**	0.918
	BI2	11.180	0.965**	
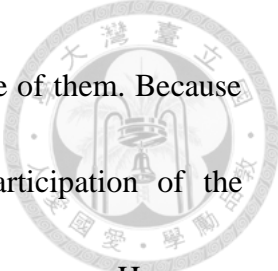
**.Correlation is significant at the 0.01 level (2-tailed).

Note: CR=Critical ratio, Correlation=Item-to-all correlation, Alpha=Cronbach's alpha

3.3.2 Data Collection
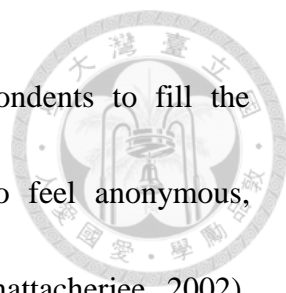
This study takes place in Taiwan, which is an appropriate location because there are 41.97% of the people hold smart device and there are 66.92% of them, who has already downloaded apps, are qualified for this research (TWNIC, 2012a).

The research target of current research includes all individuals who has suitable

device which can obtain mobile app and has downloaded at least one of them. Because of choosing LINE messenger as the parent app in research, participation of the questionnaire also limited to those who have use mobile instant message app. However, the participation of the research doesn't constraint to the user who use all three of the chosen app, LINE messenger, LINE camera, and LINE POP, for the reason that all three of the applications are popular and commonly used apps, hence users of mobile devices usually have some impression of them. Also, there are brief introductions of all three apps in the questionnaire before asking related questions. In addition, in the research of Song et al. (2010), the requirement of participating the survey was also only users who use general service similar to parent web service.

An online survey is conducted, which hosted by mySurvey system (www.mysurvey.tw), a well-known website which provides free construction of online survey and hosting service. To reach the general population of research target as close as possible, a number of the popular web forums, which discuss mobile app related topic, including ePrice (www.eprice.com.tw) and PTT Bulletin Board System (www.ptt.cc), and popular mobile accessible social website, Facebook (www.facebook.com) were choose to distribute the link of the online survey. There are several benefits to adopt online survey compared survey in paper (Wei-Tsong Wang & Hui-Min Li, 2012). First

of all, because the nature of online survey, which allows respondents to fill the questionnaire without the constraints of time and space, and to feel anonymous, researchers can reach respondents more easily and effectively (Bhattacherjee, 2002). Next, the online survey system provides the function to restrict respondents to fill out every survey items, or else they can't submit the responses, therefore prevent incomplete answers in survey results (Wang & Emurian, 2005). Third, the participants of online survey are usually voluntary, and thus tend to provide more meaningful responses than those who are not, which ensure the validity of the responses (Hsu, Ju, Yen, & Chang, 2007). Lastly, previous research indicated that the results of the online survey are less likely to be influenced by the presentation format or be affected negatively by non-serious or repeat responders (Gosling, Vazire, Srivastava, & John, 2004). Besides, the users, who can fill in the online survey, of web forums and Facebook are matched for the age and computer literacy for mobile app user.

In order to draw as many as possible participants of the survey, a lucky draw was conducted. Ten prizes were offered for the draw winners, and every respondent had approximately 4% chance of winning the prize. The data was collected from 6 June, 2013 to 4 July, 2013, a total of 4 weeks. Finally, 265 responses were collected. After deleting repeat responses and non-serious responses, the result provides 506 (253 × 2)

observations since each response evaluates two extensions.

3.3.3 Analysis Method

The collected data will be analyzed by SPSS 16 and SmartPLS 2.0, and follow the procedure showed in Figure 3-2. In step two and step three, a two-phase approach (Anderson & Gerbing, 1988) for SEM analysis was used with partial least square estimation approach following the procedure in the study of Aibinu and Al-Lawati (2010). Phase one is measurement model, which examined the overall fit, validity, and reliability using CFA. And then phase two is structural model, which examined the hypotheses.

PLS-SEM was used in this study because most of the items were perception-based measured on a Likert scale, which are of unknown distribution, and since normality of the items can't be confirmed, PLS-SEM was preferred but not normality requested covariance-based SEM.

Step1. Demographic Statistic of the sample: SPSS

Step2. Confirmatory factor analysis (CFA): SmartPLS

Step3. Structural equations modeling (SEM): SmartPLS
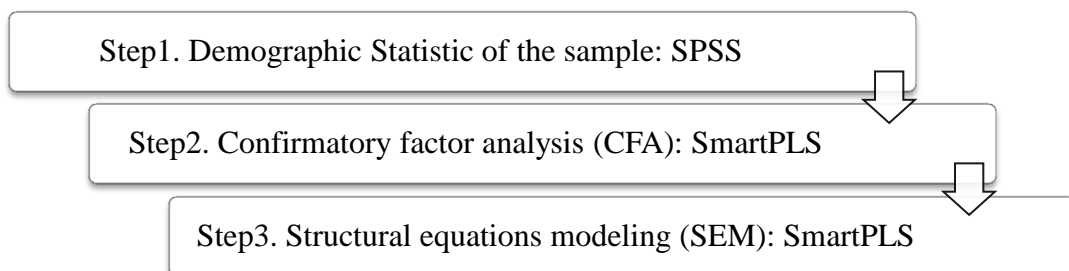
Figure 3-2 Analysis flowchart

Chapter 4   Analysis and Results
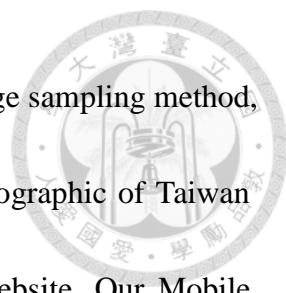
4.1   Demographic Statistic

After organizing the data, 506 samples were assessed for three major biases, which are noncoverage bias, sampling bias and nonresponse bias, in online survey (Best, Krueger, Hubbard, & Smith, 2001; Couper, 2000), to ensure the representativeness of the samples.

First, noncoverage bias means that not everyone in the research target population is in the sample frame, which in this research it represents that not everyone who use mobile app can access the online survey which distributed in the web forums and Facebook. A report in 2012 (TWNIC, 2012b) indicated that there is more than 77.25% of people in Taiwan who has the experience in surfing internet, therefore the high internet penetration imply that whether the potential respondents have access to the internet so that they can participate in the online survey is not a serious problem. Additionally, the distributed channels, web forums and Facebook are popular in Taiwan and open to everyone on the internet. Thus the research has no serious noncoverage bias.

Secondly, sampling bias refers to the situation that not all members of the sample frame are measured in the research. Because this research did not apply random

sampling method, there is potential of sampling bias. In order to judge sampling method,

the demographic of the research samples are compared to the demographic of Taiwan

smart device users[1] investigated by (Google Inc., 2012) in the website, Our Mobile

Planet, indicates the gender distribution of the research samples, which is similar to the

findings of Our Mobile Planet, where the distribution is male for 55% and female for

45%. Furthermore, a t test was performed, and the result (p=0.345 > 0.05) implies that

there is no significant difference between these gender distributions. However, the

education level and age distribution (Table 4-1) of the samples were centralize at higher

education level and younger age, which mostly are college and graduate students. This

is probably resulted of that the user of the web forums and Facebook who often

participate in answering questionnaires are generally young people and high educational

students. Nevertheless, the sample still considered representative for following reasons.

According to the summary of the investigation report of TDCDA (2012), smart device

users, 20-29 years old accounted for 83.9% and university or higher education level

accounted for 83.2%, have higher proportion of downloading app, which is in

accordance with the samples distribution of this research samples. Besides, in prior

study (Walczuch & Lundgren, 2004), the feasibility of using student sample in e-tailing

---

[1] According to (TWNIC, 2012a), there is 66.92% of smart device users who has downloaded apps.

researches is confirmed, and still many researches (Kasesniemi & Rautiainen, 2002; Katz & Sugiyama, 2006; Ling & Yttri, 2002; Ozok & Wei, 2010; Skog, 2002) demonstrate the use of student samples in research of mobile field, therefore the use of student samples in mobile app adoption are feasible. Also, the high educational level of the samples implies that the respondents were more likely to understand the survey items and thus present more reasonable responses. Overall, the sampling bias is not a serious problem in this research.

Table 4-1 Demographic distribution of sample respondents

Gender		Education			Age			
Male	**Female**	**Under High school**	**College**	**Above Master degree**	**<18**	**18-24**	**25-30**	**>30**
49.40%	50.60%	3.20%	61.30%	35.60%	0.80%	56.50%	30.80%	11.90%

Finally the nonresponse bias was assessed by comparing the early respondents with later respondents, assuming that later respondents was more similar to nonrespondents because they were less readily to respond and might response owing to the increasing call for participating the survey (Armstrong, Armstrong, & Overton, 1977). Nonresponse bias means that the answers of respondents are different from the answers of those who did not answer, which is a critical problem occurs in online survey (Best et al., 2001; Couper, 2000; Gosling et al., 2004). The demographic distribution of early
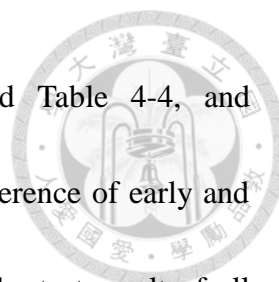
and late respondents are shown in Table 4-2, Table 4-3 and Table 4-4, and independent-samples t-test was conducted to see if there is any difference of early and late respondents in gender, education level and age distribution. The test result of all three distribution (p>0.05) indicated that the two groups of respondents were no significantly different in the demographic distribution. As a result, the nonresponse bias is not likely to occur.

Table 4-2 Gender distribution of early and late respondents

	Gender	
	Male	**Female**
Early respondents	50.80%	49.20%
Late respondents	48.00%	52.00%
p value		0.662

Table 4-3 Education level distribution of early and late respondents

	Education		
	High school and specialist (or lower)	**College and Bachelor degree**	**Master degree or higher**
Early respondents	3.20%	57.90%	38.90%
Late respondents	3.10%	64.60%	32.30%
p value			0.327

Table 4-4 Age distribution of early and late respondents

	Age			
	<18	**18-24**	**25-30**	**>30**
Early respondents	0%	56.30%	31.70%	11.90%
Late respondents	1.60%	56.70%	29.90%	11.80%
p value				0.689

In addition, the proportion of the users who have used the parent app, LINE messenger, and the extended app, LINE Camera or LINE POP, are list below (Table 4-5). It can be seen that most of the users in the research sample have used the parent app, more than half of them have used the extended app, less than one third of them haven't used both of the parent app and the extended app, which indicated that the sample user have sufficient capability to answer related questions of the apps.

