International Journal of Database Theory and Application
Vol.8, No.4 (2015), pp.123-134
http://dx.doi.org/10.14257/ijdta.2015.8.4.13

An Empirical Investigation on Customer Dissatisfaction toward using Mobile Applications

Chien-Ta Ho, Chung-Lun Wei and Kai-Ting Lin

Institute of Technology Management, National Chung Hsing University, Taichung, Taiwan
bruceho@nchu.edu.tw, alitwei@gmail.com, zacbaby2004@gmail.com

Abstract

As technology advances, mobile phones have changed significantly with devices and operating systems becoming more sophisticated. Mobile Applications (Apps) have been increasingly popular in the recent years and are changing the people's daily lives in leisure and businesses. The Booming industry of Apps makes great profit and the awareness to prevent customers or users from feeling dissatisfied is, accordingly, an important issue. Customer dissatisfaction may cause switching behavior, decreasing loyalty, and negative word-of-mouth among customers which may be the potential problem of business losses. Scarce researches have been done in discussing the effects of dissatisfaction among mobile products especially in applications issues. The purpose of this research is to propose a conceptual model and make an empirical investigation about the elements influencing customer dissatisfaction on using mobile applications. The sample consists of 200 respondents by using online questionnaires to collect data. The analysis employing structural equation modeling (SEM) shows that functionality, perceived usefulness and content have significant impacts on customer dissatisfaction. Implications for managerial perception and future research are discussed.

Keywords: *Customer Dissatisfaction, Mobile Applications, Apps, Structural Equation Modeling*

1. Introduction

As technology advances, mobile applications (Apps) have been increasingly popular in recent years around the world. The development and improvement of wireless communication infrastructures popularize the use of mobile devices. Since the first smart phone was introduced in 2007, new types of mobile businesses emerged and accelerated the development of mobile related products. One of the growing part of the mobile industry is the App Stores, which are platforms that users can download applications onto their devices and may be charged with each purchase (paid-for Apps) or within the use of applications (In-App purchases, IAPs).

The mobile applications market has a significant growth around these years. According to Gartner (2013) [1], annual downloads will reach 102 billion in 2013, up from 64 billion in 2012 and total revenue in 2013 will be $26 billion, up from $18 billion in 2012. Predictions are made that there will be a 59% growth in annual downloads from 64 billion to 102 billion and a 44% growth in revenue from $18 billion to $26 billion over the year. Besides, IAPs will account for 17 percent of the store revenue in 2013 and increase to 48 percent in 2017.

In-App purchasing rely on the continuance of using applications. Users make purchases if they are willing to experience more of the App's content. According to surveys made by Foreseeing Innovative New Digiservices (FIND) in 2012 [2], around 30% of mobile device users in Taiwan have made purchases Apps with an average of $1.3 USD per month. To be specific, 19.3% of the population spent less than $3.3 USD per

ISSN: 2005-4270 IJDTA

month while 8.1% spent more than $3.3USD and the total population is estimated to grow in the next few years.

Despite the global trend of the increasing IAPs, whether the continuance of using and purchase Apps can generate profit is a crucial issue. Researchers have stated out the importance of understanding customer dissatisfaction, which may affect competitiveness, customer loyalty and economic successes. Moreover, researchers have found that customer dissatisfaction will cause negative word-of-mouth, switching behavior, complaints and impacts on the continuance of using products and services [3-6]. Therefore, by identifying the causes of customer dissatisfaction, we can provide Apps developers or providers with better understanding of what contents should be aware of and help them to prevent losses.

Accordingly, this study aims to:

1. Propose a conceptual model, which examines the factors that affect customer dissatisfaction when using mobile applications.

2. By analyzing the relationship of empirical results, help Apps developers or providers to identify and perceive these important determinants.

2. Literature Review and Hypotheses

2.1. Smartphone and Mobile Applications

Since the first smartphone was introduced in 2007, smartphones have been significantly bonded to us and has transformed many aspects in our daily lives [7]. Although smartphones have existed for a few years, there is no clear definition about what constitutes a smartphone nor about what a smartphone is. Since hardware equipped on smartphones are constantly changing, software related are also being created and updated frequently. Generally speaking, smartphones have the characteristics of computer mobility, universal data access and pervasive intelligence for business aspects in our daily lives [8].

