TRUST IN NATIONAL IDENTIFICATION SYSTEMS:

A TRUST MODEL BASED ON THE TRA/TPB

By

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The members of the Committee appointed to examine the dissertation of XIN LI find it satisfactory and recommend that it be accepted.

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Chair

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TRUST IN NATIONAL IDENTIFICATION SYSTEMS:

A COMPREHENSIVE TRUST MODEL BASED ON THE TRA/TPB

Abstract

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Along with the renewed interest in adoption of NID systems in the U.S. to facilitate public services and improve national security, research on citizens' trust in NID systems is believed to be of assistance to successful NID system development, acceptance and usage. This dissertation proposed a comprehensive trust model to predict citizens' trust in an NID system. This model describes the formation of multi-form trust based on the theory of reasoned action (TRA) and theory of planned behavior (TPB). The context-specific trusting antecedents were also specified and integrated into this model to take accounts all trust related considerations. The overall model provides a complete understanding of trust in NID systems.

An experimental study was conducted to test this model in the context of NID systems. The instruments of different forms of trust and trust-related constructs were adapted from the existing scales or developed according to the guidelines provided in prior research. They were validated with an independent dataset and proved to be valid and reliable in this research context. The overall comprehensive trust model was tested in a 3-step process with 443 student samples. The empirical results indicate that this model can well predict trust in NID systems. This research provided a lot of implications to both theory and practice in trusting NID systems.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION AND RESEARCH QUESTIONS

1.1 Introduction

The national identity (NID) system is a public information system used at the societal or government level. They are advocated in many countries around the world as a means to facilitate public services, enhance national security and guard against illegal immigrants (Clement, Stalder, Johnson, & Guerra, 2001). They are already in use in most European countries (i.e., 11 of the 15 member states of European Union have NID card schemes) and some Asian countries and districts, such as Singapore, Malaysia, Thailand and Hong Kong (Carlile, 2004; Walton, 2002; Brennan, 2001).

A variety of NID systems have been implemented in different countries and districts. The older forms of these systems simply store citizens' information in a global database and retrieve it for verification purposes when a citizen presents his or her NID card. The newer forms of these systems, such as the Smart ID used in Hong Kong, provide more advanced features including library services, electronic payment facilities, and online access (*Hong Kong Smart ID Government Information Centre*).

NID systems have also been advocated in the U.S. for several decades. Yet, America has consistently rejected this idea since 1971 (Burns, 2001; Dority, 2002). In the U.S., many people are worried about issues, such as a loss of privacy or information security (Miller & Moore, 1995). These and other issues would become paramount if a national ID card system were implemented with a centralized database of all U.S. residents.

Since the tragic events of September 11, 2001, people have become much more aware of national security threats. Consequently, there is renewed interest in the adoption of national ID cards in the U.S., as well as in other countries such as Canada, the U.K. and the Philippines (Dershowitz, 2001; Wakin, 2001). Larry Ellison, head of Oracle Corporation, has called for the development of a national identification system and even offered to donate the technology to make such a system possible (Rogers & Ackerman, 2001; Orlowski, 2001). Despite efforts to promote the use of the NID systems, many are still reluctant for fear of potential information abuse and increased governmental privacy infringement (Thierer, 2001; Sobel, 2002). Debates on the NID issues are widespread on most public media and in academic forums.

Whether an NID system will be accepted in a country is a complex question. To answer this question, several factors must be examined and understood. For example, prior technology acceptance research and empirical studies have indicated that the successful acceptance and utilization of an information system in a given context is determined by its technical features like usefulness and ease of use (Davis, 1989; Davis, Baggozzi, & Warshaw, 1989) and the match of these features with other factors, such as user characteristics, task requirements, and contextual structures (Goodhue & Thompson, 1995; Zigurs & Buckland, 1998). Additionally, more recent researchers have found that successful technology acceptance also involves users' subjective perceptions such as the level of trust towards the systems (Gefen, Karahanna, & Straub, 2003a; Sarker, Valacich, & Sarker, 2003). Trust has also been found to help people overcome perceptions of uncertainty and risk when engaging in trust related behaviors (Mayer, Davis, & Schoorman, 1995). Consequently, gaining an understanding of trust in an NID system will help

governments better evaluate citizens' responses to such systems and assist in the design of mechanisms to reduce implementation problems.

1.2 Research Questions

The purpose of the present research is to predict citizens' trust in NID systems and to explain what factors influence this trust. This research intends to answer two questions:

RQ1: Does a TRA/TPB theoretically based model adequately predict trust in NID systems? and

RQ2: What factors affect trust for NID systems?

1.2.1 Does A TRA/TPB Theoretically Based Model Adequately Predict Trust in NID Systems?

Although trust is always regarded as a subjective concept, it also involves some related behaviors (Mayer *et al.*, 1995; McKnight, Choudhury, & Kacmar, 2002a). For example, trust in a partner involves some cooperating behaviors and trust in e-vendor involves some purchasing or information providing behaviors.

The theory of reasoned action (TRA) theorized that people's actual behavior would be immediately determined by their intention to perform a behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Therefore, whether people are willing to trust and how they build their trusting intention are the keys to predicting people's actual trusting behavior in the trusting object. The primary objective of this research is to predict people's trusting intention toward NID systems.

This dissertation proposes a trust model based on the TRA and its extension, the theory of planned behavior (TPB, Ajzen, 1985, 1991). Trust is defined as a multi-form construct. The trusting intention is predicted by using trusting attitude, subjective norm and perceived behavioral control. These three predictors are formed on different trusting beliefs.

This TRA/TPB-based, multi-form trust model will reconcile the inconsistent definitions of trust in trust literature (Gefen *et al.*, 2003a; Lewicki & Bunker, 1995; Mayer *et al.*, 1995; McKnight *et al.*, 2002a; McKnight, Cummings, & Chervany, 1998). A composite definition of trust is used to encompass various forms of trust defined in prior trust research. A TRA/TPB-based trust model, which includes not only the volitional attitude but also social influence and personal control, is suggested for predicting trusting intention towards NID systems. The trust model proposed in this dissertation is theoretically grounded and comprehensive.

1.2.2 What Factors Affect Trust for NID Systems?

The second objective in this research will examine the foundations of an individual's trust towards NID systems. According to the TRA and TPB (Ajzen, 1985, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), trusting intention is fundamentally established on various context-specific external variables, such as people's propensity to trust, their knowledge of the trusting object and the trusting context, their cognitive processes, and so on. These external variables differ across trusting objects and contexts. This research identifies the unique set of external variables that affect people's trust in the NID systems. With the understanding of various factors that affect trust, governments who are planning to use NID systems could

attentively facilitate the development of the positive factors or control the negative factors, and eventually help a successful acceptance and use of the systems.

In the present research, five streams of trust literature (Lewicki & Bunker, 1995; McKnight *et al.*, 1998; Shapiro, Sheppard, & Cheraskin, 1992; Holmes, 1991; Mayer *et al.*, 1995; Shapiro, 1987) are reviewed and various trusting bases are identified and integrated into the TRA/TPB-based trust model. This comprehensive model will provide a complete explanation as to why people trust NID systems. These trusting bases are represented by operationalized sub-constructs. They suggest implications for the factors that affect people's trust in the NID systems and how governments may improve the NID system design and adoption process.

1.3 Importance and Relevance of Research

This research is important from both academic and practical perspectives. First of all, this is a more complete application of the theories of reasoned action and planned behavior, compared to previous TRA applications in IS. Second, the composite definition of trust and the comprehensive trust model will advance the overall trust-related research. Moreover, since the proposed trust model can accurately predict trust in NID systems, it will also be valuable to the governments who are planning to adopt an NID system.

1.3.1 Importance to TRA and TPB Research

The theories of reasoned action and planned behavior (Ajzen, 1985, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) have been used in IS research for a long time. For example, Davis introduced the technology acceptance model (TAM) based on the volitional part of the TRA framework (Davis, 1989; Davis *et al.*, 1989); Venkatesh and Davis (2000) then

expanded the TAM model to include subjective norm and control (i.e., voluntariness of system usage), which are important components suggested by the TRA and TPB; McKnight et al. (2002a) also developed the initial trust model in e-commerce based on the volitional part of the TRA framework. However, few IS research and models applied the TRA and TPB in full. Most of them just used a parsimonious version of the theories, in which this or that important behavior of behavioral intention predicting component is excluded. They provided different reasons for the parsimonious applications of the theories. For example, Davis et al. (1989) didn't include TRA's subjective norm as a determinant of behavioral intention because subjective norm was one of the least understood aspects of TRA (Fishbein & Ajzen, 1975), and it was difficult to disentangle the different effects of subjective norm on the other TRA components. The latest research on TAM (Venkatesh & Davis, 2000) and some other applications of TRA, such as the initial trust model developed by McKnight et al. (2002a), excluded the construct of attitude for easy empirical operation.

The comprehensive trust model proposed in this research is based on a more complete version of the TRA and TPB. No actual behavior will be involved since an NID system has not yet been adopted in the U.S. Trusting intention is the dependent variable to be predicted in the model, and it can be used to estimate the actual trusting behavior, according to the TRA and TPB. The three intention determinants suggested by the TRA and TPB are all included in the model, and each of them is founded on a different set of trusting beliefs. The TRA (Ajzen & Fishbein, 1980) mentioned that the three set of beliefs (i.e., behavioral beliefs, normative beliefs and control beliefs), which directly work in the model, are then formed on the other context-

specific perceptions and beliefs or other factors that indirectly influence the intention or behavior formation process. These indirect variables, called external variables, are not included in the TRA or TPB framework, but they are of critical importance when predicting intention or behavior in a specific context. In the comprehensive trust model in this dissertation, the external variables are also identified from the trusting context and included in the model to predict trusting intention.

In sum, this comprehensive trust model is based on a complete version of the TRA and TPB, including every important construct of TRA and TPB. The full consideration of every trust related influence enables a more accurate prediction of trusting intention. Furthermore, the operational concern of attitude and the various effects of subjective norm are also addressed in the instrument development and validation process and model testing analysis. They provide insights into the future TRA and TPB application research.

1.3.2 Importance to Trust Research

At present, the construct of trust has been ambiguously and inconsistently defined in the literature. Some researchers defined trust in terms of actions such as making a choice or depending on the trusting object (Kramer, 1999). Some others argued that trust is not actions themselves, but the subjective willingness to perform the actions (Mayer *et al.*, 1995). Still others took trust as people's perceptions towards the trusting object, such as the object's competence (Barber, 1983), benevolence (Holmes, 1991), and integrity (Sato, 1988). Some researchers combined various definitions. For example, McKnight and his colleagues defined trust as a composite concept consisting of trusting beliefs and trusting intention (McKnight *et al.*, 2002a;

McKnight *et al.*, 1998). All these different definitions and operationalizations of trust have made the previous trust-related studies difficult to reconcile or integrate.

The first contribution of this research to the trust literature is that a comprehensive, composite definition of trust is provided which encompasses various prior trust definitions. Based on this integrated definition, a multi-form trust formation process is proposed to explain people's trusting intention towards NID systems. This integrated view of trust provides a platform to compare and accumulate the results from prior trust studies.

Secondly, this research presents a model that predicts trust in the real world. Prior trust models predicted trust based only on the trusting subject's intuitive and volitional structures (Mayer *et al.*, 1995; McKnight *et al.*, 2002a). Some important, non-volitional impacts have yet to be investigated. The comprehensive trust model proposed in this dissertation includes not only the volitional determinant of trusting intention, but also the non-volitional factors that may influence people's trusting intention in a real world situation. Besides the volitional determinant of intention (i.e., attitude), the TRA also suggests a social influence determinant of intention (i.e., subjective norm). The TPB theorizes the perceived behavioral control as another possible factor that may influence a person's intention. This trust model integrates the three determinants into a comprehensive view. It is believed to be more theoretically grounded and more powerful when predicting people's trust in the real world.

The third contribution of this research is the unique set of trusting bases identified from trust literature. According to the TRA, all the trusting constructs from the TRA framework are eventually formed by some external variables. These external variables involve factors,

perceptions and beliefs that indirectly influence the behavior of interest, such as personality, cognitive processes, perceived institutional structures, and so on. They differ across trusting objects and situations. These external variables are out of the scope of the TRA or TPB per se. But when predicting trust in a particular setting, it is critical to identify the unique set of external variables in the trusting context. Therefore, this research reviews the trust literature and identifies the trusting bases that are applicable in the context of trust towards an NID system. These bases provide essential foundations for people to form their beliefs in the evaluation of behavioral consequences, influence from important referents and personal control (i.e., behavioral beliefs, normative beliefs and control beliefs), which has more direct impact on trusting intention. The trusting bases are decomposed into operationalized levels for easy operation and understanding. The comprehensive trust model takes into account more trust related considerations and trust foundations, compared to the previous trust models (Mayer *et al.*, 1995; McKnight *et al.*, 2002a), and it is supposed to be better able to predict trust in the current research context.

1.3.3 Importance to Practice

This research is also highly relevant to practice. The comprehensive trust model can help governments accurately predict trust in an NID system before the actual implementation. Governments can also self-develop or customize the NID system according to what citizens really need and care for.

After the Sept. 11 attacks, governments have renewed interest in the use of the NID systems to enhance national security. But still, a large proportion of people are against this proposition with increasing privacy and political concerns. Many governments around the world

are experiencing difficulty in bringing an NID proposal into their agenda because of the considerable opposition and operational problems.

With this comprehensive trust model, governments will be able to evaluate whether people trust an NID system and predict how people will react to the system before they decide to adopt one in their countries. The accurate prediction of trust can help them to avoid potential failures. Furthermore, according to this trust model, trusting intention is eventually positively affected by some trust-related foundation and considerations. With the operationalized constructs and sub-constructs, this model can help governments to find out what the citizens need to assure trust in the systems. With this kind of knowledge, governments can self develop or customize the systems to manipulate citizens' trusting bases and to facilitate their trust in the systems.

In sum, this research is practically important to the countries and governments who are planning to use the NID systems. In addition, the comprehensive trust model could be generalized and used in other IS contexts to predict users' trust in other information systems. Thus this research also provides insights into general IS acceptance and use.

1.4 Structure of the Dissertation

This chapter presented the purpose and research questions of this study and outlined the scope of the research. The remaining chapters are organized as follows:

Chapter 2, Literature Review, is divided into four sections. Section I provides a review of two well accepted behavior prediction theories - the Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB) - and two existing trust models. Based on the theories and prior trust models, Section II provides a composite definition of trust. Trust components, as well

as the relationships among them, are illustrated with a TRA/TPB-based model. Section III reviews five streams of trust literature and identified four trusting antecedents that are applicable in the research context of predicting people's trust in NID systems. Finally, in Section IV, the full comprehensive trust model is proposed base on the discussions and hypotheses provided in Section II and III.

Chapter 3, Research Methodology, provides a detailed description of the empirical study designed to test the conceptual research model. This chapter consists of sub-sections that describe the specific aspects of the research design, including the sample that has been used, the experimental task and procedures, measures for each constructs and sub-constructs, data collections, and other relevant issues.

Chapter 4, Data Analysis and Results, describes the statistical techniques used for data analyses, as well as the results obtained from the analyses. There are two sections in this chapter. Section I presents the analysis techniques and results for measurement validation. Section II presents the analysis techniques and results for hypotheses and model testing.

Chapter 5, Discussion of Results, examines the data analysis results in light of the model presented in this research. Theoretical and practical implications are discussed in this chapter. It also provides possible explanations for those unexpected results.

Chapter 6, Conclusion, summarizes and concludes the entire study. The theoretical and practical contributions are summarized in this chapter. In addition, the chapter also discusses the limitations of the study and suggests possible future research.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the prior relevant theories and research related to trust prediction. First of all, general behavioral prediction theories (i.e., Theory of Reasoned Action and Theory of Planned Behavior) and prior trust models are reviewed. Trust is defined with a TRA/TPB-based model, including multi-form of trust and other important trust related constructs from prior trust research and models. Four applicable trusting antecedents are then identified from the review of five streams of trust literature. They are personality trusting base, cognitive trusting base, calculative trusting base and institutional trusting base. The full conceptual trust model is finally presented with four trust-formation stages, containing all important trust related factors.

2.1 Predicting Trust

The primary purpose of the present research is to predict people's trust in the NID systems. Therefore, the general behavior prediction theories and specific trust prediction research are first reviewed. Among those widely cited theories of behavior prediction are the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and the theory of planned behavior (Ajzen, 1985, 1991). In the following sections, the purports of the theory of reasoned action (TRA) and theory of planned behavior (TPB) are summarized. Additional application issues of the theories are discussed. Next, two existing trust prediction models are reviewed. Their contributions and limitations are discussed. These behavior prediction theories and trust prediction research provide a strong theoretical foundation to the current research.

2.1.1 Theory of Reasoned Action (TRA)

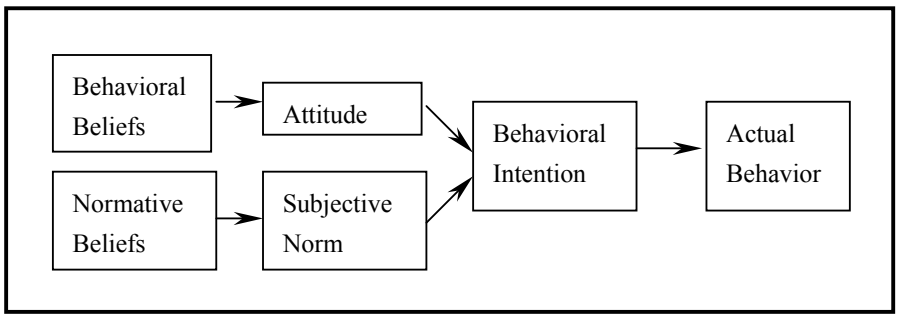
The theory of reasoned action (TRA, Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) is a widely accepted theory that predicts an individual's volitional behavior. This theory assumes that human beings are usually quite rational and make systematic use of the information available to them. Under this assumption, the TRA theorizes that a person's performance of a specific behavior is immediately determined by his or her volitional intention to perform the behavior, or what Fishbein and Ajzen called *behavioral intention*.

