

UNDERSTANDING IS CONTINUANCE: AN IS COMMITMENT PERSPECTIVE

By

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This dissertation is dedicated to my loving wife, for her patience, devotion, and sacrifices. This accomplishment is as much hers as it is mine. It was love and faith that supported us finishing through this journey. As I am seeing the light at the end of the tunnel, I must thank her for her unconditional support in the past years. Without her, this dissertation as well as my other achievements would not have been possible.

Last but not least, I dedicate this dissertation to my daughter, Jessica. She is a pure delight filled with sweetness and warmth. Our life becomes so much enjoyable because of her. Without her, this journey would have been much less meaningful and enriching.

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ABSTRACT

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The adoption of information systems (IS) by individuals has been a focus of IS research for years. Although initial adoption has been extensively studied by many researchers, less is known concerning users' psychological relationship with adopted information systems, especially when alternative systems are available. Along with the growing interest in understanding effective use of IS beyond adoption, continued use of IS attracted increasing attention in the IS field indicating a need for in depth understanding of user's loyalty to adopted systems. To date, researchers have reported few attempts to identify an effective while parsimonious model of user loyalty and switching determinants. This research is carried out with a goal to fill this research gap by providing a theoretical framework along with empirical evidence that may contribute to both academic research and management practice.

This dissertation incorporates commitment theories, which originated in social psychology, to the study of IS continuance and system switching intention. Integrating existing models of IS continuance, this dissertation proposes an IS commitment model that can help explain why some information systems enjoy sustained use while others diminish soon after initial adoption. Specifically, this dissertation suggests that IS

continuance may be best understood by investigating user commitment towards specific information systems. Three dimensions of IS commitment, i.e., affective commitment, calculative commitment, and normative commitment are identified to formulate a research model. The antecedents to each dimension of IS commitment are investigated and included in the research model. Two longitudinal studies were conducted to empirically test the research model in the context of Web-mail services and group collaboration platforms. The comparisons of this research model with other prevalent IS adoption and continuance models, such as Technology Acceptance Model (TAM) (Davis 1989) and Expectation-Confirmation Model (ECM) (Bhattacharjee 2001) suggest improved variance explained by the proposed model. The implications, limitations, and future research directions are also addressed in this dissertation.

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CHAPTER 1 - INTRODUCTION AND RESEARCH QUESTIONS

1.1 Introduction and Research Motivation

There is a growing body of research in the IS literature regarding the understanding of information system (IS) adoption and use. Although great progress has been made in the IS adoption research, a lack of empirical evidence on post adoption use becomes increasingly critical to IS research and practice. Every year, new information systems¹ are developed and adopted by individuals and organizations. While both individuals and organizations initially adopt various information systems, only a few of them experience continuous use (Selwyn 2003). For example, one critical issue concerning managers is that employees tend to be in favor of legacy applications notwithstanding newly implemented information systems such as the enterprise resources planning (ERP) system (Limayem, Hirt, et al. 2007). There is a known “productivity paradox”, which refers to the observation that as new information technology is adopted, worker productivity surprisingly goes down (Landauer 1995; Venkatesh and Bala 2008). A number of prominent IS researchers have pointed out that although IS adoption is an important step toward IS use, it does not necessarily lead to IS success unless the use becomes persistent and effective (Bhattacharjee 2001; Kim and Malhotra 2005a; Venkatesh and Davis 2000). Therefore, understanding IS continuance turns out to be one important issue for organizations’ successful IT strategy and overall productivity.

¹In this research, an Information System (IS) is defined as a system of users, information technologies, and activities that process the data and information for a given task. Examples of information systems may include an ERP system for production management, a group collaboration platform for completing a project, or an email system for personal communication, etc.

In addition, as IT investment increases at a rate of 7.7% globally (Venkatesh et al. 2008), organizations tend to spend more money on IT implementation. One example is that companies tend to employ multiple in-house data centers and install complementary application modules at thousands of workstations and servers. However, it is not uncommon that among all implemented IT facilities only a small proportion is effectively used by employees (Carr 2005). As a result, organizations end up with redundant installed modules that are licensed yet never used post implementation, incurring both upfront expenditures and unnecessary ongoing maintenance costs and fees. In addition to low adoption rate, underutilization of implemented facilities is believed to be one of the reasons that cause IT implementation failures. It is reported that Hewlett-Packard and Nike lost \$160 million and \$100 million respectively because of failed IT implementation projects (Venkatesh et al. 2008). Thus, understanding IS continuance can also help managerial decisions as to IT implementation strategy and effective use of IT resources.

As an increasing number of businesses are providing technology products and services, the market for IT products and services become extremely competitive. The executives and managers in those businesses are keen to know how and why their clients or customers choose to continue to use a certain information systems among a set of competing alternatives. This question is not only central to their marketing and sales strategy but also crucial to their customer retention policy. To date, however, there is little known in the IS literature as to users' switching behaviors leaving this important question mostly unanswered.

Therefore, IS continuance is a topic with implications to both IS practice and research. Understanding user behavior surrounding continuous use will provide a

significant extension to the technology acceptance models (Davis 1989). Aside from the use of a single information system, it is also interesting to understanding users' switching decision and behavior after adoption when many alternative information systems are available.

The IS literature provides a number of determinants of initial technology adoption decision, mainly users' cognitive beliefs, such as perceived usefulness and ease of use (Davis 1989). However, this may not be the case in the post adoption stage because such beliefs may remain in place whereas users' continuous use of the adopted information system is not always warranted. For example, it is not uncommon for individuals to adopt multiple email systems with different service providers (such as Microsoft Hotmail, Yahoo! Mail, Google Mail, etc.) but the person may tend to continue to use only one or a few of them for specific tasks notwithstanding the others provide very similar functionality. Similarly, a well trained programmer in a particular programming language may hesitate to switch to a different language even though the new language is believed to be more powerful (useful) and easier to use. Such disparity in real life calls for a closer examination of users' post adoption behavior from a new perspective such that the psychological relationship between the user and the information system needs further scrutiny in order to reveal useful insights for understanding sustained use of IS.

This research will introduce an IS commitment perspective to the study of post-adoption IS use as well as switching behaviors. Commitment, as a measure of psychological attachment in a relationship, has been widely used to predict persistent behaviors, such as marriage (Arriaga and Agnew 2001), consumer loyalty (King and Zeithaml 2003), service retention (Bansal and Irving 2004), and workplace performance

(Sheridan 1992), etc. Given the nature of IS continuance is similar to that of many other repetitive behaviors such as consumer's repurchasing behavior (Bhattacharjee 2001), the concept of commitment may provide a new angle to examine IS use, continuance, switching, and choice beyond many existing variables. With this goal in mind, this research introduces an IS commitment model with commitment dimensions and antecedents to the research of IS continuance and switching behavior in hope of shedding a light on this newly explored territory.

1.2 Research Questions

Grounded in commitment theory, this research proposes that users' continued use of IS is associated with their commitment towards that specific information system. This research will add to the literature with the following contributions.

- 1. This research proposes and empirically investigates IS commitment as a predictor to IS continuance.*
- 2. This research examines three dimensions of IS commitment to provide a comprehensive picture of IS continuance. Specifically, by introducing calculative commitment, this research emphasizes perceived cost as an important, albeit missing link that has been overlooked in the IS literature for understanding post-adoption behaviors.*
- 3. This research compares multiple models that have been suggested to help understand IS continuance.*

Although a significant number of research (Davis 1989; Taylor and Todd 1995; Venkatesh et al. 2008; Venkatesh, Morris, et al. 2003) have studied IS adoption, little has been done to examine continued IS use and switching behavior within a comprehensive framework that accommodates affective, calculative, and normative factors. This paper attempts to offer a different, perhaps complementing lens to reveal how IS continuance results from the users' perceived sense of attachment to a certain information system.

Incorporating commitment theories from social psychology and organizational behavior literature, this paper introduces an IS commitment perspective to the study of IS continuance and switching, arguing that IS continuance may be best understood by investigating user commitment towards specific technologies. The proposed IS commitment model is expected to answer the following research questions.

RQ1: Can IS commitment explain user's intention to continue to use an adopted information system?

RQ2: Can IS commitment explain user's intention to switch to an alternative information system when the current system is adopted and used for a period of time?

RQ3: Can IS commitment account for more variance in continued use of IS than other prevalent models?

RQ4: Does users' technological inertia affect their intention to continue to use an adopted system as well as to switch to an alternative system at a certain commitment level?

1.3 Structure of the Dissertation

This dissertation proceeds as follows. The next chapter will review significant prior research in the IS literature that relates to technology adoption, post adoption behaviors, and commitment theories. Synthesizing commitment theories and IS continuance theories, a theoretical model linking IS commitment to IS continuance is proposed to formulate a research model. The model development chapter is followed by chapters regarding research methodology and two empirical studies along with discussions on the findings. Finally, this dissertation will conclude with a chapter about contributions, limitations, and future research directions.

CHAPTER 2 - LITERATURE REVIEW

2.1 Research on IS Adoption

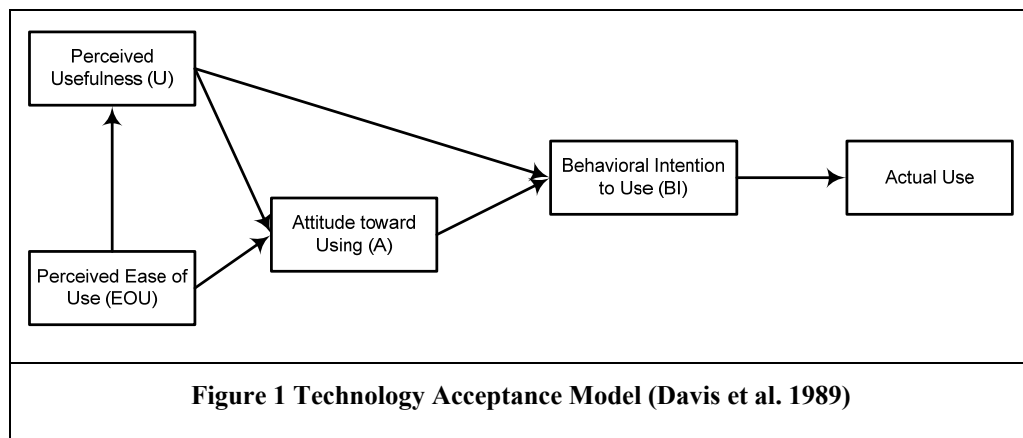
To date, Davis et al.'s technology acceptance model (TAM) (Davis 1989) has been one of the predominant templates used to investigate, develop, and refine our understanding of user adoption and use behavior. As an adaptation of TRA (Fishbein and Ajzen 1975), TAM provides a general explanation of the determinants of technology acceptance, especially when computer technologies are involved.

TAM posits two important beliefs, i.e., perceived usefulness and perceived ease of use, are the primary determinants of user's acceptance of computer technologies (Davis, Bagozzi, et al. 1989a). Perceived usefulness (P) is defined as "*the perspective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context.*" Perceived ease of use (EOU), however, is defined as "*the degree to which the prospective user expects the target system to be free of effort.*" As postulated by TAM, Perceived usefulness and perceived ease of use together influence user's intention to use the target system (BI, or Behavior Intention).

TAM, however, does not posit subject norm (SN), which is a determinant in TRA, as a determinant of users' BI due to a lack of theoretical grounds. Subject norm may have an effect on BI directly or indirect through processes such internalization, identification, or compliance (Davis et al. 1989a; Malhotra and Galletta 2005; Warshaw 1980). However, such effect may not be easily separated from the processes resulting in the confusion of compliance with mandated use. In addition, subjective norm assumes there is consensus among the population however this is not always the case. When the norm in

a population may be perceived differently (e.g., different groups of people holding opposite opinions), the measure of subjective norm becomes problematic. Therefore, the role of SN in TAM remains uncertain.

TAM has received substantial supports in the IS field about IS acceptance (or adoption) (Adams and Nelson 1992; Agarwal and Karahanna 2000; Venkatesh 2000). The two original TAM articles (i.e., Davis 1989 and Davis et al. 1989) have been cited for over 1,700 time in Social Science Citation Index and 5,000 in Google Scholars respectively (Venkatesh et al. 2008). Overall, TAM and its variations (Legris, Ingham, et al. 2003; Qingxiong Ma and Liping Liu 2004; Szajna 1996; Venkatesh et al. 2000; Venkatesh et al. 2003), along with the diffusion of innovation theory (Rogers 1995) and the theory of planned behavior (TPB) (Ajzen 1985) have proven successful in explaining users' initial acceptance of information systems (IS).



2.2 Research on Post Adoption Use

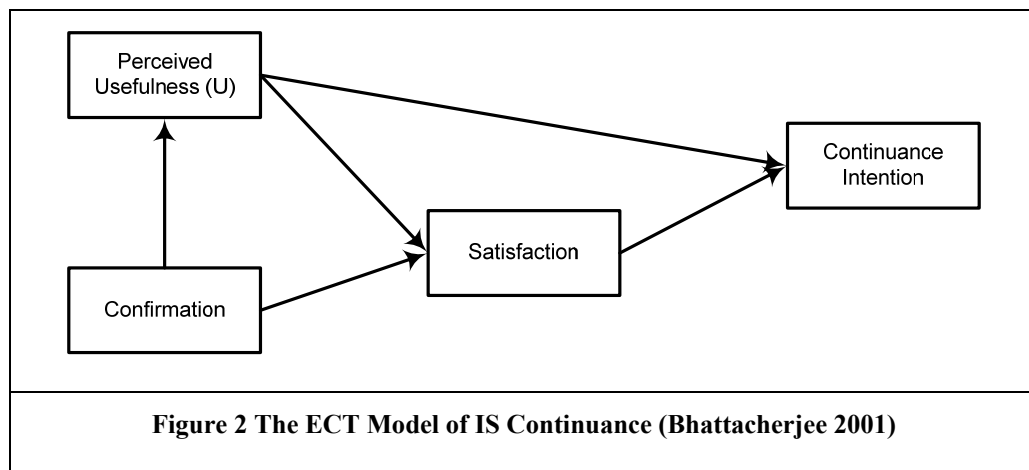
Although much research in the IS field has examined initial IS adoption (Davis and Bagozzi 1989b; Rogers 1995; Venkatesh et al. 2003; Venkatesh and Speier 2002), issues about users' post adoption behaviors, has received relatively less attention within

the IS community. People's use of an information system after adoption is sometimes referred to as IS use, indistinctively mixed used with the pre-adoption IS use, in many non-IS journals (Kim et al. 2005a; Li, Browne, et al. 2006). In the IS literature, however, post adoption use is clearly named *IS continuance*, defined as individual's continued use of a particular information system long after an initial acceptance decision (Bhattacharjee 2001),

A review of the existing IS literature finds three major perspectives in the IS discipline with regard to users' continued use of information technologies. The first perspective views continued use as an extension of acceptance. Scholars with this perspective refer to post-acceptance as a follow-up stage of the acceptance process. They find that post-acceptance use is determined by the same set of pre-acceptance predictors (Davis 1989; Venkatesh 2000). For example, TAM2 included subjective norm as one additional determinant of behavioral intention in addition to perceived usefulness and perceived ease of use (Venkatesh et al. 2000). Unified Theory of Acceptance and Use of Technology (UTAUT) presents performance expectancy, effort expectancy, social influence, and facilitating conditions as determinants of behavioral intention (Venkatesh et al. 2003). By emphasizing the unidirectional causal relationships between cognitive beliefs and behavior intentions, this group of research may have overlooked emerging determinants of continuance in the post-acceptance stage.

The second perspective identifies new sets of predictors that lead to users' subsequent beliefs and continuance decisions. For example, Bhattacharjee (2001) proposes an expectation-confirmation model incorporating new predictors (e.g., users' confirmed expectation and satisfaction from prior use) as additional causes of IS

continuance. Parthasarathy et al. (1998) suggests sources of influence as one important predictor to IS continuance decision. Although research belonging to this perspective has examined multiple new predictors, they often focused on affective and utilitarian factors leaving other elements, such as normative and calculative factors out of the picture. In addition, by assuming a planned behavior view of post-adoption decisions, this perspective may be limited in accommodating the possible impact of non-intentional based factors.

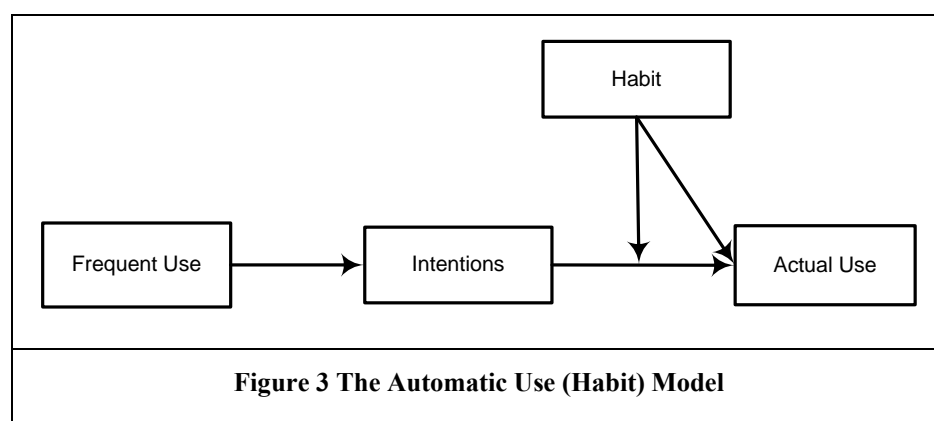


Another group of researchers have investigated post-adoption behavior from an emerging perspective of automatic or habitual use of IS (Kim et al. 2005a; Kim, Malhotra, et al. 2005c; Limayem and Hirt 2003; Limayem et al. 2007). They argue that IS use becomes spontaneous as the frequency of use increases. The Habit/Automaticity Perspective (HAP) believes that for heavy IS users the use of IS becomes less conscious of evaluating the system, therefore their continued use of IS turns out to be mostly driven by habit and automaticity rather than by cognitive beliefs and attitudes. Scholars with this perspective suggest habit as supplement and a moderator to IS continuance such that the

influencing power of intention on behavior decreases when habit comes into play (Kim et al. 2005c; Limayem et al. 2007).

Another perspective on automatic use of IS holds a different albeit complementary viewpoint on the formation of automaticity. The Instant Activation Perspective (IAP) argues that conscious evaluation and judgment remain in place as users repeatedly use an information system. However, the cognitive process becomes stabilized and stored in memory. When triggered by the same event, the stored processes will be instantly activated to form evaluations and intentions (Ajzen 2002; Ajzen and Fishbein 2000). Instead of suggesting automatic use as a result of past use, IAP is grounded on the traditional evaluation-intention-behavior model (Kim et al. 2005c).

Comparison between the two contrasting models suggests that for heavy users, the traditional evaluation-intention-behavior model explains less variance than the habit model (Limayem et al. 2007). Put in other words, HAP does a better job explaining the use of IS among frequent user. Therefore, habit instead of cognitive process, is the reason that causes continued heavy IS use (Kim et al. 2005c).



The research on automatic and habitual use of IS emphasizes frequently performed behaviors leading to habituation, but omits a stage between adoption and the

formation of habit (or heavy use). Apparently, habit is not established in one day. There is a growing process after adoption for users to routinize their use of a system. What is the driving force for users to frequently use a system and what facilitates and/or inhibits the formation of habit remain unanswered in HAP and IAP.

2.3 Research on Commitment

The concept of commitment is commonly known as organizational commitment in social psychology and organizational behavior literature. It was developed for studying employees' turnover intentions and actual turnover (Mowday, Porter, et al. 1982).

Organizational commitment draws upon the belief that employees, through interactions, form or fail to form an attachment with the organization. Employees who feel a sense of attachment are committed towards a longer tenure with an organization while employees who do not feel a sense of attachment are not (Meyer and Allen 1991; Mowday et al. 1982).

The notion of commitment can be understood as commitment to a course of action or commitment to a relationship (Allen and Meyer 1990; Li et al. 2006). Commitment to a course of action defines commitment as a "*frame of mind or psychological state that compels an individual toward a course of action*" (Meyer and Herscovitch 2001). This perspective is backed up by side bet theory (Becker 1960) and cognitive dissonance theory (Festinger 1957) believing people's commitment is a lock-in situation where beliefs are determined by actions because of internal cognitive conflict (Li et al. 2006). When people's beliefs are not in line with sustaining activities, instead of seeking termination, they may likely choose to continue the activities in order to avoid losing previous investments. A typical example is gambling, where people justify

increased loss based on their cumulative prior investment. Commitment to a course of action may lead to escalation of commitment, which is often associated with the sunk cost fallacy. In the IS literature, escalation of commitment has been often used to study cases related to software design and project implementation failure (Heng, Tan, et al. 2003; Montealegre and Keil 2000) .

Another perspective, commitment to a relationship, posits commitment as a result of positive attitude toward a social relationship (Allen et al. 1990; Li et al. 2006). A person is willing to remain in a relationship because he or she has a favorable emotion and perception that motivate him or her to engage in the relationship. Commitment to a relationship can also be explained by social exchange theory and the investment model (Michener 2004; Rusbult, Martz, et al. 1998). People form a moral obligation to the relationship partner because of the exchange of favors, rewards, and costs in a relationship. Because of the outcomes associated with such exchange, people are motivated to engage in a long-term persistent relationship in order to maximize the rewards and minimize the costs. Commitment to relationships is found to influence behavioral intentions such as turnover intention (Allen et al. 1990). The strength of the commitment to a relationship is often related to factors such as satisfaction, quality of alternatives, and investment size (Rusbult et al. 1998).

The concept of commitment received considerable attention as to its dimensionality. The original form of commitment, i.e., Mowday's organizational commitment, is undimensionalized. But Mowday's concept of organizational commitment incorporates various correlated aspects in the questionnaire such as acceptance of organizational goals, willingness to exert effort, and strong desire to

maintain a relationship. These aspects correspond to the conceptualization of affective commitment in many subsequent models.

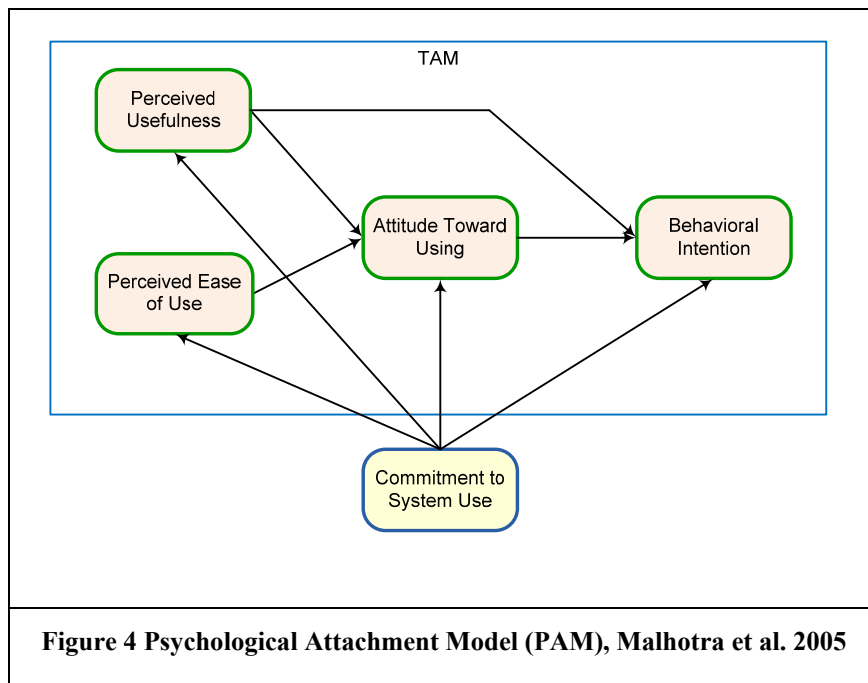
Meyer and Allen (1984) propose that commitment consists of two distinct dimensions, i.e., *affective* and *continuance* commitment. Affective commitment is related to emotional attachment to, identification with, and involvement in the organization. Continuance commitment refers to employees' awareness of costs associated with a decision to leave the organization (Meyer and Allen 1984). Later in the 1990's, another distinct component of commitment, i.e., *normative* commitment, referring to employees' sense of obligation to the organization, was proposed and became part of a three dimensional commitment model (Allen et al. 1990). Notwithstanding a few other variations, Meyer and Allen's three-dimensional organizational commitment model with affective, continuance, and normative commitment, is believed to be the most popular organizational commitment model to date (Culpepper 2000; Li et al. 2006).

2.4 Commitment in the IS Literature

The role of commitment has been introduced to some other business fields, such as consumer behavior (Bansal et al. 2004) and workplace management (Meyer and Allen 1997). In the IS field, however, user commitment had remained unexplored until recently a few empirical studies such as Malhotra and Galletta (2005) and Li, Browne, and Chau (2006) were published.

