



Consumer technology traits in determining mobile shopping adoption: An application of the extended theory of planned behavior

Kiseol Yang*

The University of North Texas, Department of Merchandising and Digital Retailing, College of Merchandising, Hospitality, & Tourism, 1155 Union Circle # 311100, Denton, TX 76203–5017, United States

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ABSTRACT

An extended Theory of Planned Behavior (TPB) model was examined within the context of mobile shopping with moderating effects of three consumer technology traits (i.e., technology self-efficacy, technology innovativeness, and level of experience of use). Among the beliefs of the extended TPB, perceived enjoyment was the strongest determinant creating a favorable attitude toward mobile shopping adoption. The results supported that consumers differ in levels of technology traits in mobile shopping adoption behavior. Implications are provided to assist in predicting potential mobile consumer adoption behavior and in designing favorable mobile shopping environments that can be compatible with the consumer characteristics.

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Introduction

Consumer use of mobile shopping is rapidly increasing and purchases by mobile phones are expected to reach 31 billion by 2016 (Forrester, 2001). Although mobile shopping still occupies a small portion of e-commerce sales (7%), the versatility of mobile shopping services supported by widespread mobile technology appeals to consumers. In this embryonic stage of mobile shopping, contextual factors such as technology characteristics and user characteristics should be examined in order to determine the likelihood of specific factors in predicting mobile shopping adoption and how the design of the mobile shopping environment meets consumer characteristics.

In the adoption of technology in traditional consumer research, consumer characteristics have been viewed as significant predictive variables in determining behavioral outcomes (e.g., Hirschman, 1980; Davis, 1986; Ellen et al., 1991; Dabholkar, 1996; Karahanna et al., 1999; Agarwal, 2000; Dabholkar and Bagozzi, 2002). In predicting consumer mobile shopping adoption, consumer characteristics in adopting the technology-mediated shopping environment could be significant determinants in moderating the relationships among predictors of mobile shopping adoption. Since consumer traits differ in technology adoption, they may generate differential effects of evaluative criteria on the technology adoption behavior (Parasuraman et al., 2005). Furthermore, in this diffusion stage of mobile shopping, examining the effects of consumer

characteristics on mobile shopping adoption will assist in understanding underlying consumer differences in adopting mobile shopping.

In this study, three consumer characteristics (i.e., technology self-efficacy, level of experience of use, and consumer technology innovativeness) are regarded as significant consumer technology traits generating different consequences of mobile shopping adoption behavior. The three consumer traits are examined with the extended Theory of Planned Behavior (TPB) to determine the moderating effects of consumer traits among predictors of mobile shopping adoption. Therefore, this study aims to examine: (1) determinants of mobile shopping adoption in the extended Theory of Planned Behavior; and (2) the differential influences of consumer traits among the relationships between determinants and mobile shopping adoption in the extended Theory of Planned Behavior. The results of this study will contribute to understanding current and potential mobile shoppers' adoption behavior and provide implications for designing mobile shopping that is compatible with consumer characteristics.

Theoretical framework and hypothesis development

Extended theory of planned behavior in mobile shopping environment

The research model examining mobile shopping adoption is grounded in the Theory of Planned Behavior (TPB) with extensions of two perceptions (i.e., perceived usefulness and perceived enjoyment) adopting the technology. In the original TPB model,

* Tel.: +1 940 369 8210; fax: +1 940 565 4348.
E-mail address: Kiseol.Yang@unt.edu

consumer intention is the formation of three beliefs— attitude, subjective norms, and perceived control (Ajzen 1985, 1991).

Determinants of attitude toward adopting mobile shopping

Attitude is the behavioral belief toward adoption of technology and refers to a consumer's positive or negative feeling in performing a particular behavior (Davis, 1989). Attitude can be further predicted by the strength of an individual's perceptions of technology adoption (Ajzen and Fishbein, 1980). In this present study, attitude can be determined by examining perceived usefulness and perceived enjoyment of using mobile shopping. Previous studies suggest that perceived ease of use, perceived usefulness, and perceived enjoyment are significant determinants of attitude in explaining consumer technology adoption behavior (Davis et al., 1989, 1992; Dabholkar, 1994b). In the extended TPB of this study, perceived ease of use is not included as a determinant of attitude because the researcher believes that perceived control in using a technology is similar in context to perceived ease of use; therefore, perceived ease of use may conflict with perceived control in fitting the extended TPB model. Previous studies (e.g., Wei et al., 2009; Cho et al., 2007) have suggested that perceived ease of use is an insignificant predictor in mobile service adoption. Thus, only two dimensions (i.e., perceived usefulness and perceived enjoyment) are used in this study to explain the effects of perceptions on attitude toward adopting mobile shopping.

