

The Adoption of M-Commerce in the United States

Anthony A. Chew*

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* Anthony A. Chew is an undergraduate student in the College of Business Administration Honors Program at California State University, Long Beach, CA 90840. This manuscript serves to fulfill his Honors Thesis requirement. Address correspondence to Anthony Chew via email at achew@csulb.edu.

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THE ADOPTION OF M-COMMERCE IN THE UNITED STATES

ABSTRACT

M-Commerce is thought to be the next big phase in technology involvement following the E-Commerce era. However, its adoption and level of use is low in the United States compared to other nations such as Sweden and Japan. Modeling Ajzen and Fishbein's Theory of Reasoned Action (1980), and Davis and Bagozzi's Technology Acceptance Model (1989), this study seeks to identify some factors that impact the adoption of M-Commerce technology in the United States. Through the use of written questionnaires and online surveys, this study presents and tests an intention to adopt M-Commerce technology framework. The critical antecedent factors include level of E-Commerce use, subjective norm, perceived trust or privacy, innovativeness, perceived usefulness, and perceived ease of use.

INTRODUCTION

M-Commerce, or mobile commerce, is the buying and selling of goods and services through wireless handheld devices such as cell phones and personal digital assistants (PDAs). Through the use of M-Commerce technology, business can be conducted electronically from anywhere at anytime. Following the E-Commerce era, mobile commerce is thought to be the next big trend in technological evolution due to the changing needs of consumers (Barnes 2002). Consumers today lead an increasingly fast-paced life and demand smaller, better, faster, and more reliable wireless technology to keep up with their lifestyles. M-Commerce is the solution to this demand because it makes traditional E-Commerce tasks available to be performed wirelessly through a cell phone or PDA.

From a business-to-consumer (B2C) perspective, some capabilities of mobile commerce include being able to pay for food from vending machines or being able to pay for parking meters wirelessly through a cell phone or PDA. Tasks previously confined to E-Commerce channels, such as purchasing a book from the Internet or getting a restaurant recommendation, are becoming more readily available to consumers through their handheld devices. Mobile commerce not only opens up the possibilities for B2C to be conducted wirelessly, but it also allows business-to-business (B2B) commerce to achieve greater efficiency. Instead of conducting face-to-face meetings or videoconferences, employees can receive information from their managers through calls or text messages to their cell phones. For example, through the use of notification and monitoring applications, shop floor workers can receive notifications if production specifications have changed, as well as respond when they have made the necessary changes.

Although the United States was a pioneer in the development of the Internet and E-Commerce era, the United States is only in its early stages of M-Commerce development and

adoption compared to many European and Asian countries (e.g., Sweden, Japan). Perhaps a big reason for the early success of mobile commerce in Japan and parts of Europe was their ability to introduce 3G, or third generation technology, as a standard for wireless communications in 2001 and 2002, respectively. Third-generation protocols support much higher data rates required for bandwidth-hungry applications such as full-motion video, pictures, games, location based services, television channels, or even full Internet access.

The purpose of this study is to identify some factors impacting the adoption or acceptance of M-Commerce technology in the United States. Although cell phones and PDAs with M-Commerce technology are becoming more readily available in the United States, the number of Americans who choose to adopt or use such technologies is still relatively low compared to other countries. According to *Forbes* (June 22, 2006), the United States only had a 71 percent cell phone penetration rate amongst those aged between 15-59 years old, compared to 95 percent in Hong Kong and 93 percent in South Korea (see Figure 1).

[Insert Figure 1 about here.]

While cell phone companies are upgrading networks to the 3G standard, providing adequate coverage in major metropolitan areas, and providing consumers with content; this study analyzes Americans' attitudes towards M-Commerce technology and their likeliness to use such technology.

BACKGROUND AND THEORETICAL FRAMEWORK

Research on the acceptance of new innovations and technologies has gained importance and popularity, as evident in the number of studies dealing with the E-Commerce evolution. However, compared to E-Commerce, there is limited academic research available on M-Commerce because it is still in its early stages of development and most consumers have not had the chance to use or adopt the technology as part of their daily lives. E-Commerce adoption-

based studies provide a foundation for M-Commerce because the adoption of end-user services in M-Commerce may be treated as a technology adoption (Pedersen 2001): i.e. they serve as a “surrogate”. In addition, M-Commerce is to be considered as a use innovation because the success of an innovative marketing mechanism, such as M-Commerce, can only be ensured through continuous use by consumers (Bauer 2005). Furthermore, “it is impossible to empirically measure adoption and use acceptance; consequently, as is typical in these scenarios, overall acceptance should be forecasted by measuring the attitude toward acceptance” (Bauer 2005).

Popular in the research of E-Commerce adoption and acceptance of new technology in general is the Theory of Reasoned Action (TRA). First developed in 1967 by Icek Ajzen and Martin Fishbein, the Theory of Reasoned Action was originally developed as a psychological model that measured the link between attitude and behavior. Due to the newness of M-Commerce in the United States, the TRA is a prime model to be used in studying the adoption of mobile commerce.

According to the TRA, the most important determinant of a person’s behavior is behavioral intention (BI). Behavioral intention is defined as the strength of one’s intention to perform a specified behavior. A person’s intention to perform a behavior is a combination of (1) the attitude towards performing the behavior and (2) his or her subjective norm (see Figure 2). Attitudes (A) can be defined as the positive or negative feelings a person has towards performing a target behavior. If a person perceives that the outcome from performing a behavior is positive, then he or she will have a positive attitude towards performing the behavior. Likewise, if a person perceives that the outcome from performing a behavior is negative, he or she will have negative attitudes towards performing the behavior. The second determinate of behavioral intention is subjective norm (SN), the influence of social pressure to perform or not perform a certain behavior. If people relevant to the person performing a behavior see that behavior as

positive, then a positive subjective norm is expected. However, it is important to note that the subjective norm measurement is only valid if the person is motivated to meet the expectations of those relevant to him or her. Therefore, a motivation to comply (MC) construct is also included in one's subjective norm because "on both theoretical and empirical grounds it appears that motivation to comply is best conceived as the person's general tendency to accept the directives of a given reference group or individual" (Fishbein and Ajzen 1975). [See Figure 2 that illustrates the proposed relationships of the Theory of Reasoned Action.]

[Insert Figure 2 about here.]