And in recent years, a new usage pattern of smartphones has risen, mobile applications (Apps). Mobile applications are software applications that operate on smartphones, tablets, and other mobile devices. Typically users can download Apps into their devices through application distributing platforms, which are owned by the developers of the mobile operating systems, such as Apple's App Store, Google Play, Windows Phone store of Microsoft and BlackBerry App World [9], called App stores or App markets in general. Mobile Apps were originally used for retrieving information and general purposes such as email, weather and calendar information. Through the rapid development of information technology and user demands, new categories of Apps were developed, such as mobile games, location-based services, banking, social networks and even mobile shopping. New types of business models emerged along with the rapid growth of the applications market. According to Holzer and Ondrus [10], the developers are the ones providing the applications on the platform, in which they create Apps through application programming interfaces (APIs) and then put on App stores to be distributed to consumers. For the role of the consumers, they seek out the applications that fit their demands and pay for downloading through App stores, which generate revenue for the App providers.

2.2 Customer Dissatisfaction

Dissatisfaction, though, is generally thought as the opposite of satisfaction, researchers have debated over time and yet there is no consensus in literature which have pointed out the sources or determinants of satisfaction and dissatisfaction [11]. Vargo *et al*. [6] have pointed out attributes of the satisfactory and dissatisfactory, satisfiers, dissatisfiers, criticals, and neutrals, based on instrumental versus expressive classification and the total

product model. They argued that dissatisfiers must be controlled at all times because they inhibit satisfaction and once dissatisfiers are managed, factors that act as satisfiers can be provided at relatively high levels, typically above what is expected, to enhance satisfaction [6].

In addition, customer dissatisfaction plays an important role in businesses. Dissatisfied customers are likely to stop purchasing the products, provide negative word-of-mouth, complain, return and boycott the products, the brand, and cause damage and loss of sales to the seller or retailer [12-13]. Moreover, consumer dissatisfaction will also cause switching behavior and the discontinuance use of products and services [3-4]. In contrast, satisfied customers will have brand loyalty, be longer customers, provide positive word-of-mouth, increase in purchases, and raises sales [14-16].

2.3 Customer Dissatisfaction in Mobile Applications

In the mobile context, most researches focus on satisfactory and purchase intentions, while the dissatisfaction concept is scarcely reviewed upon and studied. Meuter *et al*. [17] proposed five categories of dissatisfaction, namely, technology failure, process failure, technology design problem, service design problem and customer-driven failure in the context of self-service technologies. Furthermore, Salo and Olsson [18] proposed three dimensions, comprised of external, internal and situational sources, and nine dissatisfaction elements in the mobile interaction context, including technical functionality, interaction, content, customer service, privacy, compatibility, overall usefulness, consumer, and context. Consumer driven failure was not taken account in this research due to the similarity to poor design and interaction quality.

2.3.1. Functionality: Studies in dissatisfaction context indicated functionality was one of the most important factors which influenced customer intentions [17, 19-23]. Salo [24] also recorded that most of the dissatisfying experiences included issues related to technical functionality during the actual use situation. Therefore, we hypothesize that functionality significantly influences customer dissatisfaction as follow:

H1: Functionality significantly influences customer dissatisfaction.

2.3.2. Interaction Quality: Interaction quality is widely used in Technology Acceptance Models (TAM), which is capable of explaining user behaviors in computing technologies [25]. In TAM, it is named the word ease-of-use, to represent the easiness of using new technologies [26]. Koivumäki *et al*. [19] stated that interaction quality is when mobile information services provide easy and efficient ways of interaction. Meuter *et al*. [17] concluded that the poor design of the technology and service was a critical factor of dissatisfaction. Accordingly, this study hypothesizes that interaction quality significantly influences customer dissatisfaction.

H2: Interaction quality significantly influences customer dissatisfaction.

2.3.3. Content: Some researchers have confirmed that contents influenced users' dissatisfaction [27-28]. Chae *et al*. [29] noted that content quality refers to the inherent value and usefulness of the information provided by mobile services and to be confirmed as one of major sources of dissatisfaction for customers [18]. Here, in this research, hypothesizes that content significantly influences dissatisfaction of customers.

H3: Content significantly influences customer dissatisfaction.

2.3.4. Customer Service: Parasuraman *et al*. [30] defined customer service as a service provision that is responsive and helpful, and suggested that customer service influenced service quality which was also a factor of satisfaction. Salo and Olsson [18] confirmed that satisfaction was affected by the quality of mobile commerce vendors. Hence, the present research hypothesizes that customer service significantly influences dissatisfaction of customers.

H4: Customer service significantly influences customer dissatisfaction.

2.3.5. Privacy: Vlachos and Vrechopoulos [23] mentioned that privacy deals with a sense of feeling safe when using the service and the privacy of shared information.