Perceived usefulness is defined as the individual's subjective perception that use of the technology is useful (Davis et al., 1989). When consumers perceive that mobile shopping services and functions are useful in facilitating their shopping, the perception generates a positive feeling toward mobile shopping adoption. Perceived enjoyment means that the individual believes the technology is fun to use (Davis et al., 1992). The mobile shopping environment which is supported by new technology applications and immediate interactions with service encounters may generate a favorable attitude toward mobile shopping adoption. In addition, numerous studies have supported attitude as a significant predictive variable of behavioral intention (e.g., Ajzen, 1985; Bauer et al., 2005; Davis et al., 1989; Dickinger and Kleijnen, 2008; Kang et al., 2006). Thus, consumer attitude toward adopting mobile shopping influenced by the two perceptions (i.e., perceived usefulness and perceived enjoyment) is expected to have a direct and positive effect on intention to adopt mobile shopping. As a result, this study proposes that perceptions are positively related to attitude toward adopting mobile shopping and attitude will have a direct and positive effect on intention to adopt mobile shopping. Thus the following hypotheses are examined:

H1. The perceived usefulness of mobile shopping has a direct and positive effect on attitude toward adopting mobile shopping.

H2. The perceived enjoyment of mobile shopping has a direct and positive effect on attitude toward adopting mobile shopping.

H3. Attitude toward mobile shopping has a direct and positive effect on intention to adopt mobile shopping.

Subjective norm

Subjective norm is a normative belief influenced by social pressure to adopt or not to adopt technology (Young and Kent, 1985). Previous studies for technology-based services support subjective norm as a strong determinant of the services adoption (Mathieson, 1991; Taylor and Todd, 1995b; Sykes et al., 2009). Consumer adoption of technology is influenced by socialization forces associated with the desire to follow referent group norms (Kulviwat et al., 2009), thus subjective norm tends to direct group members' behavior (Kim et al., 2011). Further, consumers tend to recommend a service to others when they are satisfied with the

service (Fan et al., 2005), thus, referent group's suggestions are credible sources influencing consumer adoption decisions. Since mobile shopping is presented in a technology-mediated environment and connected via personalized mobile devices, consumers may be cautious about adopting mobile shopping and show a strong tendency to rely on significant others' opinions in making the decision to adopt. The significant others' influence on the adoption of mobile shopping will impact consumer intention to adopt mobile shopping. Thus, the following hypothesis is examined:

H4. Subjective norm has a direct and positive effect on intention to adopt mobile shopping.

Perceived behavioral control

Perceived behavioral control refers to an individual's perception of his/her capability to perform a behavior of interest (Ajzen, 1985; Ajzen and Madden, 1986). Perceived behavioral control includes perceptions of resources or knowledge to use the technology, technology facilitating conditions, and the individual's ability to perform the behavior easily (Thompson et al., 1994; Taylor and Todd, 1995a, b). The perception of user control is a key predictor of interactive technology adoption (Hoffman and Novak, 1996). When consumers perceive that technology is in their control, they perceive that they can control their task process and the perceptions will further increase consumer confidence about the outcome (Bateson and Hui, 1987). In contrast, when consumers perceive a lack of control in using technology, this prevents consumers from adopting the new technology (Hoffman et al., 1999). For the purposes of this study, perceived behavioral control is defined as the extent to which consumers have the technological infrastructure to support mobile shopping transactions (e.g., mobile Internet and data service availability, speed, and data processing capability). The technical infrastructure that supports the use of technology may be a precondition to adopt the new technology (Venkatesh et al., 2003). Technology adoption may not occur if the technology factors prevent the adoption (Kim et al., 2011). Thus, the perceived availability of technology facilitating conditions and resources may positively affect behavioral intention to adopt mobile shopping. The corresponding hypothesis is:

H5. Perceived behavioral control has a direct and positive effect on intention to adopt mobile shopping.

The moderating effects of consumer technology traits

Consumers differ in their adoption of new products, services, and shopping methods. Since consumers' perception of technology characteristics also differ, their adoption behavior may differ by individual consumer characteristic (Moore and Benbasat, 1991; Venkatesh et al., 2003). Consumer traits to use technology-based products or services will play a particularly significant role in explaining the behavioral intention to use a product or service. Demographic factors are not considered significant variables in understanding consumer behavior because in today's society, some level of access and familiarity with using simple technology devices is an everyday practice (Dabholkar and Bagozzi, 2002). Technology self-efficacy, technology innovativeness, and the individual level of experience using technology are expected to be significant in moderating the relationships among determinants of mobile shopping adoption.