The behavioral intention is a function of two basic determinants. One is attitude towards the behavior. The other is subjective norm. *Attitude* refers to the individual's positive or negative evaluation of performing the behavior. It is the person's judgment that performing the behavior is good or bad, and that he/she is in favor of or against performing the behavior. *Subjective norm* refers to the person's perception of the social pressures put on him/her to perform or not perform the behavior in question. In other words, it is the perception that most people who are important to this person think he/she should or should not perform the behavior.

Both determinants of behavioral intention (i.e., attitude and subjective norm) are founded on sets of salient beliefs. A person's attitudes are formed on his/her beliefs about consequences and attributes of given behavior. They are called *behavioral beliefs*. Subjective norm is formed on the beliefs concerned with the likelihood that specific individual or group referents approve or disapprove of performing a given behavior. They are called *normative beliefs*. Behavioral and normative beliefs in the TRA are then formed by context-specific external variables such as individual personality, knowledge about the behavior targets and its contexts, and so on. These

variables are out of the scope of the TRA. Ajzen and Fishbein (1980) suggest that these external variables are related to behavior only through their influences upon the lower level variables that determine the behavior. They are not discussed in the TRA. But it is critical to identify the unique set of external variables and specify their relationships with the TRA constructs when the TRA is used to predict behavior in a specific research context. Figure 2.1 illustrates the major constructs and relationships in the TRA framework.

Figure 2.1: The Theory of Reasoned Action



2.1.2 The Theory of Planned Behavior (TPB)

The theory of planned behavior (TPB, Ajzen, 1985, 1991) is an extension of the TRA for predicting behavior in a real-world setting. In the TPB, a non-volitional construct is postulated to be associated with the prediction of intention and behavior. It is *perceived behavioral control*, which refers to people's perception of their control in performing the behavior of interest. In other words, it reflects perceptions of internal and external opportunities and constraints on the behavior (Ajzen, 1985, 1991).

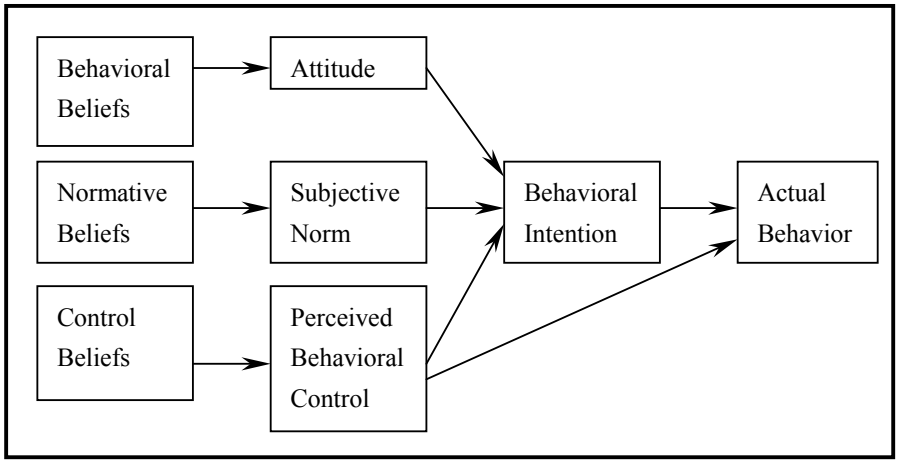
First of all, perceived behavioral control is theorized as a non-volitional determinant of the actual behavior. In the TRA, behavioral intention is regarded as the only immediate

determinant of behavior with the assumption that the behavior in question is under full volitional control and the people can decide at will to perform the behavior or not. However, in the real world, the performance of most behaviors depends upon the person's degree of control over the behavior. For example, a person may be willing to perform a behavior but be unable to because of the shortage of opportunities and resources, such as time, money, skills, and so on. Therefore, the TPB suggests that behavior is not only determined by a person's intention to perform, but also determined by that person's behavioral control in that situation.

Second, perceived behavioral control also affects the prediction of intention. In the TRA, intention is jointly determined by attitude towards the behavior and subjective norm. The TPB suggests perceived behavioral control as the third determinant of intention. When a person's attitude and subjective norm are kept constant, the greater the behavioral control one perceives, the stronger should be his/her intention to perform the behavior in question.

Similarly to attitude and subjective norm, perceived behavioral control is also based on a set of salient beliefs, which deal with the presence or absence of requisite resources and opportunities associated with the given behavior. This set of beliefs is called *control beliefs*. They are based in part on past experience with the behavior and on second-hand information about the behavior, which may come from the experiences of acquaintances and friends (Ajzen, 1991; Ajzen & Madden, 1986). Also, the control beliefs include some factors that increase or decrease the perceived difficulty of performing the behavior. For example, one type of control belief could be the self-efficacy, which refers to one's self-confidence in his/her ability to perform the behavior in question (Bandura, 1982). The TPB framework is shown in Figure 2.2.

Figure 2.2: The Theory of Planned Behavior



2.1.3 Empirical Studies and Application Issues on the TRA and TPB

The TRA and TPB have been used to predict different behaviors in various research contexts, including health behavior, ethical decisions, physical exercises, leisure participation, education decisions, consumer behavior, technology acceptance, and so on (Ajzen & Driver, 1991; Davis & Ajzen, 2002; Hrubes, Ajzen, & Daigle, 2001; Randall, 1994; Randall & Gibson, 1991; Riemenschneider, Hardgrave, & Davis, 2002; Taylor & Todd, 1995; Gentry & Calantone, 2002). Mixed results have been obtained from these empirical studies. Some meta-analytic studies summarized these TRA/TPB applications (Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Armitage & Conner, 2001; Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997; Sheeran & Taylor, 1999). Basically, the TRA-suggested relationships were well supported. However, the effects of perceived behavioral control on both behavior and behavioral intention were not always supported in different research contexts.

Additional application issues on TRA and TPB were raised from the mixed empirical results and provided implications for the future TRA and TPB research (Ajzen, 1991, 2002). Some of them are important in the current research. In the following paragraphs, four application issues, which are relevant to this research, are discussed. Their implications to the current study are also addressed.

First of all, accurate definitions and measures of the TRA and TPB components are critical to a successful prediction of the behavior of interest. All the components in the TRA and TPB model should be defined compatibly in terms of target, action, context and time (Ajzen, 2002). The measurement development guideline provided in the TRA (Ajzen & Fishbein, 1980) states that the behavior of interest should be defined first with specified target (i.e., the object at which the behavior is directed), action (i.e., the action/sub-actions in the behavior), context (i.e., the circumstance in which the behavior is performed), and time (i.e., the point or period of time in which the behavior is performed); subsequently the other TRA components should be defined in terms of exactly the same four elements. Without the compatible definitions and measures of all TRA/TPB components, the overall model may fail to predict behavior (Ajzen, 2002). In the current study, the primary object is to predict individual's intention to trust NID systems. In this situation, actual behavior is not involved. However, potential trusting behavior has to be defined with specific target, action, context and time. With a well-defined trusting behavior and these four elements, the other trust related constructs could be accurately defined and measured.

Second, Ajzen (1991) states that the relative importance of attitude, subjective norm and perceived behavioral control in predicting intention may vary across behaviors and situations.

For instance, perceived behavioral control may have great influence on intention in some voluntary situations, while in some mandatory situations it may not be related to intention at all. The magnitudes of the effects of the three intention determinants are dependent upon the type of behavior and the nature of the situation (Armitage & Conner, 2001). It is possible and reasonable that some empirical studies find that one or two of the determinants have no influence on intention or behavior. From a theory application perspective, parsimonious versions of the TRA/TPB could be used when prior theoretical or empirical studies have supported that the excluded determinant had no relation to intention or behavior in the same research context. However, when predicting intention or behavior in a new research context, such as predicting trust in NID systems, all three determinants should be considered until theories or empirical support are found to exclude some of the determinants.

Third, the overall TPB framework is complex and difficult to operate as a whole (Davis & Ajzen, 2002; Hrubes *et al.*, 2001). According to the TRA and TPB, intention or behavior forms in several stages (Ajzen, 1991; Ajzen & Fishbein, 1980). First of all, the three belief-related constructs are formed on the context-specific external variables. In their respective aggregates, these belief-related constructs produce attitude, subjective norm and perceived behavioral control, which then determine behavioral intention and finally actual behavior. In every stage, the lower level constructs transfer their influences on the final behavior into the higher level constructs. Similarly, in the next stage, the higher-level constructs represent the influences from the previous level constructs, and transfer them into the next level of constructs. Therefore, some of the TRA and TPB applications studies tested only one stage of intention or

behavior formation at a time (Davis & Ajzen, 2002; Hrubes *et al.*, 2001). This is more feasible than testing the whole TRA/TPB model all together. The same method will be used in the current study to avoid potential operational and statistical problems.

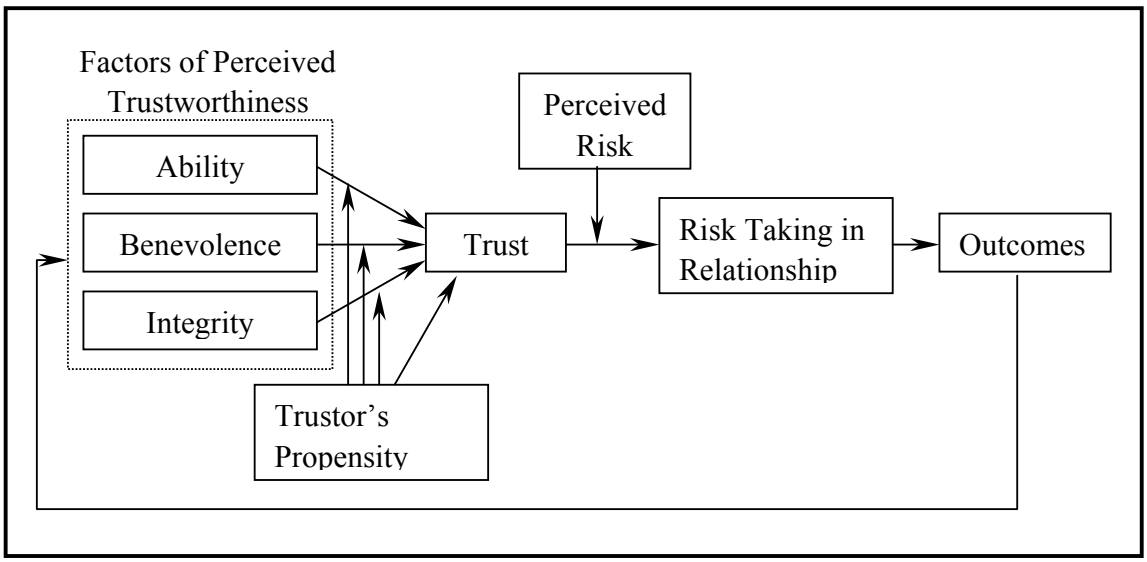
Lastly, the instruments of belief-related constructs may not fulfill the general measurement validity and reliability criteria. According to the TRA and TPB instrument guideline (Ajzen, 1991; Ajzen & Fishbein, 1980; Ajzen, 2002), behavioral beliefs, normative beliefs and control beliefs serve as indirect measures of attitude, subjective norm and perceived behavioral control, respectively. The measurement scales of the three belief constructs consist of individual belief items, which represent different dimensions of the foundations of attitude, subjective norm or perceived behavioral control. It is not necessary that these individual belief items are correlated with each other, and therefore, they are not assumed to be internally consistent and convergent (Ajzen, 2002). In the current study, instrument validation will be conducted to all instrument scales. The belief-related constructs that fail to achieve the required validity and reliability will be further discussed.

The above conceptual and methodological issues are taken into account in the application of the TRA and TPB in the current research. A comprehensive trust model will be constructed based on the TRA and TPB to predict individual's trust in NID systems. In the following two sections, two existing trust models are reviewed. These two models are partially consistent with the TRA and TPB. The important trust related considerations in these two models provide insights into the current research.

2.1.4 Mayer et al.'s Model of Trust (1995)

Mayer et al. (1995) suggested a model of trust to explain interpersonal trust in organization. It will hereafter be referred to as the Mayer model. This model has been widely cited in organizational studies. It is demonstrated in Figure 2.3.

Figure 2.3: Mayer et al.'s (1995) Trust Model



Mayer et al. (1995) defined trust as "*the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective to the ability to monitor or control that other party"*. They didn't label trust with the TRA/TPB terms, such as trusting behavior, trusting intention and so on. However, from the TRA/TPB perspective, their definition of trust implied trusting intention, which is the "willingness" to perform the trusting behavior of interest.

The Mayer model focuses on the trust relationship between two parties: a trusting party and a party to be trusted. In trust literature, the trusting party is called trustor or trusting subject, and the party to be trusted is called trustee or trusting object (Lewicki & Bunker, 1995; Lewis & Weigert, 1985; Mayer *et al.*, 1995; McKnight *et al.*, 2002a).

In the Mayer model, two factors were suggested to influence trust. One is *trustor's propensity to trust*, which leads to a generalized expectation about the trustworthiness of others. People with different developmental experiences, personality types, and cultural backgrounds vary in their propensity to trust (Hofstede, 1980). But once the trusting propensity is formed, it keeps stable across situations. The other factor included in this model is the *perceived trustworthiness of trustee* (Hovland, Janis, & Kelley, 1953). Mayer et al. (1995) specified three characteristics of trustee, which would explain a major portion of trustworthiness. They are *ability* (group of skills, competencies, and characteristics that enable a party to have influence within some specific domain), *benevolence* (the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive), and *integrity* (the extent to which the trustee adheres to a set of principles that the trustor finds acceptable). The higher the three characteristics of trustee are perceived to be, the more trustworthy the trustee will be deemed (Butler, 1991).

Mayer et al. (1995) stated that trust would increase the likelihood of the *risk taking in a relationship* (RTR), which refers to the actual trust related behaviors occurring in the context when a specific, identifiable relationship exists. During this process, the *perceived risk* will negatively affect people's decision towards the trust related behavior (Sitkin & Pablo, 1992).

Mayer et al. (1995) stated that the perception of risk involves trustor's belief about the situational factors like difficulties and constraints that encumber the trust-related behaviors, beyond and above the effect of trust on the RTR. The construct of perceived risk in the Mayer model is partially consistent with the perceived behavioral control in the TPB. After performing the trust-related behaviors, some *outcomes* from the behaviors will influence people's future perception of the trustee's trustworthiness (Boyle & Bonacich, 1970).

The Mayer model has significant contributions to the trust research. It considered both trustor and trustee's characteristics in a relationship-specific boundary condition as antecedents of trust. It clarified the differences and relationship between willingness to trust (i.e., trust) and trust related behaviors (i.e., risk taking in relationship). It also takes some perceived external constraints (i.e., perceived risk) into account. In addition, it presents the dynamic nature of trust by considering the long-term effect of trusting outcomes. In this research, Mayer et al. (1995) only proposed the conceptual model. No empirical study was conducted to test the model.

The Mayer model is partially consistent with the TRA/TPB framework. From the TRA/TPB perspective, the RTR is the actual trusting behavior. The construct of trust in the Mayer model is the behavioral intention, since it is defined as *willingness* to depend on the others. The trusting behavior (i.e., RTR) is determined by the behavioral intention. The trustee's trustworthiness and trustor's propensity to trust are direct and indirect perceptions and beliefs that affect trust formation. These constructs and relationships represent the volitional formation process of trust. However, this model doesn't include the intention-determinant level constructs like attitude, subjective norm and perceived behavioral control, although the perceived risk

represents part of the influence from perceived behavioral control on the actual behavior. The behavioral intention was directly determined by belief level constructs. According to the TRA/TPB (Ajzen, 1991; Ajzen & Fishbein, 1980), attitude, subjective norm and perceived behavioral control represent an important stage of behavior formation. The omission of this stage may influence the overall behavior prediction.

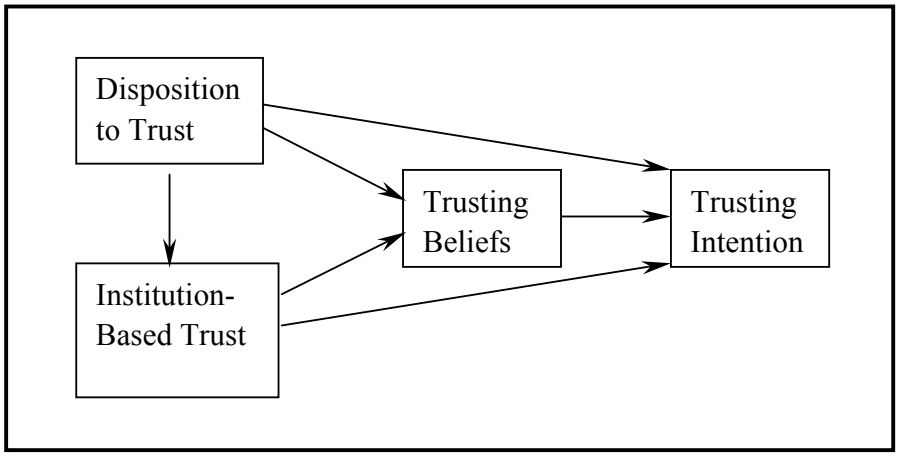
2.1.5 McKnight et al.'s Trust Model (2002a)

The other existing trust model was developed by McKnight and his colleagues (McKnight & Chervany, 1996; McKnight *et al.*, 2002a; McKnight, Choudhury, & Kacmar, 2002b; McKnight *et al.*, 1998; McKnight, Kacmar, & Choudhury, 2003). It will hereafter be referred to as the McKnight model. The McKnight model focuses on the initial trust that is formed without direct interaction with a trusting object. This point is suitable for the present research interest, predicting people's trust in NID systems before the systems are in use. McKnight et al. (2002a) adapted the model of initial trust from their early work (McKnight & Chervany, 1996; McKnight *et al.*, 1998) into an e-commerce context, and developed and validated the measures of trust. This model has been empirically tested and supported in the e-commerce context (McKnight *et al.*, 2002a, 2002b). Figure 2.4 demonstrates an overview of the McKnight model.