Table 4-5 Usage rate of the parent app and the extended app

usage rate	Parent app	Extended app	Both the parent app and the extended app
yes	97.63%	55.53%	71.94%
no	2.37%	44.47%	28.06%

4.2 Measurement Model

Before testing hypothesizes of the research model, the measurement model was tested for all constructs and its measuring items in the CFA conducted by SmartPLS 2.0. The quality of the items were evaluated by test including individual item reliability analysis, convergent validity of the measures associated with individual construct, and discriminant validity of the research items.

4.2.1 Individual Item Reliability

Individual item reliability is the extent to which measurements of the latent constructs measured with multi-item scale reflects mostly the true score of the constructs with respect to the error (Hulland, 1999). Table 4-6 shows the corresponded factor loadings of items and their respective construct in bold type. It can be seen that

all the loadings are higher than 0.7, which is a rule of thumb employed by many

research (Carmines & Zeller, 1979). As a result, all the items are at a satisfactory level

of individual item reliability.

Table 4-6 Construct loadings

	Construct						
Item No.	QUA	PU	QUAE	PUE	FIT	TIE	BI
QUA1	**0.925**	0.657	0.286	0.231	0.240	0.197	0.199
QUA2	**0.839**	0.569	0.202	0.174	0.118	0.185	0.176
PU1	0.535	**0.816**	0.270	0.292	0.165	0.109	0.295
PU2	0.650	**0.881**	0.271	0.259	0.191	0.255	0.193
PU3	0.610	**0.882**	0.263	0.282	0.230	0.209	0.257
QUAE1	0.330	0.316	**0.913**	0.695	0.443	0.286	0.597
QUAE2	0.202	0.262	**0.934**	0.768	0.366	0.133	0.799
PUE1	0.196	0.264	0.730	**0.938**	0.420	0.157	0.735
PUE2	0.241	0.316	0.751	**0.953**	0.451	0.153	0.759
PUE3	0.224	0.328	0.767	**0.941**	0.476	0.190	0.762
FIT1	0.187	0.185	0.405	0.408	**0.873**	0.348	0.328
FIT2	0.209	0.212	0.375	0.408	**0.887**	0.413	0.351
FIT3	0.175	0.214	0.382	0.456	**0.911**	0.470	0.365
TIE1	0.159	0.130	0.154	0.106	0.326	**0.789**	0.046
TIE2	0.165	0.178	0.158	0.103	0.315	**0.811**	0.037
TIE3	0.168	0.200	0.187	0.181	0.398	**0.701**	0.092
BI1	0.214	0.277	0.764	0.788	0.384	0.103	**0.976**
BI2	0.201	0.279	0.720	0.765	0.379	0.052	**0.974**
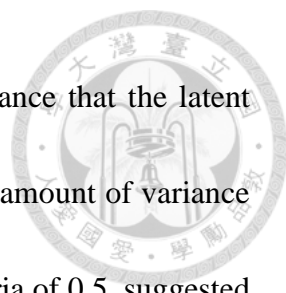
4.2.2 Convergent Validity

Convergent validity is the measure of the internal consistency, which ensures that the items measure the assumed construct and not measuring other construct (Aibinu & Al-Lawati, 2010). Several criteria were assessed to determine the convergent validity, which were average variance extracted (AVE), composite reliability scores and Cronbach's alpha (Table 4-7).

Table 4-7 Convergent validity

Construct	Item No.	AVE	CFR	Alpha
Perceived quality of parent app	QUA1	0.779	0.876	0.724
	QUA2			
perceived usefulness of parent app	PU1	0.740	0.895	0.824
	PU2			
	PU3			
Perceived quality of extended app	QUAE1	0.854	0.921	0.829
	QUAE2			
perceived usefulness of extended app	PUE1	0.891	0.961	0.939
	PUE2			
	PUE3			
Perceived Fit	FIT1	0.793	0.920	0.870
	FIT2			
	FIT3			
Perceived Tie	TIE1	0.591	0.812	0.657
	TIE2			
	TIE3			
Behavior Intention toward extension	BI1	0.950	0.974	0.947
	BI2			

Note: CFR = Composite Factor Reliability,   Alpha = Cronbach's Alpha
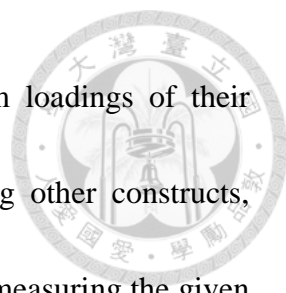
First, the presented AVE, which measured the amount of variance that the latent

constructs extracted from its measurement items with respect to the amount of variance

due to measurement errors, of all the constructs were above the criteria of 0.5, suggested

by (Fornell & Larcker, 1981). Next, composite reliability was assessed. It measures the

extent to which a set of items measures a latent construct. In this research, all of the

composite reliability were higher than the benchmark of 0.7 proposed by Nunnally &

Bernstein (1994). Lastly, Cronbach's alpha, similar to composite reliability, is the

coefficient of consistency. Churchill (1979) suggests 0.6 as acceptable value of

Cronbach's alpha and it can be seen that all construct in Table 4-7 satisfy the standard.

To sum up, the demonstrated result illustrates that the measurement model have

convergent validity and internal consistency, which indicates that the measurements

items were of fine quality.

4.2.3 Discriminant Validity

Discriminant validity is the extent to which a specific latent construct is

distinguished from other latent construct in the structural model (Hulland, 1999).

Analysis of cross-loadings and analysis of AVE were conducted to evaluate the

discriminant validity of this research. Following the method proposed by Chin (1998),

the loadings and cross-loadings of all measures in the model were examined (Table 4-6).

Looking at a given vertical column, it can be seen that the item loadings of their corresponding construct are all higher than loadings in measuring other constructs, which implies that the items were better suited than other items for measuring the given construct. Likewise, looking at any specific horizontal row, the item loading for its corresponding construct are all higher than loadings for others, indicating that the specific item was more suitable to measure the corresponded construct than other construct. Therefore the result of cross-loading analysis demonstrated discriminant validity of the latent constructs. Next, the AVE of the constructs was assessed. According to (Fornell & Larcker, 1981), AVE of a latent construct from its measurement items should be greater than the variance shred between the latent construct and other constructs, which represent different sets of measurement items. The rule is that for each construct, the square root of its AVE should be larger than its correlation with other constructs (Chin, 1998). The result is shown in Table 4-8, where the highlighted diagonal elements, which are the square root of corresponding construct, are all greater than the off-diagonal element in the corresponding rows and columns, which are the correlation with other constructs. Therefore, the outcome of analysis of AVE is also satisfied and the discriminant validity of the constructs was established.
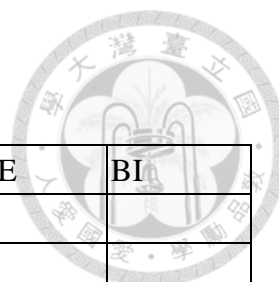
Table 4-8 Construct correlations

	QUA	PU	QUAE	PUE	FIT	TIE	BI
QUA	**0.883**						
PU	0.698	**0.860**					
QUAE	0.283	0.311	**0.924**				
PUE	0.234	0.321	0.794	**0.944**			
FIT	0.213	0.229	0.435	0.476	**0.891**		
TIE	0.216	0.227	0.221	0.177	0.461	**0.768**	
BI	0.213	0.285	0.762	0.797	0.391	0.080	**0.975**

Note: Diagonal elements are square roots of the average variance extracted (AVE).

4.3   Structural Model

Based on the result established by measurement model, the latent constructs and measurement items have satisfactory individual item reliability, convergent validity and discriminant validity. With the sufficient robustness of the measurement model, the structural model was assessed to examine the relationship of the latent constructs and the dependent constructs by determine the explanatory power and validation of the structural model.

4.3.1   Explanatory Power of the Structural Model

The explanatory power of the structural model was assessed by examining the amount of variance in the dependent variables explained by the model. According to Breiman & Friedman (1985), squared multiple correlations (R^2) is critical criterion for evaluating structural model.

In current study, the R^2 for all dependent constructs are listed in Table 4-9. The R^2
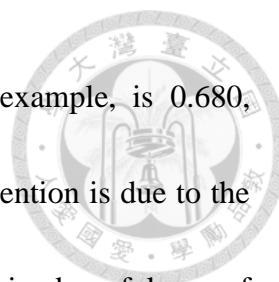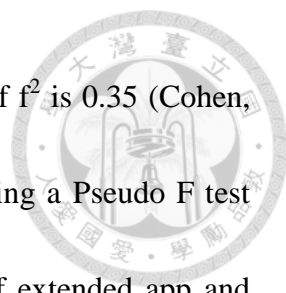
of the constructs, behavior Intention toward extension (BI), for example, is 0.680, meaning that approximately 68% of the variance in the behavior Intention is due to the two latent constructs, perceived quality of extended app and perceived usefulness of extended app, in the model. The significance of the R^2 value was evaluated by conducting F test following the recommendation of Miller & Falk (1992). As it can be seen in Table 4-9, all of the results demonstrate that the explanatory power of the model is statistically significant, which implies the predictive relevance of the structural model.

Table 4-9 R^2 value of dependent construct

Dependent Construct	R square	F	Sig. level
BI	0.680	534.438	***
QUAE	0.227	49.139	***
PUE	0.281	65.397	***
FIT	0.058	15.485	***
TIE	0.058	15.485	***

Note: ***p<0.001

The change in R^2 values were also been examined to evaluate the structural model. The impact of a specific independent latent construct on the dependent construct was assessed by calculating the effective size (f^2) (Chin, 1998). The summary of the result is displayed in Table 4-10, where R^2 excluded means the R^2 value on the dependent construct when specific latent construct was omitted in the structural equation. The effect of a specific construct on corresponding dependent construct is small at the

45

structural level when f^2 is 0.02, medium when f^2 is 0.15 and large if f^2 is 0.35 (Cohen, 1988). Also, the significance of f^2 statistic was tested by performing a Pseudo F test (Wixom & Watson, 2001). It can be seen that perceived quality of extended app and perceived usefulness of extended app both have considerable effect on behavior intention toward extension, and the effective size are significant. Furthermore, the effect of perceived quality of parent app and perceived fit on perceived quality of extended app and perceived usefulness of parent app and perceived fit on perceived usefulness of extended app are all at a moderate level and all corresponding effective size are significant. On the other hand, the effect of perceived tie on perceived quality of extended app is weak, and the effect on perceived usefulness of extended app is quite small. In addition, the effect of perceived quality of parent app and perceived usefulness of parent app on perceived tie and perceived fit are small, and the effective size of perceived usefulness of parent app are both significant.