Technology self-efficacy

Technology self-efficacy refers to belief about one's ability to perform a specific behavior with confidence in achieving positive task outcomes (Compeau and Higgins, 1995b). The effect

of technology self-efficacy on technology adoption behavior has been empirically supported in previous studies (Kankanhalli et al., 2005; Dabholkar and Bagozzi, 2002; Bandura, 1994; Ellen et al., 1991; Hill et al., 1987; Davis, 1986). The consumer's ability to use a technology can successfully leverage the degree of use of the technology and therefore evoke him/her to adopt the technology (Compeau et al., 1999). Furthermore, the perception of self-efficacy can facilitate consumers' beliefs of technology functions as fun to use (Dabholkar and Bagozzi, 2002). Thus, consumers with a high level of self-efficacy will be more likely to perceive functions and features of mobile shopping as fun to use than consumers with a low level of self-efficacy. The degree of self-efficacy to use mobile shopping will positively affect the relationship between perceived enjoyment and attitude toward mobile shopping. In addition, the individual's ability to achieve positive outcomes using a technology makes consumers feel in control of using the technology. This suggests that consumers with a high level of self-efficacy will be more likely to perceive the technology as in their own control than consumers with a low level of self-efficacy, thus consumers with a high level of self-efficacy will show strong intention to use mobile shopping. The moderating effects of self-efficacy in the relationships among predictors are examined with the following hypotheses:

H6 (a). The positive relationship between perceived enjoyment and attitude toward adopting mobile shopping will be higher for consumers with a high level of self-efficacy than consumers with a low level of self-efficacy.

H6 (b). The positive relationship between perceived behavioral control and intention to adopt mobile shopping will be higher for consumers with a high level of self-efficacy than consumers with a low level of self-efficacy.

Technology innovativeness

Technology innovativeness refers to the extent to which an individual adopts technology in a relatively earlier stage than others (Rogers, 1983). Consumers characterized by a high level of innovativeness will tend to perceive the mobile technology – mediated shopping environment favorably and their innovativeness characteristic will lead to exploration and adoption of mobile shopping as a new way to shop. Furthermore, consumers with a high level of innovativeness will be more likely to perceive the use of technology as being in their control than consumers with a low level of innovativeness. Consumers with a low level of innovativeness will be concerned about the technology being under their control (Dabholkar and Bagozzi, 2002). This suggests that consumers with a high level of innovativeness will show high perceived behavioral control which generates significant intention to adopt mobile shopping. Thus, the following hypothesis is examined:

H7. The positive relationship between perceived behavioral control and intention to adopt mobile shopping will be higher for consumers with a high level of technology innovativeness than consumers with a low level of technology innovativeness.

The level of experience of use

Consumer experience using a new technology significantly affects the continued use of the technology (Jayawardhena, 2004). Consumer perceptions of new technology with no experience of use are formed based on indirect experience that is not sufficient to make a decision to adopt the technology. In addition, consumers with a high level of experience using the technology have more information derived through direct experience than consumers with a low level of experience (Karahanna et al., 1999). Therefore, determinants of mobile shopping adoption could be differentially influenced by the level of experience.

In Morris and Venkatesh (2000), the level of experience moderates the relationship between subjective norm and behavioral intention. With increasing levels of experience of using a technology, subjective norm becomes a less important determinant to predict intention to adopt the technology. Further, the indirect experience or little knowledge of the technology use will increase the risk to use the technology (Katz and Tushman, 1979; Van den Ven et al., 1976), thus, consumers will collect more information and opinions from reference groups or significant others with direct experience in order to reduce the uncertainty (Burkhardt and Brass, 1990; Katz, 1980). The degree to which consumers are influenced by subjective norms will be higher for consumers with no experience with the technology than consumers with high levels of experience with the technology (Trandis, 1971; Thompson et al., 1994). The effects of perceived usefulness and perceived enjoyment on attitude toward adopting technology will differ with the level of experience of using the technology since the different effect of perceptions formed from direct/indirect experiences results in different intention to use the technology (Talyor and Todd, 1995a). Knowledge and understanding derived from direct experience is likely to result in the ability of individual consumers to evaluate the technology clearly, which in turn facilitates the ease of favorable attitude formation (Karahanna et al., 1999). A greater level of knowledge and experience with mobile shopping services may be associated with a greater degree of comfort with a service while reducing perceived risk associated with the service (Jiang, 2009). It suggests that the greater the level of experience, the greater the perceived usefulness and enjoyment, which results in higher mobile shopping adoption. Therefore the following hypotheses are investigated:

H8a. With a higher level of experience, the positive relationship between subjective norm and intention to adopt mobile shopping will be reduced.