In this model, McKnight et al. (2002a) developed a composite definition of trust. This composite trust consists of two components: *trusting intention* (the truster is securely willing to depend, or intends to depend, on the trustee) and *trusting beliefs* (the confident truster's perception that the trustee has attributes that are beneficial to the truster). The trusting beliefs in

the McKnight model are represented only by behavioral beliefs in the TRA and TPB framework because they measure different considerations about attitudinal determinant of trusting intention (Ajzen, 1991; Ajzen & Fishbein, 1980; Davis & Ajzen, 2002; Hrubes *et al.*, 2001). The McKnight model proposed that trusting beliefs determine trusting intention, which represents the volitional trust formation process. The social influence (i.e., subjective norm) and control influence (i.e., perceived behavioral control) were not included in the McKnight model.

Figure 2.4: McKnight et al.'s (2002a) Initial Trust Model



This model further posits disposition to trust and institution-based trust as antecedents to trusting beliefs and trusting intentions. *Disposition to trust* refers to the extent to which a person displays a tendency to be willing to depend on others across a broad spectrum of situations and persons. It is equivalent to the trustor's propensity in the Mayer model. *Institution-based trust* refers to the belief that needed structural conditions are present to enhance the probability of achieving a successful outcome in an endeavor. People's disposition to trust positively influences their institution-based trust (McKnight *et al.*, 2002a; McKnight *et al.*, 1998). Both trusting

antecedents were proposed to directly influence the trusting beliefs and trusting intention. When trusting intentions were built, it would lead to some trust-related behaviors, which is out of the scope of the McKnight model.

The McKnight model provides many contributions to the trust literature. First of all, it uses the composite definition of trust based on a parsimonious version of the TRA. This definition provides a more comprehensive understanding of trust, compared to prior trust research. Second, this research identified two trusting antecedents from the trust literature and integrated them into the trust model. The inclusion of these two antecedents allows more accurate prediction of initial trust. Third, operationalized sub-constructs and measurement scales were developed for every construct in the McKnight model. The measures have been validated and the overall model has been generally supported by the empirical data (McKnight *et al.*, 2002a, 2002b). The instrument development and validation have provided many insights into the research methodology of this dissertation.

Although McKnight et al. (2002a) stated that their initial trust model was developed based on the TRA, this model is only partially consistent with the TRA/TPB framework. The actual behavior is excluded from the model since initial trust before behavior is predicted. Trusting intention and trusting beliefs are used to present the initial trust. The trusting beliefs are represented by trustees' trustworthiness (Mayer *et al.*, 1995), which imply the potential consequences of the trust related behavior. It actually represents the behavioral beliefs in the TRA/TPB framework. Disposition to trust and institution-based trust are integrated into the

model as the context-specific external variables that form the trusting beliefs. The above constructs and relationships represent only the volitional trust formation.

Similar to those in the Mayer model, the intention-determinant level constructs, like attitude, subjective norm and perceived behavioral control, were all excluded from the McKnight Model. Trusting intention was directly determined by trusting beliefs. No social influence or control factors were considered. This makes it difficult to explain how people form trust in real world situation.

Another inconsistency between the TRA and the McKnight model is the way external variables affect the trust formation. In the McKnight model, the two external variables - disposition to trust and institution-based trust - were proposed to directly affect both trusting beliefs and trusting intention. However, the TRA theorized that the external variables only indirectly affect the intention or behavior through their influence on the belief level constructs (Ajzen & Fishbein, 1980). In McKnight et al.'s (2002a) study, the paths from the two external variables to trusting intention were not significantly supported by the empirical data. This result corroborates that the direct effects of trusting antecedents on trusting intention are violating the TRA/TPB.

In addition, the McKnight model only included two of the four trusting antecedents suggested in their previous work (McKnight *et al.*, 1998). No reason was provided to explain why the other trusting antecedents were not included as external variables. The full consideration of all of the trusting antecedents may provide more accurate prediction of trust.

2.2 Development of the Trust Formation Model

Based on the above reviews of the TRA/TPB and the existing trust models, a comprehensive trust model is developed in this section. It encompasses different forms of trust and important trust related considerations from the prior trust research and existing trust models. This trust model is believed to be comprehensive and have strong theoretical foundation.

2.2.1 Defining Trust within a TRA/TPB Framework

Prior trust studies defined the construct of trust differently. Some organizational researchers conceptualized trust in terms of individuals' choice behavior in various kinds of trust dilemma situations (Miller, 1992; Kreps, 1990; Kramer, 1999). Other researchers defined trust as willingness or intention to perform some behaviors or actions, instead of behaviors or actions themselves (Mayer *et al.*, 1995). Still other researchers presented trust as people's perceptions of the trusting objects, such as how competent, benevolent and predictable the trusting objects are (Barber, 1983; Holmes, 1991; Sato, 1988). The diverse and inconsistent definitions of trust became a big barrier for comparing results across studies and advancing trust research.

In this dissertation, a comprehensive, composite definition of trust based on the TRA and TPB (Ajzen, 1985, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) is proposed to encompass various definitions of trust in prior studies. This definition of trust will facilitate the accumulating tradition and advance trust research.

According to the TRA (Ajzen & Fishbein, 1980), trust could be a multi-form concept, including trusting behavior, trusting intention, trusting attitude, and trusting beliefs. The formation of trust involves both volitional structure and other non-volitional influence, such as

social influence and control factors. All the trust related constructs are defined in the context of NID systems.

According to the TRA/TPB (Ajzen & Fishbein, 1980; Ajzen, 2002), the different forms of trust and other trust related constructs should be defined consistently in terms of action (single action or a category of actions representing the behavior of interest), targets (the objects that the behavior of interest is directed), contexts (the situations of interest in which a behavior is performed), and times (the time periods of interest in which a behavior is performed). In the present research, the research interest focuses on people's trust in NID systems. The general behavior here is trusting and it could be decomposed into a group of actions, such as advocating NID systems, providing personal information to the systems, using the NID cards, and so on. The target is the NID systems. The context is in the U.S., and the time is when the U.S. government implements NID systems in the near future.

The TRA theorizes that the definition of behavior is the key to defining the other TRA-related constructs (Ajzen & Fishbein, 1980). Although no NID system is actually used in the U.S so far, the construct of trusting behavior has to be defined first. In this research, *trusting behavior* is defined as people's action(s) to make themselves vulnerable to the NID systems when the U.S. government implements the systems nation wide in the near future. The actions could include people advocating the systems; providing personal information to the systems; and using the NID cards.

Consistent with trusting behavior, the other trust related constructs are defined in terms of the same action, target, context and time. These definitions are summarized in Table 2.1. First,

t*rusting intention* is defined as people's willingness or intention to be vulnerable to NID systems when the U.S. government implements them nationwide in the near future. Then, three intention determinants as well as their belief foundations are defined below.

Table 2.1: Definitions of the TRA/TPB-Based Constructs

Construct	Definition
Trusting Intention	People's willingness to or intend to be vulnerable to NID systems when the U.S. government implements them nationwide in the near future.
Trusting Attitude	People's evaluation of trusting in NID systems when the U.S. government implements them nationwide in the near future.
Subjective Norm	How the people important to you think you should or should not make yourself vulnerable to NID systems when the U.S. government implements them nationwide in the near future.
Perceived Behavioral Control	People's perceived internal/external opportunities and constraints on being vulnerable to NID systems when the U.S. government implements them nationwide in the near future.
Behavioral Beliefs	People's perceptions and information about the consequences of trusting NID systems.
Normative Beliefs	People's perceptions and information about the others' opinions on NID systems.
Control Beliefs	People's perceptions of their ability, their knowledge about the recourses, opportunities, and constraints of trusting in NID systems.

Trusting attitude is defined as people's evaluation of trusting in NID systems when the U.S. government implements them nationwide in the near future. It is an aggregate of a set of *behavioral beliefs* that are defined as people's perceptions and information about the consequences of trusting NID systems.

Subjective norm, similarly, is defined as how the people important to you think you should or should not make yourself vulnerable to NID systems when the U.S. government implements them nationwide in the near future. It is an aggregate of a set of *normative beliefs* that are defined as people's perceptions and information about the others' opinions of NID systems.

Perceived behavioral control is defined as people's perceived internal/external opportunities and constraints on being vulnerable to NID systems when the U.S. government implements them nationwide in the near future. It is an aggregate of a set of *control beliefs* that are defined as people's perceptions of their ability, their knowledge about the recourses, opportunities, and constraints of trusting in NID systems.

2.2.2 Relationships in the Trust Formation

Along with the definitions of all trust related constructs, the concept of trust is clearly presented in the trust formation model in Figure 2.5.1. First, people build their different sets of trusting beliefs (i.e., behavioral trusting beliefs, normative trusting beliefs, and control trusting beliefs) based on some context-specific external variables. With the three sets of trusting beliefs, people can structure their trusting attitude, subjective norm, and perceived behavioral control, respectively. These three constructs, then, jointly determine people's trusting intention. The focus of this research study is on the trusting intention formed before people directly interact with the NID systems. Thus, trusting behavior will not be measured or analyzed. The above TRA/TPB theoretically based relationships are hypothesized below.

H1a: Trusting attitude positively affects trusting intention.

H1b: Subjective norm positively affects trusting intention.

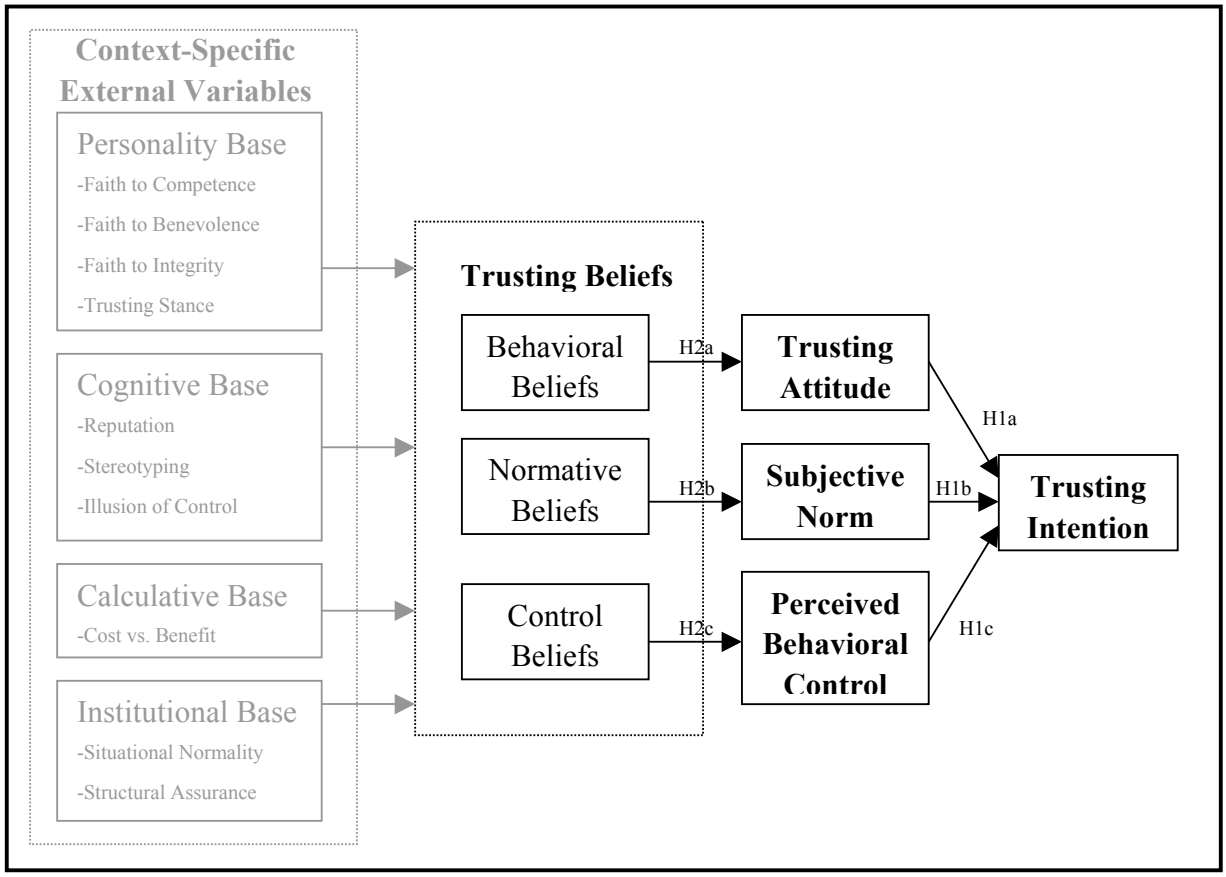
H1c: Perceived behavioral control positively affects trusting intention.

H2a: Behavioral beliefs positively correlate to trusting attitude.

H2b: Normative beliefs positively correlate to subjective norm.

H2c: Control beliefs positively correlate to perceived behavioral control.

Figure 2.5.1: The comprehensive trust model - The trust formation model



When the TRA/TPB-based model is applied to a specific research context like trust in NID systems, a unique set of external variables needs to be identified to predict different sets of trusting beliefs. These external variables are very important in the trust prediction model, because they provide the most basic foundations of individual's trust. In the following section, four external factors are identified from the trust literature. They are integrated into the trust model to predict people's trust in NID systems.

2.3 Trusting Antecedents/Bases

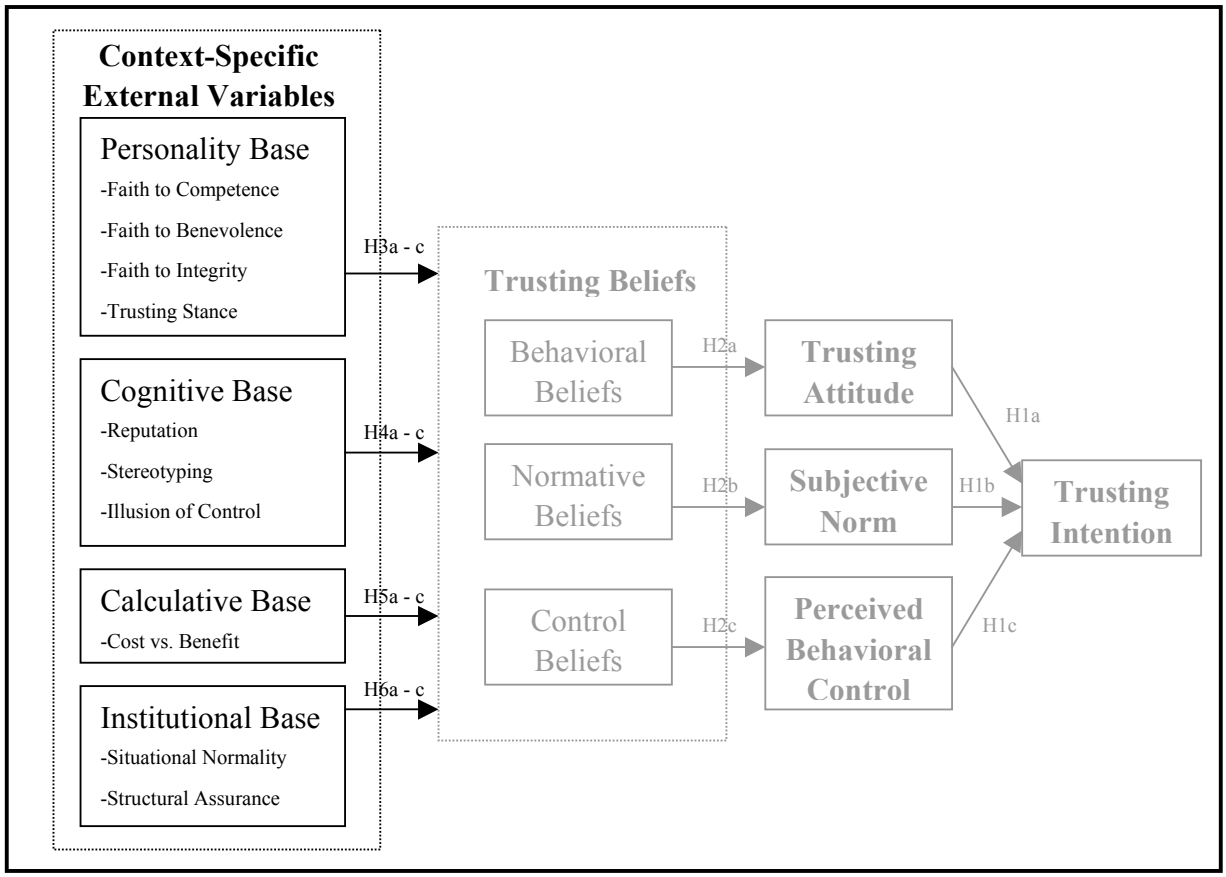
Previous researchers (Brewer, 1981; Lewicki & Bunker, 1995; Lewis & Weigert, 1985; McKnight *et al.*, 1998; Shapiro *et al.*, 1992; Zucker, Darby, Brewer, & Peng, 1996) labeled five trust research streams that shed light on how trust forms. Five trusting antecedents were identified from these research streams, respectively. They were named differently in prior studies (Gefen, Rao, & Tractinsky, 2003b; Lewicki & McAllister, 1998; Mayer *et al.*, 1995; McKnight *et al.*, 2002a). In the present research, they are uniformly named trusting bases (i.e., personality trusting base, cognitive trusting base, calculative trusting base, institutional trusting base, and knowledge trusting base) because they refer to different bases on which people build their trust.