Wolfinbarger and Gilly [31] noted that online consumers are keenly aware of their need for privacy. According to Salo [24], it was stated that customers have privacy concerns related to social networking applications. Therefore, it seems reasonable to hypothesize that privacy significantly influences customer dissatisfaction.

H5: Privacy significantly influences customer dissatisfaction.

2.3.6. Perceived Usefulness: Koivumäki *et al*. [19] adopted perceived usefulness as a construct of content quality to measure satisfaction in information services. Suki [26] tested and concluded the influence of usefulness against satisfaction in the context of mobile commerce. In the dissatisfactory discipline, perceived usefulness is the degree which the user does not feel benefited over other alternatives [24]. Hence, in this research, we hypothesize that perceived usefulness significantly influences dissatisfaction of customers.

H6: Perceived usefulness significantly influences customer dissatisfaction.

2.3.7. Compatibility: Tan and Chou [32] conducted research about the effects of compatibility in mobile information and entertainment Services, which pointed out that compatibility might constrain usage and made behavior difficult. Kim *et al*. [33] indicated that users have needs in accessing mobile services with other technologies. According to Salo [24], compatibility caused dissatisfaction when applications was unable to operate on certain mobile platforms, or malfunctioned after operation system updates. Accordingly, this study hypothesizes that compatibility significantly influences dissatisfaction of customers.

H7: Compatibility significantly influences customer dissatisfaction.

2.3.8. Contextual Quality: Studies in mobile information satisfaction have defined context as the environment in which users conduct their mobile tasks [19]. Chae *et al*. [29] concluded context quality as one of four factors of the information quality framework, in which information quality is used in satisfaction researches in mobile related topics. Thus, we hypothesize that contextual quality significantly influences dissatisfaction of customers.

H8: Contextual quality significantly influences customer dissatisfaction.

3. Methodology

3.1. Conceptual Model

In this research, we propose the conceptual model, as figure 1, by reviewing previous studies for factors which affect customer dissatisfaction when using mobile applications with hypotheses. These influent factors consist of functionality, interaction quality, content, customer service, privacy, perceived usefulness, compatibility and contextual quality.

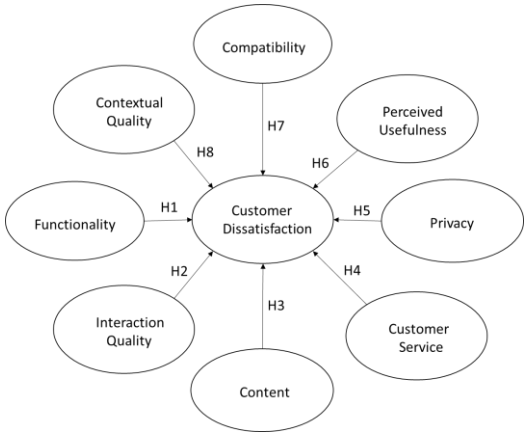

Figure 1. Conceptual Model and Hypotheses

3.2. Development of Measures

Measures used in this research are derived from existing literatures. Note that previous researches focused on customer satisfaction which the measurements were positive perceptions and for the scenario of this study, we adapts the negative measurements for the customer dissatisfaction construct to collect the negative reflections of the respondents. For Taiwan's respondents, the measures are translated from English to Chinese with necessary modifications to fit the social environment and target mobile application users. The questionnaire was completed after the review and pretest by fifty active mobile application users. In order to improve readability, ambiguous items were rephrased and scenarios with extra descriptions were also provided for respondents. The following table provides the measures with sources.

Table 1. Measures of all Variables

Variables	Measures	Sources
Functionality	I think the App is stable to use	[19] [23]
	I think the App responds to my commands quickly	
	I think the App has few errors	
Interaction quality	I think the content of the App are clearly categorized	[19] [34]
	I think it is easy to recognize where the information I need	
	I think the App is easy to operate	
Content	I think the content provided by the App is clear and understandable	[19] [23]
	I think the content of the App meets its objective	
Customer service	I think the App company has various ways to submit inquiries	[35]
	I think the response time to inquiries about content and services is rapid	
Privacy	I think my privacy is protected when using the App	[23]
	I think the App has adequate security features	
Perceived usefulness	I think the App has useful services.	[26]
	I think the App enables me to meet my requirements effectively.	
Compatibility	I think the App is compatible with other existing technologies	[33]
	I think the App is compatible with other mobile devices	
Contextual quality	I think the App is accessible whenever I need	[19] [23]
	I think the App is accessible wherever I need	
Customer dissatisfaction	I think my choice to this App is not a wise one.	[5]
	My feeling to this App is not satisfying	

3.3. Questionnaire Design

The questionnaire we developed contains two sections for this survey. The first section consists of demographic questions requiring gender, age, occupation, monthly income, type of mobile device, and the frequency of using Apps to ensure the respondent is an active mobile Apps user. The second part consists of the model-related items inquiring respondents about their perception of Apps. All of the items are measured with a 5-point Likert scale, where 1 = strongly disagree and 5 = strongly agree. To ensure that the

questionnaire was clear and understandable, a pre-test was conducted with 50 active Apps users. Modifications were made to eliminate any ambiguity and wording errors for the questionnaire.