H8b. The level of experience generates a differential effect of relationships between perceived usefulness and attitude toward adopting mobile shopping.

H8c. The level of experience generates a differential effect of relationship between perceived enjoyment and attitude toward adopting mobile shopping. Hypothesized research model is depicted in Fig. 1.

Method

Measures

Measures for the extended Theory of Planned Behavior (TPB) model (except the level of experience of using mobile shopping) were adapted from existing scales from previous relevant studies using a 7-point Likert –type scale anchored by 1 = strongly disagree and 7 = strongly agree. All scale items were modified to measure the extended TPB model and moderating effects of consumer traits in the context of mobile shopping. Perceived usefulness was measured with four items and subjective norm was measured with three items developed by Venkatesh et al. (2003). In addition, the following measurement items were adapted from existing literature: three items measuring perceived enjoyment from Davis et al. study (1992); three items on perceived behavioral control (Ajzen, 1991; Taylor and Todd, 1995a); four items on attitude (Nysveen et al., 2005); and three items on behavioral intention to use mobile shopping (Lee et al., 2002; Pavlou and Chai, 2002).

Consumer technology self-efficacy was measured with three items (Vijayasathya, 2004; Taylor and Todd, 1995a) and two

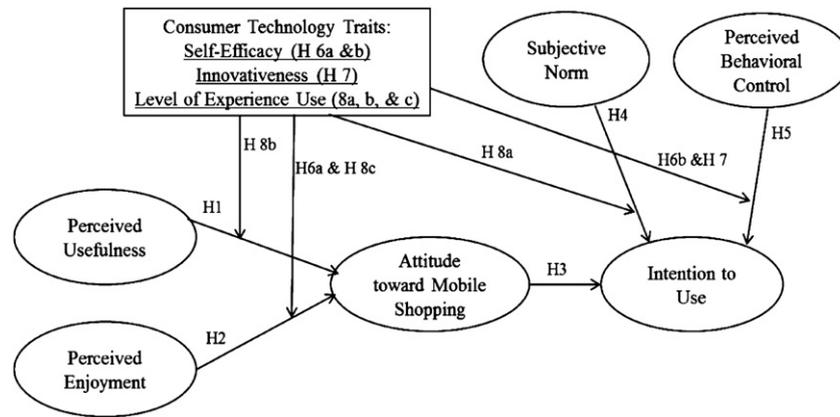


Fig. 1. Hypothesized research model.

items measuring technology innovativeness were adapted from previous studies (Oliver and Bearden, 1985; Darden and Perreault, 1976; Leavitt and Walton, 1975). The level of experience of using mobile shopping was measured with the question, “Have you ever experienced mobile shopping before?”

Confirmatory factor analysis was performed to validate the measurement model and the hypothesized paths in the extended TPB model were examined using structural equation modeling. The moderating effects of three consumer traits among hypothesized paths within the core research model were tested using multiple group structural equation modeling. Structural equation modeling is suggested as appropriate for analyzing constructs that are not scientific (i.e., benefits, attitudes, and intention) and which cannot be directly observed (Steenkamp and Baumgartner, 2000). Steenkamp and Baumgartner (2000) indicated that some constructs “can only be measured through observable measures or indicators that vary in their degree of observational meaningfulness and validity” (p.196). In this regard, SEM is an appropriate method for investigating consumer mobile data services adoption behavior. AMOS 18.0 was used to analyze the structural equation modeling.

Sample

The sample for the online survey was purchased from a market research company and consisted of a national panel of mobile services users. Randomly selected members of the consumer panel received an e-mail containing the survey link and 400 participants completed the online survey. A monetary incentive was given to the 400 participants who completed the survey. The majority of respondents was women (59 percent); most were between the ages of 19 and 30 years (78.8 percent); 40.2 percent had a college degree; 23.5 percent of respondents were in the mid income level (\$50,000–74,999); 26.3 percent of the respondents had experienced mobile shopping previously; and 78.8 percent had used a mobile phone for private purposes. According to Pew Internet & American Life Project (2010), 90 percent of 18-to-29 year olds own a cell-phone and 65 percent of them access the mobile internet. The sample of this study is congruent with the current smartphone user demographic.

Results

Measurement model evaluation

In evaluating measurements of the extended TPB research model, Confirmatory Factor Analysis (CFA) was used to assess the reliability, convergent validity, and discriminant validity of the constructs.