Table 4-10 Results of effective size (f^2) analysis

Dependent	Independent	R^2 excluded	f^2	Inference	F	Sig.
BI $R^2 = 0.680$	QUAE	0.635	0.141	Medium Effect	70.172	0.000***
	PUE	0.581	0.309	Large Effect	154.378	0.000***
QUAE $R^2 = 0.227$	QUA	0.189	0.049	Small to medium Effect	24.678	0.000***
	FIT	0.105	0.158	Medium Effect	79.229	0.000***
	TIE	0.227	0.000	Weak Effect	0.000	1.000
PUE $R^2 = 0.281$	PU	0.229	0.072	Small to medium Effect	36.306	0.000***
	FIT	0.115	0.231	Medium to large Effect	115.900	0.000***
	TIE	0.275	0.008	Small Effect	4.189	0.041*
FIT $R^2 = 0.058$	QUA	0.052	0.006	Small Effect	3.204	0.074
	PU	0.046	0.013	Small Effect	6.408	0.012*
TIE $R^2 = 0.058$	QUA	0.052	0.006	Small Effect	3.204	0.074
	PU	0.046	0.013	Small Effect	6.408	0.012*

Note: ***p<0.001, **p<0.01, *p<0.05

4.3.2　Validation of the Structural Model

The validation of the structural model was assessed by examining each path, representing each hypothesis, in the model in PLS-SEM. Test of each hypothesis was conducted by looking over the sign, value and statistical significance of the path coefficients between each latent constructs and the dependent constructs (Wixom & Watson, 2001). Table 4-11 presents the result of the hypothesis test, in which the higher path coefficient meaning stronger the effect of a predictor latent construct on the dependent construct, and the significance of the path coefficients was examined by conducting a two-tail t test and see if the t values are significance. The hypotheses were considered supported based on the conventional criterion of significance level, which is that $p < 0.05$. The result shows that eight out of twelve hypotheses were supported. The path coefficient of the paths including perceived quality of parent app to perceived quality of extended app, perceived usefulness of parent app to perceived usefulness of extended app, perceived fit to perceived quality of extended app, perceived fit to perceived usefulness of extended app, perceived usefulness of parent app to perceived fit, perceived usefulness of parent app to perceived tie, perceived quality of extended app to behavior intention toward extension, and perceived usefulness of extended app to behavior intention toward extension are all positive and significant. On the other hand,
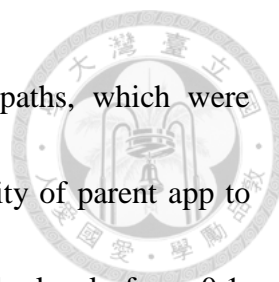
the significance level of path coefficients representing the two paths, which were

perceived quality of parent app to perceived fit and perceived quality of parent app to

perceived tie, did not meet the standard of 0.05 but were close to the level of $p < 0.1$,

therefore still remained for consideration. However, the sign of the path coefficient of

the paths, perceived tie to perceived quality of extended app and perceived tie to

perceived usefulness of extended app, were not consistent with the hypotheses and both

the path coefficient were not significant, therefore the hypotheses were not supported.

Table 4-11 Results of structural model

Hypothesis	Path	Expected sign	Path coefficient	t-value	Sig. level	Inference
H1	QUA→QUAE	+	+0.200	4.743	***	Supported
H2	PU→PUE	+	+0.236	5.116	***	Supported
H3	FIT→QUAE	+	+0.394	7.497	***	Supported
H4	FIT→PUE	+	+0.464	8.341	***	Supported
H5	TIE→QUAE	+	-0.004	0.073		Not Supported
H6	TIE→PUE	+	-0.091	1.602		Not Supported
H7	QUA→FIT	+	+0.105	1.660		
H9	PU→FIT	+	+0.156	2.254	*	Supported
H8	QUA→TIE	+	+0.112	1.637		
H10	PU→TIE	+	+0.149	2.005	*	Supported
H11	QUAE→BI	+	+0.350	7.614	***	Supported
H12	PUE→BI	+	+0.519	11.611	***	Supported

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$
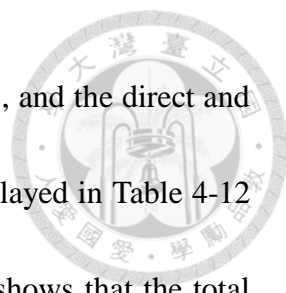
The overall result of structural model is presented in Figure 4-1, and the direct and indirect effect between the constructs according to the results is displayed in Table 4-12 Direct and indirect effects between constructs (Table 4-12), which shows that the total effect of perceived quality of parent app on behavior intention toward extension is 0.016, whereas the total effect of perceived usefulness of parent app to behavior intention toward extension is 0.036.
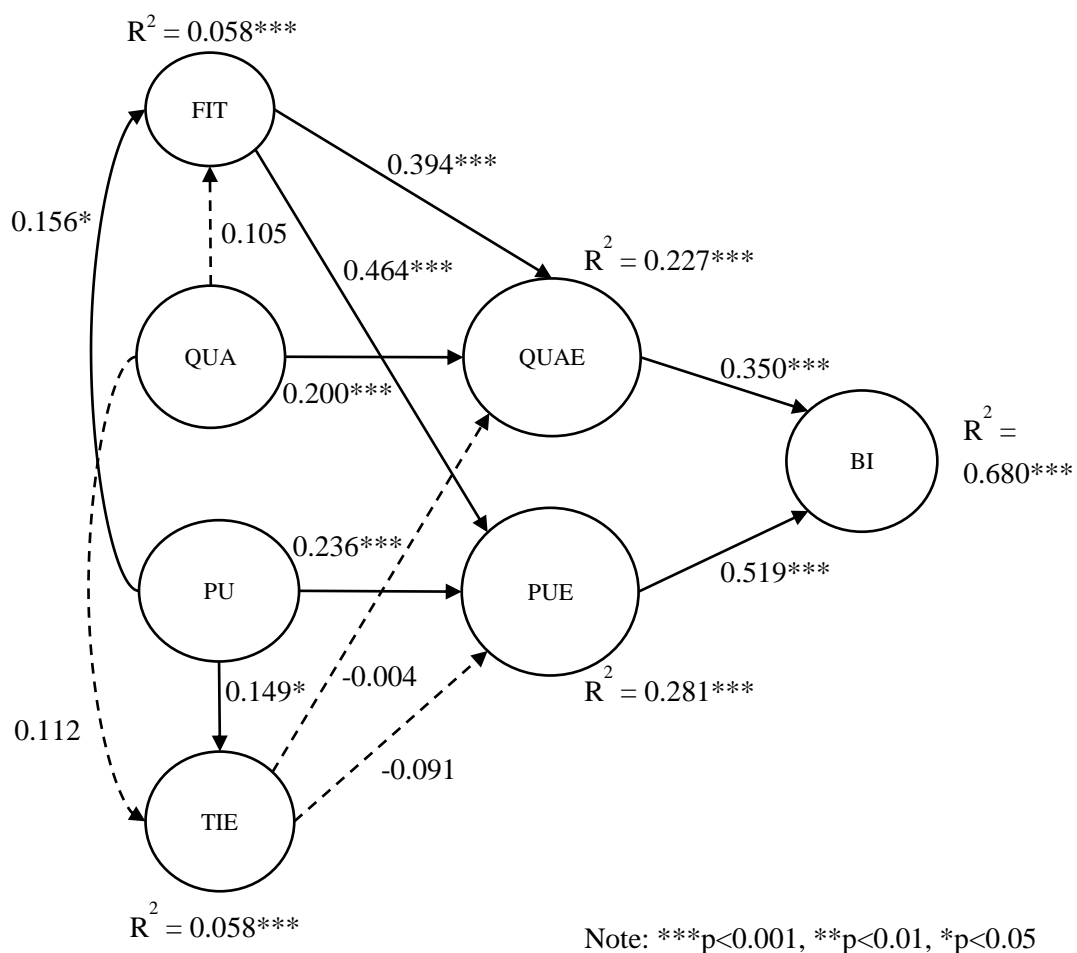
Figure 4-1 Results of PLS-SEM analysis

Table 4-12 Direct and indirect effects between constructs

Effect Type / Source		QUA	PU	QUAE	PUE	FIT	TIE	R²
QUAE	Direct	0.200				0.200		0.227
	Indirect		0.002					
	Total	0.200	0.009			0.200		
PUE	Direct		0.236			0.464		0.281
	Indirect		0.004					
	Total		0.240			0.464		
FIT	Direct		0.156					0.058
	Indirect							
	Total		0.156					
TIE	Direct		0.149					0.058
	Indirect							
	Total		0.149					
BI	Direct			0.350	0.519			0.680
	Indirect	0.016	0.036			0.084		
	Total	0.016	0.036	0.350	0.519	0.084		

4.4　Supplemental Analysis

In order to get more information from the research data, more analyses were

conducted.

First, to compare the model proposed in this research with the original model

proposed by (Song et al., 2010) in the context of web service, the same model was
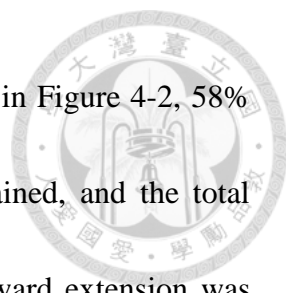
assessed using the same data in this research. As the result showed in Figure 4-2, 58%

of the changes in behavior intention toward extension were explained, and the total

effect of perceived quality of parent app on behavior intention toward extension was

0.016.