3.4. Data Collection

According to the ranking of downloads on Apple's App store and Google's Google Play (2014) [36] market, the Facebook App was ranked 16th in App store and 3rd in Google Play respectively, and is the top ranking social network App among all. Therefore, the authors sent the questionnaires to the Facebook website's members online to collect the data. Note that, for the customer dissatisfaction measures, the respondents were asked the perceptions of error messages happened when operating the Facebook App (as Figure 2. shown). The questionnaire was distributed to selected customers randomly who might share their opinions about downloading Apps. A total of 206 respondents completed the questionnaire. After discarding 6 incomplete or repeat responses, the 200 samples remained for further analysis.

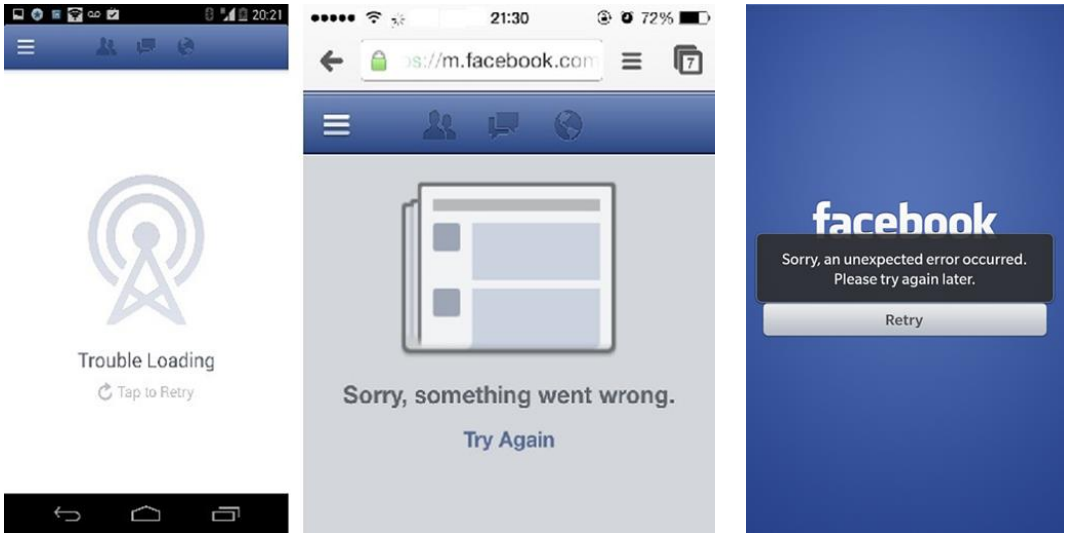

Figure 2. Facebook App with Error Messages

3.5. Data Analysis Approach

Structural equation modeling (SEM) is the analytic tool used and maximum likelihood estimation is applied in this research. The analytical procedures are conducted with the help of statistical software, SPSS and AMOS.

SEM is an approach to assess a given research model that includes multiple latent constructs with multiple observed variables. SEM consists of two parts of analysis, the measurement model and the structural model. Firstly, the measurement model should be tested by applying Confirmatory Factor Analysis (CFA) to ensure the convergent and discriminant validity and the reliability of the data which the relations between latent and observed variables are decided. Secondly, the structural model studies path strength and the direction of the relations among the latent variables [26,37].Unlike traditional regression models, various dependent variables are allowed in SEM, and it evaluates the structural model and corresponding measurement model at the same time which is considered to be appropriate for this research [38].

4. Data Analysis and Results

4.1. Sample Structure

Table 2 illustrates the demographic characteristics of the respondents. For gender, 55% were male and most of respondents aged 20 to 30 years old. The occupation structure of the respondents were mainly students, which consisted of 74% of the population. Besides, 53% of respondents owned masters' degree or above.