Knowledge trusting base refers to one's first hand information about or direct experience with the trusting object, on which one can build his/her trust in the object. Given that the present research focuses on the initial trust in NID systems formed before the systems are actually in use, people may lack this kind of first-hand information and direct experience. Therefore, knowledge trusting base is not applicable in the current research context and it is excluded from the comprehensive trust model. The other four trusting bases are proposed as antecedents of trust in NID systems and integrated into the comprehensive trust model (Figure 2.5.2).

Prior trust literature didn't provide a complete view of how different trusting bases influence the formation of trust. McKnight et al. (2002a) suggested disposition to trust and institution-based trust have impacts on both trusting beliefs and trusting intention. Gefen et al. (2003a) took knowledge-based trust, calculative-based trust and institution-based trust into account in predicting general trust-related beliefs in online shopping. Sarker et al. (2003) focused

on personality-based trust, cognitive trust and institutional-based trust as components of virtual team trust. Little research tests all of the four trusting bases in the same research context, and there is no common understanding about how different trusting bases are involved in the formation of multi-form trust.

Figure 2.5.2: The comprehensive trust model: External variables



According to the TRA/TPB (Ajzen, 1991; Ajzen & Fishbein, 1980), these trusting bases, as external variables, relate to the trust formation through their direct influence on the three trusting beliefs (i.e., behavioral beliefs, normative beliefs and control beliefs). Therefore, in the comprehensive trust model, every trusting base is hypothesized to positively affect every trusting

belief, based on their definitions and associated trust building mechanisms. In the following empirical study, an exploratory analysis will be conducted to determine the actual relationships between the trusting bases and the three trusting beliefs.

In the following sections, the four trusting bases are defined and examined. Their associated trust building mechanisms are described, and their relationships with trusting beliefs are hypothesized.

2.3.1 Personality Trusting Base

Personality trusting base refers to people's general tendency to trust an object (Erikson, 1968; Rotter, 1967, 1971, 1980). This trusting base has been used in prior trust research and models with different names, such as trustor's propensity to trust in the Mayer model (Mayer *et al.*, 1995) and disposition to trust in the McKnight model (McKnight *et al.*, 2002a; McKnight *et al.*, 1998).

Personality trusting base or similar constructs have been found to be related to trusting behaviors of interest in prior research (Moore, Shaffer, Pollak, & Taylor-Lemcke, 1987; Sabatelli, Buck, & Dreyer, 1983; McKnight *et al.*, 2002a). Normally, trust related personality or tendency forms in the very early stage of a person's life. Once it forms, it keeps stable and consistent across situations (Sitkin & Pablo, 1992). People with different levels of tendency to trust may differ in their trust-building strategies (Rotter, 1967, 1971, 1980). For instance, a person who has high tendency to trust may easily build his/her trusting beliefs towards all kinds of information systems, while a person with low tendency to trust may be suspect of all systems even if the systems known to be trustworthy. Therefore, personality trusting base could be one of

the external variables that contribute to the explanation of variation in trust (Mayer *et al.*, 1995).

Personality trusting base may have different levels of effect in different stages of trust formation. It is important at the initial stage (McKnight *et al.*, 1998; Mayer *et al.*, 1995) because people have no direct experience or knowledge of the trusting object and their assessments are more dependent on their own personality and intuition. When people directly interact with the trusting object, this effect has diminishing importance because people are more influenced by the nature of the interaction itself (Gefen *et al.*, 2003a; McKnight *et al.*, 1998).

McKnight et al. (1998) distinguished two types of personality trust base, faith in humanity and trusting stance, each of which affects trust formation in a different way. Generally, *faith in humanity* means that one assumes others are usually upright, well meaning and dependable (Wrightsman, 1991; Rosenberg, 1957). In trust research, we are more concerned in the trustworthiness of others, which is the assumption that others are trustworthy in terms of ability, benevolence and integrity (Mayer *et al.*, 1995; Doney & Cannon, 1997). Therefore, faith in humanity in trust research can be decomposed into faith in competence, faith in benevolence, and faith in integrity (McKnight *et al.*, 2002a). *Trusting stance* refers to the concept that one assumes better outcomes will result from dealing with trusting objects as though they are well meaning and reliable, regardless of what one believes about the trusting objects' attributes (Riker, 1971). An individual with strong trusting stance believes that it is better to be trusting in general than non-trusting. He/she tends to initially trust every object until something happens to prove him/her wrong.

In the comprehensive trust model, personality trusting base is proposed to be one of the

essential antecedents of trusting beliefs that indirectly affect trusting intention. The sub-constructs of faith in competence, faith in benevolence, faith in integrity and trusting stance are used to represent this trusting base. Based on prior trust research (McKnight *et al.*, 2002a; McKnight *et al.*, 1998) and TRA (Ajzen & Fishbein, 1980), personality trusting base is proposed to affect trusting beliefs. In the comprehensive trust model, this trusting base is specifically hypothesized to positively affect the three components of trusting beliefs, namely behavioral beliefs, normative beliefs and control beliefs.

H3a: Personality trusting base positively affects behavioral beliefs.

H3b: Personality trusting base positively affects normative beliefs.

H3c: Personality trusting base positively affects control beliefs.

2.3.2 Cognitive Trusting Base

Cognitive trusting base refers to various cognitive cues and impressions on which people form their trusts (Brewer, 1981). McKnight et al. (1998) integrated cognition-based trust into their model of initial formation of trust. Sarker et al. (2003) measured cognitive trust as one component of virtual teams trust. These constructs refer to the same concept as cognitive trusting base discussed in this research.

In this trust building mechanism, different cognitive cues and impressions provide foundations to build trust, rather than personal experiential interactions (Lewis & Weigert, 1985). Trust involves a degree of cognitive familiarity with the trusting object that is somewhat between total knowledge and total ignorance (Simmel, 1978; Gefen *et al.*, 2003a). When people lack direct information and experience with the trusting object, they build their cognitive

familiarity based on some impressions, cognitive cues, or the related knowledge such as second-hand information or experience with similar objects. The degree of familiarity determines their trust in this object. Similarly to personality trusting base, when people gain first hand knowledge of the trusting object, this cognitive familiarity becomes less important.

Two types of cognitive trusting base have been discussed in prior trust research (Baldwin, 1992; Kramer, Brewer, & Hannah, 1996; McKnight *et al.*, 1998; Sarker *et al.*, 2003; Langer, 1975). One is *categorization process*, which states that how people categorize the trusting object will affect their trust in the object. When people have no direct knowledge about the others trustworthiness, they will categorize the trusting object into the trustworthy group or the untrustworthy group based on second-hand knowledge, impressions and cognitive cues. Two forms of categorization are appropriate for the context of predicting trust in NID systems, namely *reputation* and *stereotyping*. Reputation is the second-hand knowledge of the trusting object. It may reflect the object's attributes of competence, benevolence, and integrity from indirect aspects (Barber, 1983; Dasgupta, 1988; Powell, 1996). Those with good reputations are more likely to be categorized as trustworthy individuals (McKnight *et al.*, 1998). Stereotyping means that the perceived stereotype of the trusting object will affect trust. When people have no direct knowledge of the trusting object, they categorize the object into an existing concept or a type of stimulus, and build their trust on these known cognitive structures (Fiske & Taylor, 1991). When the trusting object is categorized into a stereotype, which is perceived to be trustworthy, people are more likely to form positive trusting beliefs towards this object.

The other type of cognitive trusting base is *illusion of control*. In the context of predicting

trust, illusion of control refers to the fact that in an effort to gain some sense of personal control in an uncertain situation, people will assess an object's trustworthiness by observing and attending to cues that might confirm the object's trustworthiness (Gefen *et al.*, 2003a; McKnight *et al.*, 1998). Even in the absence of any evidence, the observation of these cues tends to over-inflate trust beliefs (Gefen *et al.*, 2003a; Davis & Kotteman, 1994).

In the comprehensive trust model, cognitive trusting base is proposed to be an important antecedent of trusting beliefs. Before people interact with the trusting object, their assessments of the object greatly depend on its reputation, stereotypes, and people's illusion of control (McKnight *et al.*, 1998; Sarker *et al.*, 2003). Base on prior trust research (McKnight *et al.*, 1998) and TRA (Ajzen & Fishbein, 1980), cognitive trusting base is proposed to influence a person's trusting beliefs. Specifically, in the comprehensive trust model, cognitive trusting base is hypothesized to positively affect the three components of trusting beliefs, including behavioral beliefs, normative beliefs and control beliefs.

H4a: Cognitive trusting base positively affects behavioral beliefs.

H4b: Cognitive trusting base positively affects normative beliefs.

H4c: Cognitive trusting base positively affects control beliefs.

2.3.3 Calculative Trusting Base

Calculative trusting base refers to some calculative processes involving perceived cost and benefit of performing the trusting behavior. It is equivalent to deterrence-based trust (Shapiro *et al.*, 1992), calculus-based trust (Lewicki & Bunker, 1995) and calculative-based trust (Gefen *et al.*, 2003a) used in the prior trust research.

The calculative trust building mechanism develops from the transaction cost view (Williamson, 1975, 1981). According to economic principles, people may shape trust with a calculative process, in which both trusting subject and object are assumed to be rational, calculative, and to act in their own best self-interest. People build their trust based on rational assessments of the costs and benefits of the trusting object preserving or violating their trust relationship (Shapiro *et al.*, 1992). For instance, if the punishments of violating the promised and expected trust-related behaviors or the likelihood of retributive actions outweigh the advantages and benefits of violating them, trust is warranted since violating the trust relationship is not in the best interest of the trusting object (Lewicki & Bunker, 1995).

In the comprehensive trust model, calculative trusting base is proposed to be an important antecedent of trusting beliefs. The variable of *cost vs. benefit*, which is the calculation of whether the trusting object can gain from not being trustworthy, will be used to represent the calculative trusting base (Gefen *et al.*, 2003a). Based on prior trust research (Gefen *et al.*, 2003a; McKnight *et al.*, 1998) and TRA (Ajzen & Fishbein, 1980), it is proposed that calculative trusting base help a person to build his/her trusting beliefs. In the comprehensive trust model, calculative trusting base is hypothesized separately to positively affect the three components of trusting beliefs, which are behavioral beliefs, normative beliefs and control beliefs.

H5a: Calculative trusting base positively affects behavioral beliefs.

H5b: Calculative trusting base positively affects normative beliefs.

H5c: Calculative trusting base positively affects control beliefs.

2.3.4 Institutional Trusting Base

Institutional trusting base refers to the impersonal structures that are inherent in a specific circumstance and facilitate trust building in this circumstance (Shapiro, 1987). It is also called institutional trust (Lewicki & Bunker, 1995; Zucker, 1986), institutional-based trust (Sarker *et al.*, 2003) or institution-based trust (McKnight *et al.*, 2002a; McKnight *et al.*, 1998; Gefen *et al.*, 2003a) in prior literature. Once the necessary structures are in place, people will feel secure and trust will be easily built.

Two types of institutional trusting base are discussed in prior trust research, *situational normality* and *structural assurance* (Gefen *et al.*, 2003a; McKnight *et al.*, 2002a; McKnight *et al.*, 1998). Situational normality refers to the idea that the situation is normal and everything is in its proper order (Lewis & Weigert, 1985). It involves a properly ordered setting that appears likely to facilitate a successful interaction (McKnight *et al.*, 1998). For instance, a system user may expect to see a new information system designed and developed in an authorized institution, it should be implemented and supported by professional personnel, appropriate training programs should be provided, and complete and detailed specification and user manual should come with the purchase of the system. If all these factors exist, he/she will easily trust the new system, at least initially.

Structural assurance means that safeguards such as promises, contracts, regulations, and guarantees are in place (Shapiro, 1987). These safeguards enable people to feel assured to trust the object (Sitkin, 1995). In the inter-personal or inter-organizational trust relationship, ethic regulations and legal recourse are the usual safeguards people use to assure their trust. In the

trust relationship between people and an information system, the technical standards, policies, and protocols can serve as the safeguards to facilitate people to build their trust.

In the comprehensive trust model, institutional trusting base is proposed as the fourth antecedent of trusting beliefs. Situational normality and structural assurance will be used to represent this trusting base. Based on prior trust research (Gefen *et al.*, 2003a; McKnight *et al.*, 2002a; McKnight *et al.*, 1998) and TRA (Ajzen & Fishbein, 1980), institutional trusting base is proposed to facilitate a person to build his/her trusting beliefs. In the comprehensive trust model, this trusting base is specifically hypothesized to positively affect the three components of trusting beliefs, including behavioral beliefs, normative beliefs and control beliefs.

H6a: Institutional trusting base positively affects behavioral beliefs.

H6b: Institutional trusting base positively affects normative beliefs.

H6c: Institutional trusting base positively affects control beliefs.

2.3.5 Summary of Trusting Bases

Four trusting bases have been described above and proposed to be the external variables in the context of predicting trust in NID systems. For each trusting base, the operationalized sub-constructs have been suggested and defined in the prior trust literature. The definitions are summarized in Table 2.2.

These trusting bases provide foundations of the three sets of trusting beliefs. Some of the trusting bases and their sub-constructs are different beliefs themselves. For example, faith in humanity is one's belief in trusting object's attributes, in terms of benevolence, competence and integrity. Situational normality is one's belief about whether the environment is in a proper

order. However, they are different from the trusting beliefs discussed early. These beliefs only indirectly influence the trust formation by providing foundations to build those trusting beliefs (i.e., behavioral beliefs, normative beliefs and control beliefs), which directly work in the trust formation process.

Table 2.2: Definitions of Trusting Bases

Construct	Sub-Construct	Definition
Personality Trusting Base	Faith in Humanity - Benevolence Faith in Humanity - Integrity Faith in Humanity - Competence	One assumes that others are usually benevolent, have integrity, and are competent.
	Trusting Stance	Regardless of what one believes about people's attributes, one assumes better outcomes result from dealing with people as though they are well meaning and reliable.
Cognitive Trusting Base	Reputation	One's second-hand knowledge about trusting object's trustworthiness in terms of competence, benevolence and integrity.
	Stereotyping	One understands the attributes of the trusting object through the cognitive structures that represent the knowledge about a general concept or a similar type of stimulus.
	Illusion of Control	One has expectancy of personal success probability inappropriately higher than the objective probability would warrant.
Calculative Trusting Base	Benefits vs. Costs	One's calculation of whether trusting object can gain from the untrustworthy behaviors
Institutional Trusting Base	Situational Normality -General Situational Normality -Benevolence Situational Normality -Integrity Situational Normality -Competence	One believes that the environment is in proper order and success is likely because the situation (institution) is normal (favorable), benevolent, competent, and has integrity.
	Structural Assurance	One believes that structures, like guarantees, regulations, promises, legal recourse or other procedures are in place to promote success.

Prior trust literature suggests the four trusting bases have different influences on trust (Gefen *et al.*, 2003a; McKnight *et al.*, 2002a; McKnight *et al.*, 1998; Sarker *et al.*, 2003). However, no research has been done to test them in the same context and no common understanding has been obtained about how they are actually involved in the multi-form trust formation. Based on the TRA and TPB (Ajzen & Fishbein, 1980; Ajzen, 1985, 1991), these trusting bases, as external factors, are indirectly involved in the formation of trust by providing foundations to behavioral beliefs, normative beliefs and control beliefs. Therefore, the four trusting bases in the comprehensive trust model are hypothesized to positively affect behavioral beliefs, normative beliefs and control beliefs, respectively. An exploratory analysis will be conducted with empirical data to determine how the four trusting bases actually affect the three sets of trusting beliefs.

