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AN EXTENDED UTAUT MODEL FOR THE STUDY OF NEGATIVE USER ADOPTION BEHAVIOURS OF MOBILE COMMERCE

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Abstract

An extended Unified Theory of Acceptance and Use of Technology (UTAUT) for mobile commerce (m-commerce) was empirically tested using data collected from a web survey distributed to and through the Hong Kong undergraduates and postgraduates. The partial least squares (PLS) technique of the structural equation modeling (SEM) was used to evaluate the causal model and the confirmatory factor analysis (CFA) was performed to examine the reliability and validity of the measurement model. Findings indicated that the new construct of Disturbance Concerns (DC) is a significant factor affecting users' behavioural intention. This study aims to understand both the positive and negative factors that can significantly explain user acceptance intention and use behaviour so that service providers can adjust their strategies for providing successful m-commerce services. It also provides a base for further research on the user acceptance models of new information systems.

Keywords: e-commerce, m-commerce, partial least square, structural equation modeling, user acceptance models, PLS, SEM, TAM, UTAUT

Introduction

Mobile commerce (m-commerce) extends electronic commerce (e-commerce) by allowing people to conduct business transactions through mobile devices. Nowadays, the computing power and the communication capability of contemporary mobile devices are significantly improved and sophisticated enough for surfing internet and conducting e-commerce as on the desktop computers, there is significant opportunities and growth of m-commerce business in the coming years. Hong Kong, with the highest mobile phone penetration in Asia, had 11.66 million mobile phone subscribers at the end of April 2009 as reported by OFTA [1], significantly outnumbering the total population. However, the user acceptance of m-commerce is below expectation [2]. Researches of the user acceptance of m-commerce have proven the positive user adoption determinants based on the user acceptance models of new Information Systems (IS), but only few explore the negative adoption factors.

With the popularity of internet-enabled mobile phones, it is necessary for m-commerce service providers to have better understanding of user behaviours towards the acceptance of new m-commerce service. This study is going to perform the preliminary analysis of an empirical study of the user acceptance of m-commerce conducted in Hong Kong. A proposed model extended from the Unified Theory of Acceptance and Use of Technology (UTAUT) model [3] is employed for the study of behavioural intention towards adopting m-commerce. The proposed model consists of five constructs. They are performance expectancy, effort expectancy, social influence, and a new construct of "disturbance concerns". In order to validate this model and to ensure significant effect of the new construct, this research is designed with two sets of instruments with two significant levels of survey questions for the study of the negative user acceptance factor of m-commerce. One hundred and forty eight responses were collected through a web survey. The statistical method of partial least squares (PLS) is applied to study and explain the proposed user acceptance model of m-commerce. Results of analysis proved that both levels have significant impacts on the user acceptance of m-commerce.

Basic Concepts, Research Model and Hypotheses

Announced in March 2009, Apple Inc. reported the sales of above 13.7 million iPhones in 80 countries by the end of 2008 since the introduction of iPhone in 2007. The powerful iPhone 3G represents an important push on mobile development that mobile phones are getting more computing power for fast web surfing and m-commerce service. In early 2000, Wireless Application Protocol (WAP) technology [4] was used to perform m-commerce. The WAP technology was designed to work in a mobile device with limited computing power, low bandwidth and little screen size. The user experience of conducting m-commerce with the restricted hardware and the WAP-based service are significantly different from the e-commerce with desktop computers. Nowadays, mobile devices are equipped with excellent

computing power, which generally have hundreds megahertz CPU speed (e.g. 500mhz.), several gigabytes RAM storage, screen resolution in full-color HVGA (320x480 pixels) or up to WVGA (480x800 pixels), and with a big 2.6 to 4 inches screen size. M-commerce no longer depends on the simple and primitive WAP technology. The computing power of mobiles is good enough for naturally surfing the internet and conducting m-commerce by using the mobile versions of the desktop-based internet browsers, such as pocket internet explorer (from Microsoft) or Safari (from Apple). The mobile software applications are as mature and efficient as the desktop applications. Besides that, new mobile applications are finger friendly. The innovative touch-based and multi-touch interface have provided the unique user interface of mobile devices since the introduction of iPhone. The touch technology and interface introduced new friendly experience to users and radically improved the perceived ease of use [5] of the mobile applications, which is a construct of the technology acceptance models. Moreover, the wireless communication capability of mobile devices is actually more sophisticated than the desktop computers. Modern mobile devices are generally equipped with 3G mobile connection, 3.5G plus Wi-Fi data communication, and the GPS or A-GPS feature for location detection. The sophisticated and ubiquitous communication capabilities facilitate users to conduct m-commerce transactions anywhere and anytime.