Similar to the TRA, Fred Davis and Richard Bagozzi developed the Technology Acceptance Model (TAM) at the beginning of the E-Commerce era (1989). This model is a customized version of the TRA model designed specifically for the study of user acceptance of information systems and technology. According to Davis and Bagozzi, "A key purpose of TAM is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions" (Davis and Bagozzi 1989, p.985).

Two important constructs added to TAM are perceived usefulness and perceived ease of use. Perceived usefulness (U) is defined as the person's perception of how using a specific application system will increase his or her job performance within an organizational context. Ease of use (E) refers to the degree to which the prospective user expects the target system to be free of effort (Davis and Bagozzi 1989). It is believed that these two constructs together will have an impact on one's attitude towards using a particular technology (see Figure 3).

[Insert Figure 3 about here.]

In Davis and Bagozzi's study, 107 MBA students at the Michigan Business School were given access to use a word processing system called *WriteOne*. Respondents completed surveys at both the beginning of the semester and the end of the semester, 14 weeks later. It was

discovered that the two constructs, perceived usefulness and ease of use, did indeed have strong positive relationships with behavioral intention. One notable limitation that the authors acknowledge is that the TAM model draws upon studying attitudes towards performing a behavior, and not attitudes towards a product. However, this limitation will not apply to this study because the adoption of M-Commerce serves to identify factors impacting a behavior, and not particular cell phones or PDAs that use such a technology.

Due to the proven validity of TRA and TAM in past research, these models will be applied to the M-Commerce Adoption Model used in this research. Mirroring the Theory of Reasoned Action, it is believed that one who has positive attitudes towards using M-Commerce technology will have a high behavioral intention to adopt M-Commerce technology. In addition, one who is greatly influenced by social pressure to use M-Commerce technology will have higher intentions to adopt M-Commerce technology. Thus, the following two hypotheses are proposed:

- H1:** The attitude (A) towards using M-Commerce has a positive relationship with the behavioral intention (BI) to adopt M-Commerce technology.
- H2:** The subjective norm (SN) towards using M-Commerce has a positive relationship with the intention to adopt M-Commerce technology

Antecedent Construct and Relationships

As introduced above, in addition to the fundamental relationships among BI, A, and SN, the proposed framework includes a set of antecedent constructs: i.e., perceived usefulness (U), perceived ease of use (E), perceived trust (T), and innovativeness (I). Similar to concepts developed from TAM, it is believed that one who believes M-Commerce to be useful and convenient will have positive attitudes towards using M-Commerce. Furthermore, one who perceives M-Commerce technology to be easy to use will have positive attitudes towards using M-Commerce. Hypotheses 3 and 4 are proposed as follows:

H3: The level of perceived usefulness (U) has a positive relationship with attitudes (A) towards using M-Commerce technology.

H4: The level of perceived ease of use (E) has a positive relationship with attitudes (A) towards using M-Commerce technology.

As M-Commerce is thought to be the next major phase in technological involvement following the E-Commerce era, one important factor identified to impact the adoption of E-Commerce, trust (T), will also be included in this study. According to Rousseau et al., trust is defined as “a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another” (1998, p. 395). Trust is important because it (1) helps consumers overcome perceptions of uncertainty and risk (McKnight 2002) and (2) helps build appropriate favorable expectations of performance and other desired benefits (Gefen 2000). Furthermore, for trust to exist, “consumers must believe that the sellers have the ability and motivation to reliably deliver goods and services of the quality expected by the consumers” (Jarvenpaa 2000, p. 47). Trust is not only an important factor to E-Commerce, “trust is emerging as a potentially important antecedent of IT adoption” (Gefen 2002). The current study aims to identify consumers’ perceived trust of M-Commerce technology in general as well as the consumers’ perception that their personal information will be kept private while using mobile technology. Similar to how online consumers provide credit card or other personal information to online websites, consumers utilizing M-Commerce channels will also be exposed to possible fraudulent or unethical use or distribution of personal information. Because of this, it is hypothesized that one who trusts using M-Commerce technology will have more positive attitudes towards using M-Commerce. Therefore, Hypothesis 5 proposes that:

H5: The level of perceived trust and privacy (T) in using M-Commerce has a positive relationship with attitudes (A) towards using M-Commerce.

The next factor thought to impact the adoption of M-Commerce is innovativeness (I). Although the term “innovativeness” has been used commonly throughout marketing research, there is no concrete conclusion or single description of innovativeness. For example, researchers’ descriptions of innovativeness have ranged from the “creation of newness” (Hurly and Hult 1998) to the “possession of newness” (Daneels and Kleinsmith 2001), or even the “consumption of newness” (Midgley 1978). Because there is no consensus on the meaning of innovativeness, it is important to note which definition of innovativeness will be used for one’s research (Roehrich 2004). Because this research is dealing with consumers’ adoption of M-Commerce, the term “consumer innovativeness” will be used. Consumer innovativeness, as described by Midgley, is the tendency to buy new products more often and more quickly than other people (Midgley 1978).

Measurements of innovativeness have also varied greatly across marketing research. For example, innovativeness scales designed by Goldsmith and Hofacker measured innovativeness as the tendency to learn about and adopt innovations (Goldsmith and Hofacker 1995). These scales were designed to measure domain-specific innovativeness, which is thought to be an intermediary between innate innovativeness and innovative behavior. Goldsmith and Hofacker’s innovativeness scales proved to have high predictive validity for new-product purchases and could be easily modified to retain reliability across different products (Goldsmith and Hofacker 1995). Similar to measurements of subjective norm, these scales placed a strong emphasis on societal pressures; specifically, the pressure to use or not to use a new product.

Another measurement of innovativeness was designed by Roehrich (1995). These innovativeness scales were similar to Goldsmith and Hofacker’s, however Roehrich set importance on two factors; hedonistic needs, or the need for stimulation, and social innovativeness, or the need for uniqueness. These innovativeness scales proved to be a good

predictor of the number of new products purchased. The correlation with the need for stimulation was good; however, there was no correlation with the need for uniqueness (Roehrich 2004).

A third innovativeness scale is Le Louarn's scale. Le Louarn's scale contains three dimensions of innovativeness: attraction to newness, autonomy in innovative decision, and the ability to take risks in trying newness (Roehrich 2004). These scales demonstrated good internal consistency, validity, and predictive validity for early new-product purchase intentions.

However, Le Louarn's three dimensions of innovativeness correlated poorly. Specifically, only the attraction to newness correlated with innovative behavior.