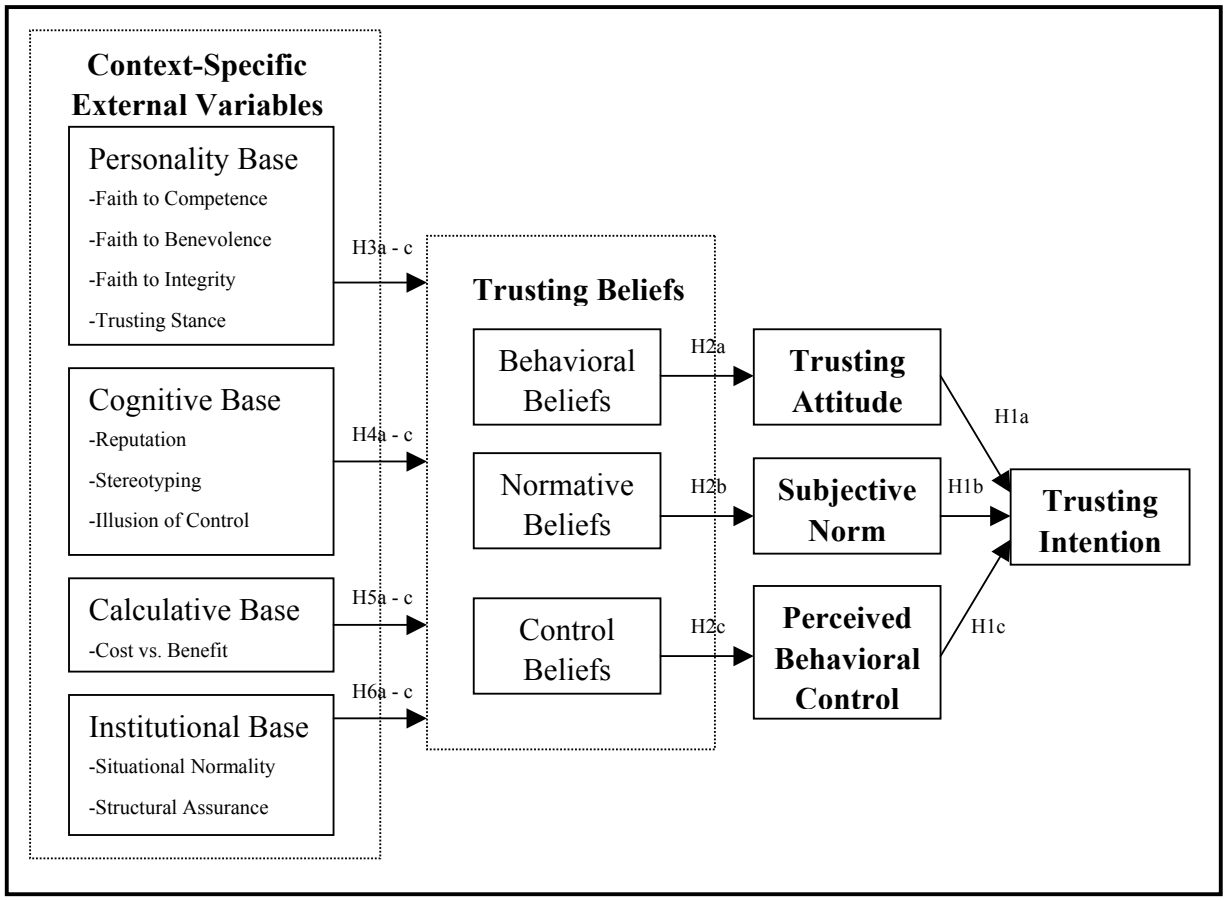
2.4 The Comprehensive Trust Model

Summarizing the above discussion, the concept of trust has been defined in a composite form, and a trust formation model has been presented with all the trusting constructs suggested by the TRA and TPB. Four trusting bases have been identified from trust literature. They have impacts on people's trust in NID systems through their different influences on trusting beliefs.

With all the trust formation constructs and trusting bases, the conceptual model of trust in NID systems is shown in Figure 2.5.3: *The comprehensive trust model*. In this model, trusting intention is jointly determined by trusting attitude, subjective norm and perceived behavioral control. These three determinants are aggregates of different sets of trusting beliefs, namely behavioral beliefs, normative beliefs, and control beliefs, respectively. Lastly, the different sets

of trusting beliefs are founded on four trusting bases. They are personality trusting bases, cognitive trusting bases, calculative trusting bases, and institutional trusting bases. Every trusting base represents a different trust building mechanism and therefore may differently affect the trust formation through their influences on some or all trusting beliefs. Figure 2.5.3 shows the full model with all of the above trust related constructs. The relationships between them have been hypothesized in the previous sections. The relationships and hypotheses are also illustrated in this comprehensive trust model.

Figure 2.5.3: The comprehensive trust model: Full Model



This model has a strong theoretical foundation as it is built on a TRA/TPB-based definition of trust and the TRA/TPB framework. This composite definition of trust encompasses the diverse definitions of trust in prior trust research. It provides a platform to compare results from previous trust studies. This model specifically includes trusting attitude, which has been excluded from other trust models or not isolated from other forms of trust. It also addresses how the other motivations, such as subjective norm and perceived behavioral control, affect people's intention to trust.

This comprehensive trust model integrates important trust related considerations from previous trust research and trust models. It takes in the important components from the Mayer model and the McKnight model. The construct of trusting intention is equivalent to the construct of trust in the Mayer model. The construct of behavioral beliefs in this model is equivalent to trustee's trustworthiness in the Mayer model and trusting beliefs in the McKnight model. Personality trusting base is equivalent to trustor's propensity to trust in the Mayer model and disposition to trust in the McKnight model. Institutional trusting base is equivalent to institution-based trust in the McKnight model. The match of the constructs in the comprehensive trust model and the two existing models is summarized in Table 2.3.

Moreover, four trusting bases are identified and integrated into the comprehensive trust model. The sub-constructs are developed in the operationalized level. These trusting bases, as well as their sub-constructs enable this model to better explain why people trust the NID systems and how to facilitate their trust.

Table 2.3 Match of constructs in the comprehensive trust model, the Mayer model and the McKnight model

Comprehensive Trust Model	Mayer Model (Not operationalized)	McKnight Model
Not included	Outcomes	*Not included*
Not included	**Risk Taking in Relationship**	***Trust Related Behavior (Not operationalized)***
Trusting Intention	**Trust**	**Trusting Intention**
Trusting Attitude	*Not included*	*Not included*
Subjective Norm	*Not included*	*Not included*
Perceived Behavioral Control	**Perceived Risk**	*Not included*
Behavioral Beliefs	**Perceived Trustworthiness**	**Trusting Beliefs**
Normative Beliefs	*Not included*	*Not included*
Control Beliefs	*Not included*	*Not included*
Personality Trusting Base	**Propensity to Trust**	**Disposition to Trust**
Cognitive Trusting Base	*Not included*	*Not included*
Calculative Trusting Base	*Not included*	*Not included*
Institutional Trusting Base	*Not included*	**Institution-Based Trust**

In summary, this comprehensive trust model proposed in this dissertation is theoretical grounded, comprehensive, and powerful in explaining and predicting people's trust in NID systems. This chapter proposes and presents the conceptual model. In the following chapters, an experimental study is designed and executed and the empirical data are gathered to test the hypotheses and the overall model. The analysis results will provide implications from both theoretical and practical perspectives.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter describes the methodology used for testing the hypotheses and the comprehensive trust model. An experiment was designed and executed. A survey instrument was developed based on various prior studies. A pilot study was conducted to validate the research design. Two sets of data were gathered in two semesters in the same sophomore business course to validate the scales and test the model. In this chapter, the study design, instrument development, pilot study and the data collecting process are described in detail.

3.1 Study Design

A 3-step experiment with two surveys was developed to test the comprehensive trust model. The specific aspects of the experiment design are described in the following sections. The detailed experimental script is available in Appendix A.

3.1.1 Samples

Undergraduate students enrolled in a sophomore level, university required business course were used as subjects in the pilot study, instrument validation process and the main study for model testing. The student sample contains some level of variances in gender, academic interests and nationality. But it may not represent all variances in the real population of trusting NID systems. In this study, the student sample worked fine in testing hypotheses and verifying model structure. However, it may be limited in predicting the actual trust in NID systems in the U.S. This is one of the limitations of this study, which will be discussed in detail in Chapter 6.

3.1.2 Study Procedure

The subjects were initially asked to complete a pre-survey that included demographic questions and the scale items for personality trusting base. The personality trusting base scale was included in a pre-survey to avoid confounding these trust-related individual differences with beliefs and attitudes toward a specific trusting object.

The subjects then reviewed some prepared material on the topic of NID systems and were given an assignment to search for information on NID systems on the Internet. The prepared NID materials include sub-topics like introduction to NID systems, technical components, functions, advantages vs. disadvantages and existing NID systems used in other countries. The PowerPoint slides for this lecture are presented in Appendix B. For the search assignment, generally used search engines and NID related keywords were provided for subjects' conveniences. These experimental interventions were designed to provide enough second-hand knowledge on NID systems for subjects to form initial trust perceptions.

After the experimental interventions, a post-survey was administered. In this post-survey, four self-reported items about knowledge on NID systems were first used to test the effect of the experimental intervention. The items evaluate whether the subjects acquired enough second hand knowledge on NID systems, on which they could form their trust perceptions. The post-survey also contained the scales for the remaining constructs, namely cognitive, calculative and institutional trusting bases, three different trusting beliefs, trusting attitude, subjective norm, perceived behavioral control, and trusting intention. Moreover, one question item that measures subjects' perception on the voluntariness of the system usage was also included in the post-

survey. This item would be used to test the moderating effect of voluntariness of system usage on trust formation.

The above experimental procedure was used for pilot study and first data collection. Prior to the second data collection, a slight change was made in the procedure. Since the institutional trusting base was measured with subjects' related perception of using general governmental information systems, the data for this construct should also be collected in the pre-survey to avoid confounding these individual differences of perception with beliefs and attitudes toward the specific trusting object – NID systems. Therefore, in the main study, the data related to the institutional trusting base were collected within the pre-survey.

3.2 Measures

The scales used to operationalize the constructs in this study were taken or adapted from existing scales whenever possible, or developed according to the guidelines provided in existing research. Every scale item is measured by a 7-point likert type scale (i.e., 1. strongly disagree; 2. moderately disagree; 3. somewhat disagree; 4. neutral; 5. somewhat agree; 6. moderately agree; and 7. strongly agree). The initial measurement scales were tested in a pilot study and refined. The modified scales are included in Appendix C. The scale development and sources are summarized in Table 3.1.

3.2.1 Instrument Scales of TRA/TPB-Related Constructs

According to the TRA, the proper definition of trusting behavior is the key to successfully measuring the other trusting constructs (Ajzen, 2001; Ajzen & Fishbein, 1980). Although the actual trusting behaviors were not measured in this research, the potential trusting

actions towards an NID system were specified as 1) advocating the adoption of the NID system; 2) providing personal information to the NID system; and 3) using an NID card. The trusting intention, trusting attitude, subjective norm, and perceived behavioral control were measured in terms of these trusting actions.

The scales of trusting intention were adapted from McKnight et al.'s research on initial trust in e-commerce (McKnight *et al.*, 2002a). Three items of *general willingness to depend* in McKnight et al. (2002a) were adapted into the research context in this study. Three items of *subjective probability of depending* were adapted for each of the three potential trusting actions specified above, namely advocating the adoption of NID systems, providing personal information to the systems, and using the NID cards.

The scales of trusting attitude, subjective norm, and perceived behavioral control were developed according to the TRA guidelines provided by Ajzen and Fishbein (1980) and from other scales that followed these guidelines (Ajzen & Driver, 1991; Davis & Ajzen, 2002; Hrubes *et al.*, 2001). Previous TRA/TPB studies used different measures for attitude, subjective norm, and perceived behavioral control (Ajzen & Madden, 1986; Ajzen & Driver, 1991; Cordano & Frieze, 2000; Davis & Ajzen, 2002; Hrubes *et al.*, 2001; Flannery & May, 2000; Fukukawa, 2002; Mathur, 1998; Bansal & Taylor, 2002; Riemenschneider *et al.*, 2002). Ajzen (2002) summarized that these three constructs could be assessed directly, by asking subjects to judge each on a set of scales, and indirectly on the basis of the corresponding beliefs (i.e., behavioral beliefs, normative beliefs and control beliefs); the direct and indirect measures should be highly correlated with each other.

Table 3.1: Instrument Development

Construct	Sub-Construct	# of Items	Source
Trusting Intention	Willingness to Depend	3	Adapted from McKnight et al. (2002)
	Probability of Depending – Advocate Probability of Depending – Provide Information Probability of Depending – Use card	9	
Trusting Attitude	- Advocate - Provide Information - Use card	3	Adapted from Ajzen and Driver (1991); Hrubes et al. (2001); Davis et al. (2002)
Subjective Norm	- Advocate - Provide Information - Use card	3	
Perceived Behavioral Control	- Advocate - Provide Information - Use card	3	
Behavioral Beliefs	Benevolence	3	Adapted from McKnight et al. (2002)
	Integrity	4	
	Competence	4	
Normative Beliefs		4	Adapted from Ajzen and Driver (1991); Hrubes et al. (2001); Davis et al. (2002)
Control Beliefs		3	
Personality Trusting Base	Faith in Benevolence	3	McKnight et al. (2002)
	Faith in Integrity	3	
	Faith in Competence	3	
	Trusting Stance	3	
Cognitive Trusting Base	Reputation	3	Developed according to McKnight et al. (1998), Sarker et al. (2003)
	Stereotyping	3	
	Illusion of Control	4	Developed according to Langer (1975)
Calculative Trusting Base	Cost vs. Benefit	3	Adapted from Gefen et al. (2003)
Institutional Trusting Base	Situational Normality - General Situational Normality - Benevolence Situational Normality - Integrity Situational Normality - Competence	11	Adapted from McKnight et al. (2002)
	Structural Assurance	4	

In the present study, both direct and indirect measures were developed for trusting attitude. Trusting attitude was first directly measured by evaluation of the three potential trusting actions (i.e., advocating the adoption of NID systems, providing personal information to the systems, and using the NID cards): whether performing these actions would result in favorable consequences. The indirect or belief-based measures (i.e., behavioral beliefs) of trusting attitude were adapted from McKnight et al. (2002a). As discussed in Chapter 2, the construct of trusting beliefs in the McKnight model is equivalent to the behavioral beliefs from the TRA/TPB perspective. Therefore, the scales of trusting beliefs in McKnight et al. (2002a) were adapted into the current research context to measure behavioral beliefs. Three scales were used to measure different aspects of the trustworthiness of NID systems: competence, benevolence and integrity, respectively (Mayer *et al.*, 1995).

Both direct and indirect measures were developed for subjective norm. First of all, subjective norm was directly measured by perceived influence from most important referents in terms of the three potential trusting actions (i.e., advocating the adoption of NID systems, providing personal information to the systems, and using the NID cards): whether the important referents would approve the performance of the actions. The indirect or belief-based measures (i.e., normative beliefs) were the opinions of different referent groups, such as parents, friends, classmates, and others (Ajzen & Driver, 1991; Davis & Ajzen, 2002; Hrubes *et al.*, 2001): whether the different referents or referent groups think the subjects should trust NID systems.

Similarly, both direct and indirect measures were developed for perceived behavioral control. First, perceived behavioral control was directly measured by perceived personal control

to perform the three potential actions (i.e., advocating the adoption of NID systems, providing personal information to the systems, and using the NID cards): whether the subjects would have full personal control over the performance of the actions. The indirect or belief-based measures (i.e., control beliefs) were developed according to the definition of control beliefs in the TPB (Ajzen, 1991, 1985) and previous TPB application studies (Ajzen & Driver, 1991; Davis & Ajzen, 2002; Hrubes *et al.*, 2001). Items were developed involving self-efficacy/ability, relevant experiences, and perceived ease/difficulty.

3.2.2 Instrument Scales of Four Trusting Bases

In the comprehensive trust model, every trusting base has already been defined at the operationalizable level or been represented by operationalizable sub-constructs. Measurement scales for each construct/sub-construct were taken or adapted from prior trust research, or developed according to the guidelines provided in existing research.

The scales of personality trusting base were directly taken from McKnight et al.'s validated measures of disposition to trust (McKnight *et al.*, 2002a). The disposition to trust in their research is equivalent to the personality trusting base in the comprehensive trust model. Since the personality is independent across situations, the exact same scale items can be used in different trust situations.

The scales of institutional trusting base were adapted from McKnight et al.'s validated measures of institution-based trust (McKnight *et al.*, 2002a). McKnight et al. (2002a) developed and validated scales to measure situational normality and structural assurance in the context of e-

commerce. In the present study, all the items for these two sub-constructs were adapted to the new context of trusting NID systems.

The scales of calculative trusting base were adapted from Gefen et al. (2003a), in which three items were used to measure calculative trust. These items were about whether trusting objects would have anything to gain by being not trustworthy, in terms of competence, benevolence and integrity in an e-commerce setting. All three items were adapted into the NID context in the present study.

Existing measurements for the cognitive trust or cognition-based trust were reviewed (Butler, 1991; Johnson-George & Swap, 1982). None of them was exactly suitable for the cognitive trusting base in the present research context. Therefore, new scales were constructed according to the guidelines provided in previous studies.

McKnight et al. (1998) suggested that categorization processes in cognition-based trust would involve information about the trusting object. Accordingly, Sarker et al. (2003) measured reputation with the second-hand knowledge of the trusting object's characteristics and traits, and measured stereotyping with the characteristics and traits of perceived stereotypes of the trusting object of interest. In the present research, reputation and stereotyping were measured by second-hand knowledge and characteristics of perceived stereotypes in terms of three trustworthiness components - competence, benevolence and integrity.

The scale for illusion of control was developed according to Langer (1975), in which four factors were suggested to be related to a person's illusion of control in a specific situation. They are competition (i.e., does the competition exist to affect confidence in one's own ability to bring

about desired outcomes), choice (i.e., do choices exist so that the objective chances of wining are better), familiarity (i.e., is the subjects familiar with the situation at a level so that they would be more confident to bring about desirable outcomes) and involvement (i.e., to what extent can the subjects be involved enough in a decision so that they would be more confident in bringing about desirable outcomes). In Langer's (1975) research, he defined the four factors in the context of lottery and gambling, but he didn't provide any guideline about how to operationalize these four factors in general research context. To date, little research successfully operationalized and empirically tested illusion of control and these factors. Although some trust literature suggests that illusion of control is a sub-construct of cognitive trusting base (McKnight *et al.*, 1998), the existing trust studies involving cognitive trusting base or similar constructs often excludes it (Sarker *et al.*, 2003; McKnight *et al.*, 1998). It is probably because of the difficulties to operationalize this sub-construct.

The illusion of control cannot be measured directly. The four factors suggested by Langer (1975), including competition, choice, familiarity and involvement, represent different dimensions of illusion of control and can be used to measure this latent construct. In the present study, four scale items are developed in the context of trusting NID systems to represent these four factors. These items will be validated with empirical data. The validation results are supposed to provide insights into the operationalization of illusion of control in future research.