Malhotra and Galletta based their research on TAM and incorporated commitment components to the TAM predictors and behavior intention. The proposed model, named *Psychological Attachment Model (PAM)*, adds internalization, identification, and compliance to perceived usefulness, perceived ease of use, and behavioral intention and

explains 58.5% percent of the variance in behavior intention to adopt and 47.5% of the variance in intention to continue to use the system (Malhotra et al. 2005). The PAM takes a two-dimensional commitment perspective with affective commitment (identification and internalization) and continuance commitment (compliance) being found to influence TAM variables. Affective commitment is found to be positively associated with TAM variables whereas the associations between continuance commitment and TAM variables are all negative. The PAM theorizes continuance commitment as compliance suggesting control and pressure being perceived negatively by users in the situation of volitional use. When compliance is perceived, users are less motivated and their intentions and attitude are negatively influence.



The definition of continuance commitment in PAM is closely related to that of the normative commitment in Meyer and Allen’s three-dimensional model. Both commitment dimensions refer to the fact that users tend to comply to social actors when

them perform a behavior. The two commitment dimensions, however, are distinguishable on the motivation of compliance. The continuance commitment holds a view that user's compliance is due to their evaluation of potential rewards and punishments, i.e., they have perceived punishments for non-compliance. The normative commitment view, however, emphasizes the internalization of social values and bases the evaluation on users' moral obligations.

Given normative commitment is ambiguously defined in different model, Li, Browne et al. (2006) excluded normative commitment from their research model arguing normative commitment is irrelevant in the relationship between user and a web site. They examined the effect of affective commitment and calculative commitment (i.e., continuance in Meyer and Allen's model) on user's behavior intention to use a web site and explained 67% of variance. In addition, they also looked at quality of alternatives and trust as antecedents to affective commitment and behavioral intention.

Although the topic of user commitment to information systems has received some attention in the IS literature, further theoretical development and empirical evidence are needed. For normative commitment, the difficulty of disentangling direct effects of subjective norms and indirect effects through internalization made it the least understood commitment dimension in the commitment theories. The objective of this research is to provide theoretical ground and empirical evidence for the advancement of IS continuance research. Accordingly, a comprehensive IS commitment model is developed and empirically validated in different technology contexts using longitudinal studies.

The following table provides a summary of the major theories (models) about IS adoption and post-adoption use in the IS literature.

Table 1 Summary of Literature Review			
Model	Full Name	Source	Arguments
TRA	Theory of Reasoned Actions	Fishbein and Ajzen (1975)	Individual behavior is driven by behavioral intention which is a function of attitude toward the behavior and subjective norms.
TPB	Theory of Planned Behavior	Ajzen (1991)	Behavioral intention is a function of attitude toward the behavior, the subjective norms, and the individual's perception of the difficulty of performing the behavior.
TAM	Technology Acceptance Model	Davis et al. (1989)	Individual's actual use of a system is determined by his or her intention to use which is further determined by perceived usefulness and perceived ease of use. Perceived usefulness is also directly impacted by perceived ease of use.
UTAUT	Unified Theory of Acceptance and Use of Technology	Venkataash et al. (2003)	Usage intention and actual use is determined by four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. Such relationships are moderated by gender, age, experience, and voluntariness of use
ECT	Expectation Confirmation Theory	Bhattacharjee (2001)	IS continuance intention is determined by users' satisfaction and perceived usefulness, as results from confirmed expectation.
HAP	Habit/Automaticity Perspective	Limayem et al. (2007)	IS use becomes automatic because of repetitive use and learning. The automatic process is non-conscious, with no formation of evaluations and intention involved.
IAP	Instant Activation Perspective	Ajzen (2002), Ajzen and Fishbein (2000)	IS use becomes spontaneous because stored evaluation and intention are automatically activated. Past use is irrelevant.
PAM	Psychological Attachment Model	Malhotra et al. 2005	Users' commitment to system use, i.e., internalization, identification, and compliance, will influence their perceived usefulness, perceived ease of use, and intention to use the system.

CHAPTER 3 - MODEL DEVELOPMENT

3.1 Definition of IS Commitment

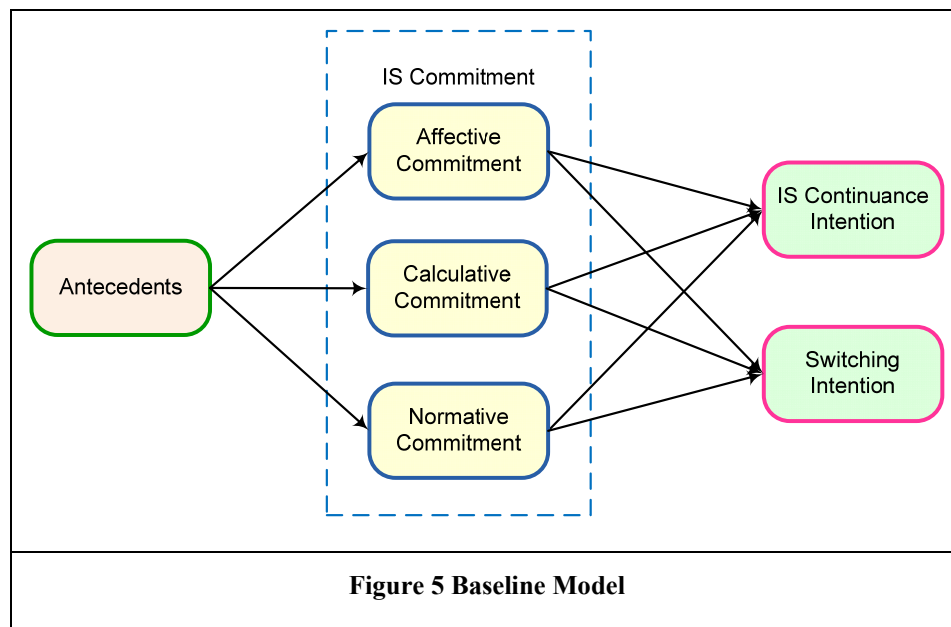
The concept of commitment does not have a clear cut definition in the literature. Commitment can be interpreted as a force (Meyer et al. 2001), a tendency (Becker 1960), a mindset (Li et al. 2006), or a relationship (Rusbult et al. 1998). The term *commitment* has been loosely used to refer to commitment process and state. Although there are a number of different interpretations of commitment, the definitions provided by Mowday et al. (1982) and Meyer and Allen (1991) are believed to best represent the commitment in a social relationship. Drawing upon the conceptualization provided by Mowday et al. (1982) and Meyer and Allen (1991), this research defines IS commitment as a *psychological bond between an individual and an information system that makes it less likely for the individual to voluntarily discontinue the use of the system.*

A closer look at the definition of IS commitment confirms that formation of commitment must follow initial acceptance and a period of use of an information system. In line with Malhotra and Galletta's (2005) finding that volitional use of information systems is underpinned by notions of user commitment, this research proposes that user commitment towards an information system is an important precursor to understanding continued IS use.

The concept of commitment may be examined from two different perspectives: the attitudinal commitment perspective and the behavioral commitment perspective (Meyer et al. 1991; Mowday et al. 1982). Attitudinal commitment has to do with the cognitive process by which users' psychological bond with the technology evolves over time as they evaluate the technology and its alternatives through actual use, whereas

behavioral commitment is interested in users' behaviors when they become "locked" to a certain technology. This research employs the attitudinal commitment perspective dedicated in studying users' IS continuance when competing systems are available.

IS commitment is a continuous variable rather than a dichotomous variable. As the definition of IS commitment indicates, users are to be more or less committed to the use of a particular information system rather than to be committed or not. The levels of commitment are dependent on a number of antecedents. As suggested by Meyer and Allen (1990), the outcome variables of IS commitment can vary from sustaining behavior (such as retention) to performing behavior (such as employee turnover). This research is mostly concerned with users' continuance intention (i.e., the intention to continue to use an information system) and switching intention (to an alternative system) as outcome variables of IS commitment. A baseline research model is illustrated in the figure below. Hypotheses development and further discussion on the antecedents to commitment are addressed in the subsequent sections.



3.2 Dimensions of IS Commitment

As discussed in the previous chapter, the concept of commitment may be viewed as one, two, or three dimensional construct. Adhering to Meyer and Allen's (1991) work on commitment, this research partitions IS commitment into three dimensions: affective commitment, calculative commitment, and normative commitment.

Affective Commitment

Affective commitment refers to a users' sense of attachment to an information system driven by internal motivation and a sense of involvement and identification (Allen and Meyer 1996; Meyer, Stanley, et al. 2002). For example, a user that values aesthetics may feel more attached to Apple's Mac OS X operating system because Mac OS X offers a richer set of unique features that may distinguish her from other non-Apple users, whereas another user that values utilitarian features may lean toward a non-GUI based Linux operating system because of his concerns over system reliability and customizability. Users' affective commitment is often associated with their emotional (e.g., enjoyment), hedonic (e.g., playfulness), and utilitarian (e.g., usefulness) feelings towards an information system when the value of the system is recognized and identified.

The concept of affective commitment also involves a sense of belonging that enhances the user's attachment to an information system. For example, users attached to Apple's Mac products will also demonstrate stronger affective commitment to Apple's other products such as iPod or iPhone than to similar products by other vendors, partly because of their willingness to be associated with the entire Apple product family.

Affective commitment has been found to be a direct antecedent to IS use (Malhotra et al. 2005) in the IS literature. There is also support for affective commitment to be

associated with repeated behavioral intentions, such as repurchase intention, as well as switching intentions, such as intention to switch service providers (Bansal et al. 2004). Thus users who experienced a sense of affective commitment to an information system will more likely feel the need to sustain their use of the information system and less likely to switch to an alternative system. Consistent with the preceding findings, the following hypothesizes are proposed:

H1a: Users' affective commitment to an information system will be positively associated with their intention to continue to use the system, such that the stronger the users' affective commitment, the stronger their intention to continue to use the system.

H1b: Users' affective commitment to an information system will be negatively associated with their intention to switching to an alternative system, such that the stronger the users' affective commitment, the weaker their intention to switch to an alternative system.

Calculative Commitment

Calculative commitment has been termed differently in the literature. Its concept is related to a users' sense of attachment to an information system driven by cost concerns about discontinuing the use of an information system and switching to an alternative information system. Given the nature of calculative commitment is directly associated with continued behaviors, the original commitment literature often refer to it as *continuance commitment* (Allen et al. 1990). Some scholars used a different name *calculative commitment* to refer to the same concept due to the concern that the word *continuance* does not faithfully reflect the nature of rational cost evaluation in this concept (Gilliland and Bello 2002). This research agrees to their argument and adopts the term *calculative commitment* in order to avoid readers' confusion caused by the word *continuance* appearing in multiple constructs.

By definition, calculative commitment is associated with cost. But the term *cost* is not limited to financial cost. A users' perceived cost may involve financial cost, social cost, and psychological cost such as opportunity cost, substitution cost, perceived learning curve, sunk cost, contractual obligation, etc. Calculative commitment may also be constraint based (Bansal et al. 2004) meaning that a lack of resources and alternatives forces users to perform a behavior (or most likely not to perform a behavior, for example termination or switching).

Calculative commitment to an information system often depends on the costs of training, investment, and opportunities (Meyer et al. 1997). For example, in IS research, calculative commitment is often traceable in projects where lock-ins lead to commitment escalation, even when the project might be perceived as being in trouble (Abrahamsson 2002). Users' concerns of costs stemming from discontinued use will increase their loyalty and thus facilitate their intended affiliation to the information system.

H2a: Users' calculative commitment to an information system will be positively associated with their intention to continue to use the system, such that the stronger the users' calculative commitment, the stronger their intention to continue to use the system.

H2b: Users' calculative commitment to an information system will be negatively associated with their intention to switching to an alternative system, such that the stronger the users' calculative commitment, the weaker their intention to switch to an alternative system.

Normative Commitment

Normative commitment represents users' sense of attachment to an information system due to *internalized obligations* to compliance (Lewis, Agarwal, et al. 2003; Malhotra et al. 2005; Meyer et al. 1991). There is a debate in the literature as to whether normative commitment exists as the third dimension of commitment or it is a part of

affective commitment or calculative commitment. Normative is found to be distinct from affective commitment and calculative commitment (Allen et al. 1990), but strong correlations with affective commitment and calculative commitment makes this argument less convincing.

In the IS literature, a few attempts to bring normative commitment into IS continuance research delivered mixed signals. One perspective argues that normative commitment needs to be understood in relation to users' compliance motivation (Malhotra et al. 2005). Thus, normative commitment becomes a part of calculative commitment because as compliance is introduced the commitment focus shifts from obligation to reward and punishment. Another perspective believes that normative commitment has its root in social exchange and norms. When it comes to technology and information systems, there is no exchange between human and computer systems therefore normative commitment is irrelevant in the IS context. Those who hold this viewpoint argue that the two-dimensional commitment model may be the point of departure for IS continuance research (Li et al. 2006).

This research employs the three-dimensional commitment model and proposes that normative commitment is a distinct dimension of commitment and it can be theoretically and empirically differentiated from the other two dimensions. In contrast with affective commitment, normative commitment to an information system reflects the influence of *external* motivation that induces users to remain attached to an information system. Users internalize normative pressures and become committed because of other people's opinions and behaviors. Normative commitment is salient only when the perceived pressure is present (Meyer et al. 1991). When the external pressure disappears, normative

commitment may become trivial. For example, a graduate student may feel attached to a certain statistical software package (e.g., SPSS) simply because his or her advisor has recommended it in class or a majority of his or her cohort is using it to analyze data, even though he or she may be affectively partial to another competing statistical software package. Given the nature of normative commitment being internalized obligations due to pressures from other people, this notion of social conformance can influence users' intention to continue to use the information system.

H3a: Users' normative commitment to an information system will be positively associated with their intention to continue to use the system, such that the stronger the users' normative commitment, the stronger their intention to continue to use the system.

H3b: Users' normative commitment to an information system will be negatively associated with their intention to switch to an alternative system, such that the stronger the users' normative commitment, the weaker their intention to switch to an alternative system.

3.3 Antecedents to IS commitment

Research shows that the salience of predictors in initial acceptance, such as ease of use, become trivial when users start to use the adopted information system for a period of time (Davis 1989; Li, Chau, et al. 2005). Some predictors, such as usefulness, are reported to remain effective in the post adoption stage. However its effect changes significantly in the new context. In post adoption stage, a new set of predictors needs to be identified and further examined for in-depth understanding of users' decisions surrounding continuance and switching. In addition, to better reveal the mechanism of IS commitment. There is a need to extend the baseline commitment model to include major commitment antecedents. Such extension will provide insightful information as to how

user commitment is influenced by external factors and how commitment can be strategically utilized by organizations to achieve IS success.

3.3.1. Antecedents to Affective Commitment

Users' affective commitment is based on their psychological attachment to the use of a system. When users sense the congruence between their personal values and the use of system, their affective commitment is motivated. Affective commitment has been found to be the most influential commitment among all three dimensions (Allen et al. 1996). Therefore, understanding the antecedents to affective commitment will provide implications to both research and practice. Two constructs, i.e., satisfaction and perceived system performance, are identified as the antecedents to affective commitment and will be discussed in the following subsections.

Satisfaction

In the IS context, satisfaction can be defined as users' positive evaluation of an information system (Bhattacharjee 2001). Past research suggested that user satisfaction is a critical factor in IS use (Au, Ngai, et al. 2008; Au, Ngai, et al. 2002). Other research identified satisfaction, among many affective factors, as the primary predictor to understanding repetitive and retaining behaviors (Anderson and Sullivan 1993; Bhattacharjee 2001).

The commitment literature found satisfaction to be a strong predictor to affective commitment (Meyer et al. 2002). For example, overall job satisfaction is strongly related to employees' affective commitment in organizations (Allen et al. 1996). Consumer's satisfaction with a service is also found to be a strong predictor to their affective commitment to the service provider. On the other hand, dissatisfaction is found to be the

primary reason resulting in the termination of established relationships (Inteco 1998). In IS research, satisfaction is also reported to positively influence user's affect and IS use (Karahanna, Straub, et al. 1999). Therefore, the positive influence of satisfaction on users' affective commitment is evidently supported by the literature (Bansal et al. 2004).

H4a: Users' extent of satisfaction with an information system will have a positive influence on their affective commitment to the information system such that the more they feel satisfied with the system, the stronger their affective commitment.

Perceived System Performance

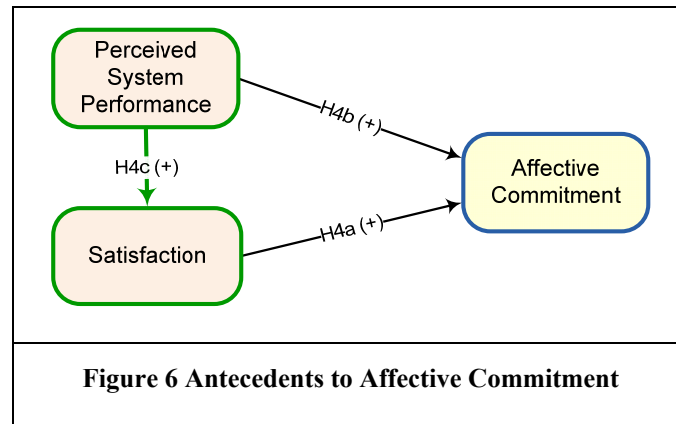
System performance may be defined as the perceived outcome from the use of an information system (Au et al. 2008). Empirical studies noted that system performance has impact on user attitude toward a system. TAM introduced perceived usefulness to refer to users' expected outcome from using an information technology (Davis 1989). As a key determinant of attitude, perceived usefulness captures users' expectancy of system performance. After initial adoption, users undergo an appraisal of the adopted information system confirming that its performance meets or exceeds their ex ante expectation. Therefore, their perceived system performance will have a positive influence on their affiliation with the adoption. Pursuant to Bhattacharjee's (2001) expectation-confirmation model, the following hypothesis is proposed.

H4b: Users' perceived performance of an information system will have a positive influence on their affective commitment to the information system such that the higher level they perceive the system can perform, the stronger their affective commitment.

System performance is also found to have a strong relationship with user satisfaction (Au et al. 2008; Bhattacharjee 2001; Sue, Kim, et al. 1994). Users evaluate and compare the performance of systems and formulate satisfaction toward them. As a

result, users become satisfied with a system when they perceive high level of performance.

H4c: Users' perceived performance of an information system will have a positive influence on their satisfaction with the system, such that the higher level the users perceive the system can perform, the more they feel satisfied.



3.3.2. Antecedents to Calculative Commitment

Defined as the psychological bond between users and information systems due to awareness of cost, calculative commitment is cognitively dependent on cost. The antecedents to calculative commitment are not as thoroughly studied as those to affective commitment in the literature. Most scholars agree upon two sets of antecedents to calculative commitment: investment and alternatives (Meyer et al. 1997). Investment involves prior investment such as sunk costs and future investment such as switching cost. Alternatives mostly refer to a lack of alternatives but the attractiveness of alternatives may also be a predictor of interest. However, since this research has a focus on users' continuance and switching behaviors when alternatives are available, only cost related antecedents are to be studied. Particularly, two cost related antecedents, i.e.,

perceived sunk cost and projected switching cost are identified as antecedents to calculative commitment.

Perceived Sunk Cost

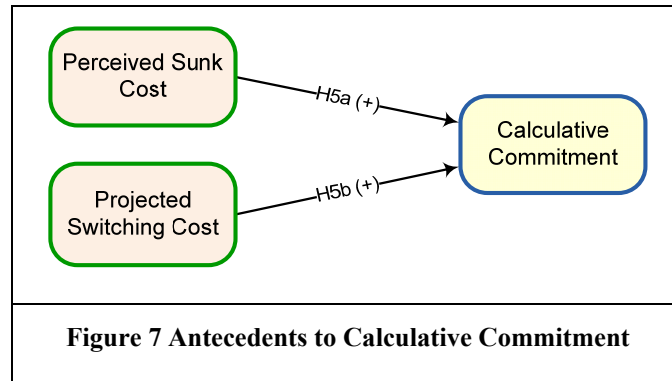
The concept of sunk cost refers to users' spent time, money, and effort on adopting, maintaining, and using an information system. Although sunk cost is economically irrelevant to decision making, it is psychologically important to users when an action is about to be taken (Jones, Mothersbaugh, et al. 2002). Cognitive dissonance theory contends that when people invest tremendous effort in a specific goal, they tend to correspondingly increase their evaluation of the goal so that the dissonance that has been created between the effort and the original goal can be eliminated (Festinger 1957; Harmon-Jones and Mills 1999). For example, a senior student who has spent over three years on degree courses is likely to have stronger commitment to the degree program than a first year student. The cognitive dissonance theory suggests that one's commitment is influenced by the effort he or she has invested even though such efforts may not be relevant to the goal. Another example is that Web developers who have been trained in Microsoft's ASP.NET platform for years may be attached to ASP.NET even if they feel that such platform may not address all their development requirements in the future. Therefore, users' calculative commitment is associated with their perceived sunk cost regardless of affective status.

H5a: Users' perceived sunk cost associated with their previous use of an information system will have a positive influence on their calculative commitment to the information system, such that the higher cost they perceive from their previous use of the system, the stronger their calculative commitment.

Projected Switching Cost

Projected switching cost refers to a user's expected time, money, and effort associated with a switching behavior before the action is taken. The switching cost includes but is not limited to evaluation cost, setup cost, learning cost, etc. (Jones et al. 2002). Contrary to sunk cost where the invested time, money, and effort are already forgone, switching cost represents the potential difficulty and risks that may emerge in the switching process. Empirical studies have found switching cost to be significantly linked with customers' retention and loyalty (Anderson 1994; Jones et al. 2002). An assessment of high switching cost will be thought of as an inhibitor that reduces the likelihood of users to make the decision to switch, and therefore enhances their bond with the currently adopted information system. For example, committed users often feel hesitate to pick up a new information system due to concerns of switching costs even when the new system is believed to be superior. One example is more than 60% of Internet users are not planning to use VOIP (voice over IP) telephony service because of their strong commitment to traditional phone services (Hardekopf 2006; Venkatesh et al. 2008). Therefore, the following hypothesis is proposed.

H5b: Users' projected switching cost associated with switching to an alternative information system will have a positive influence on their calculative commitment to the information system, such that the higher cost they project for switching to an alternative system, the stronger their calculative commitment.



3.3.3. *Antecedents to Normative Commitment*

Human behavior is often associated with people’s perception of other people’s beliefs, attitudes, and behaviors (Fishbein et al. 1975). In IS literature, normative factors have been examined in various forms, such as subjective norm in Davis (1989), social norm in Thompson and Higgins (1991), social influence in Venkatesh et al. (2003), and compliance in Malhotra and Galletta (2005) and Venkatesh and Davis (2000). Although the concept is labeled differently, central to the idea is that user’s behavior is often influenced by how others think, believe, or behave, either explicitly or implicitly within a particular social context. In this research, two normative constructs, i.e., subjective norm and descriptive norm, are captured as the antecedents to normative commitment.

Subjective Norm

Subjective norm is defined as a “*person’s perception that most people who are important to him think he should or should not perform the behavior in question*” (Fishbein et al. 1975). The idea of subjective norm has been included as a direct determinant of behavioral intention in research based on TRA (Fishbein et al. 1975), TPB (Ajzen 1985), and TAM2 (Venkatesh 2000). Subjective norm represents social

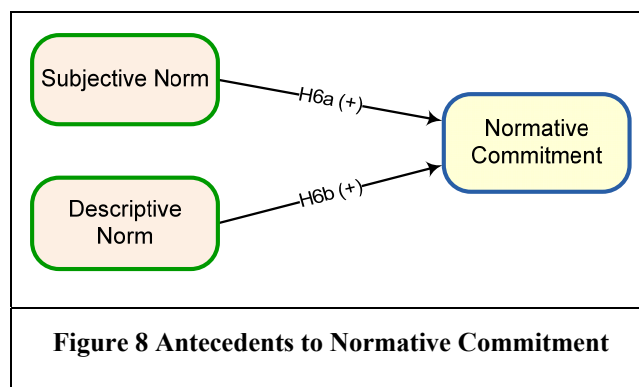
compliance meaning people may choose to perform a behavior based on their understanding of attitudes of important referents around them, even though their own attitudes toward the behavior or consequences may not be favorable (Venkatesh 2000).

H6a: Users' perceived subject norm associated with their use of an information system will have a positive influence on their normative commitment to the information system, such that the stronger they perceive the norm from people who are important to them, the stronger their normative commitment.

Descriptive Norm

Descriptive norm, on the other hand, refers to the extent to which a given behavior is prevalent in a given social context (Cialdini). The definition of descriptive norm suggests a tendency of people to “follow the crowd.” Social psychologists revealed a bandwagon effect in which people often tend to do things simply because many other people are doing the same (Leibenstein 1950). Exposure to other people’s behaviors, regardless of whether explicitly or implicitly expressed, will stimulate people’s conformity to the social norm (Myers, Wojcicki, et al. 1977).