A number of questions from these innovative scales were used in the M-Commerce adoption model. Because M-Commerce is only in its early stages of development in the United States, M-Commerce can be considered new because people have not yet had the chance to use or adopt the new technology. Thus, I hypothesize that one who is innovative will have more positive attitudes towards using M-Commerce and more likely to adopt the new technology.

H6: The level of consumer innovativeness (I) has a positive relationship with attitudes (A) towards using M-Commerce.

Lastly, because research dealing with E-Commerce versus M-Commerce comparisons is nearly nonexistent (Okazaki 2005), this study would like to identify if there is any relationship between E-Commerce adoption and M-Commerce adoption. Is it safe to assume that those who already purchase products off the Internet or are not afraid to disclose their personal information to online vendors would not mind performing such actions through mobile channels? An extreme example of this is in some Chinese cities; the number of people using mobile phones to buy and sell stocks on the Internet is greater than the number of people using fixed lines connected to the Internet (Dholakia 2001). With the limited amount of research on this subject, this study will also explore the impact of E-Commerce adoption on M-Commerce adoption.

H7: The level of E-Commerce adoption (C) is a determinant of the adoption of M-Commerce.

The above relationships proposed in H1-H7 are summarized in Figure 4.

[Insert Figure 4 about here.]

METHODOLOGY

Overview of Subjects and Procedure

In order to assess American's attitudes and their likeliness to use M-Commerce technology, a survey was administered to undergraduate students enrolled in an introductory marketing class at a large western state-supported university. To obtain a larger and more diversified sample, a survey was also made available on the Internet via www.zoomerang.com, providers of professional-grade online survey software. The online survey was identical to the survey distributed in the classroom except it contained an additional question asking the respondents to specify their current state of residence.

The online survey was also publicized through a forum post on www.thecatacombs.net, an online gaming forum. This forum was selected due to the high participation rate in prior surveys for other studies. Prior to taking the survey, respondents were advised to answer questions at their own pace, in the order presented, carefully, and honestly. A definition and a brief description of M-Commerce were given to the respondents so that they were informed of what M-Commerce is. That is, respondents were told that:

Mobile Commerce, or M-Commerce, is defined as the buying and selling of goods and services through wireless handheld devices such as cell phones or personal digital assistants (PDAs). M-Commerce allows business to be conducted electronically from anywhere at anytime, and is thought to be the next big phase in technology evolvement following the E-Commerce era. Some examples of M-Commerce include being able to pay for food from vending machines or being able to pay for parking meters wirelessly through your cell phone or PDA. Although M-Commerce technology is not readily available in the United States at this time, please complete the survey assuming such technologies are currently available for you to use.

Sample and Dependent Measures

Overall, the sample consisted of 205 respondents. The age of respondents ranged from 16 to 73, with a mean age of 27.15 and median age of 24. The sample was composed of 49.2% males and 50.8% females.

As described earlier, the first determinate of behavioral intention is attitudes. To measure overall attitudes towards using M-Commerce technology, respondents were presented with a series of bi-polar adjectives and were instructed to circle a number between one and nine indicating which endpoint better described them and to what extent. The selection of adjectives was chosen carefully, as to preserve the predictive validity and maintain a high internal consistency. Following Ajzen's suggestions in creating TRA surveys, one criterion used for the selection of adjectives was those that were instrumental in nature (e.g., worthless/valuable, not beneficial/beneficial). A second criterion used in the adjective selection process was those that were more of an experiential quality (e.g., dislike/like, not enjoyable/enjoyable, boring/exciting). In addition to these two criteria, traditional adjective pairs (e.g., negative/positive) were also included as suggested by Ajzen (2002).

To assess the second determinate of behavioral intention, subjective norm (SN), respondents were presented with a series of statements that measured the influence of social pressure on using M-Commerce (e.g., "Most people who are important to me think that I should use M-Commerce technology in the future," "The people in my life whose opinions I value would approve of me using M-Commerce technology," "Many people like me expect that I use M-Commerce technology") and were asked to what extent they agree or disagree with each statement. Agreement or disagreement with each statement was measured using 9-point scales, where a "1" represented "Strongly Disagree" and a "9" represented "Strongly Agree." As Ajzen notes, the subjective norm measurement is valid only if the person is motivated to meet

expectations of those relevant (Ajzen 1975). As a result, also included in the subjective norm section were motivation to comply (MC) statements (e.g., “Most people who are important to me will use M-Commerce technology in the future,” “The people in my life whose opinions I value will use M-Commerce technology,” “Many people like me use M-Commerce technology”).

Measuring the usefulness of M-Commerce, several questions were drawn from Davis and Bagozzi’s TAM experiment (Davis and Bagozzi 1989). Their experiment consisted of statements assessing the usefulness of a word processor in an MBA program. Contrastingly, the adoption of M-Commerce is a much more general study, and thus the usefulness questions were also generalized to match the M-Commerce industry. The first statement (“In general, I believe M-Commerce will be useful”) assessed the respondents’ overall opinion on the usefulness of M-Commerce technology. The following three statements (“To be able to buy snacks and drinks from vending machines through my cell phone or PDA is useful,” “To be able to pay for parking meters through my cell phone or PDA is useful,” “Having wireless Internet on my cell phone or PDA is convenient”) conveyed specific actions or privileges respondents would have if they utilized M-Commerce. Lastly, a statement similar to Davis and Bagozzi’s survey was placed assessing the respondents’ opinion on their productivity (“Having M-Commerce capabilities on my cell phone or PDA would save time”).

To measure ease of use (E), 9-point scales were also used. Davis and Bagozzi’s ease of use statements were adapted to fit the context of M-Commerce; the *WriteOne* software used in Davis and Bagozzi’s experiment was replaced by a cell phone or PDA. The following statements assessed the respondents’ ease of use and learning capabilities (“Learning to operate a cell phone or PDA with M-Commerce capabilities would be easy for me,” “I would find it simple to get my cell phone or PDA to do the M-Commerce capabilities I want it to do,” “It would be easy for me to become skillful at using my cell phone or PDA for M-Commerce transactions,” “I would find

my cell phone or PDA with M-Commerce capabilities easy to use”). The two constructs from TAM, usefulness and ease of use, are used in the M-Commerce Adoption Model to test the impact they have on the attitudes towards using M-Commerce.

Six statements were given to respondents rating their perceptions of trust and privacy (T) in using M-Commerce. Three of the statements (“I believe transactions conducted through M-Commerce will be secure,” “I believe payments made through M-Commerce channels will be processed smoothly,” and “I believe payments made through M-Commerce channels will be processed securely”) assessed the respondents’ level of trust. To ensure consumer trust during transactions, it is important to have transactions and payments that are handled both smoothly and securely (Gefen 2002).