3.3 Data Collection

A pilot study was conducted in the summer of 2003 using the initial study procedure and scales. Fifty-nine valid data were gathered from the sophomore business course. Generally, the

research design was validated with minor modifications to the experiment scripts and the lecture-presenting format. Some of the measurement items were also refined after receiving subjects' feedback.

The first data collection with the validated study process and modified measurements was conducted in the fall of 2003. This data collection included 390 subjects (228 males, 162 females) with an average age of 20.6. This dataset was used to validate the instrument. The detailed statistical techniques and analysis of instrument validation will be presented in the next chapter.

The second data collection was conducted in Spring 2004. In this data collection, the study procedure was almost the same as the one used in the first (Fall 2003) data collection, except that the scales of institutional trusting base were moved into the pre-survey. The second data collection included 443 subjects (286 males, 157 females) with an average age of 20.3. This set of data was used to test the hypotheses and the overall model fit. The data analysis techniques and the results will be presented in the following chapter.

CHAPTER 4

DATA ANALYSES AND RESULTS

The empirical study described in Chapter 3 was conducted and the measurement instrument developed for this study was validated. The mandatory validities, such as manipulation validity, construct validity and reliability, were assessed with an initial data collection consisting of 390 subjects. The results showed that this measurement instrument is generally valid and reliable in predicting trust in NID systems. With the validated instrument, the comprehensive trust model was tested with an additional 443 subjects. The model structure was verified. The results suggested that this model could accurately predict trust in NID systems. The detailed analysis processes and results are presented in this chapter.

4.1 Measurement Validation

Before the main study to test the comprehensive trust model, a set of 390 data was gathered in the fall of 2003 and was used to validate the measurement instruments. Quality research in the IS field calls for rigorous instrument validation before substantive research (i.e. the research focusing on covariation between different constructs or relationship between independent and dependent variables) using this instrument is conducted (Boudreau, Gefen, & Straub, 2001; Gefen, Straub, & Boudreau, 2000; Straub, 1989; Straub, Boudreau, & Gefen, 2004; Boudreau, Ariyachandra, Gefen, & Straub, 2004). A validated instrument is a necessary prerequisite for successful model and hypotheses testing (Schwab, 1980). Although most scales used in this study were taken or adapted from validated instruments, or developed based on theories, they were still validated with an independent dataset.

According to the instrument validation guideline provided by Straub et al. (2004), the mandatory validities, including construct validity, reliability, and manipulation validity, were assessed. *Construct validity* refers to the extent to which an instrument is an effective measure of a theoretical construct. It mainly consists of convergent validity and discriminant validity. *Convergent validity* refers to the extent to which the measurement items posited to reflect a given construct converge, compared to the convergence of items relevant to other constructs. *Discriminant validity* refers to the extent to which the measurement items posited to reflect a given construct differ from those that are not believed to make up the construct. *Reliability* refers to the extent to which the instrument items selected for a given construct are, taken together, consistent operationalizations of that construct. *Manipulation validity* is a measure of the extent to which treatments have been perceived by the subjects of an experiment.

The guideline also highly recommends the assessment of *content validity*, which refers to the extent to which the instruments represent the content of the constructs that they are supposed to measure (Cronbach, 1971; Kerlinger, 1964). Content validity is not easy to assess since it deals with an essentially unknowable sampling issue and not an instrument evaluation issue (Guion, 1977). Straub (1989) suggested a comprehensive and careful literature review to achieve content validity. In this study, since all the instrument scales were taken or adapted from existing validated instruments or developed with strong theoretical bases, the content validity of these instrument scales were believed to be acceptable.

Various statistical techniques have been suggested to validate an instrument (Gefen *et al.*, 2003a; Gefen *et al.*, 2000; McKnight *et al.*, 2002a; Straub, 1989; Straub *et al.*, 2004). In this

study, manipulation validity was first assessed with four self-reported items as well as the descriptive and frequency statistics. Next, exploratory factor analysis (EFA) was applied to test if every item loads on the construct that it was posited to measure and to cull out the items that load incorrectly. This analysis, to some extent, assessed the discriminant validity. Confirmatory factor analysis (CFA) as used in structural equation modeling (SEM) was then performed to assess construct validity. Convergent validity and discriminant validity was assessed respectively in this phase. Lastly, internal consistency reliability was used to assess reliability of the instrument. The detailed analysis processes and major results are presented in the following sections.

4.1.1 Manipulation Validity

First of all, manipulation validity was assessed with four self-report items about the extent to which subjects have obtained the second-hand knowledge of NID systems. Manipulation validity assessment is to measure the extent to which experimental treatments are perceived by the subjects (Bagozzi, 1977). It is an assurance on the part of the researcher that subjects are manipulated as intended (Straub *et al.*, 2004). In the current study, the treatment is the NID lecture and assignment conducted between two surveys. The purpose of this treatment is to make sure subjects have enough second-hand knowledge on NID systems, based on which they can form initial trust perceptions. The measurement validation guideline provided by Straub et al. (2004) suggested various techniques to assess the manipulation validity. Among them, a common and simple technique was used in this study: before the second survey, four self-report items about NID systems were used to test to what extent the subjects know about NID systems. These four items are:

Q1. I understand the purpose of NID systems.
Q2. I know how information technologies are used in NID systems.
Q3. I have learned about the different functions of NID systems.
Q4. I have learned the advantages and disadvantages of the NID systems.

Each item is measured by a 7-point likert type scale (i.e., 1. strongly disagree; 2. moderately disagree; 3. somewhat disagree; 4. neutral; 5. somewhat agree; 6. moderately agree; and 7. strongly agree). The descriptive statistics of the responses of the four questions are presented in Table 4.1. The frequency analysis for each item is presented in Appendix D.

Table 4.1: Descriptive Statistics of Second-Hand Knowledge Questions

Question #	N	Minimum	Maximum	Mean	Std. Deviation
Q1	390	1	7	6.05	.904
Q2	390	2	7	5.67	.932
Q3	390	1	7	5.82	.963
Q4	390	3	7	6.01	.877

The average scores for all the four items are above or close to 6, which indicate that subjects, on average, moderately agree on the statements. Most subjects are near or above the average level (i.e. item responses are 6 or 7): there are 77.2% of subjects who moderately or strongly agree that they understand the purpose of NID systems; about 60.3% of subjects moderately or strongly agree that they know how information technologies are used in NID systems; about 67.4% of subjects moderately or strongly agree that they know the different functions of NID systems; and 76.4% of subjects moderately or strongly agree that they know both pros and cons of the NID systems.

In sum, the manipulation validity is established. Most subjects have enough second hand knowledge on NID systems to form their trust perceptions, although they don not have direct information about or personally interact with the systems.

4.1.1 Exploratory Factor Analysis

Next, a series of exploratory factor analysis (EFA) were conducted. EFA is normally used to discover latent variables/factors behind a set of variables or measures when no theory or hypothesis is provided. In this study, all measurement scales were theoretically grounded. The EFA technique was used to determine the extent to which the constructs were discriminant and to cull out items that didn't load on the appropriate constructs as theories suggested (McKnight *et al.*, 2002a).

Exploratory factor analyses were conducted for each construct in the comprehensive trust model (Figure 2.5.3) individually. SPSS11.5 for windows was used to perform the exploratory factor analyses in this study. Principle components method was used as the extraction technique. Eigenvalue over 1 was first used to extract factors for every construct. A single factor with eigenvalue above 1 for each construct was expected. However, some constructs, such as behavioral beliefs, personality trusting base, cognitive trusting base and institutional trusting base, were theoretically represented by multiple sub-constructs, and therefore could result in more than one factor. In these cases, a second CFA was performed with a theoretically specified number of factors. The sub-constructs or the items for each high-level construct could be correlated with each other. Therefore, the EFA were performed using an oblique rotation. Prior theories and research didn't suggest a specific degree of obliqueness. The SPSS default degree of rotation (delta value of zero) was used.

The items for each construct were supposed to load on a single factor or to primarily load on one sub-construct as theories suggested, without large cross loadings on additional factors.

The primary loadings should be above 0.60 and cross loadings should be less than 0.40 (Boudreau *et al.*, 2001; Hair, Anderson, Tatham, & Black, 1998). The EFA results are summarized in the following paragraphs and assessed with the above criteria. The rotated factor matrices are presented in Appendix E.

When eigenvalue over 1 was used, a single factor was extracted for trusting intention, trusting attitude, subjective norm, perceived behavioral control, normative beliefs and calculative trusting base. The loadings ranged from 0.758 to 0.971. These constructs were unidimensional (Straub *et al.*, 2004; Gefen *et al.*, 2003a).

With eigenvalue over 1, two factors were extracted for behavioral beliefs. The 3 items for beliefs in benevolence and 3 items for beliefs in integrity primarily loaded on the same factor, while the 3 items for belief in competence primarily loaded on the other factor. This indicates that a person's beliefs in the trusting object's competence may be different from their beliefs in its benevolence and integrity.

Based on the theoretically suggested sub-constructs (McKnight *et al.*, 2002a), a second EFA with 3 factors specified for extraction was conducted. The results of this analysis showed all the items loading clearly on their theoretically posited constructs. All primary loadings were over 0.700 and no cross loadings were higher than 0.276.

For control beliefs, when eigenvalue over 1 was used for extraction, the first two items (TB_C1 and TB_C2) loaded on one factor and the third item (TB_C3) loaded on the other. The primary loadings ranged from 0.856 to 0.998. No cross loading was above 0.056. Examining these items suggests that the items of TB_C1 and TB_C2 are related to the subjects' ability and

knowledge about NID systems and relevant experiences, which are internal control factors (Ajzen, 1991). The item of TB_C3 is about the ease/difficulty for a subject to trust NID systems, which is one of the external control factors (Ajzen, 1991). To some extent, the internal and external control factors differ with each other. Therefore, although control beliefs items don not load on a single factor as expected, they are still theoretically explainable and acceptable.

An eigenvalue over 1 was first used for extraction in EFA with personality trusting bases and three factors were extracted. The items of faith in benevolence and those of faith in integrity loaded on the same factor. Faith of competence items loaded on the second factor, and trusting stance loaded on the third factor.

The theoretically suggested numbers of factors were specified for extraction in their second EFA. When 4 factors were specified, all items for personality trusting base loaded correctly on the four sub-constructs as theories suggested, namely faith in benevolence, faith in integrity, faith in competence, and trusting stance. The primary loadings ranged from 0.679 to 0.959. No cross loading was above 0.244.

For the institutional trusting base, when eigenvalue over 1 was used, two factors were extracted. All items clearly split into situational normality and structural assurance.

When the theoretically suggested five factors were specified for extraction, the items for situational normality split cleanly into 4 factors. These could be named as situational normality in general, benevolence, competence and integrity. The other 4 items that are posited to reflect structural assurance primarily loaded on the last factor. Most items had primary loadings above 0.613 and no cross loading above 0.320. Only one item, the third item for situational normality in

integrity (IT_SNI3), loaded on the primary factor slightly less than 0.60. However, its primary loading (0.573) was still much higher than its maximum loading on the other items (0.317). Furthermore, dropping this item would not improve construct validity or reliability of this sub-construct (see the following CFA and internal consistency analysis). Therefore, this item was retained.

An eigenvalue over 1 was used for extraction in EFA with cognitive trusting base. Three factors were extracted. The items posited to reflect reputation and stereotyping clearly split into two factors. Two items of illusion of control (ILLUS1 which represents competition and ILLUS4 which represents involvement) loaded on the third factor, while the other two items (ILLUS2 which represent choice and ILLUS3 which represents familiarity) loaded on the same factor with stereotyping items. All primary loadings ranged from 0.641 to 0.888. No cross loading was above 0.290. This result suggests eliminating ILLUS2 and ILLUS3. The overall instrument scale for illusion of control will be discussed further later in this section and in Chapter 5.

4.1.2 Confirmatory Factor Analysis

After the EFA, confirmatory factor analyses (CFA) were conducted to test the fit of the measurement models with the data and to assess the construct validity, which includes convergent validity and discriminant validity.

Multi-trait multi-method technique (MTMM) is a classic technique to assess convergent and discriminant validity without methods bias (Campbell & Fiske, 1959). However, it is not typically used in IS research for two reasons. First, there are no clear and wide-accepted criteria to verify the validities provided in prior research (Alwin, 1973-74), and it is very likely that the

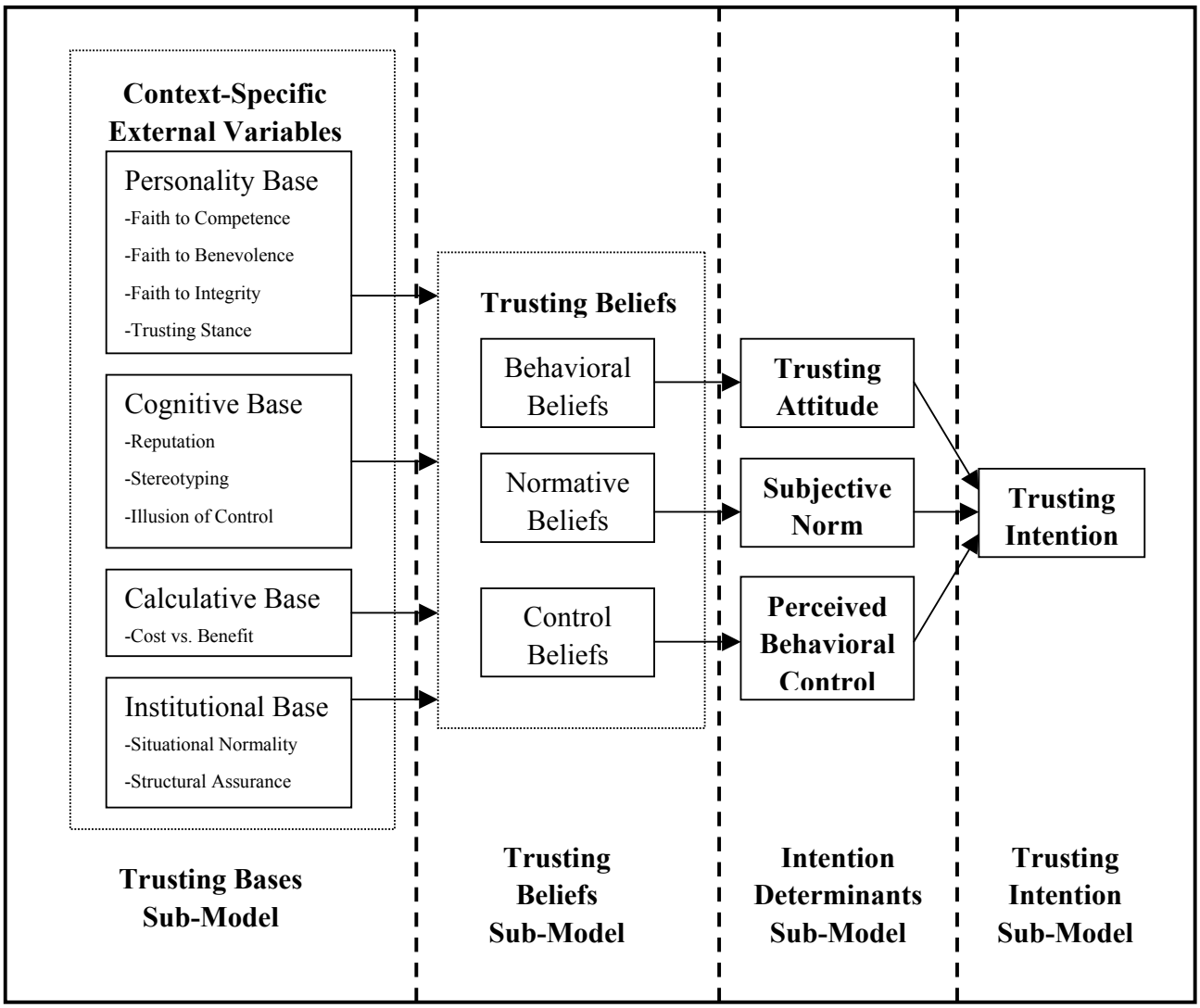
MTMM results are incorrectly interpreted. Second, it requires two different methods of gathering data and involves numerous comparisons of correlations and correlational patterns. It is very labor-intensive. The MTMM technique is suggested to be applied only after a research stream matures (Straub, 1989; Straub *et al.*, 2004). Therefore, as described later, alternative procedure was used to assess convergent and discriminant validity.

CFA with structural equation modeling technique (SEM) is a relatively new technique to verify construct validity. It is a multifunctional technique, which assesses not only convergent validity and discriminant validity, but also the extent to which the measurement model explains the variance in the data. The CFA with structural equation modeling technique generally results in a more rigorous variance analysis and provides better coefficient estimates and more accurate model analyses, compared to the traditional, first generation regression analysis (Bollen, 1989). It enables the researcher to include not only common variance but also error variance explicitly into the research model (Hair *et al.*, 1998). In the present research, the CFA in SEM was performed with AMOS 4 to assess the convergent validity and discriminant validity.

Given the complexity of the comprehensive trust model, it is not feasible to analyze all construct instruments in one big model. Construct validity only examines how variables in each distinct causal stage of the theoretical network behave. It is not important whether measures cross-load among different causal stages (Straub *et al.*, 2004). Therefore, four sub-models were developed from the comprehensive trust model (Figure 2.5.3), each including constructs in one trust-formation stage (Figure 4.1). The first sub-model consists of four trusting bases (personality, cognitive, calculative, and institutional). This model is hereafter referred to as the

trusting bases sub-model. The second sub-model includes three sets of trusting beliefs (behavioral beliefs, normative beliefs and control beliefs) and is referred to as the trusting beliefs sub-model. The third sub-model is comprised of trusting attitude, subjective norm and perceived behavioral control, and hereafter it is called the intention determinants sub-model. The last sub-model has one single construct – trusting intention, and is called the trusting intention sub-model. These four sub-models were then individually analyzed with CFA.