As the result, m-commerce with modern mobile devices can provide equivalent or better services and user experience as e-commerce with desktop computers. Many studies have conducted about the user acceptance behaviour of m-commerce and mobile service, but the dramatic hardware and software advancement of mobile devices causes those studies inadequate to explain the changed situation. Moreover, it is uncertain that those rapid mobile advancements have not stimulated the user adoption of m-commerce similar to the boom of e-commerce. The growth rate of m-commerce is actually slow. Previous studies have analyzed and explained the adoption of m-commerce and mobile service, but they only explained the positive factors of user adoption based on the user acceptance models of new IS. There are some undiscovered factors may explain the slow adoption of m-commerce, which could have negative impact of user acceptance of new IS.

Issues of m-commerce

Tarasewich et al. [5] defined m-commerce as all activities related to a (potential) commercial transaction conducted through communication networks that interface with mobile (or wireless) devices. A consumer transaction is the conduct or carrying on of trade, business or a financial matter to a conclusion or settlement including the activities of marketing, promotion, sales and customer services related to the transaction. Mobile devices include mobile phones, smart phones (with user installable applications and plug-ins), PDAs (personal digital assistance), MIPCs (mobile internet personal computer), UMPCs (ultra-mobile personal computer), and those handheld devices that can connect to the mobile services.

Though new mobile devices are powerful enough for comfortably surfing the internet and conducting m-commerce and, thus, it is difficult to identify the difference between m-commerce and e-commerce, some researchers have identified and explained the significant uniqueness of m-commerce. Okazaki [7] described the rapidly achieved worldwide penetration of the internet-enabled mobile device is due to its very personal nature and the sophisticated communication technologies. The personal mobile devices carry much private information of the owners, such as the phone number, personal data, contact addresses, and business appointments. The sophisticated wireless communication technologies enable users to conduct m-commerce transactions anywhere and anytime.

The personal nature and ubiquitous communication uniquely differentiate m-commerce with personal mobile devices from e-commerce with desktop or public computers. M-commerce with personal mobile devices can capture, process and record the personal data and user location with the transactions. Owners of the mobile device can access internet and conduct transactions anywhere and anytime. The personal nature and ubiquitous communication of m-commerce cultivated new type of services offered to consumers that may enhance customer convenience and satisfaction, and subsequently increase the potential of commercial transactions. However, new challenges are aroused, especially the security and privacy risks [9]. Tarasewick [10] identified several challenges of m-commerce, such as dynamic environment, security, safety, and social concerns. These concerns of m-commerce could be the hurdles of user adoption, which are the user rejection factors in alignment with the user acceptance factors. These factors are categorized as “Disturbance Concerns”. Mobile users worry about SMS or email spam, privacy, data leaks, security, and any potential or unexpected interrupts or disturbances.

User acceptance research of m-commerce

Mobile applications can automatically capture the privacy data through the personal mobile devices and the mobile network, and transmit the information to the m-commerce service providers. Users assume the service providers primarily use the privacy information for customizing intimate service to them

only, but the users cannot ensure if the service providers can protect the collected privacy information. Users gain user convenience and satisfaction, but taking the risk of security and privacy.

The efficiency and effectiveness of m-commerce with well internet-enabled mobile devices should have better user adoption. The researches about the user adoption of mobile service and m-commerce in different contexts have been very popular since this century. Some studies were trying to explore the cultural difference of the user adoption behaviour conducted by country. For example, Lee et al. [11] studied the cross-cultural comparison between Korea and Japan. Hung et al. [4] adopted Davis's Technology Acceptance Model (TAM) [5] to conduct one of the most comprehensive studies of mobile internet adoption in Taiwan. Nysveen et al. [12] carried out similar research in Norway. They also formulated a causal model base on the TAM [5], Theory of Reasoned Action (TRA) [13] and Theory of Planned Behaviour (TPB) [1], to examine the cross-service comparisons via multi-group structural equation modelling. Some researchers have examined the specific nature of mobile internet services [7], such as the user adoption of mobile banking and finance, and location-based services with GPS.