The last three statements measured the respondents’ perception of privacy when using M-Commerce. First, in countries such as Japan, consumers can receive advertisements on their cell phones with deals and specials from stores that they are interested in as they walk up and down store aisles. Therefore, a statement (“I would like to receive advertisements on my cell phone or PDA with deals and specials from companies that I am interested in”) was presented to see if Americans would be willing to receive advertisements on their mobile devices or if they perceived them as too aggressive. Second, cell phones have the capability of broadcasting GPS coordinates. This feature could be used by the California Highway Patrol or other police agencies to locate 911 calls placed on cell phones. In addition, GPS can also be used by consumers for turn-by-turn driving directions. However, because these signals are broadcasted wirelessly, there is the potential threat that snoopers or hackers can also identify your location. Hence, a statement (“I would like my cell phone or PDA to broadcast my location so that I could use it as a Global Positioning System”) was included to assess respondents’ perception of privacy from this perspective. The last privacy question (“I believe my personal information will

be kept confidential while using M-Commerce technology”) simply assessed the respondents’ belief that their personal information would be kept confidential when conducting transactions over M-Commerce channels.

The innovativeness scales for the M-Commerce Adoption Model borrow a number of statements from previous innovativeness research that proved to have high consistency and validity. The respondents were asked to indicate the extent to which the following statements about new products described them. The first set of questions assessed the respondents’ opinions of new products based on a comparison to their friends or other people (“I know more about new products before other people do” (Goldsmith and Hofacker 1995), “I am usually among the first to try new products” (Roehrich 2004), “In general, I am among the first amongst my friends to purchase a new product” (Roehrich 2004), which followed Roehrich’s social innovativeness factor, or the need for uniqueness. A second set of statements were presented, following Roehrich’s hedonistic factor, or the need for stimulation (“New products excite me”, cf. Roehrich 2004), and Le Louarn’s autonomy in innovative decision measurement (“I seek out the opinion of those who have tried new products or brands before I try them”, cf. Roehrich 2004).

To measure respondents’ level of E-Commerce adoption, respondents were asked to indicate the extent to which each statement described them (five 9-point scales). The first question (“I use e-mail on a daily basis”) was presented as a general Internet use question. The next two questions (“I visit online retailer websites when researching a product or service” and “I like to conduct research on products using the Internet prior to making a purchase”) assessed the respondents’ use of the Internet in conducting research prior to making a purchase using E-Commerce channels. The fourth question (“I enjoy purchasing products [tangible or intangible] via the Internet”) was asked to see if respondents liked (or otherwise had positive attitudes) buying products off the Internet. The words “tangible or intangible” were specified in the

statement so that tangible products, such as those delivered to consumers through the mail, as well as intangible products like services, electronic media or software would be included. The last question (“I use credit cards or debit cards to make online purchases”) was similar to trust and privacy questions, but also explicitly asked the subject if they have or have not used credit cards on the Internet. Together, these five statements were combined to measure the level of E-Commerce adoption.

Lastly, respondents were asked if they currently owned a cell phone. Those who did own cell phones were also instructed to indicate which features their cell phones had and whether or not those features were actually used on a daily basis. The cell phone features presented included SMS text messaging, camera, instant messenger, Internet, and video playback.

RESULTS

Construct Reliability

Applying TRA concepts to the M-Commerce Adoption Model, analyses were conducted to ensure high internal validity amongst survey statements testing each of the hypotheses. Maintaining high internal validity plays an important role in this study because the TRA, a psychological model developed to measure the link between attitudes and behaviors, is being used to study the adoption of M-Commerce technology.

As described earlier, general attitudes were assessed using two indicators (“positive/negative” and “like a lot/dislike,” $r = .85$). Utility attitudes (“necessary/unnecessary,” “valuable/worthless,” “practical/impractical,” “beneficial/not beneficial” $\alpha = .84$) were similarly reliable. On the other hand, fun attitudes (“exciting/boring or dull,” “enjoyable/not enjoyable” $r = .64$) were less reliable. Combining these three attitudinal measures to form the *attitudes towards using M-Commerce* scale yielded a highly reliable construct ($\alpha = .90$).

The *subjective norm* measure was less reliable, but acceptable ($\alpha = .77$). Reliability coefficients for the *perceived usefulness* ($\alpha = .89$), *perceived trust/privacy* ($\alpha = .83$), *innovativeness* ($\alpha = .89$), and *level of E-Commerce adoption* ($\alpha = .83$) constructs were also acceptable. The *perceived ease of use* ($\alpha = .97$), and *behavioral intention to adopt M-Commerce* ($\alpha = .97$) were highly reliable.

Hypothesis Tests

A structural equation model was estimated using LISREL 8.54 (Jöreskog and Sörbom 1993).¹ The chi-square for the M-Commerce Adoption Model (8-factor) was significant (indicating a poor fit). In addition, the overall goodness of fit statistics were only somewhat acceptable ($\chi^2 (11, N = 205) = 126.68, p < .001$), Normed Fit Index [NFI] = .823, Incremental Fit Index [IFI] = .836, Comparative Fit Index [CFI] = .832, Root Mean Square Error of Approximation [RMSEA] = .202, Standardized Root Mean Square Residual [SRMR] = .179).

The findings (Table 1, column 1) indicate that five of the seven hypotheses are supported. Consistent with results shown using Ajzen and Fishbein's Theory of Reasoned Action (1980), the attitudes towards using M-Commerce (H1) and the subjective norm (H2) do indeed have a positive relationship with the behavioral intention to adopt M-Commerce technology ($b = .27$ and $.44$, respectively, $p < .05$).

[Insert Table 1 about here.]

Applied predictions of Davis and Bagozzi's Technology Acceptance Model (1989) were only partially consistent when applied to the M-Commerce Adoption Model. Perceived usefulness (H3) did show to have a significant positive relationship with attitudes towards using M-

¹ The measurement error of the single indicator constructs (formed by summing the relevant items detailed in the previous section) were fixed at $(1 - \alpha)$ times the variance of the indicator (cf. Homer and Yoon 1992).

Commerce ($b = .31, p < .05$). However, the relationship between perceived ease of use (H4) and attitudes towards using M-Commerce was not significant ($b = .02, ns$).