H6a: Users' perceived descriptive norm associated with their use of an information system will have a positive influence on their normative commitment to the information system, such that the stronger they perceive the norm from their social context, the stronger their normative commitment.



3.4 Continuance Intention

The term *IS continuance* has been used to refer to users' continued use of IS as opposite to initial use or acceptance (Bhattacharjee 2001). Some researchers prefer using the term IS use (or IT/System use or usage) to refer to the same concept as IS continuance (Kim et al. 2005a; Kim and Malhotra 2005b; Li et al. 2006). As a result, the term IS continuance appears more often in main stream IS journals such as MIS Quarterly, whereas other business journals such as Management Science and Decision Sciences seem to have a preference for the term IS use (or IT/System use or usage). In this research, terms such as IS continuance, IS use, and usage, should be understood as interchangeable.

As a particular type of continued behavior, IS continuance may be comparable to other persistent behaviors in the literature. The organizational behavior literature indicates that strong commitment is positively associated with employee's retention in the organization (Meyer et al. 2001). In marketing research, strong commitment is found to make consumers more loyal to their current service providers (Bansal et al. 2004). As a result, commitment is believed to be a good predictor of persistent behaviors. Therefore, the three dimensions of commitment, i.e., affective commitment, calculative commitment, and normative commitment, are positively associated with users' intention to continue to use the system, such that the stronger the commitment dimensions, the stronger the users will intend to continue to use the system.

3.5 Switching Intention

In past IS continuance research, the most commonly studied dependent variable of IS continuance is users' intention to continue to use a pre-adopted system. Although

intention to continue seems to serve as a decent proxy for actual usage behavior, it is also necessary to understand system switching, as commitment is reported to be more strongly related to switching behaviors than retention behaviors in some marketing studies (Bansal et al. 2004; Gruen, Summers, et al. 2002). To date, little research has been conducted in the IS field to investigate user's switching behavior except for a few exploratory studies such as Song, Zhang et al. (2007) and Ye, Seo et al. (2006). However, understanding user switching behavior has implications to both research and practice. For research, there is a lack of accumulated knowledge based on users' switching behavior and its antecedents in the IS literature. For practice, many technology products and services are similar in functionality and offerings, resulting in reduced competitive advantage for businesses. Therefore, this research aims at providing a theoretical and empirical basis for marrying commitment to switching intention in the IS context.

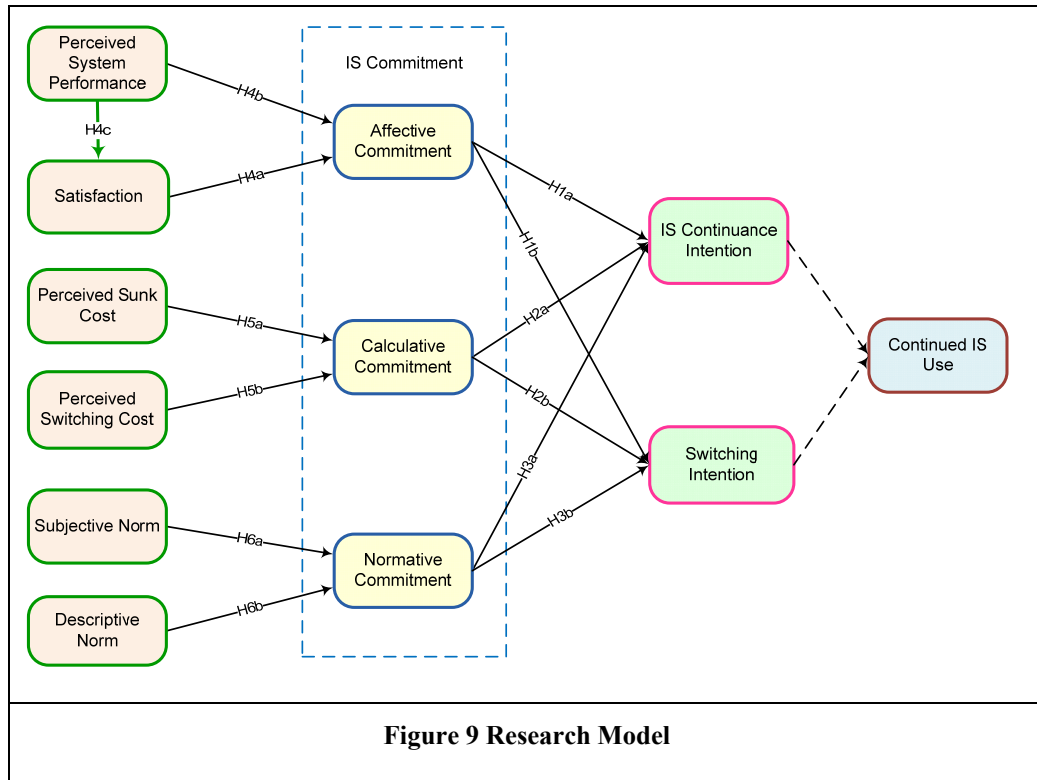
The nature of commitment is a psychological state that reduces the likelihood of a subject to terminate a relationship. There is significant evidence in the organizational behavior literature that commitment is negatively associated with employees' turnover intention. Given turnover involves a termination action between the employee and the employer, switching as a form of termination action between users and a system may also be a result of reduced user commitment to the system.

The question now becomes whether continuance and switching are merely two sides of a coin such that they are perfectly related and negatively interchangeable. There are two aspects for considering the relationship between continuance and switching. First, switching does not only mean termination but also involves intention to adopt an alternative system. When the adoption of an alternative system is in question, users may

be hesitant to make a switching decision notwithstanding their weak intention to continuance. Second, as the dual-mode processing model posits, when a user is evaluating a routine task (i.e., the adopted system), he or she may use less effort as a way to save cognitive capacity, whereas when a new task (i.e., the alternative system) is to be assessed, the user may carefully process relevant information. Therefore, a user's decision to switch systems may come from a different way than his or her decision to continue to use the adopted system.

The focus of this research is to understand user's continuance intention when alternatives are available, particularly when the alternatives are substitutable and easy to obtain, or in other words, the adoption antecedents such as usefulness and ease of use are assumed. The original commitment research has employee turnover as its focal behavior. Given that evidence in organizational behavior (Meyer et al. 2001) and marketing (Bansal et al. 2004) literature supports both retention and termination behaviors as outcomes of commitment, the three dimensions of commitment, i.e., affective commitment, calculative commitment, and normative commitment, are negatively associated with users' intention to switch such that the stronger the commitment dimensions, the weaker the users will intend to switch systems.

The complete research model is illustrated in this figure.



3.6 Technological Inertia

Technological inertia is coined by economists to describe the general tendency of human's resistance to innovation and technological change (Mokyr 1992). As a personal belief, technological inertia reflects a blind adherence to the status quo resulting in a propensity to continuous use of adopted technologies regardless of attitudinal status. Users' technological inertia may have its root in two different origins – passive inertia and active inertia. Passive inertia is a natural propensity resulting from human's tendency to prefer to remain at the status quo. It does not involve deliberate evaluation reflecting nothing but a person's spontaneous nature against potential changes. Passive inertia also reflects a sub-conscious human reaction due to indifference to choice. Individuals with

passive inertia typically dislike making choices and would rather stay with whatever they had in the first place regardless of their personal attitudes.

Active inertia, however, typically results from repeated behaviors in which human actions become automatic rather than rationale. When a technology is adopted and repeatedly used for a period of time, the use of such technology may become automatic without cognitive processes. Users' automatic, or habitual behavior is not grounded in conscious planning, therefore will not exert a direct influence on users' continuance intention. However, as a result, automatic behavior will moderate the influence of attitudes on intentions (Limayem et al. 2007) and result in spurious loyalty, in which loyalty is based on repeated behaviors despite unfavorable attitudes (Taylor, Medvidovic, et al. 1996).

Prior marketing research reported empirical support on the moderating role of inertia between consumer's affect and loyalty (Anderson and Srinivasan 2003). A high level of inertia decreases the influencing power of affect on loyalty. Therefore, users' intention to continue to use an information system is collectively determined by his or her commitment to the system along with his or her individual technological inertia. Specifically, for lower inertia users, the influencing power of IS commitment on their intention to continue to use the system becomes stronger such that their intention is more dependent on their level of IS commitment. However, for higher inertia users, IS commitment becomes less predictive because they have the tendency not to change any currently in-use systems even when their commitment to the systems is low.

H7a: The relationship between users' IS commitment and their continuance intention is moderated by users' technological inertia such that the effect will be stronger for lower inertia users.

H7b: The relationship between users' IS commitment and their switching intention is moderated by users' technological inertia such that the effect will be stronger for lower inertia users.

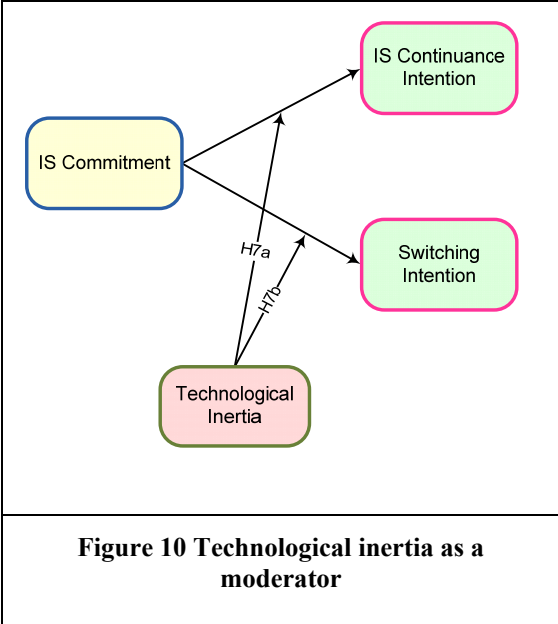


Table 2 provides a summary of the definitions of key constructs in the research model. Table 3 illustrates all hypotheses described in this section.

Category	Construct	Definition	Source
IS Commitment	Affective Commitment	Users' sense of attachment to an information system driven by internal motivation and a sense of involvement and identification	Adapted from Allen and Meyer (1990)
	Calculative Commitment	Users' sense of attachment to an information system driven by cost concerns surrounding the choice of alternative information system	Adapted from Allen and Meyer (1990)
	Normative Commitment	Users' sense of attachment to an information system due to internalized obligations to compliance	Adapted from Lewis, Agarwal, et al. 2003; Malhotra et al. 2005; Meyer et al. 1991
Antecedents to Affective Commitment	Satisfaction	User's positive evaluation of an adopted system	Adapted from Bhattacharjee (2001)
	System Performance	The extent to which the adopted system provides expected functionality	Adapted from Bhattacharjee (2001)
Antecedents to Calculative Commitment	Sunk Cost	User's perceived time, money, and effort associated with adopting, maintaining, and using an information system	Adapted from Jones et al. 2002
	Switching Cost	Users' projected time, money, and effort associated with switching from one information system to another	Adapted from Jones et al. 2002
Antecedents to Normative Commitment	Subjective Norm	User's perception that most people who are important to him or her think he should or should not perform a behavior in question	Fishbein et al. 1975
	Descriptive Norm	The extent to which a given behavior is prevalent in a given social context	Cialdini
Technological Inertia	Technological Inertia	User's blind adherence to the status quo resulting in a propensity to continuous use of adopted technologies regardless of attitudinal status	Developed
Table 2 Summary of Construct Definitions			

Code	Path	Description
H1a	AC-CI	Users' affective commitment to an information system will be positively associated with their intention to continue to use the system, such that the stronger the users' affective commitment, the stronger their intention to continue to use the system.
H1b	AC-SWI	Users' affective commitment to an information system will be negatively associated with their intention to switching to an alternative system, such that the stronger the users' affective commitment, the weaker their intention to switch to an alternative system
H2a	CC-CI	Users' calculative commitment to an information system will be positively associated with their intention to continue to use the system, such that the stronger the users' calculative commitment, the stronger their intention to continue to use the system.
H2b	CC-SWI	Users' calculative commitment to an information system will be negatively associated with their intention to switching to an alternative system, such that the stronger the users' calculative commitment, the weaker their intention to switch to an alternative system.
H3a	NC-CI	Users' normative commitment to an information system will be positively associated with their intention to continue to use the system, such that the stronger the users' normative commitment, the stronger their intention to continue to use the system.
H3b	NC-SWI	Users' normative commitment to an information system will be negatively associated with their intention to switching to an alternative system, such that the stronger the users' normative commitment, the weaker their intention to switch to an alternative system.
H4a	SAF-AC	Users' extent of satisfaction with an information system will have a positive influence on their affective commitment to the information system such that the more they feel satisfied with the system, the stronger their affective commitment.
H4b	PFM-AC	Users' perceived performance of an information system will have a positive influence on their affective commitment to the information system such that the better they perceive the system can perform, the stronger their affective commitment.
H4c	PFM-SAF	Users' perceived performance of an information system will have a positive influence on their satisfaction with the system, such that the better the users perceive the system can perform, the more they feel satisfied they.
H5a	SKC-CC	Users' perceived sunk cost associated with their previous use of an information system will have a positive influence on their calculative commitment to the information system, such that the higher cost they perceive from their previous use of the system, the stronger their calculative commitment.
H5b	SWC-CC	Users' projected switching cost associated with switching to an alternative information system will have a positive influence on their calculative commitment to the information system, such that the higher cost they project for switching to an alternative system, the stronger their calculative commitment.
H6a	SBJ-NC	Users' perceived subject norm associated with their use of an information system will have a positive influence on their normative commitment to the information system, such that the stronger they perceive the norm from people who are important to them, the stronger their normative commitment.
H6b	DESC-NC	Users' perceived descriptive norm associated with their use of an information system will have a positive influence on their normative commitment to the information system, such that the stronger they perceive the norm from their social context, the stronger their normative commitment.
H7a,b	INR on Comm.-CI/SWI	The influence of each dimension of commitment (affective, calculative, and normative) on users' continuance intention will be moderated by technological inertia such that the effect will be stronger for lower inertia users.

Table 3 Summary of Hypotheses

CHAPTER 4 – RESEARCH METHODOLOGY

4.1 Research Context

The research model has been empirically validated using a series of survey studies. In addition to the pilot studies for instrument development and validation, two longitudinal main studies were conducted. This chapter describes the methodology used for model testing and comparison with a focus on general issues across all survey studies, such as research context selection, instrument development and testing, survey design and settings, etc. The administration and analysis of individual studies are to be reported in subsequent chapters.

The concepts of IS commitment and continuance are always associated with specific information systems. Researchers in the IS literature have used various information systems, e.g., emails, WWW, intranet, instant messengers, online banking, etc. as the underlying frame of reference (Bhattacharjee 2001; Davis 1989; Limayem et al. 2007; Parthasarathy et al. 1998). Because each system is perceived differently by users, inherent system characteristics may impact users' intention to IS continuance.

In addition, user behavior in the context of a particular information system is essentially different from user behavior in light of a different, even comparable system. For example, users of Google Mail system tend to be more attached to Google's aesthetic interface whereas users of Microsoft Hotmail may be more loyal to the system due to perceived difficulties of switching services. Because this research focuses on understanding IS continuance in the context of competing alternatives, a number of substitutable systems need to be selected to operationally measure and test users' commitment and continuance intentions. Among many available information

technologies, a group of them, such as instant messengers, Webmail services, and group collaboration platforms (e.g., Microsoft SharePoint Server, Microsoft Office Groove, etc.) have been selected as the context of this research.

The choice of these information technologies was decided upon certain criteria. First, these systems are all free, easily available for implementation and use. Second, because of their popularity among college students, these systems seem to have been initially adopted by most participants for a period of time. Third, these technologies offer a wide variety of competing systems, e.g., America Online, Microsoft, Yahoo!, and Google all provide respective instant messenger applications and Webmail services. Fourth, those competing systems share a similar set of features, technologies, tasks, etc. making them comparable to each other. Lastly, it is not uncommon to find initial use of multiple systems among most users. Their decision of choosing one system over the other will be interesting to this research.

4.2 Survey Administration

All survey studies were carried out in the lab times of several undergraduate business classes. The participants were students enrolled in those sophomore or junior level courses. The samples represent a population of the age between 18 and 23.

All participants had access to the Internet using Microsoft Internet Explorer. The participants were asked to complete an online survey using the lab computers. Except for demographic questions, the survey consisted of multiple Likert-type questions. Responses to each item were measured on a 7-point scale with point anchors from 1 (strongly disagree) to 7 (strongly agree).

At the beginning of the survey, the participants were asked to complete several questions regarding their demographic background. Upon completion of those questions, they were asked to choose one information technology that they had adopted for a certain task. Their choice of the system was saved and later be used to generate customized survey questions based on the individual's choice. Thus, every participant was assigned to their pre-designated choice of information system. Data from participants who had never initially adopted an information technology for the particular task were dropped during data analysis.

One limitation of a cross sectional survey is the threat of common source and common method biases in measuring model constructs. Pursuant the suggestions by Podsakoff et al. (2003), this research employed longitudinal studies to measure model constructs at different times. In addition, the actual usage data were measured by self reports and computer generated log files. By collecting data from multiple periods and sources, this research is believed to be able to minimize the effect of common method biases.

4.3 Instrument Development

A series of pilot studies were conducted for developing a reliable and valid instrument to measure IS commitment. The development process was carried out in compliance with DeVellis' procedure (2003). The initial IS commitment items were adapted from Mowday et al.'s Organizational Commitment Questionnaire (OCQ) (Mowday et al. 1982). A total of 43 initial items were generated for preliminary screening and 9 items were found to consistently measure the underlying commitment constructs. The details of pilot studies are reported in the appendix.

CHAPTER 5 – STUDY 1 WEB MAIL SERVICES

5.1 Administration

This study followed the general procedure as described in the previous chapter. In order to understand users' IS continuance in a situation when competing alternatives are available; the participants were surveyed about their awareness of alternative Webmail systems in addition to their adopted one. The purpose of this study is threefold.

1. *To replicate the result of the pilot studies and validate the instrument of measuring commitment dimensions and antecedents,*
2. *To compare the research model with other prevalent models, and*
3. *To collect time series data and verify the research model in a longitudinal setting.*

The survey questions, along with demographic (e.g., age and gender) and personal characteristics (e.g., prior experience, inertia, computer self-efficacy, etc.) data were collected upfront so as to avoid potential confounding with the commitment instrument. At the end of the study, the participants were offered an opportunity to participate in a follow up survey with the possibility of winning a \$25 gift certificate.

In about a month after the initial survey, those participants who agreed to participate in the follow up study were sent an email request to respond to a follow-up survey. In the follow up survey, the participants were asked about their commitment level and the time and frequency of their use of the adopted Webmail service. The longitudinal data that were collected will be discussed in the following section.

The survey interface is developed by the author for this particular research. The research context is Webmail services (e.g., Hotmail, Yahoo! Mail, Gmail, etc.). A total of 311 usable responses were collected from the survey, among which 233 participants

ended up taking the follow-up study. The demographic information of the participants is reported below.

	All Participants		Continued Participants	
GENDER	Frequency	Percent	Frequency	Percent
Male	211	67.8	162	69.5
Female	100	32.2	71	30.5
Total	311	100	233	100
AGE	Frequency	Percent	Frequency	Percent
Undisclosed	1	0.3	1	0.4
18	44	14.1	36	15.5
19	96	30.9	76	32.6
20	78	25.1	60	25.8
21	43	13.8	26	11.2
22	18	5.8	11	4.7
23	8	2.6	6	2.6
24	11	3.5	8	3.4
25	3	1.0	3	1.3
26	2	0.6	1	0.4
28	3	1.0	2	0.9
29	1	0.3	1	0.4
32	1	0.3	1	0.4
34	1	0.3	1	0.4
37	1	0.3		
Total	311	100	233	100
Table 4 Study 1 Sample Demographic Information				

5.2 Validity Test

The collected data were analyzed using SPSS 13 (Norusis 2006) and EQS 6.1 (Build 83) (Bentler 2004; Byrne 2006) statistical software packages. Negatively worded questions were automatically reversed by the survey application. The data sets were carefully examined before analysis to remove incomplete responses. For confidentiality

purposes, participants' identity information were also removed before the data sets were entered for analysis.

Rigorous instrument validation is one necessary prerequisite toward quality IS research. Guided by Staub et al. (2004), the data analysis began with a set of mandatory validity checks, including *content validity check*, *reliability check*, *convergent validity check*, and *discriminant validity check*.

Content validity is recommended when new constructs are developed or existing constructs are adopted in new context (Cronbach 1971). The purpose of content validity is to ensure that the instruments correctly represent the content of the constructs to be measured. Content validity can be accessed through a careful review of the literature review and/or rigorous peer review of the instrument. In this study, the instrument scales are adapted from existing validated instruments on a strong theoretical basis. Some newly developed items went through multiple rounds of peer review and data collections. Therefore, the instrument in this study has achieved satisfactory content validity.

Reliability check is used to ensure the measurement is internally consistent and replicable. A common means of assessing reliability is through the measure of composite reliability. It is recommended that the composite reliability to be greater than 0.7 (Nunnally 1978). The descriptive data suggest satisfactory reliability. All composite reliability measures are over the 0.70 benchmark.

Construct *convergent validity* is used to check whether the measurement items that should theoretically measure a construct demonstrate strong correlations to each other. Convergent validity can be usually assessed using three criteria (Byrne 2006; Fornell and Larcker 1981): 1) all factor loadings are significant and greater than 0.70; 2) composite

reliabilities for each construct are over 0.80; and 3) average variance extracted (AVE) are over 0.50, or the square root of AVEs are over 0.71. The result shows that: 1) all factor loadings are above the 0.70 level; 2) all composite reliabilities are over 0.80; and 3) all square root of AVEs are over 0.70. Therefore adequate convergent validity is achieved in this study.

Construct	Item	Composite Reliability	Mean	Std. Deviation	Skewness	Kurtosis
AC	AC1	0.94	5.817	1.148	-0.975	0.794
	AC2		5.312	1.335	-0.332	-0.698
	AC3		5.543	1.279	-0.707	0.293
CC	CC1	0.92	3.582	1.776	0.228	-0.960
	CC2		3.415	1.781	0.248	-1.016
	CC3		3.997	1.859	-0.259	-1.066
	CC4		3.685	1.908	0.048	-1.175
NC	NC01	0.86	3.476	1.746	0.176	-0.906
	NC02		3.270	1.774	0.360	-0.686
	NC03		3.415	1.815	0.299	-0.999
CI	CI1	0.96	5.974	1.180	-1.443	2.536
	CI2		6.164	1.105	-1.844	4.273
	CI3		6.428	0.957	-2.323	7.357
	CI4		6.196	1.117	-1.776	3.722
SWI	SWI1	0.98	2.119	1.444	1.575	2.139
	SWI2		2.141	1.472	1.445	1.591
	SWI3		1.939	1.277	1.704	2.953
PFM	PFM1	0.92	5.611	1.139	-0.791	0.980
	PFM2		5.904	1.033	-1.164	3.079
	PFM3		5.807	1.108	-1.117	2.225
SAF	SAF1	0.95	6.016	0.982	-0.999	1.022
	SAF2		5.942	1.030	-0.989	1.265
	SAF3		5.714	1.239	-1.144	1.671
SKC	SKC1	0.90	6.183	1.273	-2.075	4.537
	SKC2		4.479	1.690	-0.323	-0.696
	SKC3		4.154	1.678	-0.155	-0.715
	SKC4		5.235	1.551	-0.982	0.606
SWC	SWC1	0.95	4.550	1.744	-0.387	-0.712
	SWC2		4.611	1.771	-0.530	-0.571
	SWC3		4.424	1.763	-0.389	-0.722

	SWC4		5.055	1.741	-0.837	-0.077
SBJ	SBJ1	0.91	3.839	1.576	-0.086	-0.199
	SBJ2		3.640	1.522	0.000	-0.001
	SBJ3		4.264	1.394	-0.134	0.909
DESC	DESC1	0.90	4.601	1.627	-0.460	-0.374
	DESC2		4.431	1.658	-0.284	-0.648
	DESC3		4.341	1.669	-0.258	-0.669
INR	INR1	0.84	4.093	1.481	-0.209	-0.616
	INR2		3.765	1.559	-0.087	-0.644
	INR3		4.543	1.314	-0.357	-0.193

Table 5 Study 1 Descriptive Data

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment
 CI-continuance intention; SWI: switching intention; PFM-perceived performance; SAF-satisfaction;
 SKC-perceived sunk cost; SWC-projected switching cost; SBJ-perceived subjective norm; DESC-perceived
 descriptive norm; INR-Technological Inertia

5.3 Exploratory Factor Analysis

Exploratory factor analysis (EFA) is a statistical procedure often being used to reveal underlying latent factors predicted by a set of manifested variables. EFA is used when no theory or predication is made prior to the analysis. That is why it is so called “exploratory” because no conclusion can be drawn from EFA unless further theory development or confirmatory analysis supports the finding. In this study, although all measurement scales are theoretically grounded, conducting EFA analysis is only one step to reduce weak or cross loaded items.