Before the CFA test, Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett’s test of Sphericity were examined to assess adequacy of the data for factor analysis. The result showed that KMO was 0.95 (recommended level is ranges from 0 to 1) and the Bartlett’s Test of Sphericity was significant at $p = .000$ (p -value $< .05$ is recommended level) (Hair et al., 1995; Tabachnick and Fidell, 2007). It indicated that the data was suitable for CFA.

The result of CFA indicated that the measurement model fit indices showed good fit to the data ($\chi^2 = 389.316$ with 153df at p -value $< .001$, CMIN/DF = 2.603, GFI of .910, NFI of .956, CFI of .972, and RMSEA of .063). Construct reliability was assessed using Cronbach’s alpha and each latent construct ranged from .77 to .97, exceeding the recommended level of .70. The magnitude of the factor loadings of each indicator of the intended constructs was evaluated to assess the convergent validity of each item (Anderson and Gerbing, 1988). All items loaded on the intended constructs significantly at the p value $< .001$ and the standardized factor loadings of the items ranged from .62 to .97. The composite reliabilities of each construct were assessed and ranged from .82 to .97 exceeding the recommended level of .65. The average variance extracted (AVE) ranged from .54 to .90 exceeding the recommended level of .50 (see Table 1).

AVEs for each construct were used to confirm discriminant validity among constructs by comparing AVE and the squared correlations between the two constructs of interest. All AVEs for the constructs were greater than their squared correlations (Fornell and Larcker, 1981) with the exception of the squared correlations among perceived usefulness, attitude, and behavioral intention (see Table 2). To confirm discriminant validity among the three constructs, a chi-square discriminant validity test and simple CFA tests were conducted as suggested in Dabholkar and Bagozzi’s study (2002). The result of chi-square discriminant validity showed that the constructs were quite different ($p < .001$). In addition, a simple CFA of the three constructs “as one” had poor fit indices ($\chi^2 = 547.848$ with 42df at p -value $< .001$, CFI of .904, and RMSEA of .174), whereas a second simple CFA of the three constructs “separately” had excellent fit indices ($\chi^2 = 104.236$ with 39df at p -value $< .001$, CFI of .988, and RMSEA of .065). The results of the tests indicated that discriminant validity among three constructs was satisfied. After confirming the quality of measurement items, the hypotheses were tested using structural equation modeling.

Hypotheses testing

Test of the core model

The model fits of the extended Theory of Planned Behavior were acceptable ($\chi^2 = 424.248$ with 156df at p -value $< .001$,

Table 1
Measurement model evaluation.

Latent construct	Observed indicators	N=400		
		Factor loadings	AV ^a	α^b
Perceived usefulness	I would find it useful for shopping.	.80	.54	.81
	It would enable me to spend less money on shopping	.67		
	It would increase my chances of obtaining shopping promotion information.	.68		
	It would enable me to accomplish shopping more quickly.	.80		
Perceived enjoyment	I would have fun shopping by mobile phone.	.91	.83	.94
	The actual process of mobile shopping would be pleasant.	.90		
	I would find using mobile shopping to be enjoyable.	.93		
Subjective norm	People who influence my behavior think that I should use mobile shopping.	.89	.80	.92
	I would shop by phone because of the proportion of my friends who do mobile shopping.	.87		
	People who are important to me think that I should use mobile shopping.	.92		
Perceived behavioral control	I have an Internet-enabled mobile phone to access the shopping sites via mobile phone.	.62	.57	.78
	Given the resources, opportunities and knowledge it takes to use mobile shopping, it would be easy for me to use the system.	.90		
	I have the knowledge necessary for mobile shopping.	.72		
Attitude	Shopping by mobile phone is a good idea.	.92	.89	.97
	I am favorable toward mobile shopping.	.96		
	Shopping by mobile phone is a wise idea.	.92		
	I am positive about mobile shopping.	.97		
Intention	Given the chance, I intend to shop by mobile phone.	.94	.90	.96
	I expect my mobile shopping to continue in the future.	.95		
	I intend to purchase products or services via mobile phone.	.96		

^a Average variance extracted.

^b Cronbach' α

Table 2
Correlation matrix of variables.