Similar to previous research on the role of trust and privacy in E-Commerce transactions (McKnight 2002, Gefen 2002), results from this survey show that the role of trust and privacy is also important to consumers using M-Commerce channels. That is, the level of perceived trust and privacy in using M-Commerce (H5) does have a positive relationship with attitudes towards using M-Commerce ($b = .28, p < .05$).

On the other hand, conclusions can not be drawn regarding the role of consumer innovativeness on attitudes towards M-Commerce. The level of consumer innovativeness (H6) did not show to have a significant relationship with the attitudes towards using M-Commerce ($b = .01, ns$).

Lastly, respondents who considered themselves adopters of E-Commerce did show behavioral intentions to adopt M-Commerce. As a result, the level of E-Commerce adoption (H7) is a determinant of the adoption of M-Commerce ($b = .16, p < .05$).

Revised M-Commerce Adoption Model

Examination of the modification indices provided by LISREL 8.54 suggests that creating paths linking *perceived usefulness* → *subjective norm*, *perceived ease of use* → *subjective norm*, *perceived trust / privacy* → *subjective norm*, and *innovativeness* → *subjective norm* would significantly improve the overall fit of the model (modification indices ranging from 17.29 to 67.56). [See Figure 5 for Revised M-Commerce Adoption Model.]

[Insert Figure 5 about here.]

Thus, a structural equation model was estimated that freed up the four above detailed structural paths (see Table 1, column 2). The chi-square for this Revised M-Commerce Adoption Model was insignificant (indicating a good fit), and the overall goodness of fit statistics for this

revised model also improved significantly ($\chi^2 (7, N = 205) = 29.73, p < .001$; NFI = .959, IFI = .968, CFI = .967, RMSEA = .120, SRMR = .055). The *perceived usefulness* construct from TAM has both a direct and indirect impact on *behavioral intention*, and is completely mediated by both *attitudes* and *subjective norm*. However, the other TAM construct, *perceived ease of use*, only has a direct effect on *behavioral intention* ($b = .31, p < .05$). Both attitudes and subjective norm completely mediate the relationship between *trust* and *behavioral intention*. *Innovativeness* has no significance in this model as no significant links could be identified. Direct links are demonstrated with attitudes to behavioral intention ($b = .27, p < .05$), as well as subjective norm to behavioral intention ($b = .44, p < .05$). Lastly, the *level of E-Commerce adoption* also had a direct relationship with *behavioral intention* ($b = .17, p < .05$).

DISCUSSION

Interpretation of the Findings

Support for H1 and H2 is not surprising, given the plentiful amount of research showing the validity and reliability of Ajzen and Fishbein's Theory of Reasoned Action across a variety of disciplines. The support for H1 should provide insight to American mobile commerce companies and marketers that the formation of positive attitudes towards their products (A) plays an important role in the eventual adoption (BI) of mobile devices. Not only is it important to form positive attitudes with consumers, but marketers should target consumers' friends and family as well. The support for H2 shows that the influence of social pressure (SN) from people relevant to the person using mobile commerce can also play a vital role towards the adoption of M-Commerce.

Support for H3 was also consistent with expectations. Borrowing statements from Davis and Bagozzi's Technology Acceptance Model to test the usefulness construct (U) in the M-

Commerce Adoption Model proved to be effective. As mentioned earlier, consumers today desire smaller, faster, and more reliable mobile devices to keep up with their fast-paced life styles. The findings for H3 show that the concept of having a useful mobile device at hand rates very highly in the formation of consumer attitudes.

On the other hand, being unable to support the relationship between perceived ease of use and attitudes (H4) could mean a number of things. First, it could have its literal interpretation: the difficulty level in using mobile devices simply has no impact on consumers' attitudes. Second, having a sample median age of 24 and mean age of 27.15 could have skewed the results. Many consumers in their mid 20's may already have a good foundation of knowledge on how to use mobile commerce devices and other electronics. Having said that, the construct *ease of use* could have no/limited impact on the formation of attitudes for consumers who already find mobile devices easy to use.

Being able to support the role of trust and privacy in the formation of attitudes towards using M-Commerce (H5) should signal a red flag to mobile cell phone carriers and other mobile commerce companies. Precautions taken to protect consumers during E-Commerce transactions should also be taken during M-Commerce transactions. More and more confidential information is being volunteered by and requested of consumers than ever before. As the ongoing threat of snoopers and hackers is still evident, safety measures should be taken to increase the security of mobile devices and protect consumers' confidential information as it is stored and transmitted through wireless channels.

The data failed to support the relationship between the level of consumer innovativeness and the attitudes towards using M-Commerce (H6). One possible explanation, as mentioned earlier, could be the increased pace of many American lifestyles. As adoption rates of mobile commerce increase in the United States, consumers may find a need to use their cell phones or PDAs on a

daily basis, whether they are considered “innovative” or not. After all, 97% of all respondents (including those determined to be “innovative” as well as those to be “non-innovative”) owned a cell phone at the time of this survey.

Analyses also supported H7 that E-Commerce adoption is a determinant of the adoption of M-Commerce. As described by Barnes (2002), the Internet is combining with mobile commerce and is starting to become integrated with personal computers and mobile devices alike. The capabilities of E-Commerce previously accessible exclusively through personal computers are now becoming conveniently available on mobile devices. Therefore, it is very plausible that those who adopt and use the Internet on their personal computers are also likely to have cell phones and utilize their handheld devices for M-Commerce transactions.

Perhaps the most surprising findings presented in this study were the additional paths linking perceived usefulness, perceived ease of use, perceived trust and privacy, and innovativeness to subjective norm. Based on the high modification indices provided by the Lisrel analyses, a revision to the M-Commerce Adoption Model was made to reflect the improved fit even though these links were not previously identified in TRA or TAM. The influence of those four antecedent constructs on the subjective norm make the subjective norm construct an even greater determinate in the behavioral intention to adopt M-Commerce.

Limitations

Being a study of the adoption of M-Commerce in the United States, the 205-subject sample size of this research is extremely small. The sample may not be a good representation of the United States because a majority of the respondents were undergraduate students at one university. Combining both classroom and online surveys, 95% of the respondents reside in California. Having a survey distributed solely through the Internet, a more representative sample could be obtained if responses were received from those throughout all 50 states. With this, it

would be interesting to identify whether there are any important geographical differences between California and the rest of the United States in terms of M-Commerce adoption.