$R^2 = 0.046***$

FIT

0.394***

0.214***

$R^2 = 0.227***$

QUA

QUAE

BI

$R^2 = 0.581***$

0.199***

0.762***

0.214***

-0.003

TIE

$R^2 = 0.046***$

Note: ***p<0.001, **p<0.01, *p<0.05
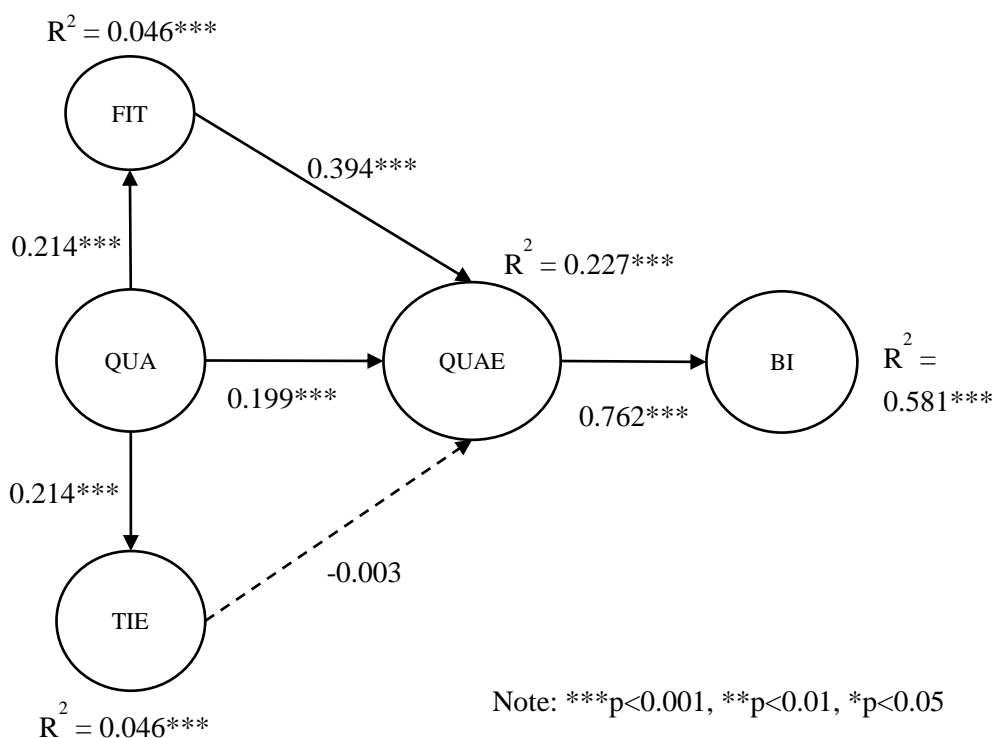
Figure 4-2 Results of PLS-SEM analysis in original model

Also, to emphasize the effect of categorization on the judgment of mobile user

toward extended app, the respondents which have higher score of perceived fit, the

highest 27%, and which have lower score, the lowest 27% were extracted from the

samples based on the statistically selection of upper and lower groups (Kelley, T. L.,
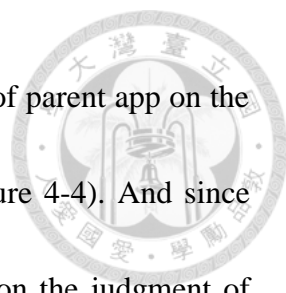
1939) to compare the effect of the perceived quality and usefulness of parent app on the perceived quality and usefulness of extended app (Figure 4-3, Figure 4-4). And since perceived tie has been examined that has no significant influence on the judgment of extended app, it won't be considered in this situation. As it can be seen in the following figures, when the users perceive higher fit between the parent app and the extended app, the judgment of the parent app, perceived quality and usefulness, the positive effect on the perceived quality and usefulness of the extended app is significant (Figure 4-4) in comparing to the situation when the users perceived lower fit between the parent app and the extended app (Figure 4-3). Therefore when user perceived a higher overall similarity between the parent app and the extended app, it's likely that they will perceived the two apps are in the same category and thus transfer the judgment of parent app to the extended app.
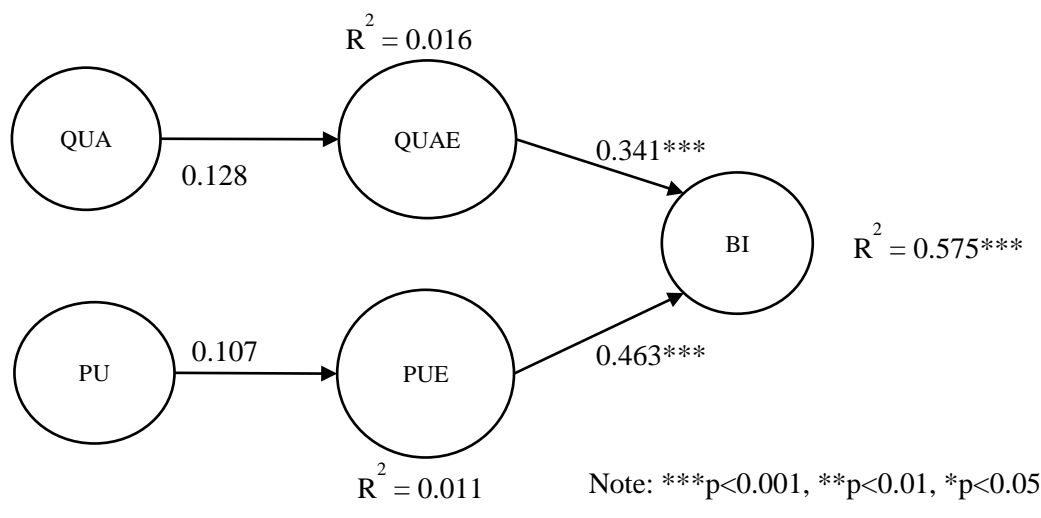

$R^2 = 0.016$

QUA → QUAE 0.128

QUAE → BI 0.341***

PU → PUE 0.107

PUE → BI 0.463***

BI $R^2 = 0.575***$

$R^2 = 0.011$

Note: ***p<0.001, **p<0.01, *p<0.05

Figure 4-3 Results of PLS-SEM analysis in lower 27% group of perceived fit

$R^2 = 0.080***$ (QUAE)

$R^2 = 0.718***$ (BI)

0.282*** (QUA→QUAE)

0.464*** (QUAE→BI)

0.366*** (PU→PUE)

0.442*** (PUE→BI)

$R^2 = 0.134***$ (PUE)

Note: ***p<0.001, **p<0.01, *p<0.05
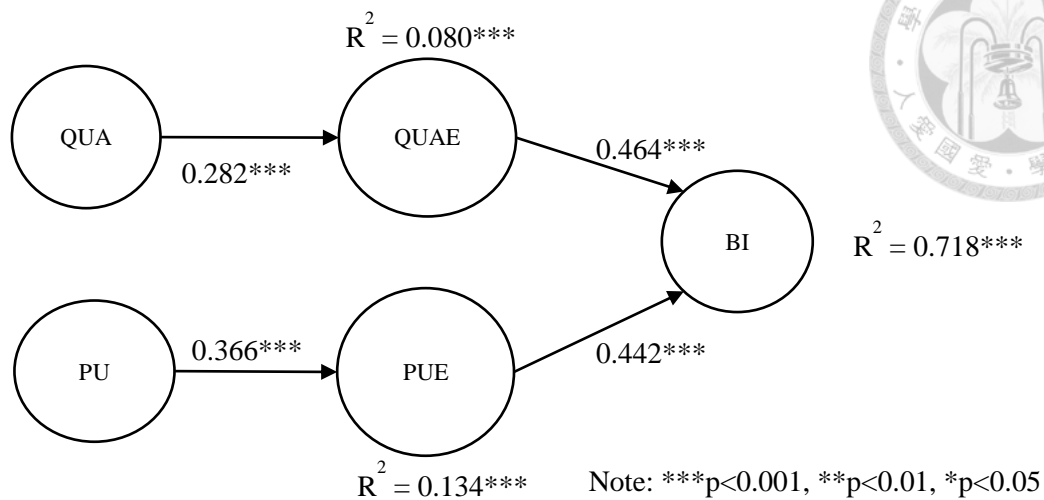
Figure 4-4 Results of PLS-SEM analysis in upper 27% group of perceived fit

Next, to evaluate the different result which may occur in different types of extended app, the data was split into two different group, evaluating the extension LINE Camera and LINE POP separately, and each contain 253 samples. The result is showed in Figure 4-5 and Figure 4-6. In the context where extended app was LINE camera, the R^2 value for behavior intention toward extension was 0.695, for perceived quality of extended app was 0.248, for perceived usefulness of extended app was 0.319, for perceived fit was 0.083, and for perceived tie was 0.061, which were overall higher than in the context where LINE POP as extended app, where R^2 value for behavior intention toward extension was 0.680, for perceived quality of extended app was 0.211, for perceived usefulness of extended app was 0.259, for perceived fit was 0.050, and for perceived tie was 0.057. On the other hand, the relationships in the context where
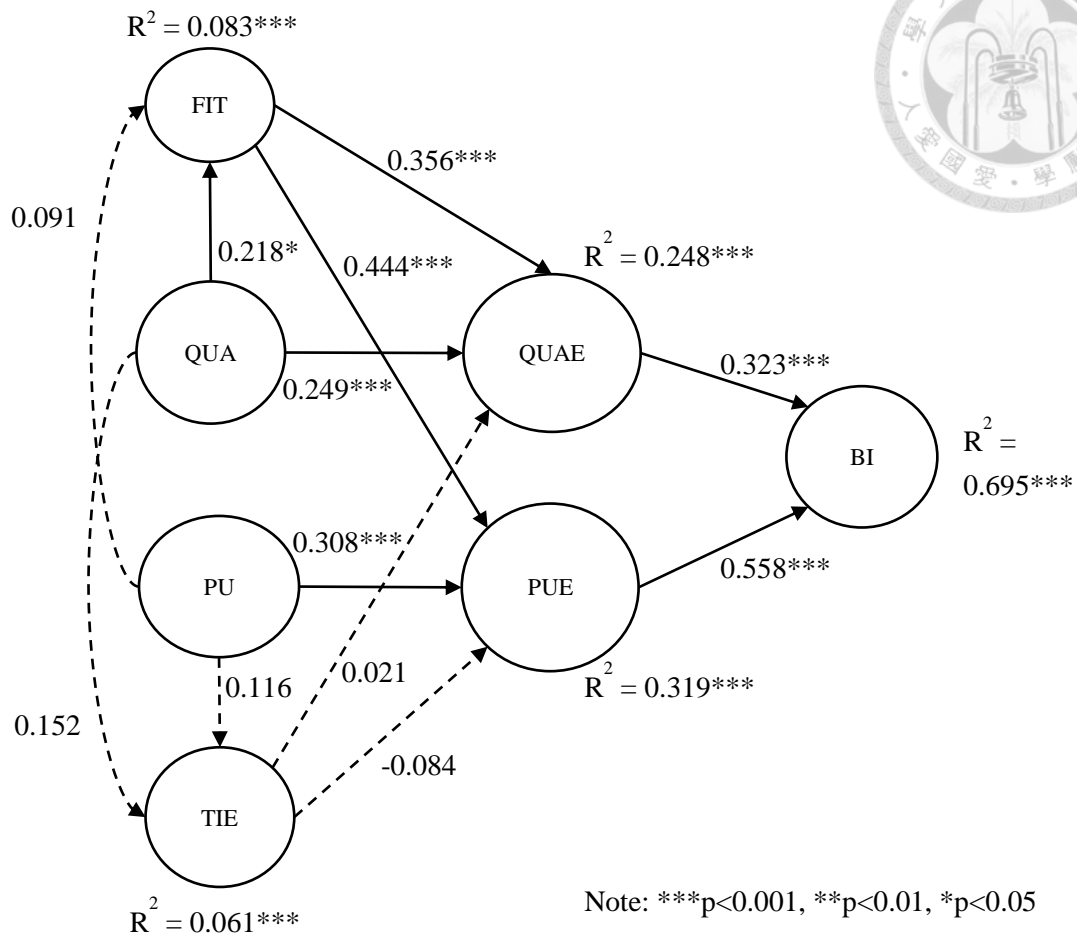
Figure 4-5 Results of PLS-SEM analysis with LINE Camera as extension