Although there were many studies of the user acceptance of m-commerce and the related areas, only few of them considered the significance of the advanced internet-enabled mobile devices and the unique market of Hong Kong. Furthermore, the researches, through the widely adopted TAM, TRA and TPB models, focused more on understanding the positive factors could influence acceptance of m-commerce. Because of the actual slow growth rate of m-commerce adoption, it is essential to identify additional factors that may affect the negative adoption behaviour (user rejection) apart from the ones defined by the employed models. This study aims to contribute additional knowledge in the existing pool of knowledge by identifying additional factors influencing the adoption of m-commerce with the support of the modern internet-enabled mobile devices. Thereby, further research can be conducted to obtain additional insight to the service providers for them to formulate appropriate business strategies, stimulate the usage of m-commerce service, and increase business transactions through better customer convenience and satisfaction by taking the advantages of those internet-enabled mobiles. It further believes that the right strategy will bring competitive advantage to the service providers of m-commerce.

Research Model and Hypotheses

Many competing theoretical models have been proposed and adopted in the research of user acceptance and adoption of information technology innovation, each with different focus and tested in different contexts and countries. Many of the previous empirically researched models were drawn from the theories of social psychology and the sociology, such as TRA [13], Motivational Model (MM) [14], and TPB [1] from the social psychology, others such as Social Cognitive Theory (SCT) [16] and Innovation Diffusion Theory (IDT) [17] from sociology. With hundreds of studies, researchers adopted these models to explain the innovation acceptance and adoption behaviour of the end-users. In the domain of IS research, TAM is the most widely adopted model followed by TRA and TPB. Davis derived TAM from the TRA. Two main factors namely, perceived ease of use and perceived usefulness, were identified as the main behavioural factors that influence the user intentions towards the use of a new system.

Although, TAM was considered to be well established and robust [17], Venkatesh and Davis [19] further enhanced the TAM to include subjective norm construct as a new component and named the enhanced model as TAM2. The acceptance theories are important to the technology investors and service providers, because the theories can help them to improve user adoption of their new products.

As various models and different thoughts of schools were out there and no consensus on which model should be the best one to be applicable to study technology adoption, researchers were facing a dilemma of choosing a suitable model to conduct a technology acceptance research. In 2003, Venkatesh et al. [3] compared the similarities and differences among various models. Eventually, they combined the eight important user acceptance models, including those above-mentioned models, identified the critical constructs of user acceptance, and constructed a unified model named as Unified Theory of Acceptance and Use of Technology (UTAUT).

UTAUT integrated constructs across eight models and provided a refined view of how the determinants of intention and behaviour evolved over time and identifies that there are three direct determinants of behavioural intention (performance expectancy, effort expectancy and social influence) and two direct determinants of usage behaviour (facilitating conditions and behavioural intention). Venkatesh et al. [3] empirically validated UTAUT with six longitudinal field studies of six different departments of six large firms in six different industries. UTAUT accounted for 70 percent of the variance (adjusted R2) in usage intention, better than any of the eight models alone did. Subsequent researches tested UTAUT and accepted it as a definitive model that synthesizes the known factors

and provides a foundation to guide future research in the area of technology adoption.

In this study, the UTAUT model will be employed as the base model to study user acceptance of m-commerce with modern mobile devices in order to further validate the model and enhance our understanding of the user adoption behaviour. However, UTAUT mainly focuses on the positive user acceptance behaviour. Several researches have identified several missing factors of the user adoption behaviour that can negatively affect the user acceptance of new technology. As described, security and privacy risk [9] are some of the key negative factors that cause the slow growth rate of user acceptance. Jarvenpaa et al. [20] conducted a cross-cultural research study involving 32 focus groups with nearly 200 active urban mobile device users in Finland, Japan, Hong Kong, and the U.S. in 2001 to explore both positive and negative user concerns of the adoption of mobile services. Although mobile communications and information services, that enable continuous connectedness, have increased users' freedoms psychologically, socially, and physically, users are experienced disorders of freedom that significantly deflect from their value. Those disorders include new pressures, anxiety, disturbance, privacy and inter-dependency. In summary, the mobile users worry about potential disturbance and subsequent loss that may arouse from the use of mobile services. In this study, the UTAUT model is extended by including a new construct of "Disturbance Concerns" as the factor to explain the negative adoption behaviour. The research will explore, analyze, and critically assess the extended UTAUT model and the relationship between the constructs of Disturbance Concerns and Behavioural Intention as depicted in Figure 1.