Additionally, although the majority of existing studies commonly use paper-and-pencil or online surveys, the validity of self-reported responses is too rarely questioned. Is it safe to assume that respondents' self-reported answers are valid and reliable data for research in the M-Commerce industry? How valid are online or paper-and-pencil surveys when our sample of interest is those who are in fact mobile users? Would it be possible to instead distribute surveys for such research through cell phones or PDAs so that we could verify if the respondents are indeed users of mobile commerce?

Many questions in this survey provide a definition of M-Commerce and inform respondents to complete the survey with the assumption that such technologies are currently available, limiting this research simply to the respondents' perceptions of M-Commerce. In agreement with Okazaki (2005), it would be beneficial to discuss more issues related to the reliability and validity of M-Commerce research methodology.

Lastly, the conclusions discussed in this research are drawn from LISREL 8.54 analyses. The structural equation analyses provided by Lisrel are under the assumption that all relationships are linear. Not only could this assumption be an oversimplification in the case of online consumer trust (Gefen 2002), but of the M-Commerce Adoption Model as a whole.

Future Research

Because M-Commerce is such a fast and evolving industry, the possibilities for future research on this industry are endless. Even between the times this survey was distributed and the time of this writing, cell phone features such as GPS turn-by-turn directions, streaming music videos and sports highlights, and mp3 playback have become more popular and readily available.

With the importance of the subjective norm identified in this research, future research could focus on how consumers exchange useful and beneficial product/service information. Is this information transmitted through E-Commerce, M-Commerce, or word of mouth? How do social norms or peer pressures influence the flow of information through these networks? It would also be interesting to see if there will be any difference in results measuring those who submitted surveys based solely on their perceptions of M-Commerce with those who have actually tried using M-Commerce and then later decided whether or not to actually adopt the technology.

Lastly, this research has shed some insight that the level of E-Commerce adoption could be a determinant of the adoption of M-Commerce. However, as M-Commerce is thought to be the next phase in technological advancement, can M-Commerce be an effective alternative to E-Commerce? Little research has been conducted to analyze whether there are any significant differences in the usage and consumer acceptance of these two industries. As M-Commerce continues to grow throughout the United States, it will be interesting to see how consumers will accept and use mobile technology and see if it can be as effective as it has become in other parts of the world.

REFERENCES

- AFX News (2006), "Hong Kong mobile phone penetration highest in Asia; China overtakes US – survey," <http://www.forbes.com/finance/feeds/afx/2006/06/22/afx2832528.html>
- Ajzen, Icek and Martin Fishbein (1975), *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Philippines: Addison-Wesley Publishing Company, Inc.
- Ajzen, Icek, and Martin Fishbein (1980), *Understanding Attitudes and Predicting Social Behavior*, Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Ajzen, Icek (2002), "Constructing a TpB Questionnaire: Conceptual and Methodological Considerations," <http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf>
- Bauer, Hans H., Tina Reichardt, Stuart Barnes, and Marcus M. Neumann (2005), "Driving Consumer Acceptance of Mobile Marketing: A Theoretical Framework and Empirical Study," *Journal of Electronic Commerce Research*, 6 (August), 181-92.
- Barnes, Stuart J. (2002), "The Mobile Commerce Value Chain: Analysis and Future Developments," *International Journal of Information Management*, 22, 2 (April), 91-108.
- Danneels, Erwin and Elko J. Kleinschmidt (2001), "Product Innovativeness from the Firm's Perspective: its Dimensions and their Relation with Project Selection and Performance," *Journal of Product Innovation Management*, 18 (November), 357– 73.
- Davis, Fred D., Ricard Bagozzi, and Paul Warshaw (1989), "User Acceptance of Computer Technology: A Comparison of Two," *Management Science*, 35 (August), 982-1003.
- Dholakia, Nikhilesh and Nir Kshetri (2002), "The Global Digital Divide and Mobile Business Models: Identifying Viable Patterns of e-Development," *Proceedings of the Seventh IFIP WG9*, Vol. 172, Elen Balka and Richard Smith, Deventer, The Netherlands, Kluwer, B.V., 94-101.
- Gefen, David (2000), "E-Commerce: The Role of Familiarity and Trust," *Omega: The International Journal of Management Science*, 28 (6), 725-37.
- Gefen, David (2002), "Reflections on the Dimensions of Trust and Trustworthiness Among Online Consumers," *Database for Advances in Information Systems*, 33 (Summer), 38-53.
- Goldsmith, Ronald E., Jon B. Friedman, and Jacqueline K. Eastman (1995), "The Generality/specificity Issue in Consumer Innovativeness Research," *Technovation*, 15 (December), 601-12.
- Harris, Patricia, Ruth Rettie, and Cheung Chak Kwan (2005), "Adoption and Usage of M-Commerce: a Cross-Cultural Comparison of Hong Kong and the United Kingdom," *Journal of Electronic Commerce Research*, 6 (August), 210-24.

- Homer, Pamela M., and Sun-Gil Yoon (1992), "Message Framing and the Interrelationships Among Feelings, Affect, and Cognition," *Journal of Advertising*, 21 (1), 19-33.
- Hurley, Robert F. and G. Tomas M. Hult (1998), "Innovation, Market Orientation, and Organizational Learning: an Integration and Empirical Examination," *Journal of Marketing*, 62 (July), 42-54.
- Jarvenpaa, Sirkka L., Noam Tractinsky, and Michael Vitale (2000), "Consumer Trust in an Internet Store," *Information Technology and Management*, 1 (1-2), 45-71.
- Jöreskog, Karl G., and Sörbom, Dag (1993), *Lisrel 8 User's Reference Guide*, Chicago, IL: Scientific Software, Inc.
- McKnight, D. Harrison, Vivek Choudhury, and Charles Kacmar (2002), "Developing and Validating Trust Measures for E-Commerce: An Integrative Typology," *Information Systems Research*, 13 (September), 334-61.
- Midgley, David F. and Grahame R. Dowling (1978), "Innovativeness: the Concept and its Measurement," *Journal of Consumer Research*, 4 (March), 229-42.
- Okazai, Shintaro (2005), "New Perspectives on M-Commerce Research," *Journal of Electronic Commerce Research*, 6 (August), 160-65.
- Pedersen, Per E. and Leif Methlie (2001), "Understanding Mobile Commerce End-User Adoption: A Triangulation Perspective," *System Sciences*, May, Nokia Research Center, Helsinki, Finland.
- Roehrich, Gilles (2004), "Consumer Innovativeness: Concepts and Measures," *Journal of Business Research*, 57 (June), 671-77.
- Rousseau, Denise M., Sim B. Sitkin, Ronald S. Burt, and Colin Camerer (1998), "Not So Different After All: A Cross-Discipline View of Trust," *The Academy of Management Review*, 23 (July), 393-404.