The EFA analysis is conducted in SPSS 13 statistical software package. The items were entered in three groups: the commitment constructs, the antecedent constructs, and the dependent constructs. In each group, all items are entered at the same time and allowed to rotate using the varimax method. The items for each proposed construct should load on the same factor with their loadings greater than 0.60. On the other hand,

the cross loadings of these items on other factors should not exceed 0.40 (Byrne 2006; Byrne and Crombie 2003).

	1	2	3
AC1	0.085	0.894	0.087
AC2	0.063	0.909	0.030
AC3	0.132	0.908	0.070
NC01	0.255	0.081	0.777
NC02	0.266	0.033	0.792
NC03	0.175	0.067	0.791
CC1	0.815	0.150	0.245
CC2	0.851	0.077	0.274
CC3	0.856	0.043	0.121
CC4	0.780	0.102	0.280

Table 6 Study 1 EFA, Commitment Constructs

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment

	1	2
CI1	0.884	-0.196
CI2	0.897	-0.296
CI3	0.873	-0.227
CI4	0.846	-0.376
SWI1	-0.265	0.927
SWI2	-0.274	0.929
SWI3	-0.285	0.913

Table 7 Study 1 EFA, Outcome Constructs

Note: CI-continuance intention; SWI: switching intention

	1	2	3	4	5	6
PFM1	0.153	0.143	0.377	0.094	0.760	0.068
PFM2	0.085	0.098	0.321	0.129	0.851	0.132
PFM3	0.105	0.102	0.335	0.139	0.802	0.160
SAF1	0.098	0.134	0.833	0.050	0.359	0.011
SAF2	0.031	0.103	0.843	0.108	0.385	0.056
SAF3	0.094	0.040	0.887	0.150	0.191	0.136
SKC1	0.090	0.162	0.016	0.595	0.446	-0.133
SKC2	0.162	0.145	0.094	0.860	0.030	0.201
SKC3	0.178	0.104	0.094	0.872	-0.025	0.256
SKC4	0.281	0.084	0.171	0.734	0.289	0.125
SWC1	0.874	0.050	0.028	0.173	0.058	0.165
SWC2	0.913	0.086	0.030	0.199	0.099	0.080
SWC3	0.891	0.090	0.055	0.136	0.060	0.168
SWC4	0.839	0.115	0.137	0.092	0.123	0.107
SBJ1	0.200	0.239	-0.037	0.180	0.072	0.819
SBJ2	0.182	0.199	0.039	0.140	0.057	0.862
SBJ3	0.123	0.213	0.238	0.113	0.157	0.721
DESC1	0.129	0.911	0.078	0.137	0.127	0.212
DESC2	0.086	0.929	0.095	0.125	0.111	0.198
DESC3	0.104	0.898	0.097	0.132	0.099	0.223

Table 8 Study 1 EFA, Antecedents

Note: PFM-perceived performance; SAF-satisfaction; SKC-perceived sunk cost; SWC-projected switching cost; SBJ-perceived subjective norm; DESC: perceived descriptive norm

Almost all theory suggested items correctly loaded on their respective latent constructs with satisfactory crossing loadings on other factors. The only exception is SKC1 which cross loaded on PFM. Given the cross loading is only marginally over the recommended limit, further analysis is needed to determine whether to eliminate this item or not. Overall, the EFA result suggests satisfactory construct convergent validity and discriminant validity.

5.4 Construct Correlations

Discriminant validity refers to whether the measurement items that should be theoretically *unrelated* demonstrate weak correlations to each other. Discriminant validity is usually assessed by comparing construct correlations with the square root of AVEs

from individual constructs (Fornell et al. 1981). If the square root of AVE is significantly greater than the construct correlations, discriminant validity is granted. The correlation table below provides positive support for discriminant validity.

	AC	CC	NC	CI	SWI	PFM	SAF	SKC	SWC	SBJ	DESC
AC	0.911										
CC	0.224	0.862									
NC	0.170	0.535	0.823								
CI	0.548	0.237	0.069	0.917							
SWI	-0.378	0.026	0.061	-0.559	0.963						
PFM	0.551	0.208	0.053	0.608	-0.390	0.894					
SAF	0.538	0.209	0.069	0.568	-0.388	0.782	0.930				
SKC	0.293	0.402	0.311	0.304	-0.053	0.359	0.317	0.834			
SWC	0.239	0.553	0.392	0.333	-0.082	0.269	0.206	0.431	0.912		
SBJ	0.330	0.451	0.475	0.255	-0.030	0.219	0.228	0.411	0.385	0.875	
DESC	0.307	0.317	0.273	0.129	-0.017	0.205	0.235	0.318	0.245	0.457	0.865

Table 9 Study 1 Construct Correlation

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment
 CI-continuance intention; SWI: switching intention; PFM-perceived performance; SAF-satisfaction;
 SKC-perceived sunk cost; SWC-projected switching cost; SBJ-perceived subjective norm; DESC: perceived descriptive norm

Diagonal is the squared root of construct Average Variance Extracted (AVE).

5.5 Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) is another means to test construct convergent validity and discriminant validity. Contrary to the EFA, CFA is usually conducted with a certain theoretical base. The purpose of CFA is to test whether the collected data fit a theoretical model deducted *a priori*. CFA is more rigorous than EFA because of its theoretical assumptions.

Three measurement models were entered into EQS 6.1. The first model includes 311 responses at the first wave of the data collection (T1). The second model includes 233 responses from T1 who participated in both waves of the data collection. The third model includes responses from the same sample but at the second wave of the data

collection (T2). All results suggest satisfactory convergent and discriminant validity except for SKC1 as previously noted in EFA. Thus, SKC1 is dropped from the data set for further analysis.

	NFI	CFI	SRMR	RMSEA	RMSEA Confidence Interval
Baseline Constructs	0.933	0.966	0.066	0.055	(.045, .065)
Antecedents	0.934	0.974	0.078	0.043	(.030, .055)

Table 10 Study 1 Measurement Model Fit Test

Note: Baseline Constructs-Commitment and Intentions

	T1 All Participants	T1 Continued Participants	T2 Continued Participants
AC1	0.914	0.874	0.808
AC2	0.903	0.861	0.869
AC3	0.916	0.863	0.931
NC1	0.852	0.715	0.672
NC2	0.839	0.708	0.796
NC3	0.777	0.749	0.748
CC1	0.858	0.797	0.893
CC2	0.887	0.856	0.927
CC3	0.843	0.761	0.849
CC4	0.859	0.772	0.885
CI1	0.904	0.864	0.848
CI2	0.948	0.946	0.965
CI3	0.892	0.870	0.936
CI4	0.923	0.927	0.901
SWI1	0.963	0.937	0.926
SWI2	0.972	0.969	0.985
SWI3	0.956	0.926	0.973
PFM1	0.893	0.839	0.919
PFM2	0.911	0.892	0.916
PFM3	0.879	0.799	0.804
SAF1	0.933	0.897	0.948
SAF2	0.948	0.943	0.932
SAF3	0.909	0.864	0.796
SKC1	0.635	0.560	0.548
SKC2	0.890	0.921	0.914
SKC3	0.907	0.926	0.944
SKC4	0.876	0.761	0.815
SWC1	0.907	0.876	0.885
SWC2	0.944	0.931	0.904
SWC3	0.927	0.871	0.851
SWC4	0.868	0.810	0.839
SBJ1	0.916	0.903	0.931
SBJ2	0.927	0.920	0.922
SBJ3	0.772	0.682	0.773
DESC1	0.793	0.950	0.914
DESC2	0.802	0.967	0.972
DESC3	0.986	0.888	0.918

Table 11 Study 1 Confirmatory Factor Loadings

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment
CI-continuance intention; SWI: switching intention; PFM-perceived performance;
SAF-satisfaction; SKC-perceived sunk cost; SWC-projected switching cost; SBJ-
perceived subjective norm; DESC: perceived descriptive norm

5.6 Model Fit Test

The collected data were then analyzed using structural equation regressions to test the overall fit between the data and the model. Structural equation regression is a statistical technique for validating structural equation models (SEM). This technique has been widely applied to IS research. SEM testing and analysis provides intuitive indicators for model fit and path significance, demonstrating the extent to which a proposed structural model accounts for the covariance in a collected data set (Straub et al. 2004). Research employing SEM testing and analysis often report a group of fit indices but researchers have not reached a consensus as to what indices are required in a SEM testing and analysis report. On the other hand, statistical software packages have their own reporting criteria resulting in some indices incomparable across reports generated by different software packages. Give this study employs EQS 6.1 as the statistical tool for data analysis, the reporting procedure will follow the guideline set forth by Byrne (2006). The major indices to be reported include Comparative Fit Index (CFI), the chi-square χ^2 value, the ratio of χ^2 to degree of freedom, and Root Mean Square Error of Approximation (RMSEA). It is suggested that a good fit model should demonstrate CFI greater than 0.90 and RMSEA less than 0.10. Because the chi-square value is sensitive to model size, the ratio of χ^2 to degree of freedom less than 3 is believed to be a better indicator in lieu of χ^2 (Byrne 2006; Straub et al. 2004). This study reports all above indicators in the following analysis.

For all 311 responses at Time 1 (T1), the regressions suggest adequate fit between the collected data and the hypothesized model. The χ^2 test yields 1.95 per degree of freedom ($\chi^2 = 1183.8$, $df = 606$). Comparative Fit Index (CFI) is .920 and the Root Mean

Square Error of Approximation (RMSEA) is 0.055 with its 90% confidence interval between .051 and .060 suggesting decent accuracy of fit. Overall, the structural model explains 44.9% of variance in IS continuance intention and 26.5% of variance in switching intention among all users. Results evidently support strong effects of IS commitment as a precursor to IS continuance and switching intention.

Among the 311 respondents, 233 agreed to participate in the follow up study and their responses matched with those collected at Time 2 (T2). These 233 respondents are so called continued participants. For the continued responses at T1, the regressions suggest similar good fit result as the complete data set. The χ^2 test yields 1.75 per degree of freedom ($\chi^2 = 1059.7$, $df = 606$). Comparative Fit Index (CFI) is .912 and the Root Mean Square Error of Approximation (RMSEA) is 0.057 with its 90% confidence interval between .051 and .062. The model explains 52.9% of variance in IS continuance intention and 19.2% of variance in switching intention among continued users.

Another set of data is collected at T2 from the same participant pool. Because there is an over a month long interval between two data collections, it is reasonable to believe that this data collection is free of the repeated test threat to internal validity and thus is independent of the first data set.

The result confirms a good fit between the collected data at T2 and the hypothesized model. The χ^2 test yielded 1.35 per degree of freedom ($\chi^2 = 818.0$, $df = 606$). Comparative Fit Index (CFI) is 0.964 and the Root Mean Square Error of Approximation (RMSEA) is 0.039 with its 90% confidence interval between .032 and .045 suggesting better fit than that of the data set from T1. Overall, the structural model explains 49.7% of variance in IS continuance intention and 30.2% of variance in

switching intention among all users. The result indicates that there is a good fit between the collected data and the proposed model and such good fit is replicable and consistent across two independently collected data sets.

	T1 (N=311)		T1 (N=233)		T2 (N=233)	
	CI	SWI	CI	SWI	CI	SWI
R²	44.9%	26.5%	52.9%	19.2%	49.7%	30.2%
AC	.643*	(0.512*)	.671*	(.433*)	.694*	(.456*)
CC	.160*	0.065	.233*	0.008	.118*	.141*
NC	(.113*)	.146*	(.126*)	.152*	(0.084)	.394*

Table 12 Study 1 Summary of Results

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment; CI-continuance intention; SWI: switching intention

5.7 Hypotheses Test

H1a is supported in all three tests. The result indicates a significant path weight between affective commitment and user's intention to continue to use. The path weight is consistently strong across all three tests (0.643, 0.671, and 0.694, respectively). H1b is also supported in all three tests. There is a strong but negative correlation between users' affective commitment and their intention to switch to an alternative system. The absolute value of the path weights between affective commitment and switching intention are consistently lower (0.512, 0.433, and 0.456, respectively) than those between affective commitment and continuance intention in all three tests. This result confirms the findings from previous literature that affective commitment seems to be the strongest predictor among all three commitment dimensions.

H2a is also supported in all three tests. Calculative commitment is positively associated with users' intention to use. The path weight in all three tests are lower than

the path weight between affective commitment and continuance intention indicating that calculative is less influential on users' continuance intention than affective commitment in this study. H2b, however, yields mixed results. When testing on the T1 data set, two tests report non-significant relationships between calculative commitment and users' switching intention. However, the test on T2 data set reports significant path between calculative commitment and switching intention. This is an interesting result worth discussion in the following section.

H3a about normative commitment also receives partial support. Strangely, both tests on the T1 data report significant but negative path weight. A follow up test on T2 data finds a non-significant but negative path. The results show that normative commitment is negatively associated with users' continuance intention in this study. H3b, however, consistently receives significant result but the path weight goes in the opposite direction as hypothesized. This result will also be discussed in the following section.

H4a is supported by two of the three tests. When tested in the T1 all response data set, the path between satisfaction and affective commitment is not significant. In the continued user's data set, satisfaction is significantly related to affective commitment at T1 and T2, and the path weight becomes stronger at T2.

H4b is supported at all times. Perceived performance is found to have a strong correlation with affective commitment in all three tests. The path weight between perceived performance and affective commitment is consistently higher than the weight between satisfaction and affective commitment suggesting that perceived performance may be powerful than satisfaction in terms of predicting user's affective commitment.

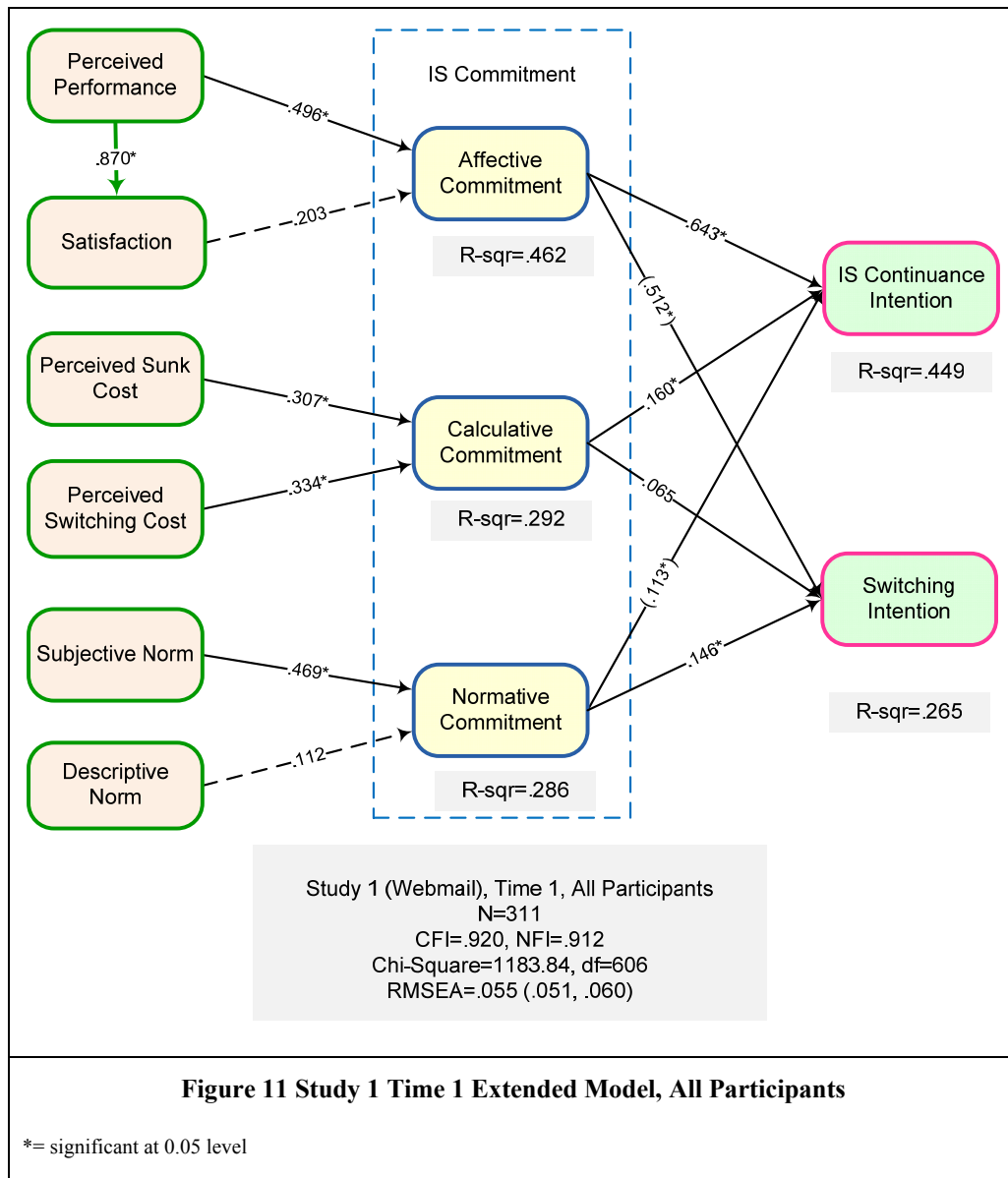
Perceived performance and satisfaction together account for a large proportion of affective commitment, ranging from 46.2% to 66.8% in the three data sets.

H4c suggests that perceived performance is an indicator of user's satisfaction. This hypothesis is supported by all three tests. There is a strong correlation between perceived performance and satisfaction and such correlation confirms the similar findings in the literature (Bhattacharjee 2001).

H5a and H5b propose that perceived sunk cost and perceived switching cost are predictors of calculative commitment. The data sets consistently support these two hypotheses. All paths are significant and the path weights suggest balanced influencing power of these two antecedents on calculative commitment. Perceived sunk cost and perceived switching cost together account for about 24.7% to 29.2% variance of the calculative commitment, leaving a majority of the variance unexplained.

H6a and H6b hypothesize that subjective norm and descriptive norm are antecedents to users' normative commitment to an information system. H6a, i.e., subjective norm, is found significantly associated with user's normative commitment. The T1 path weight suggests strong influencing power of subjective norm on normative commitment, and the T2 data set suggests moderate influencing power. H6b, which is about descriptive norm and normative commitment, is not supported by the T1 data set. The T2 data set, however, indicates significant association between descriptive norm and normative commitment. Thus, H6b is partly supported. Subjective norm and descriptive norm together account for about 20.8% to 30.6% of variance of normative commitment.

The results of H1 through H6 tests are illustrated in the following figures.



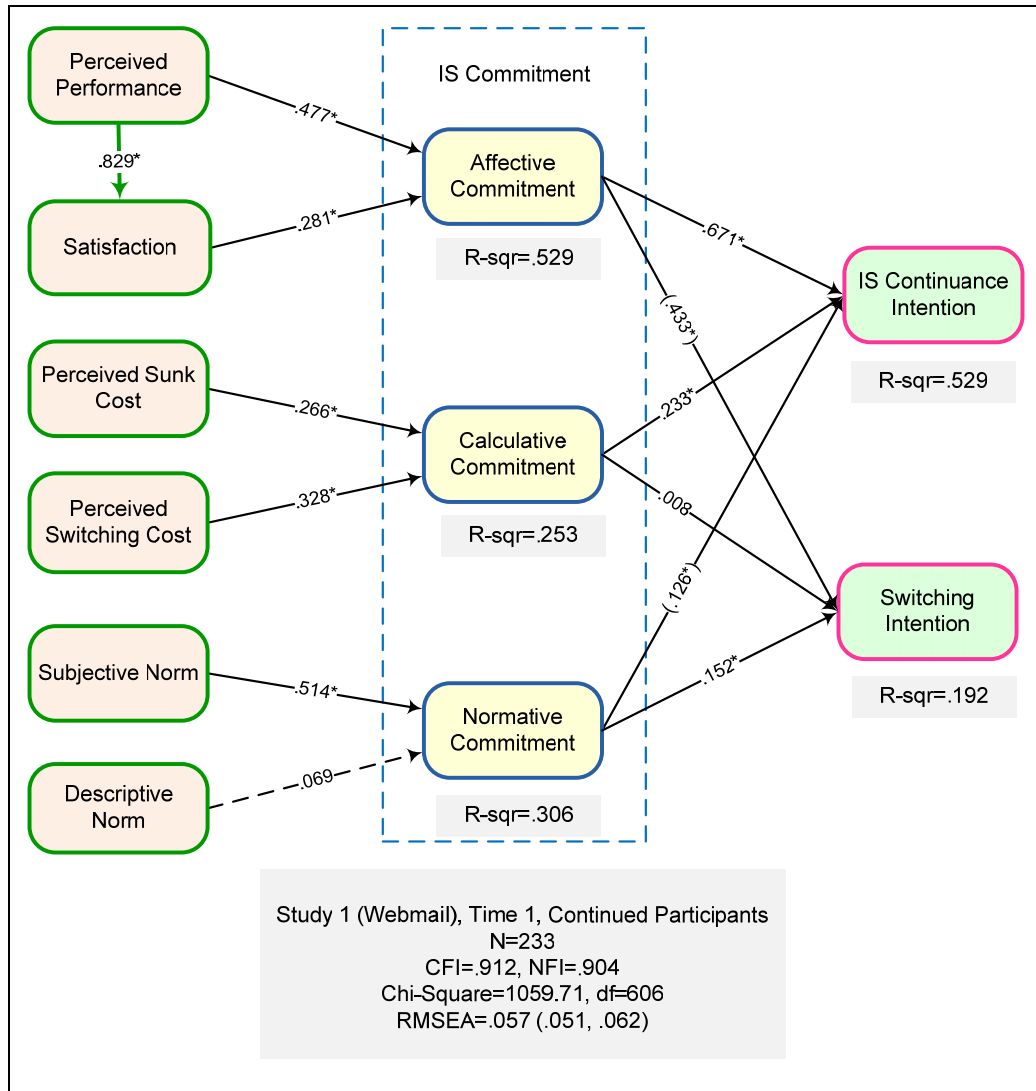


Figure 12 Study 1 Time 1 Extended Model, Continued Participants

*= significant at 0.05 level

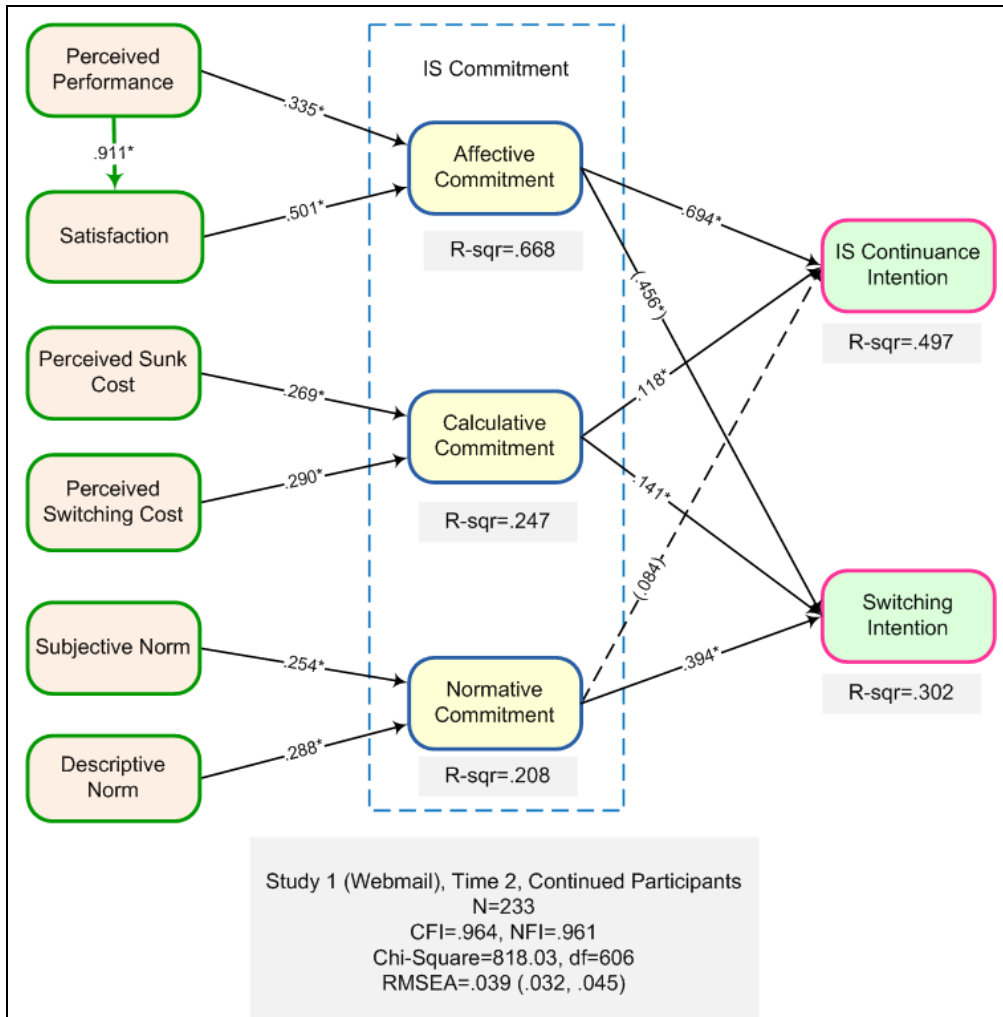


Figure 13 Study 1 Time 2 Extended Model, Continued Participants

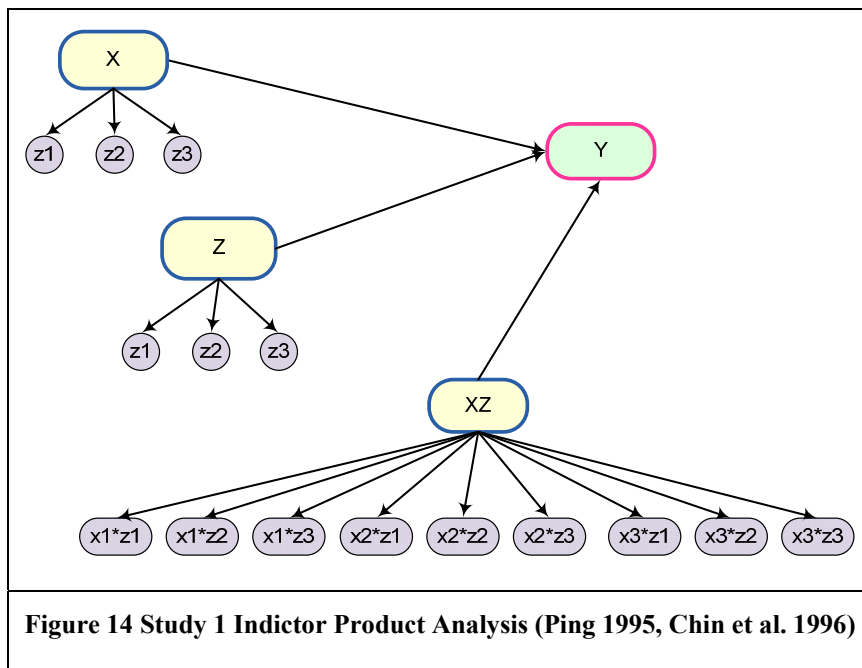
*= significant at 0.05 level

H7a proposes a moderating effect of technological inertia on the relationship between IS commitment and users' intention to continue to use an information system. There are many different approaches that can be used to test moderation effects. However, three approaches, i.e., product term regression analysis, subgroup analysis, and indicator product analysis, are most frequently employed in the literature (Ping 1995).