extended app was LINE camera showed that it is more likely that perceived quality of

parent app influence perceived quality and perceived usefulness of extended app

through the effect of perceived fit while in the context where LINE POP as extended

app perceived usefulness of parent app has more possibility in influencing perceived

quality and perceived usefulness of extended app through the effect of perceived fit.

However, in both contexts the relationships of perceived quality of parent app

influencing behavior intention toward extension by perceived quality of extended app
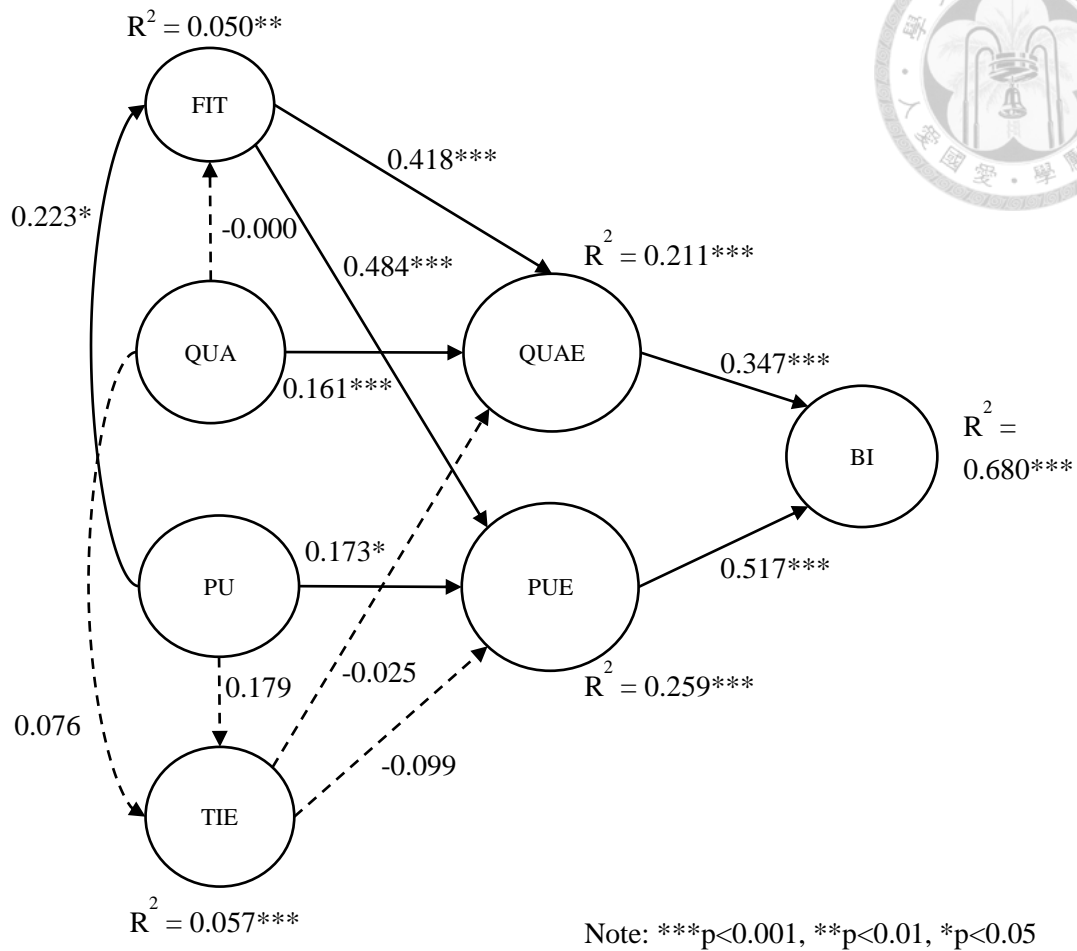
Figure 4-6 Results of PLS-SEM analysis with LINE POP as extension

and perceived usefulness of parent app influencing behavior intention toward extension by perceived usefulness of extended app were all significant. And the total effects on behavior intention toward extension by perceived quality of parent app were 0.022 and 0.012, and by perceived usefulness of parent app were 0.055 and 0.024 in the context of LINE Camera and LINE POP as extended apps respectively.

After examining through the analysis result, the discussion of the findings will be presented in next chapter.
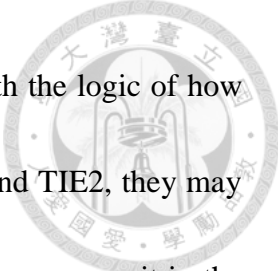
Chapter 5 Discussion and Conclusion

5.1 Discussion of Findings

The analysis results in last chapter will be discussed in the following sections from various dimensions including the quality of the questionnaire items, the result of a single path or the overall model, comparison between the models and comparison across the different extensions.

In hindsight of the result of structural model (Figure 4-1), it can be seen that the reason why the construct, perceived tie, in the model had insignificant effect might be that the quality of the measurements of the construct was poor. First of all, although all the items measuring perceived tie had pass through the criterion of the individual item reliability (0.7 of each corresponding item loading) and convergent validity (AVE > 0.5; Cronbach's alpha > 0.6), but the values just got a low pass (TIE3 loading = 0.701; AVE = 0.591; Cronbach's alpha = 0.657). In addition, there is also a research indicated that the criterion of Cronbach's alpha should be 0.7(Anderson & Gerbing, 1988), and therefore causing the result of examining the convergent validity of the construct, perceived tie, to be failed. Lastly, despite that the obvious non-serious respondents had already been deleted, answering the reverse-coded items, TIE1 and TIE2, measuring the construct, perceived tie may still be difficult to some of the respondents. They may not

notice that the questions were reverse-coded or may be confused with the logic of how

to answer the question. Also, after answering the question of TIE1 and TIE2, they may

be mistaken that TIE3 was also a reverse-coded question and therefore answer it in the

wrong way. Overall, the insignificance of the effect producing by perceived tie may

cause by the short of the measuring items' quality.

Through the result of Structural Model and analysis using the original model, the

following findings were discovered. The R^2 value of the constructs indicated that the

related results for the construct, behavior intention toward extension (0.680), had

practical value, and for the construct, perceived quality of the extended app (0.227) and

perceived usefulness of the extended app (0.281), had moderate explanatory power,

whereas the related results for perceived tie and perceived fit had weak explanatory

power. In addition, Table 4-12 Direct and indirect effects between constructs indicated

that the total effect of perceived usefulness of parent app (0.036) is stronger than

perceived quality of parent app (0.016) on behavior intention toward extension, which

implied that the influence of perceived usefulness cannot be ignored. Also, the total

effect of perceived fit on behavior intention toward extension (0.084) was considerable.

Compared with the original model proposed by (Song et al., 2010) with the same data,

where the R^2 value of the constricts were 0.581 for behavior intention toward extension,

0.058 for perceived fit and perceived tie, the overall explanatory power of the proposed

model in this research was stronger. However, in both model with the same data, the

related effects of perceived tie remained insignificant.

In comparing the different result when using different type of extended app

(Section 4.4), the outcome leads to several findings. First of all, the overall explanatory

power when using LINE Camera as extended app is stronger than using LINE POP as

extended app. When using LINE Camera as extended app, the R^2 values of behavior

intention toward extension, perceived quality of extended app, perceived usefulness of

extended app, perceived fit, and perceived tie were 0.695, 0.248, 0.319, 0.083 and 0.061

correspondingly, while the R^2 values were 0.680, 0.211, 0.259, 0.050 and 0.057

respectively when using LINE POP as extended app. Secondly, it is more likely that

perceived quality of parent app through the indirect effect of perceived fit to influence

perceived quality of extended app, perceived usefulness of extended app, and behavior

intention toward extension when using LINE Camera as extended app, while there is

more possibility that perceived usefulness of parent app through the indirect effect of

perceived fit to influence the same constructs mentioned. However, in both situations

the total effect of perceived usefulness of parent app on behavior intention toward

extension was stronger than perceived quality of parent app. According to the research

report (TWNIC, 2012a), LINE messenger belongs to the app type of sociality, LINE Camera belongs to photo editing or photography, and LINE POP belongs to game type of apps. Therefore, it can be assumed that when the sociality type of apps are as the parent app, the circumstance will be more fit to this model when the extended app is a photo editing or photography app. Since both sociality and photo editing or photography types of apps perform general task while gaming type of apps perform gaming task (Fang et al., 2006), users may perceived LINE messenger and LINE Camera to be in the same category and thus more fit to the research assumption. In addition, perceived quality is more likely to transfer to the extension through perceived fit when photo editing or photography types of apps was as extension while perceived usefulness, which can be explained as perceived playfulness in gaming type apps, is more likely to transfer to gaming type extension through perceived fit. Nevertheless, the adoption intention of both types of apps would be more influenced by the perceived usefulness of their parent app than perceived quality.