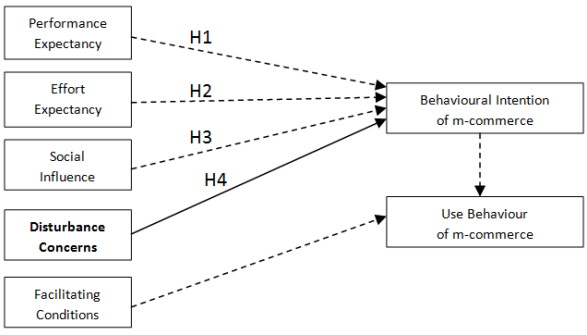

Figure 1. The Research Model

The conceptual framework depicts the interrelationships of the constructs. Constructs on the left are the independent variables that have influence on either Behavioural Intention of m-commerce or Use Behaviour of m-commerce. The first three independent variables (Performance Expectancy, Effort Expectancy, and Social Influence) are the concluded determinants of Behavioural Intention of the UTAUT model. The fourth independent variable of Facilitating Conditions and the Behavioural Intention are the determinants of Use Behaviour. The dotted lines are used to present the dependency relationships. The final independent variable of Disturbance Concerns is added to explore and analyze the potential influence on Behavioural Intention of m-commerce. The solid lines are used to present the mainly examined relationship between disturbance concerns and behavioural intention. Several hypotheses are defined for the proposed model.

Performance expectancy (PE) is the degree to which an individual believes that using the system will gain benefits or enhance job performance [3]. It is similar to the concept of perceived usefulness in TAM, extrinsic motivation in MM, job-fit in MPCU, relative advantage in IDT, and outcome expectations in SCT. The performance expectancy construct should have influence on the behavioural intention of an individual on using a new technology. In this proposed framework, the first hypothesis (H1) states that *Performance Expectancy has a positive influence on the behavioural intention towards adopting m-commerce*.

Effort Expectancy (EE) is the degree of ease to which an individual believes in the association with the use of the system [3]. Again, effort expectancy bears a similar concept of other existing technology adoption models such as perceived ease of use in TAM, complexity in MPCU, and ease of use in IDT. It generally believes that people would use a new technology if they find it easy to use. For the proposed model, the second hypothesis (H2) states that *Effort Expectancy has a positive influence on the behavioural intention towards adopting m-commerce.*

Social influence (SI) is equivalent to subjective norm TRA, TAM2, and TPB/DTPB in which an individual perceives that important others believe the person should use the new technology [3]. It is equivalent to social factors in MPCU, and image in IDT. For the proposed model, the third hypothesis (H3) states that *Social Influence has a positive influence on the behavioural intention towards adopting m-commerce*.

Facilitating Conditions (FC) is defined as the degree of believing in the existence of the technical and organizational infrastructure to support the usage of a new technology [3]. Similarly, it embodied by three constructs of user acceptance models: perceived behavioural control of TPB/DTPB, facilitating conditions of MPCU, and the compatibility of IDT. Unlike other constructs, facilitating conditions should have a direct influence on the actual usage of the new technology. The UTAUT model stated that facilitating conditions have a positive influence on the actual usage instead

of the behavioural intention. For this research about m-commerce adoption, it is difficult to examine the actual usage of m-commerce of the studied subjects because we cannot provide them with modern mobile phones and cannot record their actual usage of m-commerce applications. Thus, FC is excluded from this analysis.

Disturbance Concerns (DC) is the degree to which an individual believes and worries about the potential disturbance and subsequent loss aroused from the use of the system. The construct extends the original UTAUT model to explore, analyze and critically assess the negative influence factors on the adoption model of m-commerce. Disturbance is an activity that is a malfunction, intrusion, or interruption as defined in the dictionary of WordNet 3.0 of the Princeton University. Disturbance can be security or privacy [9], customer trust, pressures, stress, anxiety, inter-dependency [20], mobile spam [21], hidden transaction cost [22], and any unanticipated (potential) loss aroused from the use of the system. The proposed model of this study is going to explore the impact of Disturbance Concerns; hence, the fourth hypothesis (H4) is defined as *Disturbance Concerns has a negative influence on the behavioural intention towards adopting m-commerce.*

To conclude the research model and hypotheses, the first three hypotheses are designed to verify and validate the proposed model. If results of the study match with the original UTAUT model, the structure of the proposed model can be considered as the valid extension of the UTAUT model. As explained, there is a limitation of this research to measure and understand the actual use behaviour of the studied subjects. The research has excluded the study of facilitating conditions and use behaviour. However, it will not affect the validity of the proposed model.