Product term regression analysis sums up indicators of independent variables as well as the product of indicators of the proposed interaction variables, and regresses the dependent variable on the summed variables along with the interaction variable. This approach is generally recommended for continuous variables (Ping 1995). Subgroup analysis divides the sample into subgroups based on the proposed interaction variable, and then compares the model coefficients across subgroups (Wang and Datta 2006). This approach is appropriate when subgroups are easily identified and the categorization is theoretically grounded. Another approach, indicator product analysis is similar to product term regression; however, instead of running a regression this approach involves latent variables and allows structural model test with latent dependent variable and latent interaction variable (Ping 1995).

The last approach, indicator product analysis, is recommended by many prominent IS researchers when testing moderation in a structural model is needed (Chin, Marcolin, et al. 1996; Limayem et al. 2007; Venkatesh et al. 2008). Because this study involves structural model analysis and the latent constructs are measured by manifested variables (indicators), the indicator product analysis seems to be appropriate in this context. Therefore, employing the indicator product analysis, the moderation test is conducted following the steps suggested by Chin et al. (1996).

First, all indicators of independent variables are standardized using SPSS to generate the z-scores. Standardizing the indicators helps reduce errors as well as collinearity and makes the result easier to interpret (Chin et al. 1996). Second, each indicator's z-score from the main construct is multiplied with those from the moderating construct to form a new interactions construct (see the figure below). And third, the new interaction construct are entered into the model along with the main effect constructs for a significant test. If the interaction construct indicates significant relationship with the dependent construct, a further R^2 change test is needed to confirm the moderation effect (Carte and Russel 2003; Limayem et al. 2007).



Illustrated in the following figures, the results, however, do not seem to support the hypothesized moderating effects very well. None of the interaction constructs is significant.

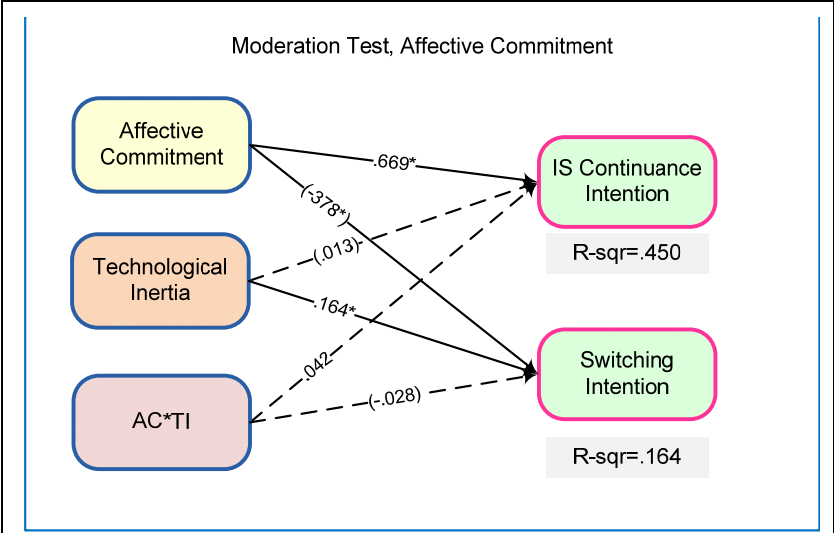


Figure 15 Study 1 Moderation Test, AC*TI

*= significant at 0.05 level

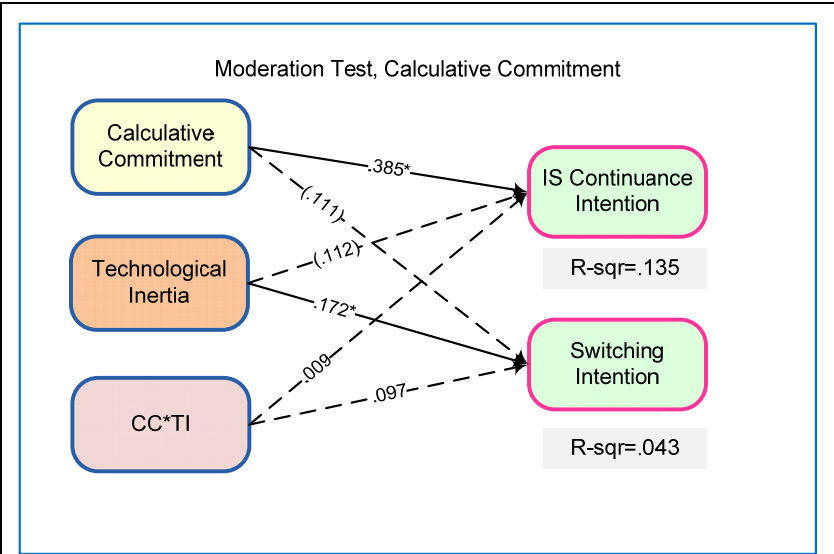
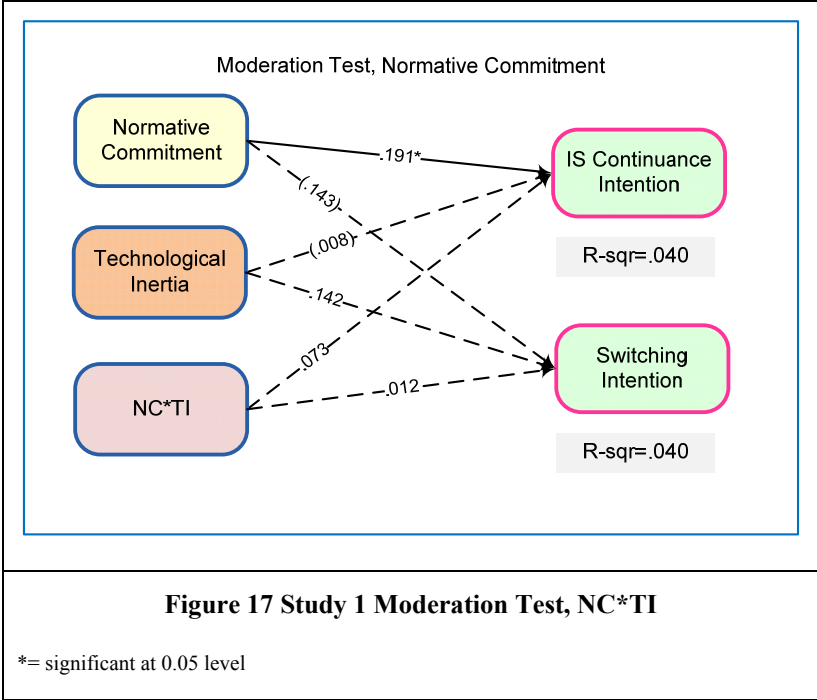


Figure 16 Study 1 Moderation Test, CC*TI

*= significant at 0.05 level



Code	Path	Support
H1a	AC-CI	Supported
H1b	AC-SWI	Supported
H2a	CC-CI	Supported
H2b	CC-SWI	Supported
H3a	NC-CI	Supported In Opposite Direction
H3b	NC-SWI	Supported In Opposite Direction
H4a	SAF-AC	Supported
H4b	PFM-AC	Supported
H4c	PFM-SAF	Supported
H5a	SKC-CC	Supported
H5b	SWC-CC	Supported
H6a	DESC-NC	Supported
H6b	SBJ-NC	Supported
H7a	INR moderating Commitment-CI	Not Supported
H7b	INR moderating Commitment- SWI	Not Supported

Table 13 Study 1 Summary of Hypotheses Support

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment
CI-continuance intention; SWI: switching intention; PFM-perceived performance; SAF-
satisfaction; SKC-perceived sunk cost; SWC-projected switching cost; SBJ-perceived subjective
norm; DESC: perceived descriptive norm

5.8 Discussion

Affective Commitment

Results from Study 1 suggest satisfactory measurement and modeling of IS commitment as a predictor to IS continuance intention. Especially, the findings confirm that affective commitment is particularly important for the user to choose an information system over available substitutes. This finding is consistent with the consensus in the IS literature that affective commitment has the strongest association with behavioral intention (Allen et al. 1996; Li et al. 2006). The participants' responses also agree to this observation.

“I love [a particular Webmail system]. I love the features and the functionality it offers. I would highly recommend it to anyone and I would not switch to other emails.”

The results also show perceived performance induces users' desire-based commitment, leading users to stay with the system over time. Perceived performance has been modeled as perceived usefulness in TAM and is found to influence both users' attitude and behavioral intention. This study confirms that in a technology context perceived performance is a strong antecedent to affective commitment. Here are two participant's responses that support this quantitative finding,

*“I basically use [a particular Webmail system] because **it has the largest file storage system** so that I don't have to delete messages, and because of **its search feature**, which lets me look through all of my old messages for a specific one.”*

*“ [A particular Webmail system]'s **functionality and ease-of-use**, as well as the many **3rd party programs, encourage and allow for retained users** and a (so far as I would assume) steady rate of primary-user increase.”*

It is hard to distinguish perceived performance from satisfaction in this study due to the strong correlation between these two constructs. However, the causality is apparently

supported such that greater perceived performance leads to greater satisfaction. The findings of this study suggest that both performance and satisfaction are important for users to be affectively committed to an information system, but perceived performance of a system seems to be a more powerful antecedent, i.e., how an information system helps improve people's work performance matters more than how it satisfies people notwithstanding these two factors are often highly correlated. For example, good looking interface is always important for user satisfaction but compared to features and functionality it may not affect user's affective commitment as much. This finding provides an implication that when everything else remains equal, a user may be more committed to a well performing system than to an attractive system.

Calculative Commitment

A weaker but significant relationship is confirmed between calculative commitment and IS continuance intention. Such relationship reflects that users are concerned with costs, especially switching costs when discontinuance decisions are to be made. The finding highlights the importance of cost as an element of commitment. In the case of Webmail, perceptions of costs, although low because of the ease of substitution, still appear significant due to the difficulty of notifying others of the new address. This conclusion is confirmed by user's responses:

*“There a people like me who use [a particular Webmail system] because we have used it so long. And it is **an effort to provide people with a new address.**”*

*“Changing over to another web mail **would require extensive time** to change on various forums and through various companies I associated with”*

*“Since I started with hotmail it just makes sence to stay with them unless I find a reason to leave. It is just **too much of a hassle to switch services**”*

Cost concerns are often a function of the system. Not all technologies are associated with high costs of use and switch. For example, switching between Web browsers is much easier than between programming languages. Users' calculative commitment to a Web browser may be insignificant compared to a programming language. To further understanding the difference of calculative commitment in different technology context, a between technology analysis may provide more insight.

The literature also indicates that one important antecedent of calculative commitment is a lack of alternatives. When there is no available alternative, users' decision to continue using becomes inevitable. In this research, since available alternatives are assumed, users should not have concerns of a lack of alternatives. However, responses still show that the availability of alternative remains to be a concern,

*"I just chose [a particular Webmail system] because **that is the only one I knew of. I just wouldn't go through the hassle of changing my email for those around me.**"*

A second study that will explicitly provide available alternatives is expected to answer this concern.

Normative Commitment

A negative effect is found between normative commitment and IS continuance intentions. The findings suggest that subjective and social norms both have considerable effects on normative commitment, but Webmail users seem to value normative commitment negatively in the formation of their continuance intention. In the comments, participants demonstrated mixed attitude toward the norm and it seems that overall their continuance is independent of perceived norm.

“I don’t really care what anyone thinks... all I know is I started with [a particular Webmail system] and there hasn’t been a good enough reason to change.”

“I found [a particular Webmail system] is overrun with spam and junk mail. But I still continue to use it because lots of my friends and family have that as my primary email.”

Normative factors have always received mixed viewpoints in the IS literature. Although TRA and TPB emphasized subjective norm as an important predictor to behavior, TAM dropped normative factors because the normative influence on individuals’ acceptance decisions is much lower than do utility factors (Davis 1989).

The effect of normative commitment on IS continuance may not be as direct as the other two dimensions. Users may accept normative influence differently depending on the underlying mechanisms. For example, some users tend to comply with peer pressure whereas others tend to build up normative commitment based on social exchange. In addition, the motivation to comply with social norms may also be an individual characteristic that could moderate the association between normative commitment and IS continuance.

It is also possible that the effect of normative commitment is depending on affective commitment and calculative commitment so that when partialled out the affective commitment and calculative commitment, the effect of normative commitment becomes trivial. This is confirmed by conducting a stand-alone path model including normative commitment, continuance intention, and switching intention. The results are in line with the hypotheses as normative commitment is positively and significantly associated with continuance intention and it is negatively and significantly associated with switching intention.

Continuance Intention and Switching Intention

Prior IS research mostly focuses on IS use or continued IS use, however little has been done with users' switching intention and behavior. Therefore, studying switching intention as well as comparing between continuance and switching intentions may provide some interesting discussions.

Although continuance intention and switching intention seem to have a strong negative correlation, one is not exactly the opposite of the other. A user with intention to continue to use a system may not necessarily think against switching. One participant responded,

*“When the time comes I will make the **switch to** [an alternative Webmail system]... The only reason I am with [the current Webmail system] is because **I have used to (it) forever.**”*

This is a typical example of dual-intent when a user has the intention to continue to use a currently adopted system while in the mean time seeks opportunity to switch to an alternative system. For example, an unsatisfied user is more likely to search for information about alternative systems. But when alternatives are unavailable or dissatisfactory, the user may have to be committed to the current system (calculative commitment) resulting in high continuance intention and high switching intention. Such disparity causes switching intention to be less explained by IS commitment than continuance intention.

Timing is another issue when it comes to the differences between continuance intention and switching intention. New adopters tend to look for ways to switch because their calculative commitment may be lower. However, they may also be very committed to the newly adopted system because of novelty effect. Such conflict may lead to the IS

commitment model explaining more variance in experienced users than in new users. Comparing the R^2 tables, one may find that the R^2 difference between continuance intention and switching intention at T2 is much smaller than at T1. This finding partially confirms that over time the predicting power of commitment on switching intention will be closer to their continuance intention.

Technological Inertia

Technological inertia is hypothesized to moderate the relationship between commitment and continuance and switching intentions such that high inertia users are less influenced by commitment because they intrinsically resist changes regardless of attitudinal status. Although the collected data do not seem to support this hypothesis, participants' responses may provide a different argument.

*“Once you start using a service and **you are adept at using it, there is no reason to switch** to another service that offers mainly the same stuff.”*

*“Most of the time people will sign up for one webmail service and then use it **for the rest of their life.**”*

*“I have **never thought of changing** to another webmail service. Its not that I like [a particular Webmail system], **its just that it was my first one** and I've never seen a reason to change it. **If it isn't broke, don't fix it.**”*

*“I use [a particular Webmail system] and **I'm just lazy to switch**”*

These comments evidently support the fact that users have a tendency to remain using an information system regardless of their attitudinal or cognitive status. The discrepancy between the quantitative data and the qualitative comments suggests a missing variable, probably a moderator, between commitment and intention. If technological inertia is not the moderator, what else could be this missing variable?

A revisit to the literature suggests three candidate variables: past use, habit, and motivation. Past use has been used to successfully predict use in many previous studies (Kim et al. 2005b). Habit has been found to be a moderator between intention and actual usage (Limayem et al. 2003; Limayem et al. 2007). Motivation, however, has not been well explored in the IS literature therefore may constitute a direction for future research.

Comparison between Service Providers

Among all available Web mail systems, two most popular services are Hotmail by Microsoft and Gmail by Google. The data show that out of 311 responses, 166 (or 53.4%) chose Hotmail and 72 (or 23.2%) chose Gmail as their primary Web mail service. Together the users of Hotmail and Gmail account for 76.6% of the entire sample.

It would be interesting to compare users' commitment to these two different Web mail systems. Hotmail as a web-based email service was initially released in 1996², whereas Gmail was first launched on April 1, 2004 as an invitation-only service and was not opened to the general public until February 7, 2007³. A t-test confirms that the average years of usage for Hotmail users is significantly longer than that of Gmail users ($F=12.969$, $p<.001$). Therefore, a comparison between the IS commitment of Hotmail users and Gmail users may provide us with insight into how IS commitment evolves over time. Although this observation is exploratory in nature, the result may suggest directions for future research.

The model comparison is only conducted on the baseline model (i.e., without antecedents). Given the complexity of the complete research model and the relatively

² From Wikipedia under the list of "Hotmail", <http://en.wikipedia.org/wiki/Hotmail>, retrieved June 22, 2008

³ From Wikipedia under the list of "Gmail", <http://en.wikipedia.org/wiki/Gmail>, retrieved June 22, 2008

small size of the subsamples, running SEM regressions on the complete model may not yield reliable estimates. The baseline model contains five constructs compared to eleven constructs in the complete research model therefore is more appropriate for comparison.

The data set is divided into two groups, one for Hotmail users and the other for Gmail users. The rest of responses are dropped in this comparison. The SEM results show that both groups have a reasonable fit to the proposed baseline model. CFI is 0.964 for Hotmail users and 0.895 for Gmail users. Although the CFI for Gmail users seems to be a bit low, given the model has been repeatedly validated using the multiple data sets, such CFI is believed to be acceptable. Another important fit index RMSEA is 0.052 for the Hotmail group and 0.089 for the Gmail group, both confirming that the overall model fit is acceptable.

The comparison shows that IS commitment accounts for 58.7% variance in Hotmail users' intention to continue to use Hotmail and 27.9% variance in their intention to switch to a different Web mail system. For Gmail users, IS commitment account for 46.3% of variance in their continuance intention and 13.9% of variance in their switching intention.

Apparently, IS commitment explains more variance in Hotmail users' continuance intention and switching intention than those in Gmail users'. This may partly be attributed to the length of use. As mentioned before, Hotmail users have much longer experience of using Hotmail system than Gmail users of Gmail. Thus, it is possible that Hotmail users' commitment grows over time and after a long period of usage they become strongly committed to Hotmail. Therefore, time may be an important variable in considering IS commitment and its influence on users' IS continuance.

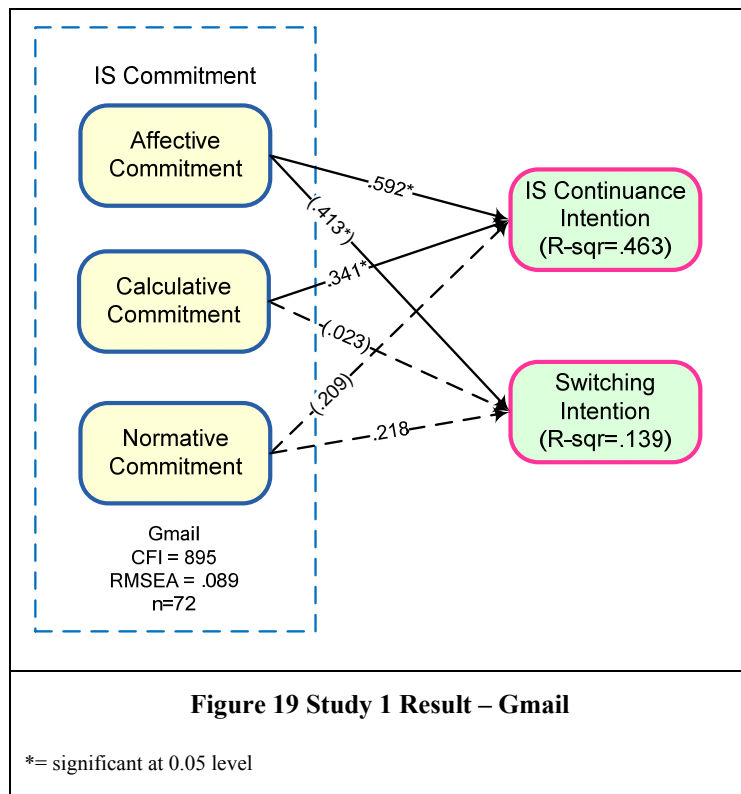
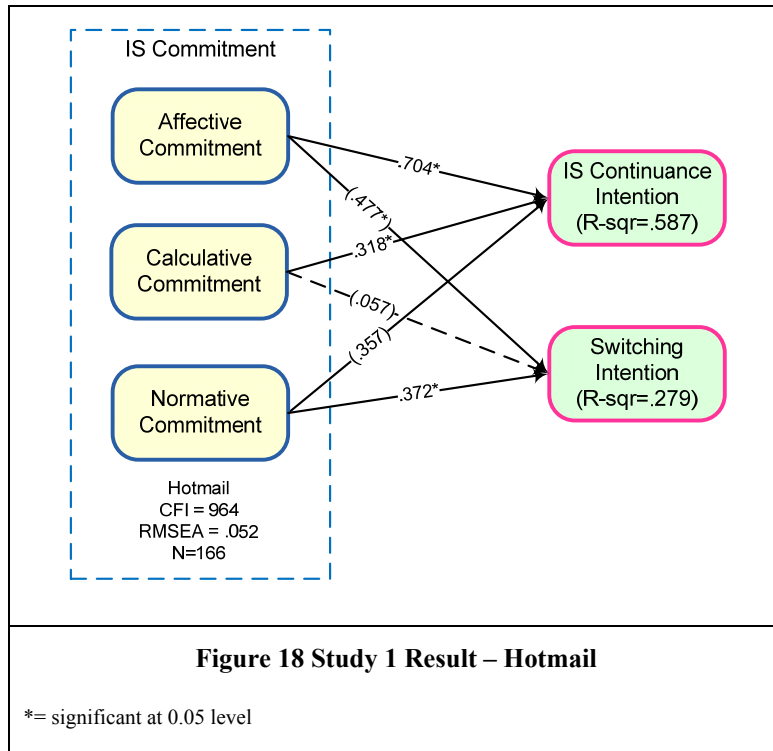
The break-down of commitment dimensions shows that affective commitment is the strongest predictor of IS continuance and switching intention. This is consistent with the findings previously discussed. Hotmail users have a stronger association between affective commitment and continuance intention as well as switching intention than Gmail users. A few participants responded:

I religiously use hotmail.com because it was free, and it was easy to set up. The rest just fell in line. Not to mention it is really easy to navigate and rarely has problems. It is a very reliable service especially for free.