	1	2	3	4	5	6
1.Perceived usefulness	0.54					
2.Perceived enjoyment	0.60	0.83				
3.Perceived behavioral control	0.45	0.52	0.57			
4.Subjective Norm	0.39	0.52	0.30	0.80		
5.Attitude	0.64	0.76	0.55	0.48	0.89	
6.Intention	0.57	0.79	0.55	0.54	0.86	0.90

CMIN/DF=2.720, GFI of.904, NFI of.953, CFI of.970, and RMSEA of.066). All hypothesized paths were significant at $p < .05$ and in line with the hypothesized direction (see Table 3). The effects of perceived usefulness (p -value $< .001$; $\Gamma = .323$, $t = 6.022$) and perceived enjoyment (p -value $< .001$; $\Gamma = .630$, $t = 11.258$) on attitude toward adopting mobile shopping were significant and positive, supporting H1 and H2. Attitude toward adopting mobile shopping influenced by the effect of perceived usefulness and perceived enjoyment was positively related to intention to adopt mobile shopping (p -value $< .001$; $\beta = .726$, $t = 18.288$), confirming that attitude was a strong predictor of behavioral intention to adopt mobile shopping. Thus, H3 was supported. The effect of subjective norm on intention to adopt mobile shopping was significant and positive (p -value $< .001$; $\Gamma = .181$, $t = 5.915$), supporting H4. The effect of perceived behavioral control on behavioral intention to adopt mobile shopping was significant and positive (p -value $< .001$; $\Gamma = .115$, $t = 3.422$), thus, supporting H5. The standardized path coefficients for each hypothesized path are provided in Table 3. The Squared Multiple Correlations (SMC) of attitude and behavior were .82 and .89, respectively, indicating that 82% of variance in attitude was explained by perceived usefulness and perceived enjoyment and 89% of variance in intention was explained by all determinants.

Test of moderating effects of consumer traits

To test the moderating effects of three consumer traits (i.e., self-efficacy, technology innovativeness, level of experience),

items measuring self-efficacy and innovativeness were used to group the respondents as high or low levels of self-efficacy and innovativeness. Median split was used to divide the group with a score ≥ 3.6 as high self-efficacy ($N = 318$) and innovativeness ($N = 298$) and a score ≤ 3.5 was grouped as low self-efficacy ($N = 82$) and innovativeness ($N = 102$). The questionnaire item about mobile shopping experience was used to divide the two groups into: (1) no experience of mobile shopping ($N = 295$); and (2) some or greater experience of mobile shopping ($N = 105$). Moderating effects of hypothesized paths were examined using the chi-square differences between the constrained model (equality constraints imposed on each path that was hypothesized to be moderated across two groups) and the unconstrained model (free parameter estimation). Path coefficients of the hypothesized paths for each group, the significance, and the chi-square differences to verify the moderating effects of the three consumer traits are presented in Table 4.

The result of H6a regarding the moderating effect of self-efficacy on the relationship between perceived enjoyment and attitude toward adopting mobile shopping (H6a: $\Delta\chi^2 = 7.350$ at p -value = .007) was significant and consumers with a high self-efficacy ($\Gamma = .569$ at p -value $< .001$) showed a stronger relationship between perceived enjoyment and attitude toward adopting mobile shopping than consumers with a low self-efficacy ($\Gamma = .417$ at p -value $< .001$), supporting H6a. The moderating effect of self-efficacy between perceived behavioral control and intention to adopt mobile shopping (H6b: $\Delta\chi^2 = 4.757$ at p -value = .029) was significant and the path coefficients confirmed that the relationship was stronger for consumers with high self-efficacy ($\Gamma = 1.46$ at p -value = .002) than consumers with low self-efficacy ($\Gamma = -.024$ at p -value = .808). Thus, the results confirmed H6b.

The moderating effect of technology innovativeness on the relationship between perceived behavioral control and intention to use mobile shopping was tested and the result indicated a partial moderating effect on the relationship ($\Delta\chi^2 = 3.253$ at p -value = .071). This demonstrated a stronger moderating effect on the relationship for consumers with high innovativeness ($\Gamma = .131$ at p -value = .005) than consumers with low innovativeness ($\Gamma = -.018$ at p -value = .821), partially supporting H 7.

Table 3
Results of hypothesis testing.

Paths	N=400 Standardized coefficients	t-value
H1: Perceived usefulness- > Attitude toward mobile shopping	.323 [*]	6.022
H2: Perceived enjoyment- > Attitude toward mobile shopping	.630 [*]	11.258
H3: Attitude toward mobile shopping- > intention to use mobile shopping	.726 [*]	18.288
H4: Subjective norm- > intention to use mobile shopping	.181 [*]	5.915
H5: Perceived behavioral control- > intention to use mobile shopping	.115 [*]	3.422

* $p < 0.001$

Table 4
Results for moderating effects models.