5.2 Implications
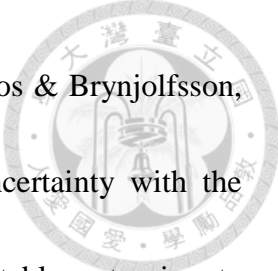
After expounding the discovery in the results, following sections will further discuss the implications theoretically and practically.

The theoretical implications of current study lie mainly in the extension of the

categorization theory and existing researches of mobile app adoption. This study extend

the model proposed by (Song et al., 2010) from the context of web service adoption to

the context of mobile app, and further introduce the perception constrict, perceived

usefulness, which extracted from the existing researches of mobile app adoption, into

the model. Given that perceived usefulness of parent app is influential in extended app

adoption, the future application in adopting categorization theory in explaining the

transference of usage in other context should consider including adoption factor with

strong influence under the context into the research model, just as perceived usefulness

in the context of mobile app adoption. Furthermore, the research of mobile app adoption

is extended by this research into the transference of adoption. The acceptance of

extended app, especially when both parent and extended app perform same type of tasks,

may depend on the acceptance and usage of relates apps. This research shows that the

perceived quality and perceived usefulness of parent app and perceived fit have

significant influence on subsequent apps adoptions.

For business practice, the findings of the study also implied some suggestions.

First of all, the research confirms the influence of fit on the perceived quality and

perceived usefulness of extended app. Also, existing research indicated that user tend to

place value on a collection of products, i.e. products under a category, with lower

variance per product than they place on a product individually (Bakos & Brynjolfsson, 1999, 2000), where lower variance represents lower risks and uncertainty with the releasing of product. Hence the managers should choose the suitable extension to succeed in the new app market, because the extension will affect the perceived fit and consequently the possibility of being seen as under the same category with the parent app and, ultimately, the behavior extension toward the extension. However, compare to the context of web service, the effect of perceived tie is insignificant in mobile app service. The probably reason is that the users might have been accustomed to that there is links between the parent product and the extension, and may even be counterproductive if there is too much promotion of the extension on the parent product. Secondly, perceived usefulness is confirmed to be an important role not only in mobile app adoption by existing researches (section 2.3) but also in extended mobile app adoption by this research. Therefore to make sure the mobile app business goes well, it is crucial for the developer to make sure that the mobile app they plan to release has its main feature which results in high level of perceived usefulness.

5.3   Limitations and Future Research

However, this research still has its own limitations and inadequacies, which requires future work of research to improve it. First, it should be noted that in

generalizing the findings of this research, the results is best applied to mobile app users who exhibit the characteristic similar to the samples used in this research, and to those who are disposed to respond to a circulated request to take part in a similar survey. Also, caution is required when intending to generalize the results to other type of mobile apps, where replication of the study is needed. Second, to explain the influence of the parent app on its extension, there are other perspective, for example, network effect, halo effect and feedback effect, which might need to be concerned (Song et al., 2010). In extending the results of this research, the issue of how to increase the perception of fitness between the parent app and its extension so that they can share the profit from the good image of the parent app still needs further research. In addition, the circumstances of product segmentation, where the extended app doesn't share the impression of its parent app, and the situation when the extended app try to reverse the impression of its parent app are not under consideration in this research, but both of which would be interesting and valuable to research.

5.4 Conclusion

In conclusion, this research further confirmed the categorization theory-based model in the context of mobile app with modification using the results of existing researches. By examining the usage intention transfer behavior with online survey,

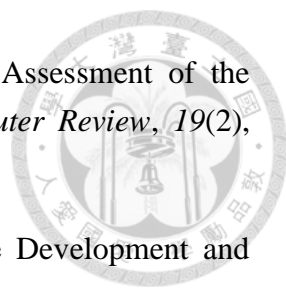perceptions including perceived quality and perceived usefulness of the parent app are

identified to be transfer to the extension, and perceived fit between the apps is verified

that having a positive impact on the effect of perception transfer. According to the

results of this study, suggestions were made for both academic and practical use, hoping

to provide a deeper understanding in the usage behavior of mobile application.

REFERENCE

夔蒠. (2013). 你撑过 2012 了吗. 中欧商业评论, *2013 年 1 月刊*(57).

Aaker, D. A., & Keller, K. L. (1990). Consumer Evaluations of Brand Extensions. *Journal of Marketing*, *54*(1), 27–41. doi:10.2307/1252171

Agarwal, R., & Prasad, J. (1999). Are Individual Differences Germane to the Acceptance of New Information Technologies? *Decision Sciences*, *30*(2), 361–391. doi:10.1111/j.1540-5915.1999.tb01614.x

Aibinu, A. A., & Al-Lawati, A. M. (2010). Using PLS-SEM technique to model construction organizations' willingness to participate in e-bidding. *Automation in Construction*, *19*(6), 714–724. doi:10.1016/j.autcon.2010.02.016

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411–423. doi:10.1037/0033-2909.103.3.411

Angry Birds Go: Something new is coming! (2013). *Angry Birds Go*. Retrieved June 17, 2013, from http://go.angrybirds.com/

Apple-iPhone 5 - Learn about apps from the App Store. (2013). Retrieved from http://www.apple.com/iphone/from-the-app-store/

Armstrong, S., Armstrong, and J. S., & Overton, T. S. (1977). Estimating Nonresponse Bias in Mail Surveys. *Journal of Marketing Research*, *14*, 396–402.

Baker, W. E., Sciglimpaglia, D., & Saghafi, M. (2010). Branding of post-purchase ancillary products and services: An application in the mobile communications industry. *European Journal of Marketing*, *44*(5), 547–566. doi:10.1108/03090561011032261

Bakos, Y., & Brynjolfsson, E. (1999). Bundling Information Goods: Pricing, Profits, and Efficiency. *Management Science*, *45*(12), 1613–1630. doi:10.1287/mnsc.45.12.1613

Bakos, Y., & Brynjolfsson, E. (2000). Bundling and Competition on the Internet. *Marketing Science*, *19*(1), 63–82. doi:10.1287/mksc.19.1.63.15182

Best, S. J., Krueger, B., Hubbard, C., & Smith, A. (2001). An Assessment of the Generalizability of Internet Surveys. *Social Science Computer Review*, *19*(2), 131–145. doi:10.1177/089443930101900201

Bhattacherjee, A. (2002). Individual Trust in Online Firms: Scale Development and Initial Test. *J. Manage. Inf. Syst.*, *19*(1), 211–241.

Bottomley, P. A., & Doyle, J. R. (1996). The formation of attitudes towards brand extensions: Testing and generalising Aaker and Keller's model. *International Journal of Research in Marketing*, *13*(4), 365–377. doi:10.1016/S0167-8116(96)00018-3

Bottomley, P., & Holden, S. (2001). Do we really know how consumers evaluate brand extensions? Empirical generalizations based on secondary analysis of eight studies. *Journal of marketing research*, *38*(4), 494–500.

Boush, D. M., & Loken, B. (1991). A Process-Tracing Study of Brand Extension Evaluation. *Journal of Marketing Research*, *28*(1), 16–28. doi:10.2307/3172723

Breiman, L., & Friedman, J. H. (1985). Estimating Optimal Transformations for Multiple Regression and Correlation. *Journal of the American Statistical Association*, *80*(391), 580–598. doi:10.2307/2288473

Broniarczyk, S. M., & Alba, J. W. (1994). The Importance of the Brand in Brand Extension. *Journal of Marketing Research (JMR)*, *31*(2), 214–228.

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and validity assessment*. Beverly Hills, Calif.: Sage Publications.

Categorization. (2013, June 8). In *Wikipedia, the free encyclopedia*. Retrieved from http://en.wikipedia.org/w/index.php?title=Categorization&oldid=558720373

Chen P.-W. (2012, June 16). *Examining Consumers' Intention to Use Mobile Phone Applications: A Decomposed Theory of Planned Behavior Perspective* (thesis). National Central University. Retrieved from http://thesis.lib.ncu.edu.tw/ETD-db/ETD-search-c/view_etd?URN=994201018

Chin, W. W. (1998). The partial least squares approach for structural equation modeling. In *Modern methods for business research* (pp. 295–336). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Chowdhury, M. H. K. (2007). An investigation of consumer evaluation of brand extensions. *International Journal of Consumer Studies*, *31*(4), 377–384. doi:10.1111/j.1470-6431.2006.00568.x

Churchill, G. A. (1979). A Paradigm for Developing Better Measures of Marketing Constructs. *Journal of Marketing Research*, *16*(1), 64–73. doi:10.2307/3150876

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, N.J.: L. Erlbaum Associates.

Couper, M. (2000). Web surveys: a review of issues and approaches. *Public opinion quarterly*, *64*(4), 464–494.