I have used hotmail for nearly 10 years, with the same email address. It provides a lot of functionality, which meets my communication needs.

Hotmail has every feature i need, and it has been extremely helpful to keep in touch with my family, freinds, and professors. Why switch to another e-mail account when they will give you the exact same features?

The testimony shows that long terms users tend to have strong desire based commitment to the system that they are used to and have spent most of time with. We may find similar examples in our real life. For instance, when one spends a number of years in a school, he or she may feel strongly attached to that institution. This may explain why most people feel proud of their undergraduate institution partly because they spent four years there. Similarly, a long term SAS user may feel SAS is the best statistical software package in the world. Given affective commitment has been consistently found to be the most influential commitment dimension on IS continuance, understanding that time may have a cumulative effect on affective commitment provides a direction for follow up research.



Model Comparison

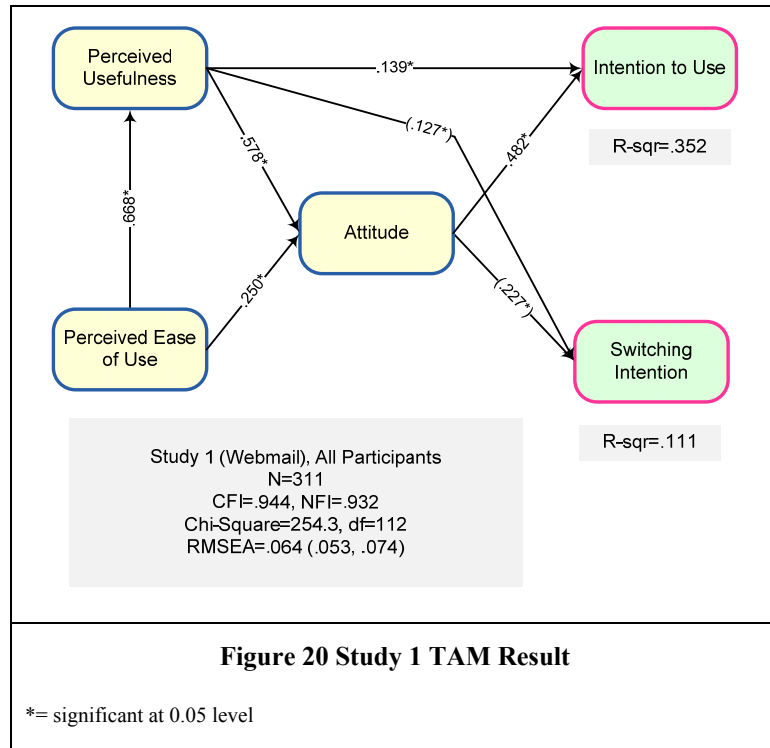
To further understand IS continuance and its antecedents, a comparison is conducted between the proposed research model and two prevalent models, i.e., TAM (Davis 1989) and Expectation-Confirmation Model (ECM) (Bhattacharjee 2001). TAM has been accepted as the most popular model to explain technology use. Consistently, TAM has been found to explain about 40% of the variance in individuals' intention to use (Venkatesh et al. 2008; Venkatesh et al. 2003). In addition, TAM has also been used to study IS continuance and served as the basis for extended continuance models, such as PAM (Malhotra et al. 2005). Comparing the IS continuance model with TAM may help reveal the similarities and differences between adoption and continuance and provide directions for future theory refinement.

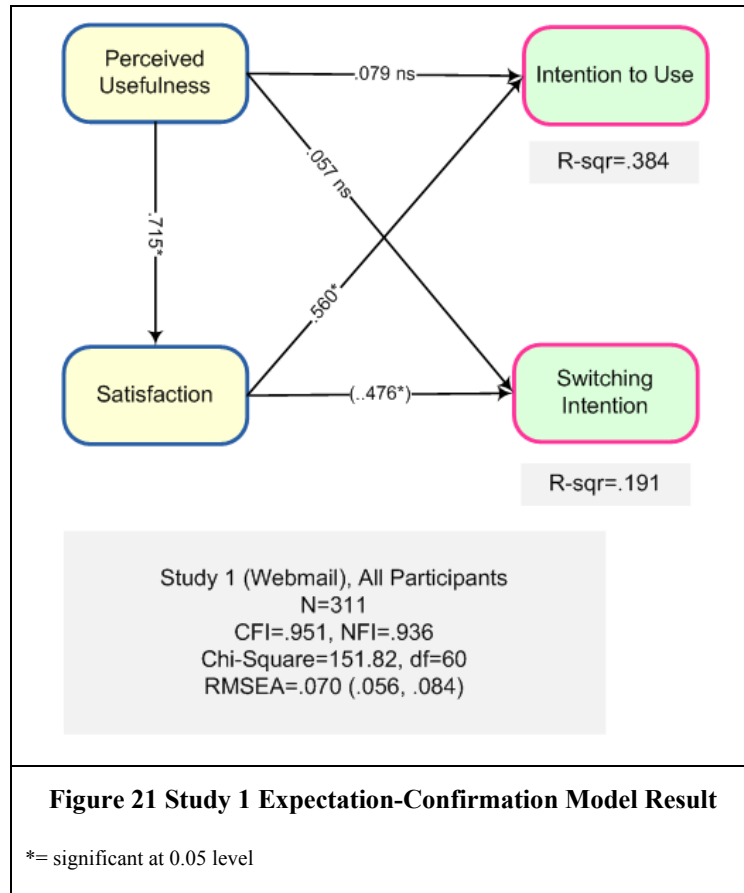
ECM is the earliest IS continuance model that has been introduced to the study of post adoption behaviors. As one of the most successful models to explain IS use, ECM demonstrates strong explanatory power for IS continuance behavior. It is expected ECM can explain about 41% variance of IS continuance behaviors (Bhattacharjee 2001).

The model comparison is conducted on three sets of data: the data set with all participants at Time 1, the data set with continued participants at Time 1, and the data set with continued participants at Time 2. The results are shown in the table below. The proposed IS continuance model explains more variance of continuance intention than TAM and ECM at Time 1. At Time 2, however, TAM does a better job (55.2%) than the proposed IS commitment model (49.7%) and ECM (20.4%).

For switching intention, however, the proposed IS continuance model outperforms TAM and ECM in all cases. The result indicates that through the

incorporation of calculative and normative commitment, the proposed IS continuance model can explain variance in switching intention that has been overlooked by previous models.





The following table summarizes the results from model comparison. The numbers shown in the table are model R^2 , i.e., the variance accounted for by a particular model.

	T1 All (N=311)		T1 Continued (N=233)		T2 Continued (N=233)	
	CI	SWI	CI	SWI	CI	SWI
This Model	0.449	0.265	0.529	0.192	0.497	0.302
TAM	0.358	0.117	0.442	0.099	0.552	0.061
ECM	0.384	0.191	0.465	0.153	0.204	0.067

Table 14 Study 1 Model Comparison (Variance Accounted For, VAF)

Note: CI-continuance intention; SWI- switching intention; TAM-Technology Acceptance Model (Davis 1989); ECM-Expectation-Confirmation Model (Bhattacharjee 2001)

CHAPTER 6 – STUDY 2 COLLABORATIVE PLATFORMS

6.1 Motivation

Study 1 successfully validated the IS commitment instrument and the research model in the context of Web mail systems. Although the research model has been empirically validated, there are several limitations in Study 1 that need to be further studied.

First, the outcome variable in Study 1 is limited to users' continuance intention, which includes intention to continue use and intention to switch to an alternative system. However, although theoretically intention is a good indicator of actual behavior, there are reports that intention and actual behavior are disconnected in empirical research. There is a need to study the relationship between intention and actual behavior to attest that user commitment is associated with actual continuance behavior.

Second, the technology context of Study 1 is personal Web mail systems. Since the adoption of personal Web mail systems are mostly an individual decision, the research context may not appropriately reflect individual adoption and continuance of information systems in organizations, making the conclusion less convincing to IS managers.

Third, one limitation of a cross sectional survey is the threat of common source and common method biases in measuring model constructs. Although Study 1 employs longitudinal studies, the self-reported data also make the conclusion vulnerable to common method biases and social desirability bias. To address this issue, there is a need to measure actual system usage from an independent source, ideally objective measurement.

Fourth, although Study 1 involves alternative systems, the likelihood of switching to an alternative system is quite low given the short interval between the two studies. In other words, people are not very likely to decide to switch Web mail systems in one month's time period. Therefore, a second study is conducted to revalidate this research model in a different technology context, ideally when alternative systems are available and switching to an alternative is possible.

6.2 Administration

This study incorporates longitudinal observations of users' behavior from initial adoption to commitment. The purpose of this study is to observe the actual use of adopted information systems and users' possible switching behavior. Again, participants will be undergraduate students enrolled in a business class. At the beginning of the fall semester, participants are introduced to two comparable group collaboration platforms, i.e., Microsoft SharePoint Server and WebCT e-Learning. The two platforms have similar features but are reasonably different from each other so that they are both easily adopted but there is a learning curve to completely switch from one to the other.

After a brief training, the participants are instructed to establish accounts with both services and agree to give the researcher full access to their accounts. All participants are asked to upload their assignments (finished or in-progress) to either one of the services. In about a month from the initial training, the participants are asked to take a survey on their initial IS commitment, continuance intention, and other information. This survey is repeated once in the semester in about a month from the initial survey to study users' commitment change over time. In addition to the follow up measures of users' commitment and intention, users' actual usage data are collected. The

participants are asked to report the extent to which they used the collaborative platform in the past month by filling out the frequency of use (FREQ) and the time they spent on using the system (TIME). These two questions constitute a self reported use construct (USE_SELF) as one variable of actual use. On the other hand, users' usage behavior is recorded on the server and the number of posts they created is used to constitute an actual use variable (USE_ACT).

A total of 70 responses are found matched across two data collections. The demographic information of the participants is reported in the following table.

GENDER	Frequency	Percent
Male	52	74.3
Female	17	24.3
Undisclosed	1	1.4
Total	70	100.0

AGE	Frequency	Percent
18-22	52	74.3
23-27	12	17.1
28 and above	5	7.1
Undisclosed	1	1.4
Total	70	100.0

Table 15 Study 2 Sample Demographic Information

6.3 Validity Test, EFA, and CFA

The collected data are analyzed using SPSS 13 (Norusis 2006) and PLS-graph (Chin et al. 1996). Partial least squares (PLS) is a component based structural equation modeling (SEM) technique capable of integrating measurement and structural models. One advantage of PLS compared to other factor-based covariance techniques (e.g., EQS) is that PLS has minimal demands on measurement scales, sample size, and residual

distributions (Chin et al. 1996). The sample size in this study is only 70 and EQS generally requires over 200 data points to make stable and reliable estimations, therefore PLS becomes the best analysis tool for this particular study.

The EFA test is conducted in SPSS 13. All items are entered at the same time. The items for each proposed construct are expected to load on the same factor with the loadings over 0.60. The cross loadings of these items are expected to be below 0.40. The EFA result indicates overall satisfactory convergent and discriminant validity. The cross loadings of CI03 on AC at Time 1 and NC01 on CI at Time 2 are marginally over the limit. Given other items are correctly loaded on their each factors, this slight cross loaded item is acceptable in PLS analysis.

	1	2	3	4
AC01	0.853	0.157	0.065	0.250
AC02	0.929	0.121	0.081	0.217
AC03	0.927	0.114	0.152	0.104
NC01	0.037	0.150	0.897	0.027
NC02	0.217	0.096	0.908	0.023
NC03	0.031	0.268	0.764	0.242
CC01	0.204	0.768	0.375	-0.073
CC02	0.148	0.936	0.136	0.077
CC03	0.067	0.924	0.097	0.132
CI01	0.043	-0.079	0.195	0.863
CI02	0.248	0.198	-0.028	0.891
CI03	0.417	0.078	0.076	0.720

Table 16 Study 2 EFA, Time 1

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment; CI-continuance intention

	1	2	3	4	5
AC01	0.177	-0.054	-0.159	0.854	-0.137
AC02	0.106	0.127	-0.188	0.878	0.110
AC03	0.265	0.127	-0.226	0.876	0.042
NC01	0.458	0.702	-0.039	0.090	0.191
NC02	0.385	0.799	-0.136	0.057	0.180

NC03	-0.032	0.880	-0.042	0.104	0.203
CC01	0.205	0.669	0.009	-0.030	0.543
CC02	0.181	0.194	0.084	0.080	0.893
CC03	0.124	0.391	0.062	-0.081	0.845
CI01	0.852	0.326	-0.190	0.162	0.165
CI02	0.893	0.254	-0.186	0.216	0.076
CI03	0.790	0.041	-0.294	0.313	0.220
SWI1	-0.161	0.048	0.856	-0.242	0.127
SWI2	-0.115	-0.092	0.957	-0.184	0.049
SWI3	-0.247	-0.117	0.882	-0.148	-0.025

Table 17 Study 2 EFA, Time 2

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment; CI-continuance intention

The CFA test is conducted in PLS-graph. All results suggest satisfactory convergent and discriminant validity.

Construct	Item	Composite Reliability	Loading	Mean	Std. Dev	Skewness	Kurtosis
AC	AC1	0.941	0.920	4.814	1.467	-1.000	0.789
	AC2		0.939	4.671	1.411	-0.632	0.334
	AC3		0.893	4.771	1.466	-1.095	1.550
CC	CC1	0.954	0.926	3.600	1.645	0.009	-1.096
	CC2		0.953	3.543	1.742	0.079	-1.162
	CC3		0.926	3.500	1.648	0.090	-0.880
NC	NC01	0.923	0.932	4.743	1.700	-0.495	-0.535
	NC02		0.887	4.400	1.592	-0.445	-0.049
	NC03		0.863	5.343	1.423	-0.759	0.230
CI	CI1	0.970	0.993	4.986	1.367	-1.094	1.200
	CI2		0.956	4.714	1.616	-1.024	0.353
	CI3		0.972	4.800	1.528	-0.981	0.681
	CI4		0.922	4.657	1.658	-1.060	0.658
USE_SELF	FREQ	0.962	0.962	4.657	1.693	-0.122	-1.059
	TIME		0.962	5.429	3.858	0.304	-1.500
USE_ACT	POST			4.983	4.096	1.024	0.071

Table 18 Study 2 Descriptive Data and Confirmatory Factor Analysis

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment; CI-continuance intention; USE_ACT-actual usage; USE_SELF-self reported usage

	AC	NC	CC	USE_ACT	CI	USE_SELF
AC	0.918					
NC	0.348	0.894				
CC	0.397	0.484	0.935			
USE_ACT	-0.053	0.276	-0.060	1.000		
CI	0.807	0.441	0.549	-0.118	0.943	
USE-SELF	0.122	0.279	0.110	0.388	0.081	0.943

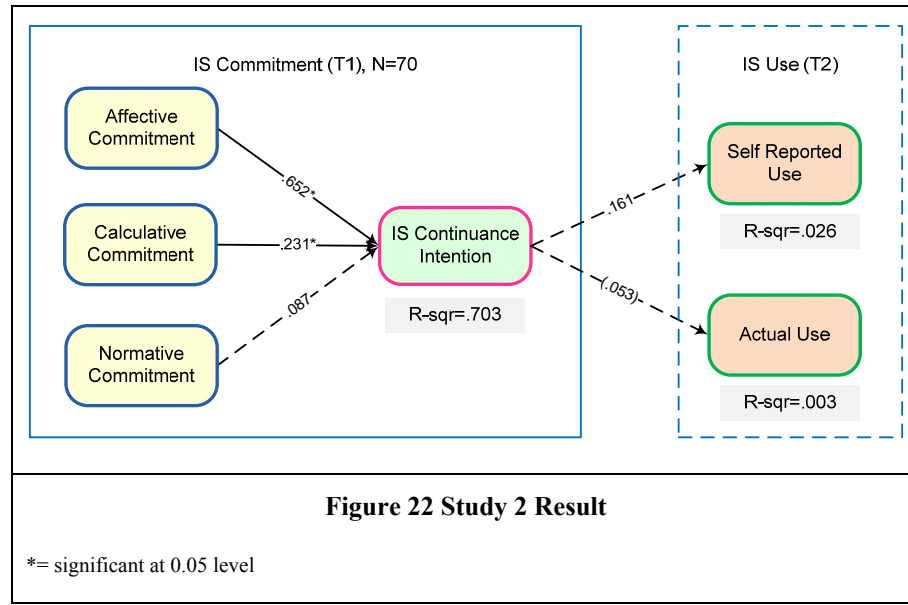
Table 19 Study 2 Correlation Table

Note: AC-affective commitment; CC-calculative commitment; NC-normative commitment
CI-continuance intention; USE_ACT-actual usage; USE_SELF-self reported usage

6.4 Model Test

The structural model is tested in PLS-graph and the result is shown in the following figure. The baseline model test successfully validates H1a, H2a, and H3a, and also replicates the results in Study 1. The result shows that the baseline IS commitment model consistently explains a large proportion of variance in user’s continuance intention across different technology context

However, the paths between continuance intention and actual use, either self-reported use and actual use, are not significant. Therefore, continuance intention is not found to be a predictor of users’ actual usage.



6.5 Discussion

The intention based commitment model does not successfully explain users' actual usage of collaborative platforms. The concept of personal norm may help explain this discrepancy. Contrast to social norm, the concept of personal norm, i.e., espoused values embedded in one's self-concept based upon the social value systems has been found to shape personal commitment (Malhotra et al. 2005). Only when the social value system corresponds to individuals' self value system will the normative factors become salient. When a user perceives strong external influence on the use of an information system, for example, a professor's choice of statistical software package in class, although the use of IS remains voluntary and the user is given the freedom to choose the application, the user would not practice his or her "freedom" rather comply with the norm although his or her intention may be against the norm. Therefore, users may not be particularly favorable towards mandates, coercion, and compliance, demonstrating departed intentions from

actual behavior. Arguably, the setting of this study may better reflect the real environment of IS use in organizations because of the presence of strong norm.

Alternative Model

An alternative model is provided from a behavioral commitment perspective suggesting that IS commitment can be used to directly predict actual usage without being mediated by intention. A test of the direct effect of IS commitment on actual usage yields significantly higher VAF than the intention based model. IS commitment accounts for 9.7% of variance in self-reported use and 15.6% of variance in actual use.

The significance test for path weight shows one significant path, i.e., normative commitment on self-reported use. Given this survey and data collection is conducted in an on-going class and the platforms are introduced for group communications, participants may perceive high norm, either from the instructor or from their team members, regarding the use of one particular platform application. Therefore, the obligation-based normative commitment becomes the strongest predictor to self-reported use. The participants' comments seem to resonate with this finding.

*“The biggest reason to use [a particular collaborative platform] is **most of the professors use it...**”*

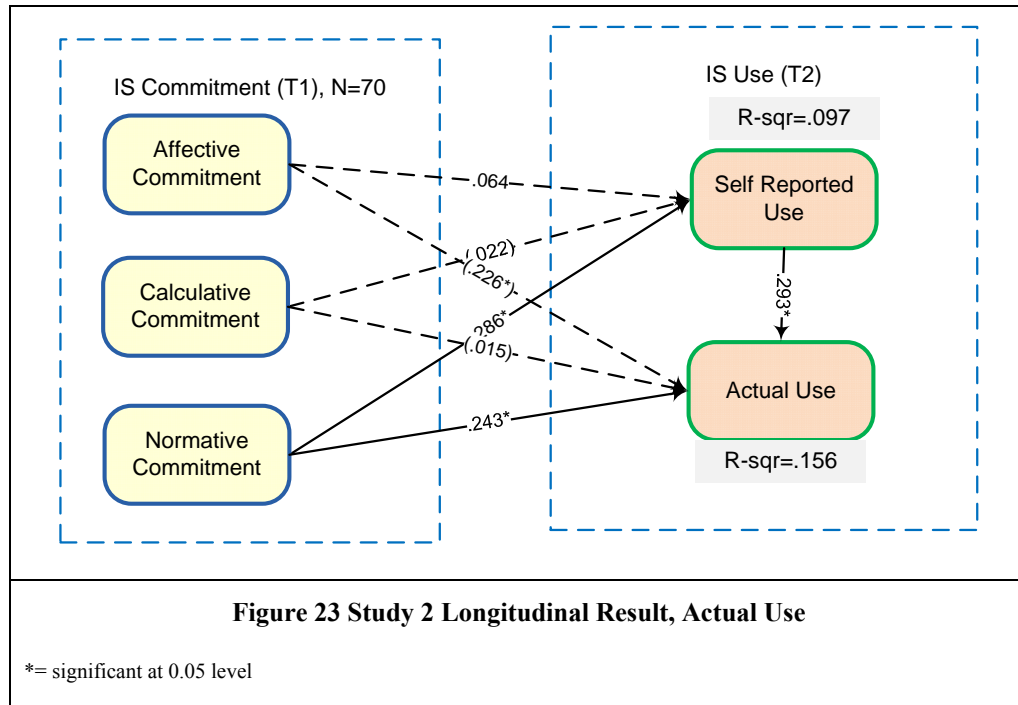
*“... because **most people around of me use that**. It's pretty useful to **use something everybody use...**”*

The study also reveals two significant paths between IS commitment and users' actual use. Affective commitment is significantly, though negatively, associated with actual use and normative commitment, again, is significantly associated with actual use. The negative path between affective commitment and actual use draws some interesting discussions.

Both the theory and previous studies indicate that affective commitment is a strong predictor to users' continuance intention. According to TRA and TPB (Ajzen 1985; Ajzen 2002; Ajzen et al. 2000; Fishbein et al. 1975), users' intention can be used to well predict users' behavior. However, these links are all broken in this study. The participants' comments may help translate this problem:

I do not like [a particular collaborative platform] but I have to use because all of my classes are on it.

The negative path between affective commitment and continuance intention comes from a conflict between affective commitment and normative commitment. If one commitment dimension is dominantly stronger than the other ones and there is a conflict between the dominant one and another commitment, the other commitment may show a negative link to the continuance intention. This can be verified by testing the direct relationship between affective commitment and continuance intention without partial out normative commitment and the result shows positive and significant ($t=2.305$, $p<0.05$).



The model test results are summarized in the following table.

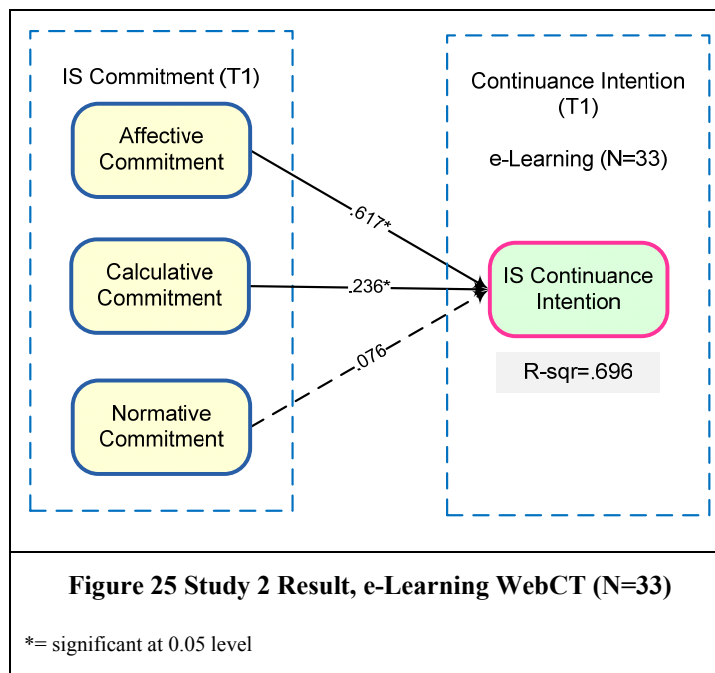
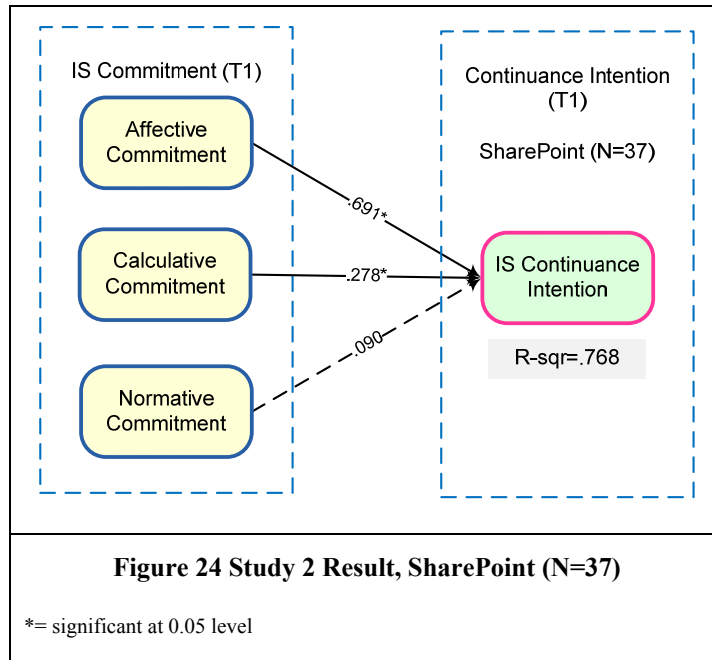
	T1 (N=70)	T2 (N=70)		
	CI	CI	USE (Self Reported)	USE (Actual)
R²	70.3%	46.7%	9.7%	15.6
AC	0.652*	0.389*	.064	(0.226)
CC	0.231*	0.077	(0.022)	(0.015)
NC	0.087	0.394*	0.388*	0.243*

Table 20 Study 2 Summary of Result, Overall Model

Comparison between Collaborative Platforms

A comparison between the use of two different platforms is conducted. Among all 70 participants, 37 chose to use Microsoft SharePoint Server and 33 chose to use e-Learning WebCT as the collaborative platform. The structural model test confirms again

that the IS commitment model can consistently explain a large proportion of users' IS continuance intention and affective commitment and calculative commitment are the two most influential commitment dimensions on user's continuance intention.