Table 2. Sample Structure

Attribute	Distribution	Frequency	Percentage
Gender	Male	110	55.%
	Female	90	45.%
Age	20 to 30	173	86.5%
	Under 20	21	10.5%
	30 to 39	3	1.5%
	Above 50	2	1%
	40 to 49	1	0.5%
Occupation	Student	148	74.%
	Service	12	6.%
	Military, Government, Education	11	5.5%
	Business	9	4.5%
	Technology	8	4.%
	Freelance	3	1.5%
	Others	9	4.5%
Level of education	Masters and above	106	53.%
	Bachelor	89	44.5%
	High School	4	2.%
	Junior high school or less	1	0.5%

Table 3 shows the attributes of Apps usage of the respondents. The most popular device for the respondents was smartphones. The daily usage of Apps having 45.5% of respondents was 2 to 4 hours. As for the experience of using Apps, more than half of the subjects have 1 to 2 years of experience. Lastly, there are 65.5% of respondents that does not have experience in purchasing Apps.

Table 3. Attributes of Apps Usage

Attribute	Distribution	Frequency	Percentage
Type of device	Smartphone	187	93.5%
	Tablet	9	4.5%
	Others (such as iPods etc.)	2	1.%
	Personal digital assistant(PDA)	1	0.5%
	Electronic readers	1	0.5%
Daily usage	2 to 4 hours	91	45.5%
	4 to 6 hours	47	23.5%
	Below 1 hour	32	16.%
	More than 6 hours	30	15.%
Experience	1 to 2 years	112	56%
	3 to 4 years	44	22%
	Less than 1 year	32	16%
	More than 5 years	12	6%
Experience of	No	131	65.5%

Purchasing Apps	Yes	69	34.5%

4.2. Measurement Model

As Table 4 shows, All Cronbach's alpha values of variables are higher than 0.7, which is considered as unidimensional [39]. On the other hand, standardized factor loading of each item is greater than the threshold value of 0.5, and the composite reliability of each variable is greater than 0.6 [40]. Also, AVE of each construct exceeds 0.5 [41]. Thus, convergent validity of the constructs are within satisfactory level.

Table 4. Factor Loading, Composite Reliability and Cronbach's Alpha

Construct	Item	Standardized factor loading	Composite reliability	Cronbach's α
Functionality	F1	0.752	0.833	0.863
	F2	0.799		
	F3	0.821		
Interaction quality	I1	0.753	0.861	0.878
	I2	0.827		
	I3	0.881		
Content	C1	0.809	0.820	0.851
	C2	0.859		
Customer service	CS1	0.791	0.754	0.836
	CS2	0.766		
Privacy	P1	0.896	0.905	0.822
	P2	0.923		
Perceived usefulness	PU1	0.901	0.880	0.877
	PU2	0.930		
Compatibility	COM1	0.835	0.847	0.824
	COM2	0.880		
Contextual quality	CQ1	0.787	0.880	0.796
	CQ2	0.896		
Dissatisfaction	D1	0.679	0.740	0.848
	D2	0.849		

As Table 5 demonstrates, the square root of the AVE of each construct (the diagonal) is higher than its correlations (the off-diagonal) with all other constructs, support for discriminant validity is provided [42].

Table 5. Correlation Matrix and AVE

Constructs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)Functionality	**0.791**								
(2)Interaction quality	0.655**	**0.822**							
(3)Content	0.644**	0.702**	**0.778**						
(4)Customer service	0.438**	0.578**	0.436**	**0.834**					

(5)Privacy	0.409**	0.460**	0.323**	0.460**	**0.909**				
(6)Perceived usefulness	0.296**	0.429**	0.373**	0.403**	0.343**	**0.915**			
(7)Compatibility	0.328**	0.288**	0.385**	0.482**	0.225**	0.317**	**0.857**		
(8)Contextual quality	0.429**	0.356**	0.424**	0.466**	0.293**	0.447**	0.538**	**0.887**	
(9)Dissatisfaction	0.244**	0.177*	0.168*	0.191**	0.193**	0.016	0.123	0.155*	**0.768**

Notes: The square root of the AVE is provided in the diagonal (in bold).
Off-diagonal elements are the correlations between the constructs.