Research Methodology

This is a survey research. The research questions were designed with reference to the published questions for the survey research of the UTAUT model [3]. A web site was constructed to facilitate the collection of user responses. Respondents can freely forward the site address of the survey to others so that the survey can liberally collect responses from people. The survey includes the collection of the required user profile but not the identity of the respondent in order to ensure the unbiased analysis of the data. A pilot of the questionnaires was conducted in late 2008 by a group of 20 undergraduates. In early 2009, one hundred and forty eight responses were collected via the web survey of the constructed web site with the majority are the undergraduates and postgraduates of the City University of Hong Kong.

The questionnaire of the survey includes the collection of the required data of user profile that are useful for further analysis of the user behaviour by different user profiles. For the original constructs of Performance Expectancy (PE), Efficiency Expectancy (EE), Social Influence (SI), and Behavioural Intention (BI) of the UTAUT model, three to four questions are set for each of them. Since this research is to extend the well-established UTAUT model, there are ten questions related to the new construct of Distributed Concerns (DC). In order to test if different levels of distributed concerns have different impact on the behavioural intention, the ten questions are basically divided into two sets of five equal questions for two different situations.

The two situations stated in the questionnaire are as follows:

1) "If your mobile device (such as your phone) can use an internet browser to surf the Internet"
2) "If your mobile device (such as your phone) can install some applications for taking online transactions and those applications can access your privacy information (such as phone number and contacts) and your current location (such as by means of GPS or A-GPS)"

The five questions applicable for the above two situations are:

1) I worry about being spammed when using the mobile device to conduct online transactions.
2) I worry about losing privacy data (such as my location, my phone number) when using the mobile device to conduct online transactions.
3) I worry about my personal information (such as address, bank account, etc) being stolen or leaked if I use the mobile device for online transactions.
4) The mobile transaction is not as secure as the traditional electronic commerce.
5) I worry that using the mobile device for online transactions may result unexpected interrupts or disturbances.

In situation 1, users understand that their mobile devices are equivalent to desktop computers equipped with the internet browser for surfing the Internet. Their personal data are protected similar to the protection in the desktop computers. In the situation 2, users are reminded that their personal data can be captured by someone during the conduction of m-commerce. The five questions covers the disturbance concerns of spam, privacy, information leaks, security, unexpected interrupts, or any potential disturbances. In data analysis, both situations were tested individually and in a combined model. The purpose of this approach is to test the disturbance concerns of the different levels of data protection on those two typical situations of

m-commerce and study the validity of the extension of disturbance concerns scrupulously applicable to both situations.

Data Analysis and Results

Structural Equation Modelling (SEM) is a family of statistical technique for testing and estimating causal relationships using a combination of statistical data and qualitative causal assumptions. SEM encourages confirmatory modeling that is suited to theory testing of the researched model. Partial Least Squares (PLS) [23] is a second generation technique of SEM that enables researchers to answer a set of interrelated research questions by modeling the relationships among multiple independent and dependent constructs simultaneously [24]. PLS is widely used in IS research to test the statistical quality and standard of the research result. Thus, the data analysis of this research was conducted with PLS, using SmartPLS 2.0 software [25].

Demographic characteristics

The demographic characteristic of the 148 responses are summarized in the Table 1.