Consumer traits	Model	χ^2 (d.f.)	$\Delta\chi^2$ (p-value)	Standardized coefficients	Standardized coefficients
Self-efficacy				High (N=318)	Low (N=82)
	Model A ^a	1044.192(344)			
	Model B ^b	1051.542(345)	7.350(.007)	.569 ^{**}	.417 ^{**}
Innovativeness	Model C ^c	1048.949(345)	4.757(.029)	1.46 [*]	-.024
				High (N=298)	Low (N=102)
	Model A	1002.440(344)			
Experience	Model D ^d	1005.693(345)	3.253(.071)	.131 [*]	-.018
				High (N=295)	Low (N=105)
	Model A ^a	1133.146(344)			
	Model E ^e	1144.764(345)	11.617(.001)	-.003	.103
	Model F ^f	1143.958(345)	10.811(.001)	.118	.423 ^{**}
	Model G ^g	1146.654(345)	13.507(.000)	.863 ^{**}	.523 ^{**}

* $p < 0.05$.

** $p < 0.001$.

^a Unconstrained.

^b Constrained path: perceived enjoyment- > attitude.

^c Constrained path: perceived behavioral control- > intention.

^d Constrained path: perceived behavioral control- > intention.

^e Constrained path: subjective norm- > intention.

^f Constrained path: perceived usefulness- > attitude.

^g Constrained path: perceived enjoyment- > attitude.

Hypotheses 8a–c regarding the moderating effect of level of experience of using mobile shopping showed that the relationship between subjective norm and intention to adopt mobile shopping was different ($\Delta\chi^2=11.617$ at p -value=.001) between two groups and the relationship was weaker for consumers with some mobile shopping experience ($\Gamma = -.003$ at p -value =.973) than consumers with no experience of mobile shopping ($\Gamma = .103$ at p -value =.148), supporting H 8a. Interestingly, the moderating effect of the level of experience on the relationship between perceived usefulness and attitude was significant ($\Delta\chi^2 = 10.811$ at p -value=.001) and it was stronger for consumers with no experience of mobile shopping ($\Gamma = .423$ at p -value < .000) than consumers with some experience of mobile shopping ($\Gamma = .118$ at p -value =.104). This implies that consumers with no experience more strongly perceive that mobile shopping would be useful than consumer with mobile shopping experience. Thus, the result supported H8b. The moderating effect of the level of experience on the relationship between perceived enjoyment and attitude was significant ($\Delta\chi^2 = 13.507$ at p -value =.000) and was stronger for consumers with some experience of mobile shopping ($\Gamma = .863$ at p -value < .001) than consumers with no experience of mobile shopping ($\Gamma = .523$ at p -value < .001). Thus, the result supported H8c. This result suggests that consumers with some experience of mobile shopping enjoy shopping via mobile phone and shopping enjoyment of mobile shopping channel is a significant determinant creating a favorable attitude toward mobile shopping.

Discussions and implications

The present research contributes to identifying the moderating effects of three consumer technology traits (i.e., technology self-efficacy, level of experience of use, and consumer technology innovativeness) on the extended model of Theory of Planned Behavior (TPB). The beliefs (i.e., perceived usefulness, perceived enjoyment, perceived behavioral control, and subjective norm) in the extended TPB study effectively explained consumer mobile shopping adoption behavior with 89% variance and three consumer technology traits confirmed the differential effects on the relationships among determinants of mobile shopping adoption.

The extended of theory of planned behavior

The two beliefs added to the measures of TPB creating positive attitudes toward mobile shopping were perceptions of usefulness and enjoyment of using mobile shopping. The results demonstrated that perceived enjoyment was a stronger determinant affecting positive attitude toward adopting mobile shopping than perceived usefulness of mobile shopping, suggesting that consumers derive shopping enjoyment from using innovative functions and features of technology-mediated mobile shopping environment. The result is consistent with previous studies in technology adoption (Bruner and Kumar, 2005; van der Heijden and Sangstad, 2003.). The immediate interactions with retailers and shopping services offered via mobile phone without temporal

and spatial constraint may increase shopping enjoyment in the mobile shopping channel. In addition, the on-the-go characteristic of the mobile shopping channel enables consumers to experience the omnipresent shopping channel delivering localized and personalized shopping information right to customers' hands. Attitude toward adopting mobile shopping formed with the two perceptions (i.e., perceived usefulness and perceived enjoyment) was a significant predictor of intention to use mobile shopping with 82% of variance in the extended Theory of Planned Behavior model in the study.

Subjective norm and perceived behavioral control were significant determinants of mobile shopping adoption in the study and attitude toward mobile shopping as proved in previous studies in technology adoption (Kim et al., 2011; Luarn and Lin, 2005). Due to the innovative characteristic of the mobile shopping channel, important others' opinions about mobile shopping significantly influenced consumer adoption decisions. In addition, the consumer perception of mobile shopping control was a significant determinant in the adoption of mobile shopping, meaning that good functioning mobile phones that facilitate mobile shopping transactions easily (e.g., fast data processing capability, user friendly interface, unlimited data usage plan) are critical factors in the adoption of mobile shopping.