Figure 4.1: Four Sub-Measurement Models



Basically, four AMOS measurement models were constructed corresponding to these sub-models. Trusting intention sub-model has only one single construct – trusting intention, which is theoretically represented by four sub-constructs. The sub-constructs were taken as latent variables in the AMOS measurement model, and the items posited to reflect each sub-construct were taken as observed indicators of that latent variable.

The intention determinants sub-model has three high level constructs, namely trusting attitude, subjective norm and perceived behavioral control. Each construct has items related to the three potential actions (i.e., advocating the adoption of NID systems, providing personal information to the systems, and using the NID cards). So, in the AMOS measurement model, the three high level constructs – trusting attitude, subjective norm and perceived behavioral control – are latent variables, and the three items for each construct are observed indicators for that latent variable.

The trusting beliefs sub-model is more complicated. This sub-model consists of three belief related constructs. The construct of behavioral beliefs is multifaceted and has three components (i.e., benevolence beliefs, competence beliefs and integrity beliefs), each of which are measured by multiple items. The other constructs - normative beliefs and control beliefs – are uni-faceted. Therefore, in this study, an individual CFA was conducted for behavioral beliefs first, with sub-constructs as latent variables and scale items as observed indicators. When the instrument of behavioral beliefs was validated, a second CFA was performed for the whole sub-model.

Different approaches can be used to analyze measurement models involving multifaceted constructs. Among them, the partial aggregation approach was used in this study to allow the estimations of the degree of correspondence between the construct and its sub-constructs and the measurement errors in the same model (Bagozzi & Heatherton, 1994). The partial aggregation approach treats separate facets of the construct as indicators of a single latent variable, with each dimension being an aggregation of items. Therefore, to analyze the overall trusting beliefs sub-model, behavioral beliefs, normative beliefs and control beliefs were taken as latent variables. The individual items posited to measure normative and control beliefs were taken as observed indicators for these two latent variables. As for the behavioral beliefs, the individual items for beliefs in competence, benevolence and competence were bundled, and their averages were taken as observed indicators of the latent variable of behavioral beliefs.

The last sub-model, the trusting bases sub-model, has one construct with a single component (i.e., calculative trusting base) and three multifaceted constructs (i.e., personality trusting base, cognitive trusting base and institutional trusting base). Similar to the analysis of the trusting beliefs sub-model, individual CFA were performed for personality, cognitive and institutional trusting bases first. When the instruments for the three constructs were validated, a second CFA was then performed with the overall sub-model with partial aggregation approach. The four trusting bases were taken as latent variables and averaged (as in personality, cognitive and institutional trusting bases) or individual items (as in calculative trusting base) were taken as observed indicators. All of the AMOS measurement models are presented in Appendix F.

4.1.2.1 Measurement Model Fit Statistics

First of all, the model fit indices for the measurement models were examined. Model fit statistics provide good indicators of the extent to which a measurement model accounts for the covariance in the data (Straub *et al.*, 2004). Previous literature suggests various indices and standards to assess model fit in the structural equation modeling technique. In this study, both absolute and relative model fit indices were used. The absolute fit indices include likelihood-ratio chi-square (χ^2), the ratio of χ^2 to degree of freedom (χ^2/df), goodness of fit index (GFI) and adjusted goodness of fit index (AGFI). The relative indices, which compare the substantive model to the null model, include normed fit index (NFI), comparative fit index (CFI) and root mean squared error of approximation (RMSEA).

In this study, χ^2/df less than 3, GFI, NFI, and CFI above 0.90, AGFI above 0.80 and close to GFI, and RMSEA below 0.08 were used to indicate a good model fit (Gefen *et al.*, 2000; Hair *et al.*, 1998; Jarvenpaa, Tractinsky, & Vitale, 2000). More restrictive standards may be suggested in other fields. However, previous research in the IS field has seldom shown excellent model fit in all of the indices (Gefen *et al.*, 2003a; Jarvenpaa *et al.*, 2000; McKnight *et al.*, 2002a). The above standards have been accepted in leading MIS journals (Boudreau *et al.*, 2004; Boudreau *et al.*, 2001; Straub *et al.*, 2004). All of the model fit statistics are summarized in Table 4.2.

Four out of eight AMOS measurement models had excellent model fits based on the above standards. They are individual measurement models for personality trusting base and cognitive trusting base, and the measurement models for the intention determinants sub-model and trusting bases sub-model. The measurement model for trusting beliefs sub-model had a

slightly high ratio of chi-square to degrees of freedom (χ^2 /df = 3.122). The other indices in this sub-model indicated a good model fit.

Table 4.2: Measurement Model Fit Statistics

Measurement Model	χ^2 /df	GFI	AGFI	NFI	CFI	RMSEA
Trusting Intention	3.755	0.926	0.879	0.970	0.978	0.084 (0.071 – 0.097)
Intention Determinants	1.582	0.980	0.962	0.988	0.995	0.039 (0.011 – 0.061)
Behavioral Beliefs	4.780	0.917	0.866	0.954	0.963	0.099 (0.085 – 0.113)
Trusting Beliefs	3.122	0.949	0.913	0.962	0.973	0.074 (0.058 – 0.090)
Personality Trusting Base	2.671	0.949	0.918	0.954	0.971	0.066 (0.052 – 0.079)
Cognitive Trusting Base	2.541	0.974	0.946	0.970	0.981	0.063 (0.040 – 0.087)
Institutional Trusting Base	3.664	0.909	0.863	0.930	0.948	0.083 (0.073 – 0.093)
Trusting Bases	2.872	0.921	0.887	0.909	0.938	0.069 (0.059 – 0.080)

The measurement model for the trusting intention sub-model had GFI, NFI and CFI over 0.9. Its AGFI was 0.879, which was very close to the GFI. However, this sub-model had higher χ^2 /df (3.755) than 3.0, and its root mean square of error (RMSEA = 0.084) was also slightly higher than 0.08. Similarly, the individual measurement model for institutional trusting base has GFI, NFI and CFI over 0.9 and AGFI close to the GFI. It had high χ^2 /df (3.664) and slightly high RMSEA (0.083). The individual measurement model of behavioral beliefs had the highest χ^2 /df (4.780) and RMSEA (0.099) in all of the measurement models in this study (Table 4.2). Its other indices were in the similar level with those of the other models.

The above fit indices indicated that these three measurement models didn't fit the data very well. Efforts were made to improve these measurement models. First of all, modification indices were reviewed, but none of the suggested modifications were theoretically explainable. Second, the problematic item (IT_SNI3) identified in the previous EFA was reexamined. The elimination of IT_SNI3 from the individual measurement model of institutional trusting base

resulted in a worse model fit (i.e., χ^2 /df = 3.800, RMSEA = 0.085). Finally, prior trust research was reviewed. McKnight et al. (2002a) presented the model fit indices at the similar level in their study. Their measurement model of trusting intention had χ^2 /df at 4.815, which is even worse than that in the present study. Their measurement model of institution-based trust (i.e., be equivalent to institutional trusting base in the present study) had χ^2 /df at 4.091, which are better than that in the present study but still much larger than 3.0. Their measurement model of trusting beliefs (i.e., be equivalent to behavioral beliefs in the present study) had χ^2 /df = 8.368 and RMSEA = 0.101. Both indices are much worse than those in the present study. McKnight et al. (2002a) used a more lenient criteria in their research and accepted all these indices. Therefore, the measurement models in the present study are at least comparable with those in McKnight et al.'s study.

4.1.2.2 Convergent and Discriminant Validity

After the examination of the model fit statistics, the convergent and discriminate validity were assessed with the CFA. The convergent validity was assessed with three criteria: (1) all factor loadings being above 0.70; (2) all of them being significant; and (3) all of them being higher than twice their standard error (McKnight *et al.*, 2002a; Straub *et al.*, 2004). The discriminant validity was assessed by comparing the χ^2 of the original measurement model to the alternative models with each pair of latent variables combined into one (Gefen *et al.*, 2003a; McKnight *et al.*, 2002a; Straub *et al.*, 2004). If the χ^2 of the original model is significantly smaller than those of the alternative models, the discriminant validity is established. The

standardized loadings for scale items are presented in Appendix G and the χ^2 comparisons are presented in Appendix H.

First of all, the construct validity of the instrument of trusting intention was assessed. In the trusting intention sub-model, all factor loadings were significant, ranging from 0.80 to 0.96. The standard errors for the items ranged from 0.023 to 0.040. All item loadings were greater than twice their standard errors. The convergent validity was established. To assess the discriminant validity, six alternative models were made by combining each pair of latent variables into one. The χ^2 of the alternative models were found to be significantly larger than that of the original trusting intention sub-model, taking the degree of freedom into account. Therefore, the discriminate validity was evidenced, too.

Second, the construct validity of the instruments of trusting attitude, subjective norm and perceived behavioral control was assessed. In the intention determinant sub-model, all but one of the factor loadings were higher than 0.70. Only the first item of perceived behavioral control (PBC_A) loaded at 0.66. All loadings were significant at 0.000 and greater than twice their standard errors, which ranged from 0.024 to 0.050. From a statistical perspective, the modification indices didn't suggest any modification related to PBC_A. The exclusion of this item from the measurement model made the model fit worse (i.e., χ^2 /df = 1.787 and RMSEA = 0.045). Theoretically, to keep consistency with the trusting attitude and subjective norm scales, this item was retained. Thus, the convergent validity of this measurement was not perfect but acceptable. The χ^2s of the alternative models combining pairs of latent variables were found to be much larger than the χ^2 of the original model. Discriminant validity was established.

Third, the construct validity of the instruments of behavioral beliefs, normative beliefs and control beliefs was assessed. Before the trusting beliefs sub-model was analyzed, the measurement model for behavioral beliefs was analyzed individually. The item loadings in the behavioral beliefs measurement model ranged from 0.76 to 0.93. They were all significant at 0.000 and larger than two times of their standard errors (0.031 – 0.044). The combination of each pair of latent variables resulted in a much larger value of χ^2 compared to the original model. Both convergent and discriminant validity were evidenced.

Based on the validated instrument of behavioral beliefs, the trusting beliefs sub-model with bundled behavioral belief items was analyzed. The item loadings for normative beliefs ranged from 0.80 to 0.94 and were significant at 0.000. They were greater than twice their standard errors, which ranged from 0.031 to 0.041. However, two items for control beliefs (TB_C1 and TB_C3) had loadings less than the standard of 0.70. The loading of TB_C1 is 0.40 and that of TB_C3 is 0.05. Moreover, the loading for TB_C3 was non-significant ($p = 0.244$) and not greater than twice standard errors. The scale developed for control beliefs fails in achieving convergent validity. This result is within the expectation because the previous EFA had shown that the scale for control beliefs was not unidimensional. Alternative models of this scale were made by combining pairs of latent variables, and they were compared to the original model. The χ^2 of all alternative models were much larger than that of the original trusting beliefs sub-model. The discriminant validity was established.

Statistically, the above convergent validity analysis suggests the failure of the measurement scale for control beliefs. However, recent unpublished TPB research by Ajzen

(2002) argued that the three belief-related constructs (i.e. behavioral beliefs, normative beliefs and control beliefs) consist of individual beliefs in different aspects of behavioral consequences, referent opinions and perceived control. These individual belief items may be formative observed variables of the three belief-related constructs. It is not necessary that the formative variables for one latent construct be internal consistency (Gefen *et al.*, 2000; Straub *et al.*, 2004). Internal consistency reliability is generally considered a necessary but not sufficient condition for convergent validity (Schwab, 1980). Therefore, bad convergent validity in the three belief-related constructs is reasonable. Based on this line of thought, the control beliefs items were retained although they didn't achieve desirable convergent validity.

Lastly, the construct validity of the instruments which measured the four trusting bases was assessed. Individual analyses were first conducted for personality, cognitive and institutional trusting bases. Factor loadings in personality trusting base model ranged from 0.72 to 0.92. Two out of eight factor loadings (i.e., STEREO3 and ILLUS1) in cognitive trusting base model were slightly less than 0.70. The others ranged from 0.77 to 0.90. All loadings in institutional trusting base model ranged from 0.73 to 0.89. All loadings in the three measurement models were significant at 0.000 and greater than twice standard errors (0.040 – 0.120). The convergent validity of these three construct measurements was thus acceptable. Furthermore, for all of the three measurement models, the alternative models with combined latent variables resulted in much higher χ^2 than those of the original models. The discriminant validity was also established in these three construct measurements.

Based on the validated measurements for personality, cognitive and institutional trusting bases, an overall CFA was conducted with four trusting bases as latent variables and bundled or individual items as observed indicators. The convergent validity of calculative trusting base was first assessed. Two item loadings were above 0.70 (CAL1 and CAL2), while the other (CAL3) was only 0.54. They were all significant at 0.000 and larger than twice their standard errors (0.67 – 0.74). The modification indices didn't suggestion any modification related to CAL3. The elimination of this item resulted in a worsening of the model fit (i.e., χ^2 /df = 2.965 and RMSEA = 0.071). Since this scale has been validated in previous research (Gefen *et al.*, 2003a), this item (CAL3) was retained in this study. Again, the discriminate validity was assessed by comparing the original measurement model to alternative ones, each combining a pair of latent variables. The χ^2 of each alternative model was much larger than that of the original trusting bases sub-model. The discriminate validity was evidenced.

In summary, the construct validity of all instruments has been verified with EFA and CFA. Minor modification was suggested in the instrument (i.e. the items of ILLUS1 and ILLUS4 were eliminated). In the following section, reliabilities of the updated instrument scales were assessed.

4.1.3 Reliability

Internal consistency reliability, which refers to the extent to which items that reflect the same construct yield consistent results, is usually used to test the reliabilities of the scales. It is measured by looking at the statistical relationship among items from a single scale. If the items were supposed to measure the same construct, strong correlations would be found among them.

Internal consistency reliability analysis has been extensively discussed since Cronbach (1951) proposed his famous reliability coefficient alpha. Recently, the discussion has been focused within the structural equation modeling, and another reliability coefficient – ρ – has been widely used within the SEM technique to test the internal consistency reliability (Green & Hershberger, 2000; Hancock & Mueller, 2000; Komaroff, 1997; Raykov, 2001). The coefficient of ρ can be computed using the following formula:

$$\rho = \frac{(\sum_{i=1}^{P} \lambda_i)^2}{(\sum_{i=1}^{P} \lambda_i)^2 + \sum_{i=1}^{P} \psi_{ii}}$$

in which λi refers to the factor loading of the ith scale items and ψii stands for the error variance of that item (Bagozzi & Heatherton, 1994; Kano & Azuma, 2003).

In this study, the reliability coefficient ρ for each scale was calculated using the factor loadings and error variances estimated in the above CFA. Individual ρ was calculated for every uni-faceted construct, including trusting attitude, subjective norm, perceived behavioral control, normative beliefs, control beliefs and calculative trusting base. For the multifaceted constructs like trusting intention, behavioral beliefs, personality trusting base, cognitive trusting base and institutional trusting base, the ρ values were calculated for their sub-constructs first. The partial aggregation models, in which items for sub-constructs are bundled as indicators of the overall construct (Bagozzi & Heatherton, 1994), were then used to calculate the ρ for the overall constructs. All reliability coefficient ρ values for measurement scales in this study are presented in Table 4.3. The ρ value over 0.70 indicates a reliable instrument scale.

Table 4.3: SEM Reliability Coefficient ρ

Construct	ρ	Construct	ρ
Trusting Intention	**0.89**	**Personality Trusting Base**	**0.72**
Advocate	0.77	Faith in Benevolence	0.79
Provide Information	0.73	Faith in Integrity	0.76
Use card	0.89	Faith in Competence	0.90
Willingness to Depend	0.89	Trusting Stance	0.81
Trusting Attitude	**0.78**	**Cognitive Trusting Base**	**0.75**
Subjective Norm	**0.92**	Reputation	0.79
Perceived Behavioral Control	**0.70**	Stereotyping	0.71
Behavioral Beliefs	**0.82**	Illusion of Control	0.45
Benevolence	0.82	**Calculative Trusting Base**	**0.70**
Integrity	0.90	**Institutional Trusting Base**	**0.89**
Competence	0.82	SN - General	0.84
Normative Beliefs	**0.86**	SN - Benevolence	0.82
Control Beliefs	**0.46**	SN - Integrity	0.82
		SN - Competence	0.84
		Structural Assurance	0.86

Table 4.3 shows that all but two ρ values were above 0.70. They ranged from 0.70 to 0.92. Two scales had ρ-values below 0.70. They are control beliefs and illusion of control.

The ρ-value for control beliefs was 0.46. As discussed above, the items in this scale may be best represented as formative observed variables of control beliefs. They represent different dimensions or aspects of a person's control perception in the situation. The low reliability of this scale is thus reasonable and acceptable (Ajzen, 2002; Gefen *et al.*, 2000; Straub *et al.*, 2004).

The ρ-value for illusion of control was 0.45. Similarly, the illusion of control may be best represented as the summation of several formative observed variables. These observed variables are not assumed to be correlated with each other or to represent the same underlying dimension (Chin, 1998). The low reliability is acceptable.

4.1.4 Summary

A sample with 390 valid data has validated the measurement instrument developed in this study. All the mandatory validities suggested by Straub et al. (2004) were assessed. Generally, they were all evidenced in the instrument. The overall instrument was valid and reliable.