Czellar, S. (2003). Consumer attitude toward brand extensions: an integrative model and research propositions. *International Journal of Research in Marketing*, *20*(1), 97–115. doi:10.1016/S0167-8116(02)00124-6

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, *13*(3), 319–340. doi:10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, *35*(8), 982–1003. doi:10.2307/2632151

Eagly, A. H. (1992). Uneven progress: Social psychology and the study of attitudes. *Journal of Personality and Social Psychology*, *63*(5), 693–710. doi:10.1037/0022-3514.63.5.693

Erdem, T., & Swait, J. (1998). Brand Equity as a Signaling Phenomenon. *Journal of Consumer Psychology*, *7*(2), 131–157. doi:10.1207/s15327663jcp0702_02

Fang, X., Chan, S., Brzezinski, J., & Xu, S. (2006). Moderating Effects of Task Type on Wireless Technology Acceptance. *Journal of Management Information Systems*, *22*(3), 123–157. doi:10.2753/MIS0742-1222220305

Fiske, S. T., & Pavelchak, M. A. (1986). Category-based versus piecemeal-based affective responses: Developments in schema-triggered affect. In Sorrentino, Richard M. & Higgins, E. Tory (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (pp. 167 – 203). New York: Guilford Press.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with

Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Francisco, T. B. in S., & London, R. C. in. (2013, March 8). Upstart knocks Angry Birds off its perch. *Financial Times*. Retrieved from http://www.ft.com/intl/cms/s/0/c929fdae-87fe-11e2-8e3c-00144feabdc0.html#ax zz2WTkm9qwK

Google Inc. (2012). *Our Mobile Planet: Taiwan Understanding the Mobile Consumer*. Google Inc. Retrieved from http://www.thinkwithgoogle.com/mobileplanet/zh-tw/

Gosling, S. D., Vazire, S., Srivastava, S., & John, O. P. (2004). Should we trust web-based studies? A comparative analysis of six preconceptions about internet questionnaires. *The American psychologist*, *59*(2), 93–104. doi:10.1037/0003-066X.59.2.93

Gwee, Y.-T., Hui, K.-L., & Chau, P. (2002). Determinants of Brand Equity in E-Businesses: An Exploratory Study. *ICIS 2002 Proceedings*. Retrieved from http://aisel.aisnet.org/icis2002/57

Hong, S.-J., & Tam, K. Y. (2006). Understanding the Adoption of Multipurpose Information Appliances: The Case of Mobile Data Services. *Information Systems Research*, *17*(2), 162–179. doi:10.1287/isre.1060.0088

Hsu, M.-H., Ju, T. L., Yen, C.-H., & Chang, C.-M. (2007). Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations. *International Journal of Human-Computer Studies*, *65*(2), 153–169. doi:10.1016/j.ijhcs.2006.09.003

Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: a review of four recent studies. *Strategic Management Journal*, *20*(2), 195–204. doi:10.1002/(SICI)1097-0266(199902)20:2<195::AID-SMJ13>3.0.CO;2-7

Hwang, Y., & Kim, D. J. (2007). Customer self-service systems: The effects of perceived Web quality with service contents on enjoyment, anxiety, and e-trust. *Decision Support Systems*, *43*(3), 746–760. doi:10.1016/j.dss.2006.12.008

InsightXplorer. (2013, March 23). 創市際 ARO 公佈台灣首份智慧型手機使用行為測量報告. *InsightXplorer*. Retrieved from

http://www.insightxplorer.com/news/news_03_23_13.html

Jacobson, R., & Aaker, D. A. (1987). The Strategic Role of Product Quality. *Journal of Marketing*, *51*(4), 31–44. doi:10.2307/1251246

Kasesniemi, E.-L., & Rautiainen, P. (2002). Mobile culture of children and teenagers in Finland. In J. E. Katz & M. A. Aakhus (Eds.), *Perpetual contact* (pp. 170–192). New York, NY, USA: Cambridge University Press. Retrieved from http://dl.acm.org/citation.cfm?id=644547.644559

Katz, J. E., & Sugiyama, S. (2006). Mobile phones as fashion statements: evidence from student surveys in the US and Japan. *New Media & Society*, *8*(2), 321–337. doi:10.1177/1461444806061950

Kelley, T. L. (1939). The selection of upper and lower groups for the validation of test items. *Journal of Educational Psychology*, *30*(1), 17–24. doi:10.1037/h0057123

Ko, E., Kim, E. Y., & Lee, E. K. (2009). Modeling consumer adoption of mobile shopping for fashion products in Korea. *Psychology and Marketing*, *26*(7), 669–687. doi:10.1002/mar.20294

Li, Y.-M., & Yeh, Y.-S. (2010). Increasing trust in mobile commerce through design aesthetics. *Computers in Human Behavior*, *26*(4), 673–684. doi:10.1016/j.chb.2010.01.004

Liaogang, H., Chongyan, G., & Zi'an, L. (2007). Customer-Based Brand Equity and Improvement Strategy for Mobile Phone Brands: Foreign versus Local in the Chinese Market. *International Management Review*, *3*(3), 76.

LINE. (2013, July 1). In *Wikipedia, the free encyclopedia*. Retrieved from http://zh.wikipedia.org/w/index.php?title=%E8%BF%9E%E6%88%91&oldid=27094347

Ling, R., & Yttri, B. (2002). Hyper-coordination via mobile phones in Norway. In *Perpetual Contact*. Cambridge University Press. Retrieved from http://dx.doi.org/10.1017/CBO9780511489471.013

Lu, H.-P., & Su, P. Y.-J. (2009). Factors affecting purchase intention on mobile shopping web sites. *Internet Research*, *19*(4), 442–458. doi:10.1108/10662240910981399

Lu, Y., Deng, Z., & Wang, B. (2010). Exploring factors affecting Chinese consumers'

usage of short message service for personal communication. *Information Systems Journal*, *20*(2), 183–208. doi:10.1111/j.1365-2575.2008.00312.x

Mahatanankoon, P., Wen, H. J., & Lim, B. (2005). Consumer-based m-commerce: exploring consumer perception of mobile applications. *Computer Standards & Interfaces*, *27*(4), 347–357. doi:10.1016/j.csi.2004.10.003

Mary Meeker, & Liang Wu. (2012). *2012 Internet Trends (Update)*. Kleiner Perkins Caufield & Byers. Retrieved from http://www.kpcb.com/insights/2012-internet-trends-update

Mary Meeker, & Liang Wu. (2013). *2013 Internet Trends*. Kleiner Perkins Caufield & Byers. Retrieved from http://www.kpcb.com/insights/2013-internet-trends

McCarra, D. (2013, January 4). Google Play will hit one million apps this June. *The Sociable*. Retrieved June 17, 2013, from http://sociable.co/mobile/google-play-will-hit-one-billion-apps-this-june/

Miller, N. B., & Falk, R. F. (1992). *A primer for soft modeling* (1st ed.). Akron, Ohio: University of Akron Press.

Mobile app. (2013, June 13). In *Wikipedia, the free encyclopedia*. Retrieved from http://en.wikipedia.org/w/index.php?title=Mobile_app&oldid=559688240

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*. New York: McGraw-Hill.

Ozanne, J. L., Brucks, M., & Grewal, D. (1992). A Study of Information Search Behavior during the Categorization of New Products. *Journal of Consumer Research*, *18*(4), 452–63.

Ozok, A. A., & Wei, J. (2010). An empirical comparison of consumer usability preferences in online shopping using stationary and mobile devices: results from a college student population. *Electronic Commerce Research*, *10*(2), 111–137. doi:10.1007/s10660-010-9048-y

Park, C. W., Milberg, S., & Lawson, R. (1991). Evaluation of Brand Extensions: The Role of Product Feature Similarity and Brand Concept Consistency. *Journal of Consumer Research*, *18*(2), 185–193. doi:10.2307/2489554

Rick Martin. (2012a, April 13). With 28 Million Using Line VoIP App, NHN Japan

Launches "Line Camera." *Tech in Asia.* Retrieved from http://www.techinasia.com/line-camera-nhn-japan/

Rick Martin. (2012b, December 3). Line Pop Hits 10 Million Downloads in Just 12 Days. *Tech in Asia.* Retrieved from http://www.techinasia.com/line-pop-10-million-downloads/

Rosch, E. (1975). Cognitive representations of semantic categories. *Journal of Experimental Psychology: General*, *104*(3), 192–233. doi:10.1037/0096-3445.104.3.192

Scharl, A., Dickinger, A., & Murphy, J. (2005a). Diffusion and success factors of mobile marketing. *Electron. Commer. Rec. Appl.*, *4*(2), 159–173. doi:10.1016/j.elerap.2004.10.006

Scharl, A., Dickinger, A., & Murphy, J. (2005b). Diffusion and success factors of mobile marketing. *Electronic Commerce Research and Applications*, *4*(2), 159–173. doi:10.1016/j.elerap.2004.10.006

Schierz, P. G., Schilke, O., & Wirtz, B. W. (2010). Understanding consumer acceptance of mobile payment services: An empirical analysis. *Electronic Commerce Research and Applications*, *9*(3), 209–216. doi:10.1016/j.elerap.2009.07.005

Sean Hollister. (2013, June 3). "Draw Something" studio OMGPOP reportedly shuttered amid Zynga layoffs. *The Verge*. Retrieved June 17, 2013, from http://www.theverge.com/2013/6/3/4393694/draw-something-studio-omgpop-re portedly-shuttered-amid-zynga-layoffs

Sharif Sakr. (2013, June 10). Apple claims over half a billion store account holders, other big stats at WWDC. *Engadget*. Retrieved June 17, 2013, from http://www.engadget.com/2013/06/10/apple-store-account-holders-stats/

Shin, D.-H. (2009). Towards an understanding of the consumer acceptance of mobile wallet. *Computers in Human Behavior*, *25*(6), 1343–1354. doi:10.1016/j.chb.2009.06.001

Siau, K., Lim, E.-P., & Shen, Z. (2001). Mobile Commerce. *Journal of Database Management*, *12*(3), 4–13. doi:10.4018/jdm.2001070101

Skog, B. (2002). Mobiles and the Norwegian teen: identity, gender and class. In J. E.
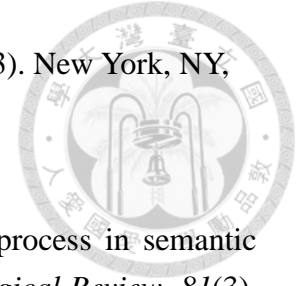
Katz & M. A. Aakhus (Eds.), *Perpetual contact* (pp. 255–273). New York, NY, USA: Cambridge University Press. Retrieved from http://dl.acm.org/citation.cfm?id=644547.644564

Smith, E. E., Shoben, E. J., & Rips, L. J. (1974). Structure and process in semantic memory: A featural model for semantic decisions. *Psychological Review*, *81*(3), 214–241. doi:10.1037/h0036351

Song, P., Zhang, C., Xu, Y., & Huang, L. (2010). Brand extension of online technology products: Evidence from search engine to virtual communities and online news. *Decision Support Systems*, *49*(1), 91–99. doi:10.1016/j.dss.2010.01.005

Steve Dent. (2012, October 30). Google Play closing in on Apple's store with 700K apps, says Bloomberg. *Engadget*. Retrieved June 17, 2013, from http://www.engadget.com/2012/10/30/google-play-store-racks-up-700k-apps-says-bloomberg/

Stewart, K. (2006). How Hypertext Links Influence Consumer Perceptions to Build and Degrade Trust Online. *J. Manage. Inf. Syst.*, *23*(1), 183–210. doi:10.2753/MIS0742-1222230106

Stewart, K. J. (2003). Trust Transfer on the World Wide Web. *Organization Science*, *14*(1), 5–17. doi:10.1287/orsc.14.1.5.12810

Sujan, M. (1985). Consumer Knowledge: Effects on Evaluation Strategies Mediating Consumer Judgments. *Journal of Consumer Research*, *12*(1), 31–46. doi:10.2307/2489379

Sujan, M., & Dekleva, C. (1987). Product Categorization and Inference Making: Some Implications for Comparative Advertising. *Journal of Consumer Research*, *14*(3), 372–378. doi:10.2307/2489498

Sviokla, J., & Paoni, A. J. (2005). Every Product's a Platform. *Harvard Business Review*, *83*(10), 17–18.