4.3. Structural Model

Absolute fit measures include normed chi-square, goodness-of-fit index (GFI), and root mean square error of approximation (RMSEA). Bagozzi and Yi [40] recommended that the value of normed chi-square is better between 1 and 5 and value below 3 is most desirable. As shown in table 6, the value of normed chi-square is 2.22, which stands for a good fit between the data and the model. GFI and RMSEA have values of 0.892 and 0.065 where GFI suggested greater than 0.9 and RMSEA smaller than 0.08. GFI does not exceed 0.9 but it is still considered acceptable when greater than 0.8 [43]. For incremental fit measures, adjusted goodness-of-fit index (AGFI) which is 0.878 and comparative fit index (CFI) which is 0.956 exceed or very close to the recommended value of 0.9. Also, Normed fit index (NFI), incremental fit index (IFI) and relative fit index (RFI) have the recommended value of exceeding or very close to 0.9, where NFI=0.91, IFI=0.957 and RFI=0.872. For parsimonious fit measures, parsimony comparative of fit index (PCFI) and parsimony normed fit index (PNFI) both satisfy the recommended value of 0.5 which 0.674 for PCFI and 0.642 for PNFI. In summary, the data obtained from the survey fit well with the research model.

Table 6. Goodness-of-fit Measures of the Structural Model

Fit Indices	Model Value	Recommended Value
Absolute Fit Measures		
$\chi 2$ (Chi-square)	298.5	
df (Degrees of Freedom)	134	
Chi-square/df ($\chi 2$/df)	2.22	<3
GFI (Goodness of Fit Index)	0.892	>0.9
RMSEA (Root Mean Square Error of Approximation)	0.065	<0.08
Incremental Fit Measures		
AGFI (Adjusted Goodness of Fit Index)	0.878	>0.9
NFI (Normed Fit Index)	0.91	>0.9
CFI (Comparative Fit Index)	0.956	>0.9
IFI (Incremental Fit Index)	0.957	>0.9
RFI (Relative Fit Index)	0.872	>0.9
Parsimony Fit Measures		
PCFI (Parsimony Comparative of Fit Index)	0.674	>0.5
PNFI (Parsimony Normed Fit Index)	0.642	>0.5

Along with the structural model tests (the results provided in Table 7), three hypotheses are found to be supported in this research, that is, functionality, perceived

usefulness and content significantly influence on customer dissatisfaction with the standardized coefficient of 0.358 ($p<0.05$), 0.311 ($p<0.05$) and 0.198 ($p<0.05$) respectively. The other hypotheses, hypothesis 2, 4, 5, 7 and 8, are not supported due to the p-value of not significant.

Table 7. Hypotheses Testing Results

Path			Estimate (β)	S.E	C.R	*p*	Result
Dissatisfaction	←	Functionality	0.358*	0.098	3.969	0.039	Supported
Dissatisfaction	←	Perceived Usefulness	0.311*	0.079	4.278	0.027	Supported
Dissatisfaction	←	Content	0.198*	0.096	2.333	0.023	Supported
Dissatisfaction	←	Interaction Quality	0.145	0.18	0.905	0.136	Not supported
Dissatisfaction	←	Customer Service	0.22	0.162	1.489	0.244	Not supported
Dissatisfaction	←	Privacy	0.097	0.193	1.234	0.217	Not supported
Dissatisfaction	←	Compatibility	-0.066	0.127	-0.653	0.418	Not supported
Dissatisfaction	←	Contextual Quality	0.017	0.102	0.303	0.274	Not supported

Note: β = standardized beta coefficient; S.E. = standard error; C.R. = critical ratio; *p< 0.05

5. Conclusion

This research identifies eight factors which was found to influence customer dissatisfaction when using mobile applications based on the literature review, namely, functionality, interaction quality, content, customer service, privacy, perceived usefulness, compatibility and contextual quality. Accordingly, we investigated empirically the perceptions of the online users, who have downloaded and used the Apps, in Taiwan. The results show that only functionality, content and perceived usefulness are considered to be significant determinants toward customer dissatisfaction. This is consistent with Salo and Olsson's [18] findings that 83.3% of respondents feel dissatisfied by functionality issues, 54.8% related to content issues and 38.1% considered to perceived usefulness related.

With the results of this research, developers and providers of Apps should design or provide applications that are properly functioning and have less errors in the features or core functionalities. Also, the maintenance of the Apps such as updates and revisions should be high prioritized tasks. In addition, the content of the Apps should be consistent with the title, introductions and specs, which promise the features. And before launching to customers, the Apps should be put in a series of pre-tests for modifications and adjustments especially when obtained feedback from customers.

Finally, the topics to be studied further in the future include:

(1) To analyze the conceptual model in other cultural settings due to, in this research, the perspectives of online users of Taiwan only.

(2) An extension of the study can be merged in the post-dissatisfaction influences, e.g. behavioral intentions, for the customers.

(3) To categorize the mobile applications, for this study, may helpful to understand what different effects on customer dissatisfaction among those determinants across particular categories of Apps.