Table 1
Summary of Standardized Structural Estimates for
M-Commerce Adoption Model and Revised M-Commerce Adoption Model

<i>Estimated Path</i>	<i>Standardized Path Coefficients</i>	
	<i>Original Model</i>	<i>Revised Model</i>
<i>Indirect Effects</i>		
Perceived Usefulness (U) → Attitudes (A)	.31 ^a	.31 ^a
Perceived Ease of Use (E) → Attitudes (A)	.02	.02
Perceived Trust / Privacy (T) → Attitudes (A)	.28 ^a	.28 ^a
Innovativeness (I) → Attitudes (A)	.01	.01
Attitudes (A) → Behavioral Intention (BI)	.27 ^a	.25 ^a
Subjective Norm (SN) → Behavioral Intention (BI)	.44 ^a	.42 ^a
E-Commerce Adoption (C) → Behavioral Intention (BI)	.16 ^a	.17 ^a
Perceived Usefulness (U) → Subjective Norm (SN)	--	.24 ^a
Perceived Ease of Use (E) → Subjective Norm (SN)	--	.08
Perceived Trust / Privacy (T) → Subjective Norm (SN)	--	.51 ^a
Innovativeness (I) → Subjective Norm (SN)	--	.02
<i>Direct Effects</i>		
Perceived Usefulness (U) → Behavioral Intention (BI)	.20 ^a	.16 ^a
Perceived Ease of Use (E) → Behavioral Intention (BI)	.31 ^a	.27 ^a
<i>Goodness of Fit Statistics</i>		
χ^2	126.68	29.73
d.f.	11	7
$p <$.001	.001
NFI	0.823	.959
CFI	0.832	.967
IFI	0.836	.968
RMSEA	0.202	.120
SRMR	.179	.055

^a $p < .05$

FIGURE 1

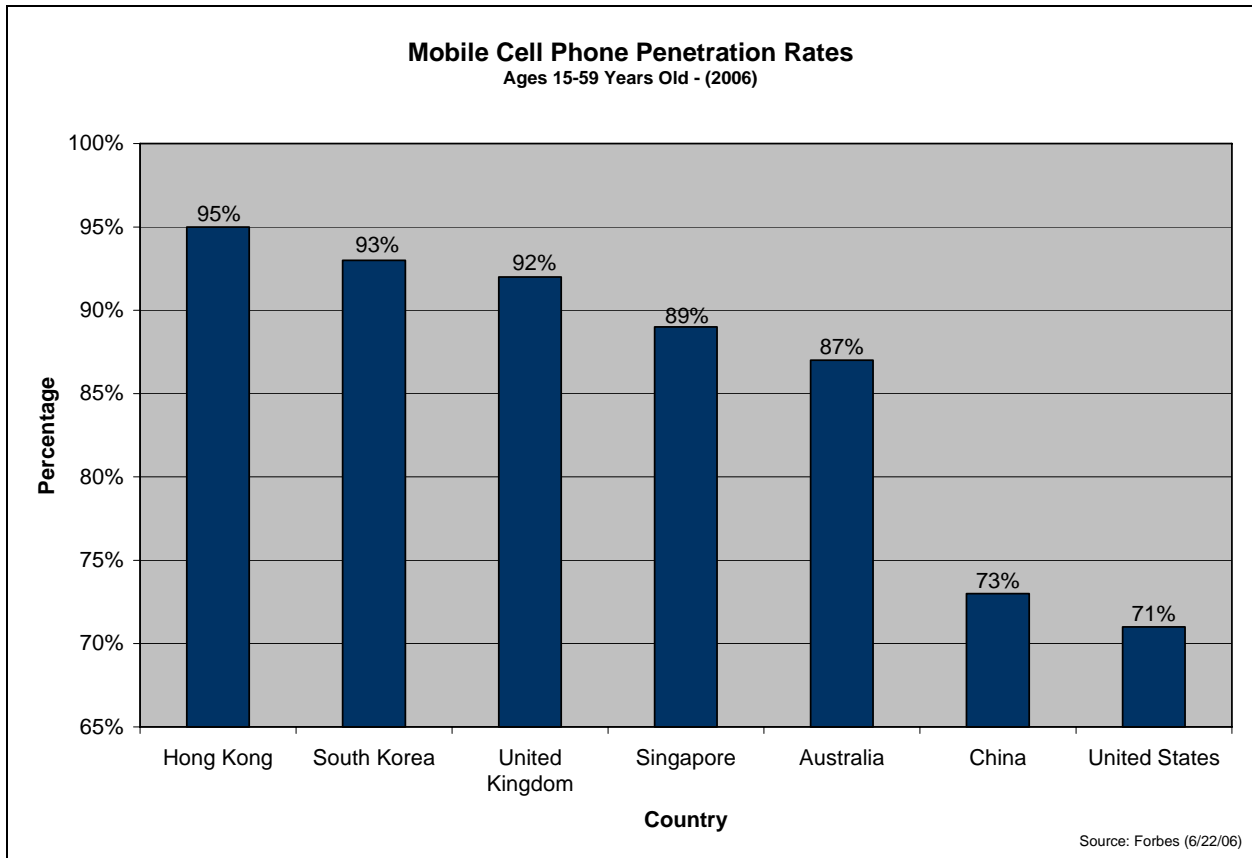
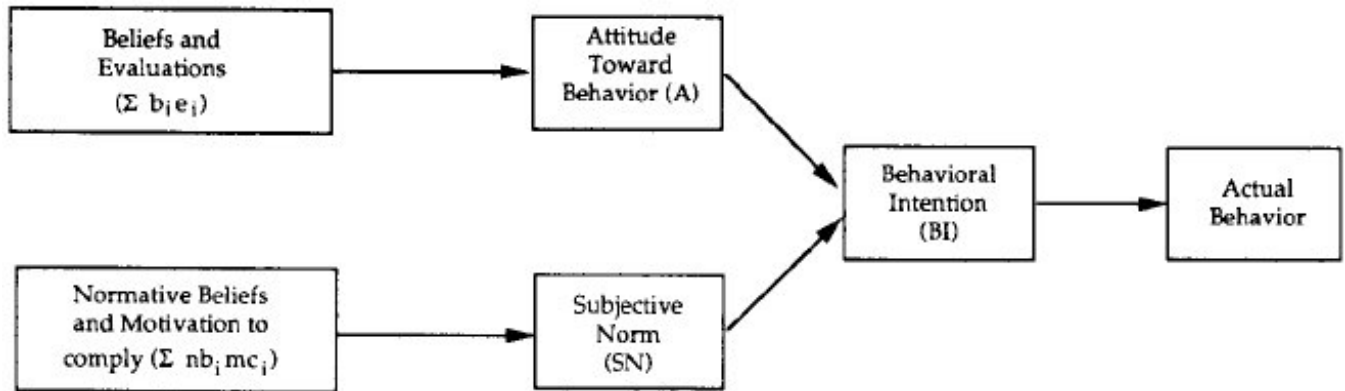
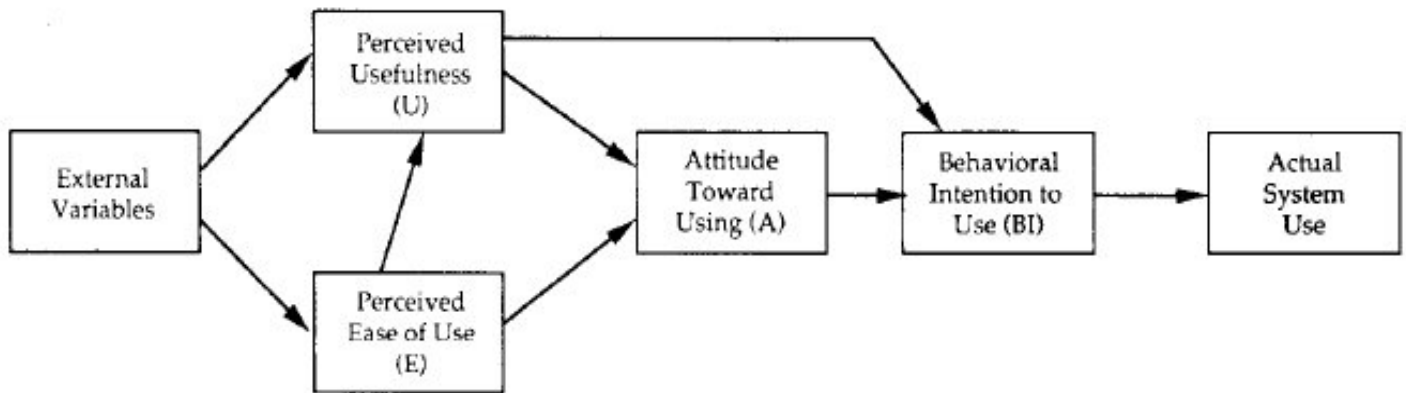