Tai-Li Ho, Huei-Hsia Hsu, & Chia-Cheng Chang. (2012). Why Do People Use Application Service-The Case of Apple's App Store? *Journal of China University of Science and Technology*, (50), 166–186.

TDCDA. (2012). *Taiwan smartphone usage behavior massive survey*. Digital

Convergence Development Association, Taiwan (TDCDA). Retrieved from http://www.inside.com.tw/2013/01/25/2012-taiwan-smartphone-survey

Thong, J. Y. L., Hong, S.-J., & Tam, K. Y. (2006). The effects of post-adoption beliefs on the expectation-confirmation model for information technology continuance. *International Journal of Human-Computer Studies*, *64*(9), 799–810. doi:10.1016/j.ijhcs.2006.05.001

Tsiotsou, R. (2006). The role of perceived product quality and overall satisfaction on purchase intentions. *International Journal of Consumer Studies*, *30*(2), 207–217. doi:10.1111/j.1470-6431.2005.00477.x

TWNIC. (2012a). *Wireless Internet Usage in Taiwan*. Taiwan Network Information Center (TWNIC). Retrieved from http://www.twnic.net.tw/download/200307/200307index.shtml

TWNIC. (2012b). *A Survey of Broadband Usage in Taiwan*. Taiwan Network Information Center (TWNIC). Retrieved from http://www.twnic.net.tw/download/200307/200307index.shtml

Venkatesh, V., & Davis, F. D. (1996). A Model of the Antecedents of Perceived Ease of Use: Development and Test*. *Decision Sciences*, *27*(3), 451–481. doi:10.1111/j.1540-5915.1996.tb00860.x

Völckner, F., & Sattler, H. (2006). Drivers of Brand Extension Success. *Journal of Marketing*, *70*(2), 18–34. doi:10.1509/jmkg.70.2.18

Walczuch, R., & Lundgren, H. (2004). Psychological antecedents of institution-based consumer trust in e-retailing. *Inf. Manage.*, *42*(1), 159–177. doi:10.1016/j.im.2003.12.009

Wang, Y. D., & Emurian, H. H. (2005). Trust in E-Commerce: Consideration of Interface Design Factors. *Journal of Electronic Commerce in Organizations*, *3*(4), 42–60. doi:10.4018/jeco.2005100103

Wang, B.J. (2002). *Windows version of SPSS and Behavioral Science Research* (2nd ed.). 心理.

Wei-Tsong Wang, & Hui-Min Li. (2012). Factors influencing mobile services adoption: a brand-equity perspective. *Internet Research*, *22*(2), 142–179.

doi:10.1108/10662241211214548

Wixom, B. H., & Watson, H. J. (2001). An empirical investigation of the factors affecting data warehousing success. *MIS Q.*, *25*(1), 17–32. doi:10.2307/3250957

Wu, I.-L., Li, J.-Y., & Fu, C.-Y. (2011). The adoption of mobile healthcare by hospital's professionals: An integrative perspective. *Decision Support Systems*, *51*(3), 587–596. doi:10.1016/j.dss.2011.03.003

Yi-Shun Wang, Hsin-Hui Lin, & Pin Luarn. (2006). Predicting consumer intention to use mobile service. *Information Systems Journal*, *16*(2), 157–179. doi:10.1111/j.1365-2575.2006.00213.x

Zeithaml, V. A. (1988). Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence. *Journal of Marketing*, *52*(3), 2–22. doi:10.2307/1251446

Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1996). The Behavioral Consequences of Service Quality. *Journal of Marketing*, *60*(2), 31–46. doi:10.2307/1251929

Appendix A. Questionnaire

第一部分		
(1)請問您是否為智慧型手機／裝置的使用者？	1. 是	2. 否
(2)請問您是否曾經在智慧型手機／裝置的應用程式平台下載過行動應用程式（App）？	1. 是	2. 否
(3)請問您是否在智慧型手機／裝置上使用過行動即時通訊應用程式？	1. 是	2. 否

第二部分								
(1)請問您是否使用過手機即時通訊 app－LINE messenger？					1. 是		2. 否	
對 LINE messenger 的知覺品質	非常低						非常高
(2_1)手機即時通訊 app－LINE messenger 的整體品質。	1	2	3	4	5	6	7
(2_2)當以手機即時通訊 app 傳遞訊息時，使用 LINE messenger 的可能性。	1	2	3	4	5	6	7
對 LINE messenger 的知覺有用性	非常不同意						非常同意
(3_1)使用手機即時通訊 app－LINE messenger 應該會改善我與別人溝通時的表現。	1	2	3	4	5	6	7

(3_2)使用手機即時通訊 app－LINE messenger 應該能使我更容易地與別人進行溝通。	1	2	3	4	5	6	7
(3_3) 我認為手機即時通訊 app － LINE messenger 在我與別人進行溝通時應該是有用的。	1	2	3	4	5	6	7

第三部分

(4)請問您是否使用過手機照相 app－LINE camera？				1. 是		2. 否	
對 LINE camera 的知覺品質	非常低						非常高
(5_1)手機照相 app－LINE camera 的整體品質。	1	2	3	4	5	6	7
(5_2)我會嘗試使用 LINE camera 的可能性。	1	2	3	4	5	6	7
對 LINE camera 的知覺有用性	非常不同意						非常同意
(6_1)使用手機照相 app－LINE camera 應該會改善我拍攝照片時的表現。	1	2	3	4	5	6	7
(6_2)使用手機照相 app－LINE camera 應該能使我更容易地拍攝照片。	1	2	3	4	5	6	7
(6_3)我認為手機照相 app－LINE camera 在我進行照片拍攝時應該是有用的。	1	2	3	4	5	6	7

LINE messenger 與 LINE camera 的知覺配適度	非常低						非常高
(7_1)手機即時通訊 app－LINE messenger 與手機照相 app－LINE camera 的整體相似性。	1	2	3	4	5	6	7
(7_2)當 LINE messenger 的開發商計畫推出 LINE camera 時，用於推出 LINE messenger 的 [人員、設備及技術] 對推出 LINE camera 產生幫助的程度。	1	2	3	4	5	6	7
(7_3) LINE messenger 之下的團體/組織與手機照相 app－LINE camera 相關的程度。	1	2	3	4	5	6	7
LINE messenger 與 LINE camera 的知覺連結度	非常不同意						非常同意
(8_1)手機即時通訊 app－LINE messenger 與手機照相 app－LINE camera [沒有] 連結。	1	2	3	4	5	6	7
(8_2)手機即時通訊 app－LINE messenger 應該 [不可能] 推薦個人使用手機照相 app－LINE camera。	1	2	3	4	5	6	7
(8_3)手機即時通訊 app－LINE messenger 與手機照相 app－LINE camera 彼此之間存在商業關係。	1	2	3	4	5	6	7

對 **LINE camera** 的行為意圖	非常不同意						非常同意
(9_1)假設我能夠使用手機照相 app－LINE camera，則我會使用它。	1	2	3	4	5	6	7
(9_2)我未來打算增加我對手機照相 app－LINE camera 的使用。	1	2	3	4	5	6	7

第四部分

(10)請問您是否使用過手機遊戲 app－LINE POP？		1. 是		2. 否	

對 **LINE POP** 的知覺品質	非常低						非常高
(11_1)手機遊戲 app－LINE POP 的整體品質。	1	2	3	4	5	6	7
(11_2)我會嘗試使用 LINE POP 的可能性。	1	2	3	4	5	6	7

對 **LINE POP** 的知覺有用性	非常不同意						非常同意
(12_1)使用手機遊戲 app－LINE POP 應該會改善我使用手機獲得娛樂時的表現。	1	2	3	4	5	6	7

	非常低						非常高
(12_2)使用手機遊戲 app－LINE POP 應該能使我更容易地使用手機娛樂。	1	2	3	4	5	6	7
(12_3)我認為手機遊戲 app－LINE POP 在我進行手機娛樂時應該是有用的。	1	2	3	4	5	6	7
LINE messenger 與 LINE POP 的知覺配適度	非常低						非常高
(13_1)手機即時通訊 app－LINE messenger 與手機遊戲 app－LINE POP 的整體相似性。	1	2	3	4	5	6	7
(13_2)當 LINE messenger 的開發商計畫推出 LINE POP 時，用於推出 LINE messenger 的 [人員、設備及技術] 對推出 LINE POP 產生幫助的程度。	1	2	3	4	5	6	7
(13_3) LINE messenger 之下的團體/組織與手機遊戲 app－LINE POP 相關的程度。	1	2	3	4	5	6	7
LINE messenger 與 LINE POP 的知覺連結度	非常不同意						非常同意
(14_1)手機即時通訊 app－LINE messenger 與手機遊戲 app－LINE POP [沒有] 連結。	1	2	3	4	5	6	7

	非常不同意						非常同意
(14_2)手機即時通訊 app－LINE messenger 應該 [不可能] 推薦個人使用手機遊戲 app－LINE POP。	1	2	3	4	5	6	7
(14_3)手機即時通訊 app－LINE messenger 與手機遊戲 app－LINE POP 彼此之間存在商業關係。	1	2	3	4	5	6	7
對 LINE POP 的行為意圖	非常不同意						非常同意
(15_1)假設我能夠使用手機遊戲 app－LINE POP，則我會使用它。	1	2	3	4	5	6	7
(15_2)我未來打算增加我對手機遊戲 app－LINE POP 的使用。	1	2	3	4	5	6	7

基本資料

(16)性別				1. 男	2. 女

(17)年齡	1. 小於18歲	2. 18-24歲	3. 25-30歲	4. 大於30歲

(18)學歷	1. 高中職(含以下)	2. 大專院校	3. 研究所(含以上)

(19)如願意參加抽獎，請留下您的 E-mail 以作為聯絡之用。