References

[1] Gartner Report, Retrieved from http://www.gartner.com/newsroom/id/2592315, **(2013)**.
[2] Foreseeing Innovative New Digiservices, Retrieved from, **(2012)**.
[3] J. H. Ahn, S. P. Han and Y. S. Lee, "Customer churn analysis: Churn determinants and mediation effects of partial defection in the Korean mobile telecommunications service industry", Telecommunications Policy, vol.30, no.10, **(2006)**, pp.552-568.
[4] A. Bhattacherjee, "Understanding information systems continuance: an expectation-confirmation model", MIS quarterly, vol.25, no.3, **(2001)**, pp.351-370.

[5] Z. Deng, Y. Lu, K. K. Wei and J. Zhang, "Understanding customer satisfaction and loyalty: An empirical study of mobile instant messages in China", International Journal of Information Management, vol.30, no.4, **(2010)**, pp.289-300.
[6] S. L. Vargo, K. Nagao, Y. He and F. W. Morgan, "Satisfiers, dissatisfiers, criticals and neutrals: A review of their relative effects on customer (dis) satisfaction", Academy of Marketing Science Review, vol.11, no.2, **(2007)**, pp.1-19.
[7] T. Smura, A. Kivi and J. Töyli, "A framework for analysing the usage of mobile services", vol.11, no.4, **(2009)**, pp.53-67.
[8] P. Zheng and L. M. Ni, "Spotlight: the rise of the smart phone", Distributed systems online, IEEE, vol.7, no.3, **(2006)**.
[9] Cybertegic, Retrieved from http://www.cybertegic.com/smartphone-app-development.html, **(2011)**.
[10] A. Holzer and J. Ondrus, "Mobile application market: A developer's perspective", Telematics and Informatics, vol.28, no.1, **(2011)**, pp.22-31.
[11] J. L. Giese and J. A. Cote, "Defining consumer satisfaction", Academy of marketing science review, vol.1, no.1, **(2000)**, pp.1-22.
[12] R. L. Day, K. Grabicke, T. Schaetzle and F. Staubach, "The hidden agenda of consumer complaining", Journal of Retailing, vol.57, no.3, **(1981)**, pp.86-106.
[13] A. O. Hirschman, Exit, voice, and loyalty: Responses to decline in firms, organizations, and states, Harvard University press, MA, **(1970)**.
[14] D. A. Aaker, "The value of brand equity", Journal of business strategy, vol.13, no.4, **(1992)**, pp.27-32.
[15] E. W. Anderson, C. Fornell and D. R. Lehmann, "Customer satisfaction, market share, and profitability: findings from Sweden", The Journal of Marketing, vol.58, no.3, **(1994)**, pp.53-66.
[16] C. Fornell, "A National Customer Satisfaction Barometer: The Swedish Experience", Journal of Marketing, vol.56, no.1 **(1992)**, pp.6-21.
[17] M. L. Meuter, A. L. Ostrom, R. I. Roundtree and M. J. Bitner, "Self-service technologies: understanding customer satisfaction with technology-based service encounters", Journal of marketing, vol.64, no.3, **(2000)**, pp.50-64.
[18] M. Salo and T. Olsson, "Consumer dissatisfaction of mobile interaction with the real world", Proceeding of the IADIS International Conference on e-Society, **(2012)**; Berlin, Germany.
[19] T. Koivumäki, A. Ristola and M. Kesti, "The effects of information quality of mobile information services on user satisfaction and service acceptance–empirical evidence from Finland", Behaviour & Information Technology, vol.27, no.5, **(2008)**, pp.375-385.
[20] Y. F. Kuo, C. M. Wu and W. J. Deng, "The relationships among service quality, perceived value, customer satisfaction, and post-purchase intention in mobile value-added services", Computers in human behavior, vol.25, no.4, **(2009)**, pp.887-896.
[21] R. L. Oliver, "Cognitive, affective and attributes of the satisfaction response", Journal of consumer research, vol.20, no.2, **(1993)**, pp.418-430.
[22] Y. J. Park, P. S. Heo and M. H. Rim, "Measurement of a customer satisfaction index for improvement of mobile RFID services in Korea", ETRI journal, vol.30, no.5, **(2008)**, pp.634-643.
[23] P. A. Vlachos and A. P. Vrechopoulos, "Determinants of behavioral intentions in the mobile internet services market", Journal of Services Marketing, vol.22, no.4, **(2008)**, pp.280-291.
[24] M. Salo, "Sources of Dissatisfaction: Mobile Interaction with the Real World and Other Mobile Internet Applications", 2013 46th Hawaii International Conference on System Sciences, **(2013)**; Hawaii.
[25] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology", MIS quarterly, vol.13, no.3, **(1989)**, pp.319-340.
[26] N. M. Suki, "A structural model of customer satisfaction and trust in vendors involved in mobile commerce", International Journal of Business Science and Applied Management, vol.6, no.2, **(2011)**.
[27] S. Negash, T. Ryan and M. Igbaria, "Quality and effectiveness in web-based customer support systems", Information & Management, vol.40, no.8, **(2003)**, pp.757-768.
[28] P. B. Seddon, "A respecification and extension of the DeLone and McLean model of IS success", Information systems research, vol.8, no.3, **(1997)**, pp.240-253.
[29] M. Chae, J. Kim, H. Kim and H. Ryu, "Information quality for mobile internet services: a theoretical model with empirical validation", Electronic Markets, vol.12, no.1, **(2002)**, pp.38-46.
[30] A. Parasuraman, V. A. Zeithaml and L. L. Berry, "A conceptual model of service quality and its implications for future research", Journal of marketing, vol.49, no.4, **(1985)**.
[31] M. Wolfinbarger and M. C. Gilly, "Shopping online for freedom, control and fun", California Management Review, vol.43, no.2, **(2001)**, pp.34-55.
[32] F. B. Tan and J. P. Chou, "The relationship between mobile service quality, perceived technology compatibility, and users' perceived playfulness in the context of mobile information and entertainment services", Intl. Journal of Human–Computer Interaction, vol.24, no.7, **(2008)**, pp.649-671.
[33] C. Kim, M. Mirusmonov and I. Lee, "An empirical examination of factors influencing the intention to use mobile payment", Computers in Human Behavior, vol.26, no.3, **(2010)**, pp.310-322.
[34] C. S. Wu, F. F. Cheng, D. C. Yen and Y. W. Huang, "User acceptance of wireless technology in organizations: A comparison of alternative models", Computer Standards and Interfaces, vol.33, no.1, **(2011)**, pp.50-58.