Gender	*Male*	*Female*		
	67.36%	**32.64%**		
Age	*16-25*	*26-35*	*36-45*	*46-55*
	81.25%	**13.19%**	**4.17%**	**1.39%**
Education Level	*Doctorate*	*Post-Grad.*	*Under-Grad.*	*High School*
	1.39%	**18.75%**	**78.47%**	**1.39%**
Mobile with WiFi	*Support*	*Not Support*		
	47.22%	**52.78%**		
Internet Access	*Support*	*Not Support*		
	73.61%	**26.39%**		
m-Commerce Experience:	Never	One-time	Occasional	Frequent
m-Banking	**81.94%**	**4.17%**	**9.72%**	**4.17%**
m-Bidding	**90.28%**	**3.47%**	**4.17%**	**2.08%**
m-Booking	**65.97%**	**9.72%**	**18.75%**	**5.56%**
m-Shopping	**82.64%**	**5.56%**	**11.11%**	**0.69%**
m-Trading	**88.89%**	**4.86%**	**5.56%**	**0.69%**
m-Ticketing	**70.14%**	**9.03%**	**18.75%**	**2.08%**
Other transactions	**76.39%**	**6.94%**	**15.28%**	**1.39%**
Purpose of M-Commerce	Job-required	Voluntary		
	20.83%	**79.17%**		

Table 1: Demographic Summary

Two-third is male. Four-fifth respondents are in the age of 16-25. All are educated at least in the high-school level. Around four-fifth respondents are undergraduates. Over 73% respondents have Internet-enabled mobile phones although only 47.22% mobiles are equipped with WiFi. As shown in the section of m-commerce experience, it is obvious that majority of them have never conducted any type of m-commerce transactions. Surprisingly, there are 20.83% respondents are required to conduct m-commerce due to their work/study requirement. The percentage is almost equivalent to the percentage of those occasional and frequent m-commerce users. It can reflect that the m-commerce acceptance rate of the respondents is really low for the voluntary users.

Data Reliability and Validity

The internal consistency is used to assess the tolerable reliability of the related measures. The heuristics of SEM to measure the internal consistency is by means of Cronbach's alpha correlations and SEM reliability coefficients [26]. Cronbach's alpha should be above 0.7 for confirmatory analysis and in PLS. In this study, both the calculated Cronbach's alpha correlations and composite reliability coefficients are all above 0.8 as shown in the corresponding columns of the Table 2, which indicates the statistical reliability of the internal consistency of the measures. For the measures of the studied distributed concerns, the figures are higher than the other measures and all above 0.9, which indicates the higher reliability of the extended construct.

Construct validity can be determined by the convergent and discriminant validities among the measures of constructs. In PLS, two indicators are considered: (1) the own-loadings are higher than the cross-loading; (2) the square root of each construct's Average Variance Extracted (AVE) is larger than its correlations with other constructs [19]. The table 2 shows the Cross-loadings between the constructs and the measures. The bolded figures are own-loadings of the constructs. They are all above 0.75 and higher than the cross-loading with other measures. On the left of Table 2, the grids of latent variable correlations of the constructs indicate that the square root of each construct's AVE (shown in the grey diagonals) are all above 0.8 and larger than their correlations with other constructs. It can be concluded that the construct validity of this research can fulfill the statistical quality criteria.

	BI	DC	EE	PE	SI
BI1	**0.8588**	0.0577	0.5656	0.5603	0.3848
BI2	**0.9173**	-0.0706	0.5033	0.4760	0.4776
BI3	**0.7707**	-0.2170	0.4231	0.3054	0.4229
DC11	-0.0662	**0.7648**	0.1335	0.1869	0.0010
DC12	-0.0192	**0.8667**	0.0876	0.2267	0.0757
DC13	-0.0848	**0.9016**	0.0983	0.2423	-0.0100
DC14	-0.0505	**0.6873**	0.0091	0.1134	0.1031
DC15	-0.0610	**0.8238**	0.1471	0.2508	0.0363
DC21	-0.0220	**0.8513**	0.2212	0.2734	0.0238
DC22	-0.1138	**0.9001**	0.1421	0.3172	0.0604
DC23	-0.0716	**0.9156**	0.1417	0.3093	0.0574
DC24	-0.0405	**0.7593**	0.1033	0.1872	0.0823
DC25	-0.0540	**0.8782**	0.1483	0.2745	0.0321
EE1	0.5117	0.0281	**0.8675**	0.4720	0.4140
EE2	0.5409	0.0662	**0.8836**	0.5020	0.3619
EE3	0.5342	0.1281	**0.8890**	0.6001	0.3675
EE4	0.3912	0.3248	**0.7548**	0.5511	0.2298
PE1	0.4671	0.1776	0.4644	**0.8635**	0.3050
PE2	0.4941	0.2465	0.6453	**0.9049**	0.3715
PE3	0.4419	0.3594	0.5250	**0.8772**	0.3759