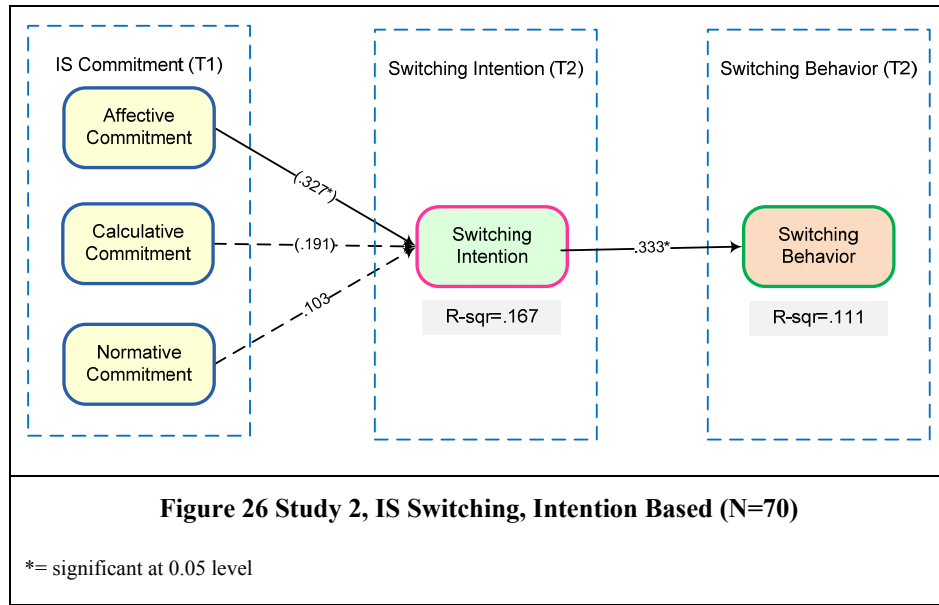
Switching Intention and Switching Behavior

This study provides two competing collaborative platforms for users to choose from. They are allowed to adopt either one platform to start with and are free to switch between the two platforms. In the survey at T2, the participants are asked about whether they have switched from their originally selected platform and this variable is used to analyze their switching behavior.

The data suggest that users' switching intention is negatively influenced by their affective commitment. Users' low affective commitment will increase their intention to switch to an alternative system. This significant path corresponds to the definition of IS commitment in the model development chapter. The other commitment dimensions, however, are not found to be significantly influencing users' switching intention. Overall, users' IS commitment explains 16.7% variance in their switching intention.

There is a significant path between users' switching intention and their switching behavior. In this study, users' switching intention is positively associated with their switching behavior and accounts for 11.1% of variance in self-reported switching behavior.

It is not surprising that the switching intention explains only a small proportion of variance in self-reported switching behavior. The switching intention construct is used to measure behavior expectancy; however, in this study only past usage behavior is traceable.



CHAPTER 7 – GENERAL DISCUSSION

7.1 Revisiting Research Questions

This section summarizes the major findings of this research and briefly answers the research questions raised in the first chapter of this dissertation.

RQ1: Can IS commitment explain user's intention to continue to use an adopted information system?

Yes. This question is answered by conceptualizing an IS commitment model and empirically validating the model using longitudinal data collected from various technology context. As a result, a definition of IS commitment is provided and an instrument scale is developed to measure users' commitment to an information system.

Empirical data was collected to validate the research model in multiple iterations. The results repeatedly show that IS commitment, i.e., affective commitment, calculative commitment, and normative commitment, consistently explain about 40% to 70% of variance in users' continuance intention. This finding has been replicated using data collected from Web mail system use and team collaboration platform use. Desire-based commitment, i.e., affective commitment is found to be the most influential commitment on users' continuance intention. Cost-based commitment, i.e., calculative commitment, also demonstrates strong relationship with users' continuance intention.

RQ2: Can IS commitment explain user's intention to switch to an alternative information system when the current system is adopted and used for a period of time?

Yes. The proposed research model incorporated IS commitment has found to be able to explain approximately 20-30% of variance in users' intention to switch. This is consistent with other studies in the literature. Bansal et al. (2004) reported that the three-

dimension model can explain $R^2=29\%$ of variance in consumers' intention to switch service providers. As one of the first attempts to introduce commitment models into the study of IS users' switching behavior, this research has yielded satisfactory results in support of the hypotheses.

RQ3: Can IS commitment account for more variance in continued use of IS than other prevalent models?

Yes. A model comparison shows that the proposed IS commitment model explains more variance in users' continuance intention than Expectation-Confirmation Model in a longitudinal setting. The proposed model also explains more variance than TAM in the T1 data set but in the T2 data set the proposed model explains a bit less variance in continuance intention than TAM.

In terms of switching intention, the proposed model explains more variance than ECM and TAM in all settings.

RQ4: Does users' technological inertia affect their intention to continue to use an adopted system as well as to switch to an alternative system at a certain commitment level?

No. This research does not find support to the hypotheses that users' technological inertia moderates the relationship between users' commitment and their continuance intention and switching intention. Technological inertia as a new construct has not been well studied in the IS literature, therefore little is known as to what roles it plays in users' post adoption commitment. This research proposes a moderation role of technological inertia based upon previous findings in marketing, however, additional theoretical work as well as empirical evidence is needed to promote our understanding of

technological inertia. The concept of technological inertia will be further discussed in the following section.

7.2 Normative Commitment

The effect of social influence has received extensive attention in the IS literature. In TRA based model, e.g., TAM, social influence is conceptualized as subject norm or social norm, but the effect of social influence on users' behavioral intention has yielded mixed results in different studies. Although the initial TAM studies excluded social influence from the determinants of behavioral intention, subsequent studies reported more favorable results in support of social influence as a predictor to behavior.

This argument has shifted its focus from whether social influence plays a role in users' adoption of technologies to how social influence impacts users' intention and behavior in adoption and post-adoption stages. Recent research suggest that the effect of social influence on users' intention and behavior be mediated by internalization, identification, and compliance (Malhotra et al. 2005). Simply strong social influence is not necessarily leading to strong behavioral intention but through internalization and compliance would social influence affects users' behavioral intention.

One aspect that might have been overlooked in this research is social conformity. Normative commitment may have its root in social obligation and social conformity. Obligation-based commitment derives from social exchange such that the process of internalization is implied. Obligation-based commitment may be salient when the context of IS use is volitional and non-hierarchical. However, compliance-based commitment is motivated by the evaluation of potential reward and punishment. Users' overt intention and behavior may deviate from their internal cognition due to control,

pressure, or surveillance. This may be often seen in an organizational context, especially in an organization with strong hierarchical influences. Therefore, when compliance is present, individuals' use of IS in organizations needs to be studied differently by examining users' motivation to comply with social norms as well as their self-regulation in terms of internalization of external motivations.

7.3 Technological Inertia

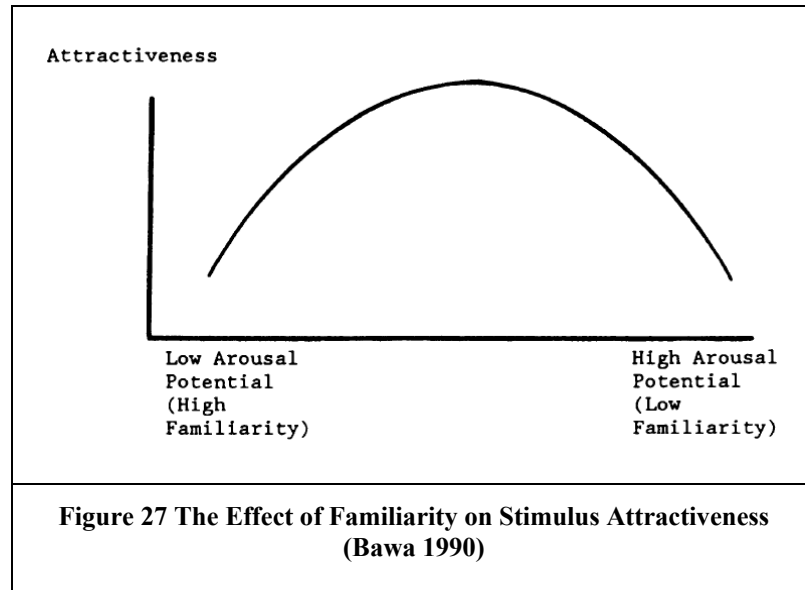
The nature of inertia has been understood differently contingent upon the context. Some people believe inertia is a state of remaining inactive (Tykocinski and Pittman 1998), some people describe inertia as a pattern of repeating the same behavior (White and Yanamandram 2004), some people suggest inertia is a tendency of resistance to change (Mokyr 1992), and some people refer to inertia as one aspect of loyalty and habit (Bawa 1990; Jeuland 1979). Although there are many different perspectives on the notion of inertia, one important consensus among most researchers is that inertia is a function of past behaviors and must be understood in a context that repeated behaviors are possibly involved.

One most frequently referenced type of inertia in the psychology literature is inaction inertia, which refers to the decreased likelihood of subsequent actions due to initial inaction, i.e., forgone attractive action opportunities (Tykocinski et al. 1998). A typical example is that when one consumer missed a clearance sale of clothing with a 50% price reduction, this consumer would be less likely to purchase the same items in subsequent sales opportunities when the discount offerings seem to be less attractive. Inaction inertia reflects a cognitive bias that people tend to evaluate attractive past experiences as a cost to avoid similar actions in future behaviors. Studies find that

inaction inertia may be reduced by increased avoidance costs (Tykocinski et al. 1998). Therefore, inaction inertia is the product of a cognitive process dependent on a specific behavioral context.

However, inertia is not necessarily a function of context. Another perspective believes there is a tendency existing in between repeated behaviors and such tendency may be attributed to inertia as a heuristic, or a result from minimized “cost of thinking” (Shugan 1980). For example, when a consumer is satisfied with a product or service, he or she may likely repeat the purchase of the same product or service in the next occasion without repeatedly evaluating its characteristics. Inertia is found to be the driving force toward routinized behaviors (White et al. 2004). On the other hand, not all behaviors are routinized and not all (or probably no) routinized behaviors become indefinite. People may become bored with the same behavior over time. There is another driving force, i.e., variety-seeking, that may play a role in routinized behaviors.

A search of literature confirms that variety-seeking and inertia tendencies may co-exist within an individual (Bawa 1990) suggesting that the effect of inertia may be diluted by the effect of variety-seeking. Berlyne’s (1954) theory of exploratory behavior provides an “inverted-U” shaped curve to explain attractiveness as a function of arousal (or familiarity). The relationship between attractiveness and familiarity is curvilinear because of the joint effect of inertia and variety seeking (Bawa 1990). When a person is unfamiliar with a stimulus, curiosity (variety seeking) may increase attractiveness resulting in repeated behavior and inertia. When one is very familiar with a stimulus, the level of attractiveness may decrease due to boredom. The effect of inertia, in turn, may be taken the place by variety seeking.



The hybrid model suggests that individual level inertia needs to be considered as a time, context, and personal dependent variable. Technological inertia, in particular, may be studied in a model that takes time, system, and personal characteristics into account. The non-significant moderation effect of technological inertia in this research may be attributed to the lack of appropriate controls of time and system (i.e., user experience with the system being studied) in the survey study.

7.4 Intention and Behavior

Many prior studies on IS adoption and use employ intention as a proxy for adoption or use behavior and such substitute seems to become a routine in the IS research. We have been warned that even well-developed intention-based predictors explain only a small amount of variance of actual IS use (Kim et al. 2005b). Therefore, simply explaining intention is not sufficient for in-depth understanding of IS use. Actual use may not be corrected predicted by use intention in empirical studies. The empirical studies in this research confirmed this argument.

Theoretical work on this dissertation suggests that the IS commitment model provides a complementing perspective on continued IS use. As the data suggest, IS commitment can explain more variance in users' actual use behavior, both self-reported and observed. Although such finding is exploratory in nature, it provides implications to future research, especially when IS use is studied in a situation where strong norm is present. It is possible that self-reported intention and usage behavior are biased or influenced due to concerns such as social desirability or perception of norm. Therefore, interpreting intention must be very careful and any conclusions regarding actual behavior drawn from intention must accompany rigorous examinations of social desirability and social norm.

CHAPTER 8 – CONCLUSION

8.1 Contributions

This research contributes to existing IS research in many ways. First, this research may be among a few attempts in the IS literature to explain users' sustained use of technologies from an IS commitment perspective. Prior research on IS adoption and use have a focus on personal beliefs such as usefulness and ease of use, however fails to examine the psychological link between users and information systems therefore leaving some other factors, such as users' cost concerns, normative influence process, etc., mostly unexamined. As the importance of effective use of IS being emphasized in the IS literature, this research provides a perspective to examine users' loyalty and attachment to adopted information systems in hope of closely analyzing users' motivation to use IS in organizations. In addition, by bringing attention to affective, calculative, and normative factors, the research investigates IS commitment as a multifaceted construct such that the practical implications of this research can be easily drawn from the distinct dimensions.

Second, the research may be one of the earliest attempts in the IS literature to examine user's switching behavior when an information system is adopted and alternatives are available. Users' continuance intention and switching intention are two related but distinct concepts. Switching intention is more closely related to users' technological inertia therefore is less explained by user's IS commitment. This research also reveals users' dual-intent which refers to the fact that users' continuance intention and switching intention are both high when they are hesitant about switching decisions.

Third, this research also contributes to the literature by decomposition of the IS commitment and providing an illustration of its antecedents. Although a few prior studies have applied the commitment theories within other context (Li et al. 2006; Malhotra et al. 2005), this study is one of the first to introduce a detailed set of antecedents to IS commitment. Grounded upon prior studies, this research examines the roles of satisfaction, perceived system performance, sunk cost, switching cost, subjective norm, and descriptive norm and their effect on users' continuance and switching intentions. In addition, the study on technological inertia, although not significant, provides some exploratory results that may help identify more factors in future research.

Fourth, this research is among a few empirical studies that examines actual usage behavior rather than stopped at intention. Studying actual behavior helps exclude the effect of common method bias and social desirability. The results show that the proposed IS commitment explains less variance in users' actual behavior than in their intentions, suggesting possible inflation of VAF due to common method bias and self-report bias. The results also indicate that IS commitment may serve as a direct determinant of users' actual continuance and switching behavior without being mediated by intentions. The actual usage test warns against using self-reported intention as a predictor to actual behavior, especially when strong social influence is present in the organization.

Fifth, this research provides support to the advantage of the proposed IS commitment model over TAM and ECM. By addressing cost concerns and social influence, the proposed IS commitment model provides a more comprehensive view of IS continuance than the prevalent model. They study results consistently show that calculative commitment is able to account for a part of variance in users' continuance and

switching intention in addition to affective commitment, implying cumulative cost becomes critical to our understanding of IS continuance.

8.2 Implications to Practice

Understanding IS continuance will offer tremendous benefits for the industry. This research introduces an IS commitment model which may be used to understand the dynamics of IS continuance in an organization.

For IS vendors, the fierce competition is often a function of substitutable information systems. Take for example the statistical software industry that often relies on revenues from annual individual and site licenses. While SAS, SPSS, and Minitab may each claim significant product differentiation advantages, all three programs offer a similar set of features. Subsequently, organizations may agree to initially adopt and use all three software programs. However, if after a year, the organization finds that individual members continue to use a particular product more often than others, it will most likely decide to not renew licenses of the other two competing products. As a result, adopted yet underused information systems cost organizations in the U.S. millions of dollars every year (Markus and Keil 1994). Given that continuous use rather than initial acceptance of an information system is crucial for organizations, this research will help practitioners to better understand the preconditions for IS continuance.

Modern businesses more and more depend on technologies to increase productivity and build up competitive advantages. Fast changing work environments requires employees to be adaptive to newly adopted technologies and information systems. It is critical for managers to understand the difference between use and committed use. Intrinsically motivated use of IS is also associated with full engagement,

high performance, and increased productivity. However, use of IS with a lack of commitment could result in the “productivity paradox” such that technology becomes the inhibitor dragging down the overall performance and efficiency. The IS commitment model helps managers capture the dimensions of commitment as well as the antecedents to commitment so that they may plan strategically to increase users commitment to adopted information system and achieve quality use of IS.

For managers, motivating effective use of information infrastructure and resources becomes a challenging task. Swift adoption of new information systems may serve as a double-edge sword. On one hand, companies may save costs on IT implementation project and hope for the employees to make best use of the system and start to create value soon. On the other hand, however, rush implementation without user commitment to the system may result in a lack of motivation and lead to implementation project eventually to fail. The IS commitment model suggests that user commitment grows over time, especially affective commitment and calculative commitment. Therefore, establishing appropriate norm at the early stage of post adoption may help promote normative commitment and further turn into calculative commitment. In the case of implementing new systems, it may be important to examine users’ calculative commitment to the old system which may result in resistance to the new system. Hence, advance measures may be needed to reduce users’ perceived switching cost so that the rejection of new systems may be prevented.

8.3 Limitations

Like most empirical studies, the research is not without limitations. First, the participants were undergraduate students and their perceptions of commitment and

continuance may not be reflective of a general population. In this research, the technology context is relevant to the participants and the survey is captive to their psychological status, however, the use of IS by college students for studying purposes may be different from the settings in typical business operations. Therefore, this research may suffer from the threat of external validity which limits the conclusions from being generally applied.

Second, the findings are constrained to Webmail systems and group collaboration platforms and need to be validated in light of technologies in other categories, especially technologies for organizational use such as ERP systems or proprietary information systems. Prior research has reported that similar models perform differently in various technology settings. Therefore, conclusive findings may not be drawn until the proposed IS commitment model receives stringent scrutiny in multiple information systems.

Third, as Burton-Jones and Gallivan (2007) indicated, studying system usage (use) at a single level of analysis may be disjointed from how information systems are used in practice. The definition and measurement of system use are quite ambiguous and inconsistent in the IS literature. To pursue a deeper understanding of IS continuance, further investigation in operationalizing system use measure may be needed before a more complete picture can be drawn. Such requirement also calls for diverse research methods to be applied in this area of research in order to evidently advance our knowledge and understanding of IS continuance and use.

8.4 Future Research

Although this research has achieved its preset goals, a number of questions remain unanswered at this time and require further investigations. First, the role of normative

commitment and its influencing mechanism are still not very clear. A search of literature suggests further examination of users' internalization and self-regulation processes.

Normative commitment may be understood by separation of internalization, which is a process that transforms external regulations into internal motivations (Black and Deci 2000; Malhotra et al. 2005), and self-regulation, which is a process that comply with the external regulation by controlled behaviors. The differences between these two processes may offer insightful explanations as to why normative commitment fails to explain enough variance in users' continuance intention and switching intention.

Second, the users' IS commitment as well as its antecedents are not static and they constantly change over time. Although the longitudinal studies in this research provide some exploratory observations, the results should be viewed only as preliminary evidence. Further exploratory and confirmatory studies are needed to quantitatively and/or qualitatively examine users' commitment change over time.

Third, the measure of actual IS use remains a popular topic in the IS literature. This research employs two conventional measures, one is self report time and frequency of use and the other is productivity count. However, both of the two measures suffer from a lack of richness in the measurement. As pointed out by Burton-Jones and Gallivan (2007), one must distinguish the function of use and the structural of use. The former refers to use at individual level and the latter refers to the use involving interactions in a collective setting. For example, the use of SharePoint server for individual search and backup is a different use from the use for group collaboration. However, this research has not captured the richness of measuring IS use and this gap is expected to be fixed by future research

Fourth, the three-dimensional model has been criticized for having strong correlation between the commitment dimensions. This research also observed high correlation between normative commitment and calculative commitment. Prior studies also reported high correlations between affective commitment and normative commitment. Future study may need to further refine the scale of measuring IS commitment and further separate the commitment dimension. In addition, it is not impossible that the commitment dimensions have some level of interactions, for example, the interaction between affective commitment and calculative has been found to influence users' switching intention (Bansal et al. 2004). Future research may examine the interactions of commitment dimension and their effect on users' continuance intention and behavior.

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APPENDIX

Appendix A – Instrument

<i>Personal Characteristics</i>			
Construct	Sub-Construct	Item	Item Description
Gender		GENDER	I am a _____
Age		AGE	I am _____ years old
<i>Technology Use</i>			
Construct	Sub-Construct	Item	Item Description
Frequency of Use		FREQ	On average, how frequently did you log in [this technology] website over the past month?
Quantity of Use		TIME	On average, how much time did you spend on [this technology] website every time you logged in?
Email sent		SEND	On average, how many emails did you send through [this technology] every day over the past month?
Table 21 Instrument Items, Background Information			

<i>Technological Inertia</i>		
Construct	Item	Item Description
Technological Inertia	INR1	I hesitate to change the technologies that I am using.
	INR2	Unless absolutely necessary, I am reluctant to change the technology that I am currently using.
	INR3	If I can, I will use stay with the technologies that I'm currently using.
Table 22 Instrument Items, Technological Inertia		

IS Commitment

Construct	Item	Item Description
Affective Commitment	AC1	I am glad that I chose to use [this technology] in the first place.
	AC2	I find [this technology] to be the best among available alternatives.
	AC3	Deciding to use [this technology] was definitely the right choice for me.
Normative Commitment	NC1	It would be better if I consistently use the same webmail service.
	NC2	I feel a sense of moral obligation to stay with [this technology].
	NC3	Even if there is a better service I would not feel right to stop using [this technology].
Calculative Commitment	CC1	I would have to give up a lot if I have to stop using [this technology].
	CC2	Discontinue the use of [this technology] now would require considerable personal sacrifice.
	CC3	Some aspects of my life would be affected if I stop using [this technology] now.
	CC4	I would find it difficult to stop using [this technology] right now, even if I wanted to.
Continuance Intention	CI1	As long as the present service remains the same, I will continue using [this technology].
	CI2	I plan to continue using [this technology] in the near future.
	CI3	I predict I will continue using [this technology] in the next month.
	CI4	My intention is to continue using [this technology].
Switching Intention	SWI1	I am looking for another Webmail system to replace [this technology].
	SWI2	I intend to switch to a competing system if I can find one.
	SWI3	I will make a switch to an alternative system as soon as I can find one.

Table 23 Instrument Items, IS Commitment

Commitment Antecedents

Construct	Item	Item Description
Perceived Performance	PFM1	[this technology] offers a high level of useful functionality.
	PFM2	[this technology] is practical for my immediate needs.
	PFM3	[this technology] offers reliable functionality.
Satisfaction	SAF1	I'm satisfied with the overall experience of [this technology].
	SAF2	My experience with [this technology] is pleasing.
	SAF3	I have a delightful experience with [this technology].
Perceived Sunk Cost	SKC1*	I have been using [this technology] for a long time.
	SKC2	I have put a lot into working with [this technology].
	SKC3	I have spent a lot of effort on [this technology].
	SKC4	I have done a lot with [this technology].
Perceived Switching Cost	SWC1	It may take me a lot of time to change from [this technology] to another Webmail system.
	SWC2	I feel that switching to another Webmail system will cost me a lot of effort.
	SWC3	On the whole, it is not an easy job to change my Webmail system.
	SWC4	For me, changing to another Webmail system would be a bother.
Subjective Norm	SBJ1	People that I often communicate with would like me to use [this technology].
	SBJ2	My friends would think that I should use [this technology].
	SBJ3	People around me would support my using [this technology].
Descriptive Norm	DESC1	Many people that I often communicate with use [this technology].
	DESC2	A large percentage of the people that I interact with use [this technology].
	DESC3	Many of the people in my social circle use [this technology].

Table 24 Instrument Items, IS Commitment Antecedents

*: Item dropped due to lack of convergent validity.