[35] J. Choi, H. Seol, S. Lee, H. Cho and Y. Park, "Customer satisfaction factors of mobile commerce in Korea", Internet research, vol.18, no.3, **(2008)**, pp.313-335.
[36] Google play, Retrieved from https://play.google.com/store/apps/category/SOCIAL, **(2014)**.
[37] J. C. Anderson and D. W. Gerbing, "Structural equation modeling in practice: A review and recommended two-step approach", Psychological bulletin, vol.103, no.3, **(1988)**.
[38] R. B. Kline, "Principles and practice of structural equation modeling", Guilford press, New York, **(2011)**.
[39] M. Tenenhaus, V. E. Vinzi, Y. M. Chatelin and C. Lauro, "PLS path modeling. Computational statistics and data analysis", vol.48, no.1, **(2005)**, pp.159-205.
[40] R. P. Bagozzi and Y. Yi, "On the evaluation of structural equation models", Journal of the academy of marketing science, vol.16, no.1, **(1988)**, pp.74-94.
[41] C. Fornell and D. F. Larcker, "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error", Journal of Marketing Research, vol.18, no.1, **(1981)**, pp.39-50.
[42] J. Hulland, "Use of partial least squares (PLS) in strategic management research: A review of four recent studies", Strategic management journal, vol.20, no.2, **(1999)**, pp.195-204.
[43] M. W. Browne, R. Cudeck, K. A. Bollen and J. S. Long, "Alternative ways of assessing model fit in", Testing structural equation models, Beverly Hills, CA: Sage, **(1993)**, pp.136-162.

Authors

Chien-Ta Bruce Ho, he is a Professor in the Institute of Technology Management at National Chung Hsing University, Taiwan. He has over 110 publications in the form of journal papers, books, edited books, edited proceedings, edited special issues and conference papers. Samples of his work can be found in the Journal of the Operational Research Society, the International Journal of Production Research, Online Information Review, Industrial Management and Data Systems, Computers & Operations Research and the International Journal of Production Economics. He is also the Editor of the International Journal of Value Chain Management and International Journal of Electronic Customer Relationship Management.

Chung-Lun Wei, he is a Ph.D. student in the Institute of Technology Management at National Chung Hsing University, Taiwan. His research interests include electronic commerce, customer behavior and customer relationship management (CRM).

Kai-Ting Lin, he works for a telephone company. He has a master's degree and his research interests cover electronic commerce and customer behavior.