The moderating effects of consumer traits

The results of moderating effects of three consumer technology traits (i.e., technology self-efficacy, level of experience of use, and consumer technology innovativeness) deepen our understanding of underlying differences in consumer mobile shopping adoption behavior. Consumers with a high self-efficacy showed greater perceived enjoyment than consumers with a low self-efficacy and the higher self-efficacy affects consumer perception of perceived behavioral control positively, resulting in a positive and stronger relationship between perceived behavioral control and intention to use mobile shopping than consumers with a low self-efficacy. This suggests that when consumers become confident in shopping via the mobile channel, they become more comfortable shopping in the mobile channel and explore more functions and features that enrich their mobile shopping experience. In this embryonic stage of mobile shopping, consumers may be more likely to focus on the usefulness of functions and features of mobile shopping; however, when mobile shopping is more proliferate, enjoyment of shopping via the mobile channel would become more critical in determining the continued use of mobile shopping. In the same vein, a higher confidence in mobile shopping would lend a stronger positive feeling that the individual is in control, resulting in continued intention to use mobile shopping. Good functioning mobile shopping sites and services can increase mobile shopping confidence and increase the positive perception of personally controlling mobile shopping. Thus, in designing and developing mobile shopping services, user friendly functions, features, and navigation of mobile shopping is critical in supporting the diffusion of mobile shopping.

The moderating effect of the consumer technology innovativeness characteristic was partially significant on the relationship between perceived behavioral control and intention to use mobile shopping. Since consumers with a higher technology innovativeness characteristic tend to adopt functioning and advanced technology devices earlier than consumers with lower technology innovativeness, consumers with higher technology innovativeness are likely to perceive mobile shopping as in their control. However, consumers with lower technology innovativeness will perceive the lack of knowledge and technology resources for mobile shopping, meaning they will be late adopters of mobile shopping.

Consumers with previous mobile shopping experiences are more likely to enjoy mobile shopping services and its unique benefits than consumers with no mobile shopping experience. The results imply that when consumers get accustomed to mobile shopping, they enjoy the shopping environment and engage with the mobile shopping channel for fun to explore and get new ideas. Interestingly, a difference was found in the relationship between perceived usefulness and attitude toward mobile shopping with the higher or lower level of experience of mobile shopping. Consumers with no previous mobile shopping experience perceived mobile shopping as more useful than consumers with previous mobile shopping experience. Since the perception was derived from indirect experience, indirect experience of mobile shopping may limit the degree of perception of mobile shopping enjoyment. It would be important to give an opportunity to experience mobile shopping in order to increase use of the mobile shopping channel. Retailers should encourage consumers to use mobile coupons or localized shopping information that provides benefits or incentives in order to promote mobile shopping for inexperienced mobile shopping consumers. Furthermore, the effect of subjective norm on intention to use mobile shopping was more prominent for consumers with no mobile shopping experience than consumers with some mobile shopping experience. Consumers with indirect experiences are likely to rely on significant others' evaluation and suggestions of mobile shopping in order to support their mobile shopping adoption decision. Thus, in this diffusion stage of mobile shopping, retailers need to provide testimonials and customer reviews for mobile shopping in order to enrich knowledge and resources of mobile shopping.

Limitations and future research implications

The extended Theory of Planned Behavior model was examined within the context of mobile shopping and the research model supported mobile shopping adoption behavior with three consumer technology traits. The added beliefs (i.e., perceived usefulness and perceived enjoyment) adapted from the Technology Acceptance Model enabled better prediction in explaining adoption of mobile shopping. This study further confirmed that how consumers differed in their levels of technology traits in the mobile shopping adoption behavior in the extended TPB. The implications derived from consumers with high technology traits enable us to predict potential mobile consumer adoption behavior. Future research recommendations include incorporating perceived determinants that hinder consumers from adopting mobile shopping (e.g., perceived barriers, perceived financial risks) in order to identify factors of mobile shopping that should be improved in the future. Perceived trust, network security, and perceived cost have been suggested as critical factors leveraging technology adoption in previous studies (Luarn and Lin, 2005; Wei et al., 2009), thus, these predictors should be included in determining mobile shopping adoption and use. The limitations of this study may be found in the sampling. The majority of the participants were between the ages of 19–30 years, therefore the results may not be generalized to older consumers.

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