SI1	0.4629	0.0791	0.3731	0.2885	**0.8502**
SI2	0.3963	0.0679	0.3188	0.3246	**0.8556**
SI3	0.3671	-0.0799	0.2118	0.2210	**0.7900**
SI4	0.4147	0.0799	0.4237	0.4635	**0.7828**

Table 3: Cross Loadings

In the table 2, it is divided into three sections. The first section (labeled as (1) at the top-left corner of the grid) examines the measures of the situation 1 in which users understand that their mobile devices are equivalent to

The PLS Results for the proposed research model

Latent Variable Correlations: (Diagonal = sqrt of AVE) — *Summary of PLS Analaysis:*

(1)	BI	*DC1*	EE	PE	SI	AVE	Composite Reliability	R Square	Cronbachs Alpha	Redundancy	(BI) Path Coefficients
BI	0.8511					0.7243	0.8868	0.4856	0.8068	-0.0048	
DC1	-0.0735	0.8551				0.7312	0.9313		0.9091		-0.1848
EE	0.5879	0.1170	0.8505			0.7233	0.9124		0.8718		0.3377
PE	0.5334	0.2400	0.6202	0.8820		0.7780	0.9131		0.8572		0.2628
SI	0.5023	0.0330	0.4101	0.3976	0.8204	0.6730	0.8915		0.8377		0.2654

(2)	BI	*DC2*	EE	PE	SI	AVE	Composite Reliability	R Square	Cronbachs Alpha	Redundancy	(BI) Path Coefficients
BI	0.8511					0.7244	0.8870	0.5057	0.8068	-0.0137	
DC2	-0.0853	0.8943				0.7998	0.9521		0.9408		-0.2455
EE	0.5860	0.1568	0.8505			0.7233	0.9124		0.8718		0.3332
PE	0.5297	0.3128	0.6201	0.8820		0.7780	0.9131		0.8572		0.2947
SI	0.5039	0.0595	0.4100	0.3974	0.8204	0.6730	0.8915		0.8377		0.2647

(DC = DC1 + DC2)

(3)	BI	*DC*	EE	PE	SI	AVE	Composite Reliability	R Square	Cronbachs Alpha	Redundancy	(BI) Path Coefficients
BI	0.8511					0.7244	0.8869	0.5003	0.8068	-0.0102	
DC	-0.0837	0.8379				0.7021	0.9590		0.9527		-0.2295
EE	0.5868	0.1452	0.8505			0.7233	0.9124		0.8718		0.3344
PE	0.5311	0.2937	0.6201	0.8820		0.7780	0.9131		0.8572		0.2863
SI	0.5033	0.0500	0.4101	0.3975	0.8204	0.6730	0.8915		0.8377		0.2638