FIGURE 2
THEORY OF REASONED ACTION



Source: Davis and Bagozzi (1989)

FIGURE 3
TECHNOLOGY ACCEPTANCE MODEL



Source: Davis and Bagozzi (1989)

FIGURE 4

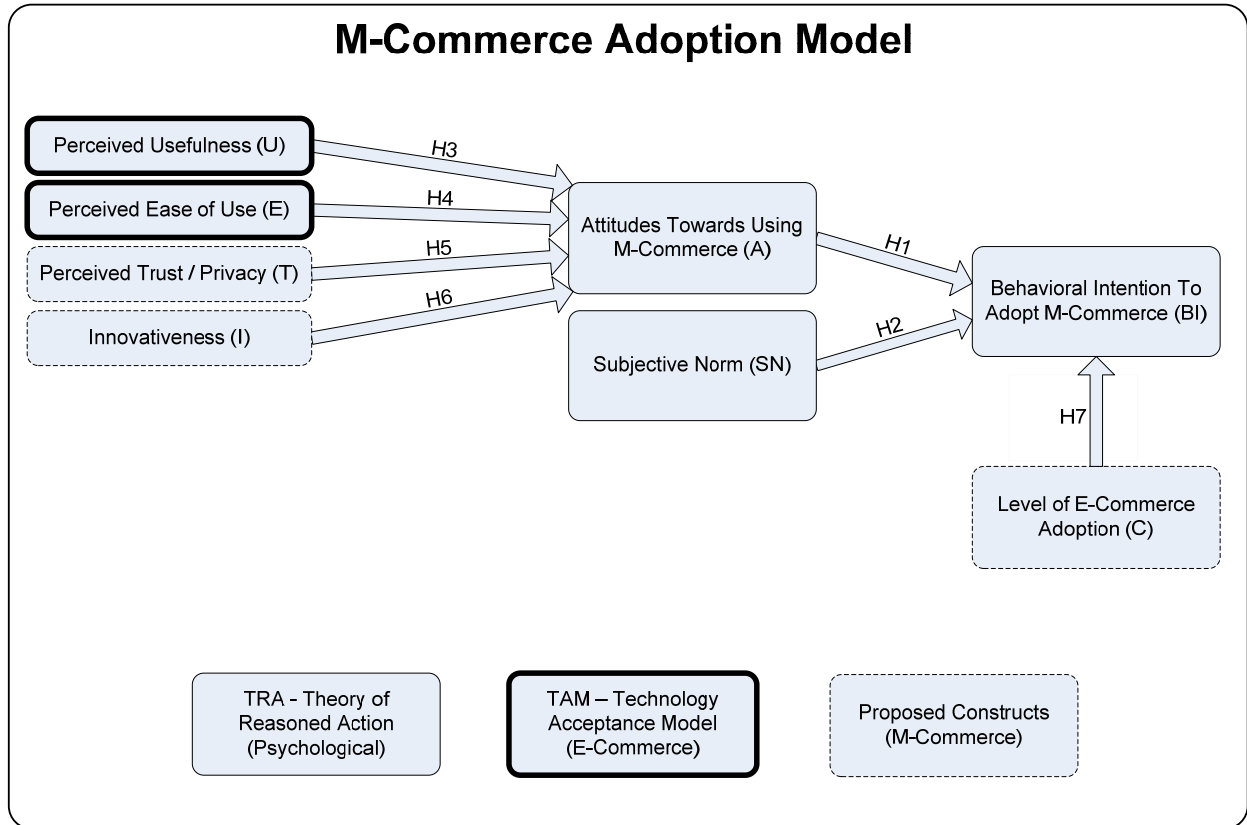


FIGURE 5