Appendix B – Interface

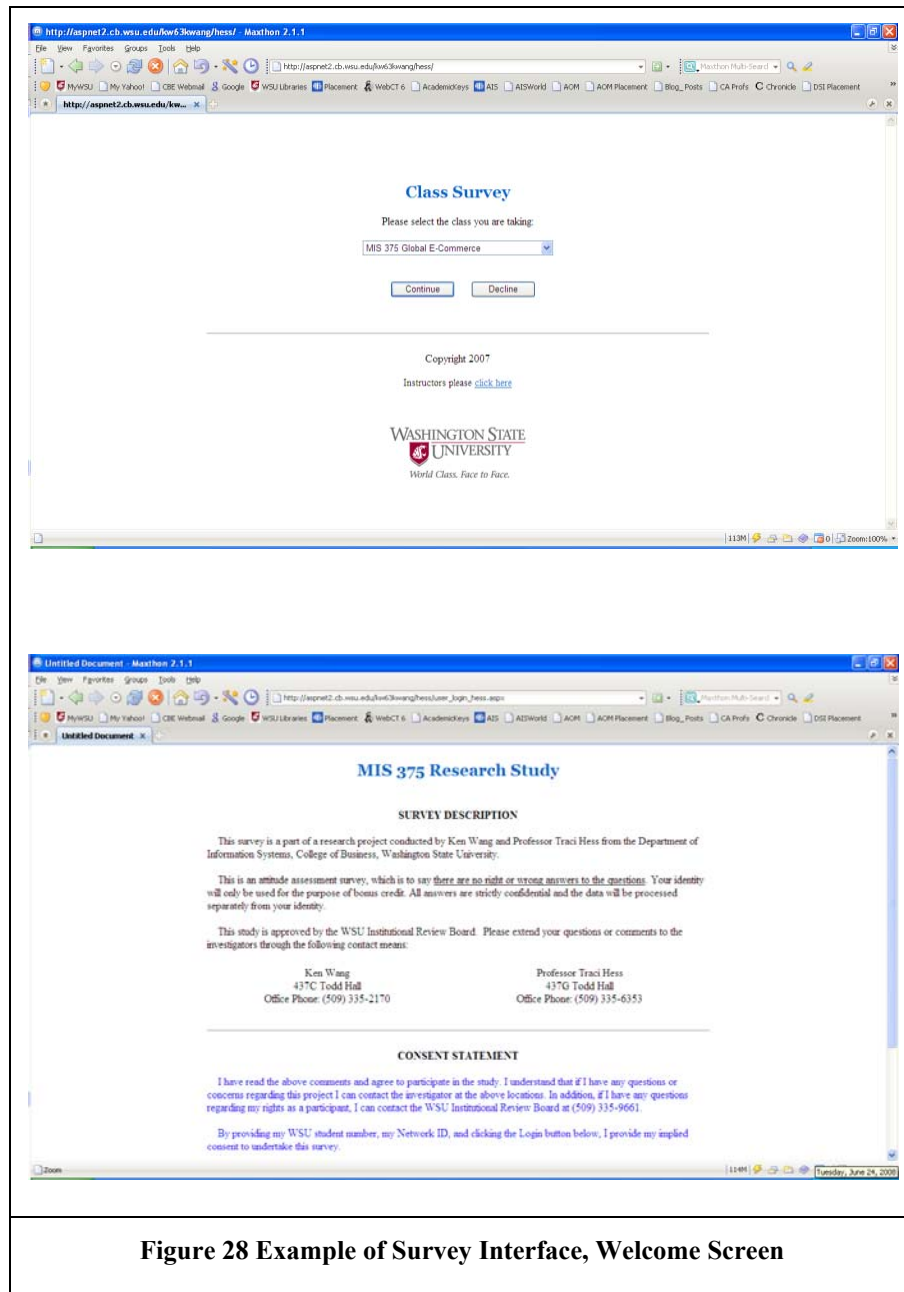


Figure 28 Example of Survey Interface, Welcome Screen

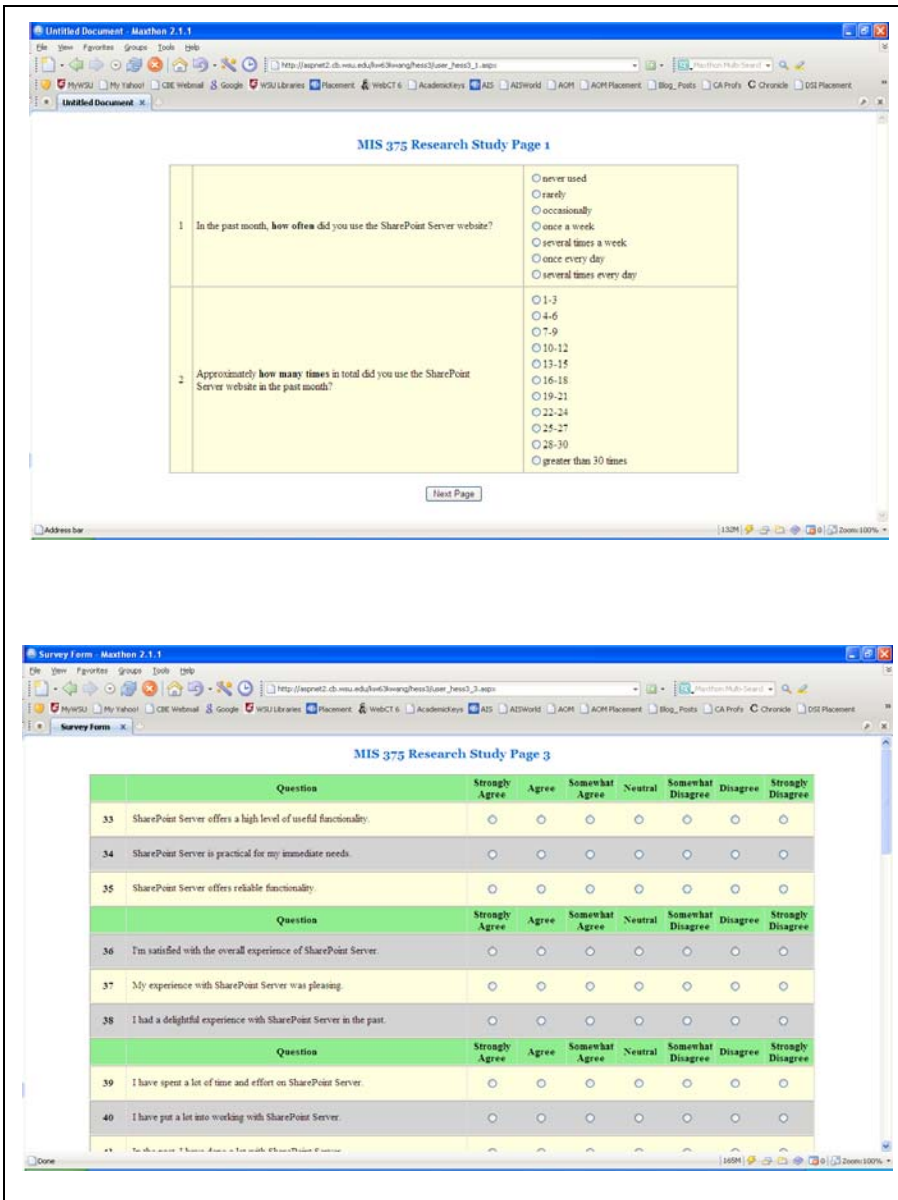


Figure 29 Example of Survey Interface, Survey Questionnaire

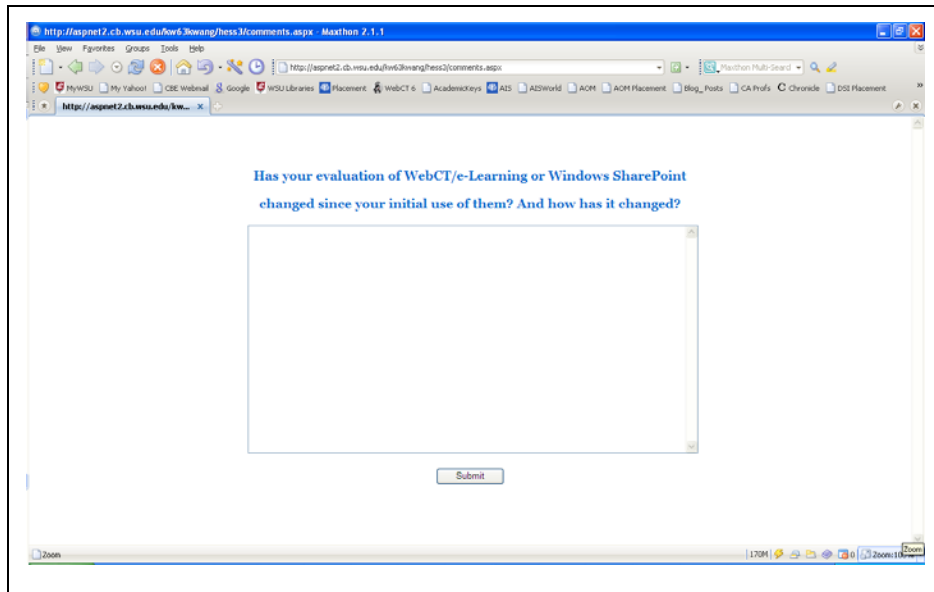


Figure 30 Example of Survey Interface, Open-end Question

Appendix C - Pilot Studies

Initial Scale Development

The instrument was developed in light of a scale development procedure proposed by DeVellis (1994). Initial items were adapted from Mowday et al.'s Organizational Commitment Questionnaire (OCQ) (Mowday et al. 1982). Two types of OCQ forms have been widely used in employee's commitment test. One is a longer 15-item version and the other is a shorter 9-item version. The original item bank for measuring TC is generated based upon a modified version of the 15-item OCQ.

The OCQ was widely used to test employees' commitment towards organizations (Mowday, Steers, and Porter, 1979). Modifications on OCQ were made to fit the technology context with the goal to develop a scale to measure users' commitment toward information systems. A specific technology needs to be selected to operationally measure and test people's commitment attitudes. Among many available technologies, Instant Messenger was chosen because of its popularity (widely adopted) among college students. Responses to each item were measured on a 7-point scale with scale anchors labeled: 1–strongly disagree to 7-strongly agree. The initial questions are provided below. An “R” denotes a negatively phrased and reversed scored item. Such denotation was not visible to the respondents.

1	I am willing to put in a great deal of effort beyond that normally expected in order to keep using this technology
2	I talk up this technology to my friends as a great technology to use
3	I feel very little loyalty to this technology (R)
4	I find that this technology matches my need
5	I am proud to tell others that I am using this technology
6	I could just as well be using a different technology as long as the type of work was similar (R)
7	The technology really inspires the very best in me in the way of performance
8	It would take very little change in my present circumstances to cause me to give up using this technology (R)
9	I am extremely glad that I chose this technology to use over others I was considering at the time I had chance to choose
10	There's not too much to be gained by sticking with this technology indefinitely (R)
11	Often, I find it difficult to agree with
12	I really care about the fate of this technology
13	For me, this is the best of all possibly available technologies
14	Deciding to use this technology was a definite mistake on my part (R)
15	I would be very happy to spend time on this technology
16	I enjoy using this technology
17	I really feel this technology is cool
18	I think I can easily become as attached to another technology as I am to this technology (R)
19	I do not feel I like this technology (R)
20	I do not feel emotionally attached to this technology (R)
21	This technology has a great deal of meaning for me
22	I do not feel a strong sense of belonging to this technology
23	I am not afraid of what might happen if I give up using this technology
24	It would be very hard for me to stop using this technology right now
25	Too much in my life would be disrupted if I decide not to use this technology
26	It wouldn't be too costly for me to abandon this technology
27	Right now, keep using this technology is a matter of necessity as much as desire
28	I feel that I have too few options to consider quit this technology
29	Once of the few serious consequences of giving up using this technology would be the scarcity of available alternatives
30	One of the major reasons I continue to use this technology is that withdrawal would require considerable personal sacrifice - another technology may not match the overall benefits I have here
31	The longer I keep using this technology, the harder it is to withdraw
32	It would be difficult for me to adapt to a new technology
33	Many changes would have to occur in my present circumstances to cause me to give up this technology
34	It would be hard for me to decide withdraw this technology at this time
35	It's an easy decision for me to abandon this technology
36	I would be willing to stick with this technology until it phases out

37	I would give up a lot by abandoning this technology
38	I am grateful for the opportunity to use this technology
39	I think that people these days switch too often from one technology to another
40	I do not believe that a person must always be loyal to one technology (R)
41	Switching from one technology to another does not seem problematic to me at all (R)
42	One of the major reasons I continue to use this technology is that I feel a sense of obligation to remain using this technology
43	If there is a better technology out there I would NOT feel it was right to switch

Table 25 Original questions adapted from OCQ

Data Collection

The data were collected from three undergraduate level business courses using online surveys. The sample is from the same school, same year students who take the same level of business classes. This arrangement ensures the homogeneity of the sample across multiple collections. A total number of 412 students voluntarily participated in the study in exchange for extra credits. Those who decided not to take this survey were given opportunities to make up their credits by submitting a one-page essay. No one ended up choosing not to take this survey.

The participants were asked to complete the online survey in a computer lab. The IRB approval information as well as a consent form was presented at the beginning of the survey. The survey was confidential and the student IDs were collected solely for the purpose of bonus credits. At the beginning of the survey, participants were asked to choose an instant messenger application (such as MSN, Yahoo!, AOL, etc.) that they most frequently use. As they completed the first page, their choice was used to generate the rest of the survey so that every participant was assigned to one group of instant messenger type. For those who reported not to have used any instant messengers, they

were asked questions regarding their general attitude toward instant messengers. This is to ensure they spend about equal time in the lab so as not to potentially distract others.

The entire survey process took approximately 15-20 minutes. All respondents reported their use of at least one Instant Messenger application. The most popular IM application is AOL Instant Messenger (AIM), and the second comes to MSN Messenger.

Data Analysis

The data set was analyzed using SPSS 13 and EQS 6.1 (Build 83) statistic software package. According to DeVellis (1994), the following indicators need to be reported: item means, item standard deviation, skewness, kurtosis, item-total correlations, and Cronbach's alpha.

First, the mean, the standard deviation as well as the skewness and kurtosis were calculated in SPSS. For most items, the absolute values of skewness and kurtosis are smaller than 1.5 except for NC01 and BI01. Overall, skewness and kurtosis do not raise a concern in this data set.

Second, the item-total correlation and Cronbach's alpha were calculated. All items yielded greater than .85 significant correlations with the total. The Cronbach's alpha were all greater than .7. Therefore, the data set indicated good internal consistency.

Description	Item	Mean	Std	Skewness	Kurtosis	Item-Total	Cronbach's Alpha
Affective Commitment	AC01	2.473	1.321	0.998	1.072	0.910	0.916
	AC02	2.663	1.423	0.885	0.525	0.930	
	AC03	2.609	1.351	0.862	0.873	0.936	
Continuance Commitment	CC01	5.102	1.717	-0.611	-0.691	0.887	0.865
	CC02	4.915	1.820	-0.486	-0.921	0.899	
	CC03	4.971	1.785	-0.518	-0.761	0.876	
Normative Commitment	NC01	2.214	1.429	1.621	2.525	0.938	0.915
	NC02	2.517	1.556	1.269	1.280	0.918	
	NC03	2.493	1.503	1.221	1.132	0.919	
Behavior Intention	BI01	2.522	1.321	1.312	2.129	0.860	0.716
	BI02	3.073	1.613	0.866	0.172	0.909	
Valid Cases (N)	412						

Table 26 Pilot Study, Descriptive Data

Exploratory Factor Analysis

An exploratory factor analysis (EFA) was also conducted. All items yielded factor loadings greater than .70 and crossing loading smaller than .3 except for BI01. The result demonstrated decent convergent validity and discriminative validity.

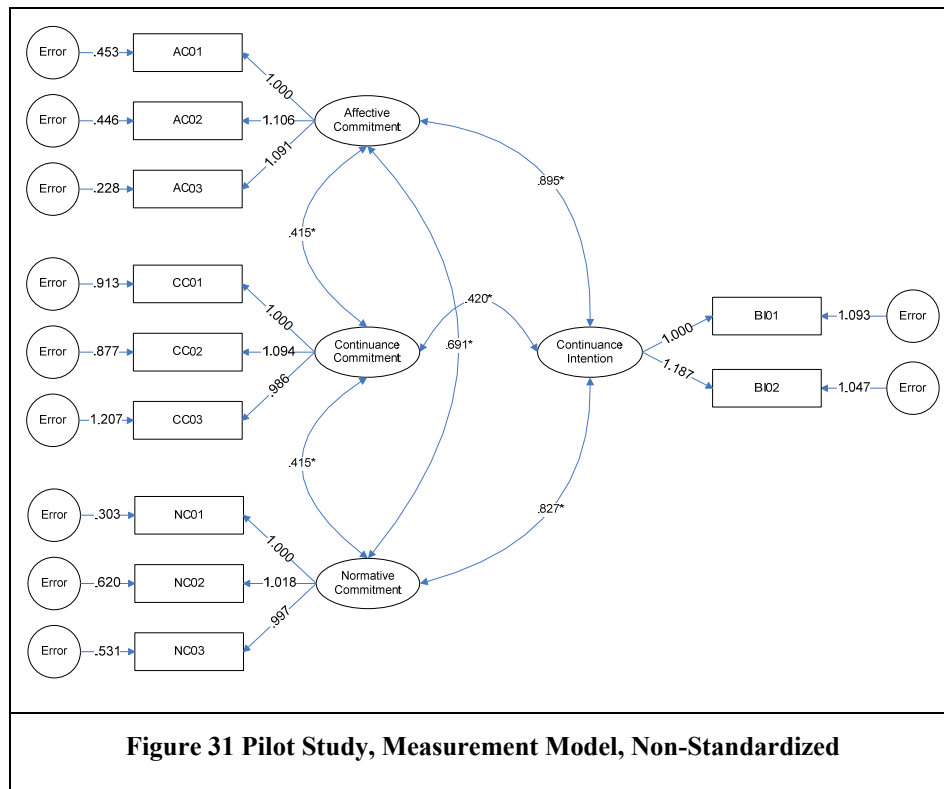
	Component			
	1	2	3	4
AC01	.238	.823	.104	.282
AC02	.177	.898	.087	.175
AC03	.160	.884	.105	.251
CC01	.032	.074	.889	.053
CC02	.085	.117	.885	.047
CC03	.117	.056	.859	.084
NC01	.919	.163	.047	.144
NC02	.859	.198	.114	.207
NC03	.879	.184	.106	.170
BI01	.263	.352	.020	.767
BI02	.230	.308	.164	.789

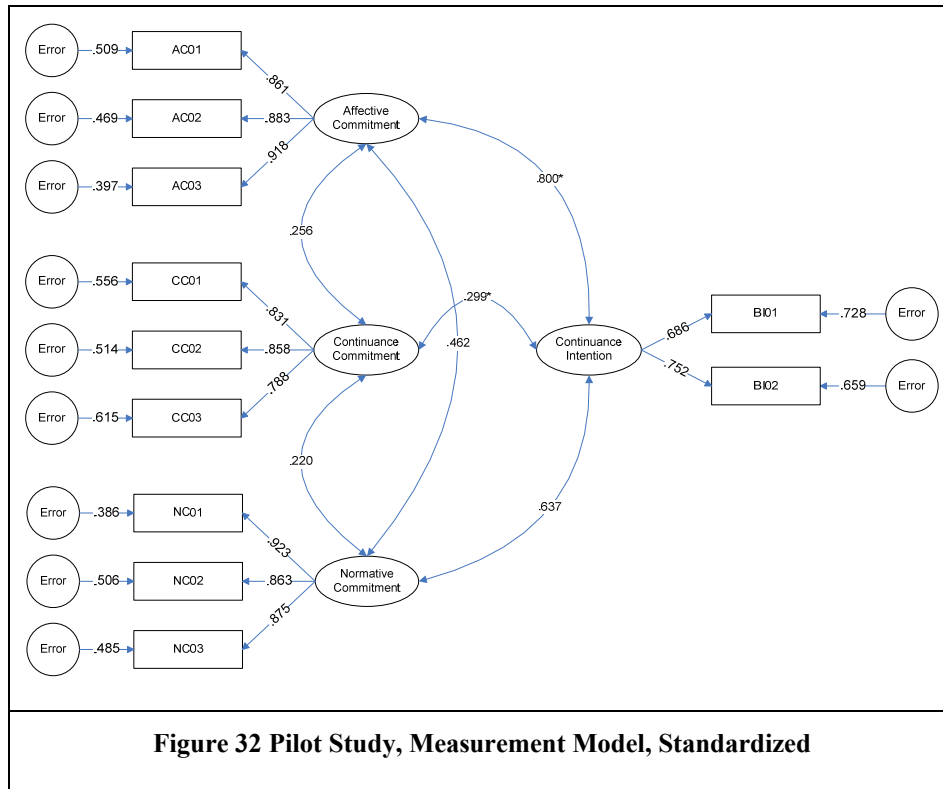
Table 27 Pilot Study, Exploratory Factor Analysis

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

The Measurement Model

In order to provide sophisticated evidence, a confirmatory factor analysis was run using to test the measurement model. The model obtained chi-square of 72.438 at 38 degrees of freedom. The chi-square per degree of freedom is less than 2 which indicates good fit of the model. Other fit indices also support this result. The CFI is 0.988, the RMR is 0.03, and the RMSEA is 0.047 with the 90% confidence interval between .030 and .063.





Model Choice

A two-dimension model was also entered for a test for the optimal model. The result doesn't reveal significant differences between the two models. Although the AIC value suggests better fit of the two-dimension model, the three-dimension model seems to be a better choice because it has lower RMSEA, and more importantly, the three-dimension model is more theoretically grounded.

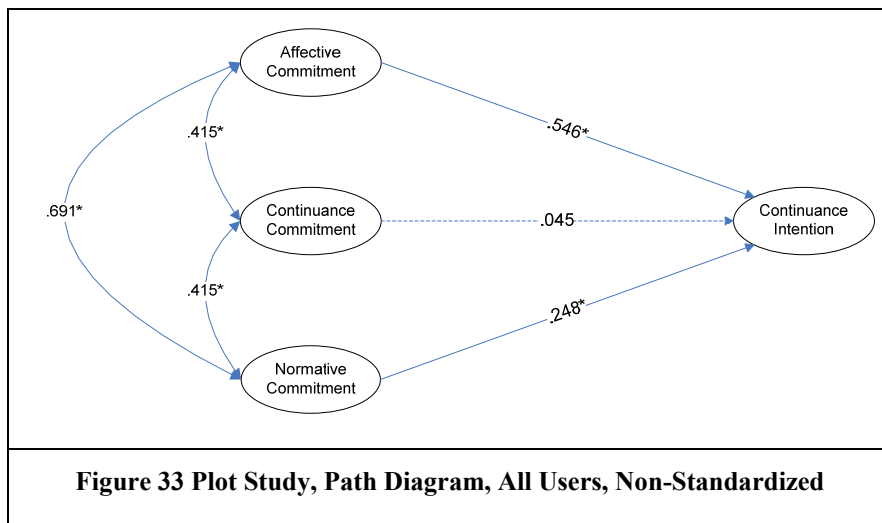
		df	χ^2	CFI	SRMR	RMSEA	90% CI of RMSEA	R-sqr	AIC
Three-Dimensional Model	All Users	38	72.438	0.988	0.030	0.047	(.030, .063)	0.735	-3.56
Two-Dimensional Model	All Users	17	49.997	0.985	0.031	0.069	(.047, .091)	0.732	16.00

Table 28 Pilot Study, Model Comparison (two-dimensional vs. three-dimensional)

The Structure Model

The path coefficients between three exogenous factors and one endogenous variable were tested in the structure model. The path between affective commitment and continuance intention is significant. Another path between normative commitment and continuance intention is also significant. Continuance commitment, however, is not significantly associated with continuance intention.

The three exogenous factors are significantly correlated to each other, especially between affective commitment and normative commitment. Empirical research using three-dimensional model consistently yielded high correlations between affective commitment and normative commitment (Meyer et al. 2002). Some researchers even challenged normative commitment as a separate dimension in the commitment model. I argue that normative commitment is worth retaining given its correlations with other variables are sufficiently different from other two dimensions (Cohen 1996).



Discussion

According to the SEM analysis, affective commitment and normative commitment are positively associated with users' continuance intention. However, users' commitment to the use of instant messenger software is not dependent on their perceived costs. As an attempt to shed light on IS continuance using the commitment theories, this study has three contributions. First, it introduces a new perspective to explain users' attitude toward continuous use of an IS technology. Second, the three-dimension model examines overall influences, from emotional feelings to social desirability and obligation, on users' attitude change and maintenance. Third, the technology commitment model can serve as a versatile framework that fits into different information systems with various technology contexts.