Table 2: PLS Analysis Report

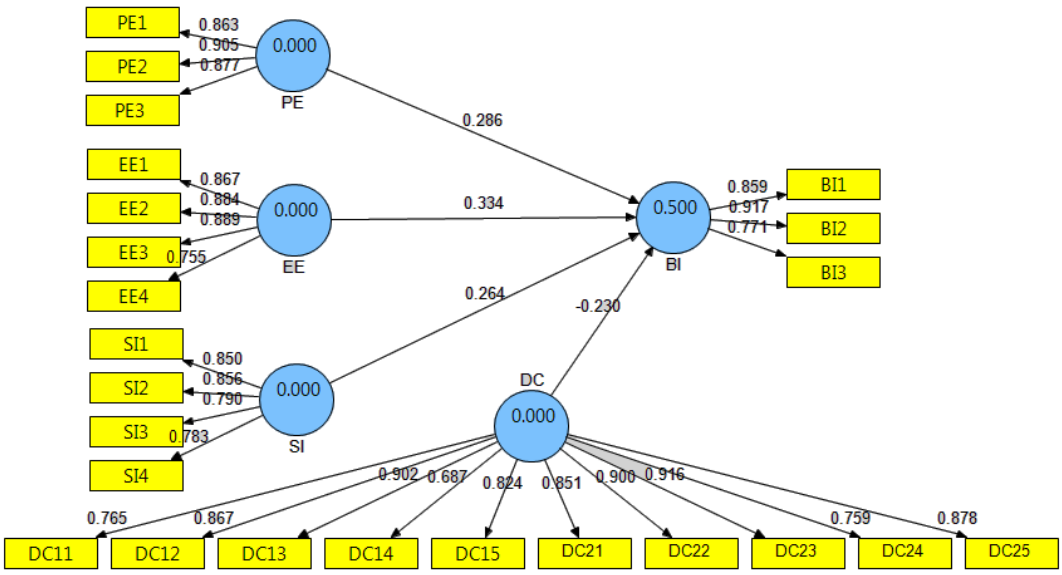

Figure 2: PLS Paths of the Proposed Model

by someone during the conduction of m-commerce. The final section (3) combines all measures of (1) and (2) to analyze the overall impact of disturbance concerns. The results as indicated by the R-squared values and the path coefficients shown the last column are similar and satisfactory, although the R-squared value (0.4856) of situation 1 is a bit lower that the R-squared value (0.5057) of situation 2. The redundancies of all tested models are small and satisfactory. The model with combined measures gave the R-squared value of 0.5003. It implied that respondents showed the similar behaviour of disturbance concerns to behaviour intention in both typical situations. Therefore, the combined measures were adopted as the concluded model.

Figure 2 summarises the analysis of this preliminary study. It shows the PLS path coefficients model of the proposed research model in which the disturbance concerns (DC) combines all 10 measures of both situation 1 and 2. The path coefficients are shown alone the arrow lines between the constructs, and all are significant at least at the .05 level. The R-squared value of the extended model which includes the extension of disturbance concerns is 0.5. According to the path coefficients, performance expectancy (PE), efficient expectancy (EE), and social influence (SI) have significant and near positive effects on behavioural intention (BI) since the coefficients are 0.286, 0.334, and 0.264. They match with the original UTAUT model. The new construct of disturbance concerns (DC) has significant negative effect on the behavioural intention of m-commerce acceptance because of the negative value (-0.230) of the coefficient. Since the weights of the path coefficients are near, it statistically indicates that the proposed model is a valid extension of the UTAUT model and the disturbance concerns (DC) represents a negative factor of the model for the measurement of m-commerce acceptance.

Discussion and Conclusion

The structural model of the proposed model was analyzed by the PLS method with the help of the SmartPLS software. The general applicability of a structural model depends on the reliability and validity of the modeling results. The required minimal sample size of PLS is at least 10 times the number of constructs for IS research [24]. The preliminary study of 148 responses is good for PLS analysis. Reliability and validity of the proposed model was assessed by internal consistency (reliability), convergent validity and discriminant validity. All test results are found to be satisfactory. The primary objective of PLS is the maximization of variance explained in all dependent constructs, which can be measured by R2 values of structural models. The R2 value for behaviour intention is 0.5. All the relationships between the latent constructs in the structural model are significant ($p<0.001$). This result satisfies the crucial requirement for reliability and validity of structural model.

The proposed model is extended from UTAUT which consists of well-established theories and approaches of user acceptance of new IS. The original UTAUT model includes the positive factors that can significantly explain user acceptance intention and use behaviour of new IS. The proposed model with extension of the new construct of disturbance concerns (DC) introduced the negative factor that significantly explains the negative user acceptance (or user rejection) intention of m-commerce acceptance. A major design of the measurement model is the use of two sets of questions to study the user's concerns of disturbance in the two typical situations, which sufficiently tested the validity of user behaviour in these two typical situations. The analysis result indicated little difference among the situations. Thus, the final measurement model ignored the situations and combined all questions of disturbance concerns. The concluded model indicated that the new construct of disturbance concerns is an important factor of m-commerce acceptance.

The proposed research model represents a substantial and original contribution to understand the user acceptance of m-commerce, which will combine both positive and negative constructs that may influence the behavioural intention and use behaviour of the users. Further study and analysis will carry out in order to ensure the validity of the results and enhance the rigorousness of the enhanced acceptance model. Although the study was conducted in Hong Kong, the data are useful for comparing with the studies of other countries in order to validate the acceptance model. Furthermore, this study reveals additional factors that may influence technology acceptance. The factors are believed to be applicable to the user acceptance of general IS, because privacy, security, spam, information leak, unexpected interrupts, or any potential disturbances are general issues of information systems and they are obstacles of user acceptance. The applicability of disturbance concerns warrants further exploration and research.

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