A couple of problematic scales have been found. One is the scale for control beliefs and the other is the scale for the illusion of control, which is one of the components of the cognitive trusting base. These two scales may be best represented as formative constructs, in which items are not assumed to be highly correlated with each other. Therefore, it is reasonable and acceptable for the scale items of these two constructs to be unreliable and not convergent.

4.2 Hypotheses and Model Testing

The comprehensive trust model proposed in this research is comprised of 11 constructs that work in different levels of trust formation. Although the model is theoretically grounded (Ajzen, 1985, 1991) and part of the model has been empirically supported (Mayer *et al.*, 1995; McKnight *et al.*, 2002a), it is not feasible to analyze such a big and complex trust model with a single AMOS structural equation model.

Theoretically, the comprehensive trust model suggests a multiple-stage trust formation process based on the TRA/TPB framework. First of all, different trusting beliefs, including behavioral beliefs, normative beliefs and control beliefs, form based on the four trusting bases. Secondly, trusting attitude, subjective norm and perceived behavioral control are developed based on the aggregates of the three trusting beliefs respectively. Lastly, trusting attitude, subjective norm and perceived behavioral control jointly determine trusting intention. In each

stage, the lower level constructs provide foundations for the higher level constructs and then the latter ones pass the influences of the former ones into the next stage. Therefore, most TRA/TPB related studies focused on only one stage of the TRA/TPB framework (Bansal & Taylor, 2002; Cordano & Frieze, 2000; Doll & Ajzen, 1992; Flannery & May, 2000; Randall, 1994; Riemenschneider *et al.*, 2002). Some others analyzed different stages in separate steps (Ajzen & Madden, 1986; Davis & Ajzen, 2002; Hrubes *et al.*, 2001; Mathieson, 1991). Similarly, when analyzing the comprehensive trust model, it is not necessary to include every construct in one big research model. In this study, a three-step analysis was conducted to test the comprehensive trust model. Each step just analyzed one stage of trust formation in this model.

The second set of 443 data collected in Spring 2004 was used for model and hypotheses testing. The following section (Section 4.2.1) presents some descriptive analysis of this dataset. The main analysis is presented in next three sections. Section 4.2.2 focuses on the prediction of trusting intention. Section 4.2.3 is the analysis of how the three belief constructs provide foundations of trusting attitude, subjective norm, and perceived behavioral control. Section 4.2.4 presents an exploratory analysis of how the four trusting bases affect the trust formation process. The last section summarizes the model and hypotheses testing.

4.2.1 Descriptive Analysis

Before the main analysis for model and hypotheses testing, some descriptive analyses were performed for the major TRA/TPB components in the comprehensive trust model, namely trusting attitude, subjective norm, perceived behavioral control, and trusting intention. The individual items for these four constructs were bundled and the averages and standard deviations

of the bundled items are summarized in Table 4.4. Since each item was measured by a 7-point likert type scale, the average scores should also be in the 1-7 range.

Table 4.4: Descriptive Analyses of Major Variables

Variables	Gender		Citizen		Perceived Volunteriness of System Usage						Total
					Recode Method 1			Recode Method 2			
	F	M	US	Non-US	V	N	M	V	N	M	
No. of cases	157	286	399	44	87	148	208	55	268	120	443
Trusting Attitude	3.94 (1.27)	3.84 (1.52)	3.83 (1.43)	4.33 (1.47)	3.10 (1.29)	3.99 (1.15)	4.12 (1.53)	2.82 (1.51)	3.99 (1.20)	4.10 (1.68)	3.88 (1.44)
Subjective Norm	3.52 (1.35)	3.63 (1.54)	3.55 (1.49)	3.98 (1.36)	2.64 (1.33)	3.67 (1.30)	3.93 (1.49)	2.36 (1.35)	3.71 (1.29)	3.89 (1.65)	3.59 (1.48)
Perceived Behavioral Control	5.03 (1.69)	5.10 (1.54)	5.08 (1.61)	5.05 (1.42)	5.09 (1.89)	5.25 (1.35)	4.93 (1.62)	5.12 (2.00)	5.19 (1.35)	4.80 (1.86)	5.08 (1.59)
Trusting Intention	3.61 (1.33)	3.59 (1.60)	3.57 (1.53)	3.85 (1.30)	2.72 (1.29)	3.70 (1.34)	3.89 (1.57)	2.40 (1.28)	3.73 (1.31)	3.84 (1.75)	3.60 (1.51)

F: female; M: male; V: voluntary usage; N: neutral; M: mandatory usage

The analyses of variance between groups (ANOVA) were conducted for gender, citizen and perceived voluntariness of system usage. The purpose of the ANOVA is to test if the three factors significantly affect subjects' trusting attitude, subjective norm, perceived behavioral control and trusting intention. The ANOVA results are presented in Appendix I.

First of all, the overall descriptive analysis was conducted for the whole sample. The average trusting attitude was 3.88, which indicates subjects had a slightly negative evaluation of trusting NID systems. The average subjective norm was 3.59, which indicates that subjects, on average, perceived slightly negative social influence about trusting NID systems. Average perceived behavioral control was 5.08, which indicates subjects had a positive perceived control towards trusting NID systems. Based on the three determinants, average subjects had a slightly negative intention (3.60) to trust NID systems.

Second, descriptive analysis was conducted by gender. This sample includes 157 female subjects and 286 male subjects. Female subjects had a slightly higher score of trusting attitude than male ones, while their average subjective norm and perceived behavioral control scores were slightly lower than those of male subjects. Females had a slightly higher intention to trust NID systems than males. The ANOVA results show that all of the four major constructs have non-significant differences between male and female groups ($p > 0.1$). Gender difference doesn't significantly influence the trust in NID systems.

The third descriptive analysis was conducted by citizenship. Since this study was conducted in a U.S. university, most subjects are U.S. citizens. Only 44 out of 443 subjects are not U.S. citizens. Both U.S. citizens and non-U.S. citizens were asked about opinions on the NID systems in the U.S. The non-citizen subjects had an average positive evaluation of trusting NID systems, while the citizen subjects had a negative one. The non-citizen subjects received a neutral social influence on average, while citizen subjects had a negative one. Both citizen and non-citizen subjects had similar levels of positive perceived control in trusting NID systems. Non-citizen subjects had a higher average intention to trust NID systems than citizen subjects, although both of their intentions are negative. In sum, the non-citizen subjects are more likely to trust NID systems. The ANOVA results show that the U.S. citizens significantly differ from non-citizens in trusting attitude ($p = 0.028$) and subjective norm ($p = 0.062$). However, they don not significantly differ from each other in perceived behavioral control and trusting intention ($p > 0.100$). Citizenship at most partially moderates a person's trust in NID systems. Moreover, in this study, the non-citizen group has much less subjects compared to the citizen group (i.e., 44 non-

citizens vs. 399 citizens). More non-citizen subjects are needed to further test the moderating effect of citizenship.

Lastly, a descriptive analysis was performed by perceived voluntariness of system usage. Subjects were asked to evaluate a statement of "The NID System will be required by the U.S. government" with a 7-point likert type scale. These responses were recoded for additional analysis. First, the responses of 1, 2 and 3 are recoded to indicate that subjects believe in different levels that NID systems will be voluntarily used in the U.S.; the responses of 5, 6 and 7 indicate subjects, in different levels, perceive the mandatory usage of NID systems; and the responses of 4 indicates neutral. Eighty-seven out of the 443 subjects believed in different levels that the future use of NID systems in the U.S. would be voluntary. Two hundred and eight subjects believed the U.S. government would adopt the NID systems in a mandatory way. The remaining 148 subjects were neutral. The descriptive analysis results are presented in Table 4.4 as "Recode Method 1".

The mandatory group had a slightly positive evaluation of trusting NID systems, while the voluntary group had a negative one and the neutral group was almost neutral. Although all three groups perceived negative social influence, the mandatory group had much positive scores than either the neutral group or the voluntary group. The mandatory group perceived less control towards the behavior of trusting NID systems than the voluntary group and the neutral group. The mandatory group had a much higher intention to trust NID systems than the other two groups, although all of the intentions were negative. In sum, the subjects, who believed the U.S. government would adopt a mandatory NID system, were more likely to trust the systems than

those who believed in a voluntary system and those who stayed neutral. The ANOVA results show that these three groups significantly differ in trusting attitude, subjective norm and trusting intention ($p = 0.000$). But they don not significantly differ in perceived behavioral control ($p = 0.116$).

A second coding approach was also used to test the moderating effect of perceived voluntariness. In the second ANOVA, the responses of 1 and 2 indicate perceptions of voluntary system usage; the responses of 3, 4 and 5 indicate neutral perception; and the responses of 6 and 7 indicate the perceptions of mandatory system usage. The voluntary, neutral and mandatory groups have 55, 268 and 120 subjects, respectively. The descriptive analysis results are similar to those of the first analysis. The averages and standard deviations of the four major constructs are presented in Table 4.4 as the Recode Method 2.

The second ANOVA results are also similar to those of the first one. These three groups significantly differ in trusting attitude, subjective norm and trusting intention ($p = 0.000$). The only difference is that the second ANOVA also shows significant difference of perceived behavioral control among the three groups ($p = 0.078$). Both two ANOVA show that perceived voluntariness of system usage could be a moderator in predicting trust in NID systems.

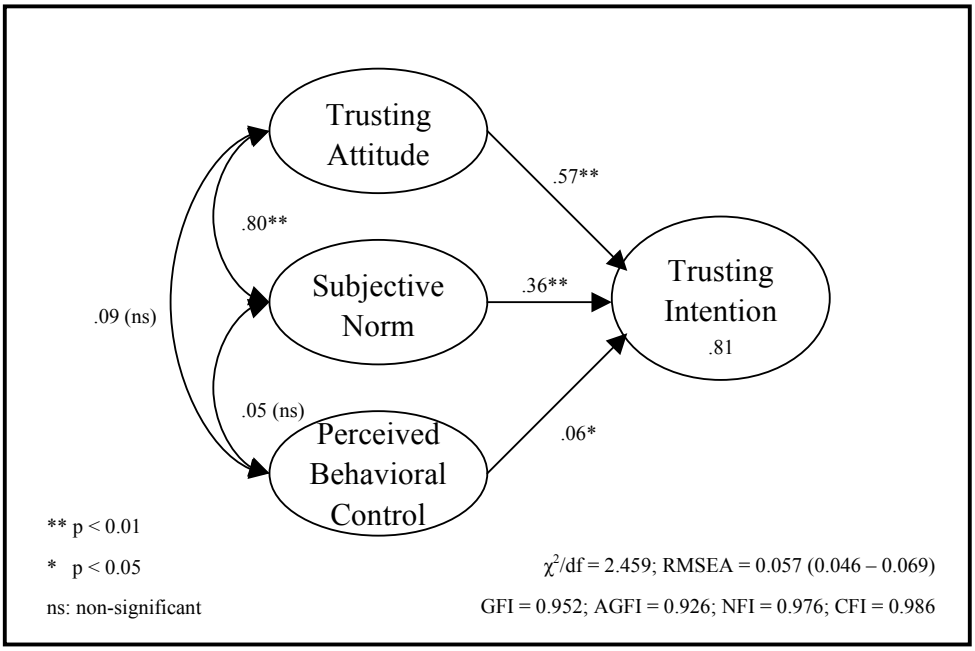
4.2.2 Prediction of Trusting Intention

The model/hypotheses testing was conducted in a three-step process. In the first step of the analysis, the regression equation analysis was performed with AMOS 4 to evaluate the prediction of trusting intention with trusting attitude, subjective norm and perceived behavioral control. The structural model is shown in Figure 4.2. Direct paths were specified from trusting

attitude, subjective norm and perceived behavioral control to trusting intention. Each path represents a sub-hypothesis of H1.

The model fit statistics were first examined. The same model fit standards used in the measurement validation were applied in the main analysis. In this structural model, the ratio of chi-square to degree of freedom (χ^2/df) was less than 3; GFI, AGFI, NFI and CFI were all above 0.90; RMSEA was 0.057. All these statistics indicate an excellent model fit.

Figure 4.2: Regression Equation Model for Trusting Intention and its Determinants



Next, the magnitude and significance of the three path loadings were examined. The standardized weight for trusting attitude was 0.57, which was significant at 0.000. Trusting attitude is the primary determinant of trusting intention. H1a is strongly supported. The standardized weight of subjective norm was 0.36, which was also significant at 0.000. Subjective

norm is the secondary determinant of trusting intention. H1b is strongly supported. The standardized weight of perceived behavioral control was 0.06 and significant at 0.034. The third determinant has a relatively small contribution to trusting intention. H1c is supported, too. All of the three determinants explained 81% of the variance in trusting intention, which indicates that trusting intention was well predicted by these three determinants.

The results of this step of the analysis also showed high correlation ($r = 0.80$, $p = 0.000$) between trusting attitude and subjective norm. This relationship was neither proposed in the comprehensive trust model nor supported by the TRA/TPB. Further discussion of this relationship will be presented in Chapter 5.

4.2.3 Behavioral Beliefs, Normative Beliefs and Control Beliefs

The above analysis showed that trusting attitude, subjective norm, and perceived behavioral control were implicated as important predictors of peoples' intention to trust NID systems. All of them together successfully predicted trusting intention in this study.

The next analysis was performed to see how these predictors are formed based on different trusting beliefs. In the comprehensive trust model, three belief-related constructs were proposed to provide foundations to the three predictors of trusting intention. They were behavioral beliefs, normative beliefs and control beliefs. These three sets of beliefs don not determine trusting intention directly (Ajzen, 1991; Ajzen & Fishbein, 1980). However, from a practical perspective, the specific underlying beliefs should be of greatest utility because these beliefs provide substantive information about the kinds of considerations that guide the behavioral intention and ultimately guide the behavior (Davis & Ajzen, 2002).

In this step of analysis, the correlations between the three predictors and their corresponding belief constructs were calculated to test the second set of hypotheses. The correlations were also calculated between the predictors and individual belief items to see how various individual beliefs constructed foundations of the three intention predictors. The correlations are presented in Table 4.5.

First, correlation between trusting attitude and behavioral beliefs was calculated. The average of the three direct measures of trusting attitude was correlated with the average of the 11 individual behavioral belief items. The correlation coefficient was 0.696 ($p < 0.01$), suggesting that this set of behavioral beliefs captured the overall attitudinal considerations of trusting NID systems reasonably well. H2a is strongly supported.

Table 4.5: Correlations between Attitude, Subjective Norm, Perceived Behavioral Control and their Belief Components

Correlation with Trusting Attitude						Correlation with Subjective Norm		Correlation with Perceived Behavioral Control	
Behavioral Beliefs	.696(**)					**Normative Beliefs**	.816(**)	**Control Beliefs**	.311(**)
Beliefs in Benevolence (TB_BB)	.703(**)	**Beliefs in Competence (TB_BC)**	.477(**)	**Beliefs in Integrity (TB_BI)**	.640(**)				
TB_BB1	.711(**)	TB_BC1	.405(**)	TB_BI1	.609(**)	TB_N1	.827(**)	TB_C1	.287(**)
TB_BB2	.558(**)	TB_BC2	.353(**)	TB_BI2	.578(**)	TB_N2	.764(**)	TB_C2	.223(**)
TB_BB3	.606(**)	TB_BC3	.512(**)	TB_BI3	.577(**)	TB_N3	.642(**)	TB_C3	.139(**)
		TB_BC4	.382(**)	TB_BI4	.526(**)	TB_N4	.728(**)		

** $p < 0.01$(2-tailed)

Next, the average measure of subjective norm was correlated with the average measure of normative beliefs. The correlation coefficient was 0.816 ($p < 0.01$), which indicated that this set

of normative beliefs captured the important considerations related to subjective norm. H2b is strongly supported.

Similarly, the average measure of perceived behavioral control was then correlated with that of control beliefs. The correlation coefficient was 0.311 ($p < 0.01$), showing that this set of control beliefs captured a certain amount of considerations associated with perceived behavioral control. The correlation was also significant although its magnitude was relatively small, compared to the previous two. H2c is supported, too.

To get a further understanding of how trusting attitude, subjective norm, and perceived behavioral control were constructed with individual beliefs, the aggregate measures of these three predictors were then correlated with individual belief items.

Trusting attitude was positively correlated with every individual behavioral belief. The magnitude ranged from 0.353 to 0.711 ($p < 0.01$). When all the items were bundled into 3 sets, namely beliefs in benevolence, beliefs in competence and beliefs in integrity, trusting attitude was found to have the highest correlation with beliefs in benevolence ($r = 0.703$, $p < 0.01$). It correlated with beliefs in integrity at a similar level ($r = 0.640$, $p < 0.01$). The correlation between trusting attitude and beliefs in competence was relatively lower ($r = 0.477$, $p < 0.01$), which indicates that people may rate goodwill and honesty higher than ability in a trust relationship.

Similarly, subjective norm had positive correlations with all of the four individual normative beliefs. The magnitude of the correlations ranged from 0.642 to 0.827 ($p < 0.01$). The family influence (TB_N1) had the largest impact on the subjects, followed by influences from

friends (TB_N2) and other acquaintances (TB_N4). The influence from classmates had less impact than the other three types of influence, but still contributed to the overall social influence on the subjects.

Perceived behavioral control was also positively correlated with the three individual control beliefs. The magnitude of correlations ranged from 0.139 to 0.287. The correlations were all significant at $p < 0.01$, although they were much lower than those of attitude and subjective norm. Among the three individual control beliefs, self-efficacy (TB_C1) had the most important contribution to perceived behavioral control. The related experiences (TB_C2) had slightly smaller contribution, and the perceived ease/difficulty (TB_C3) had the smallest contribution to perceived behavioral control.

4.2.4 Trusting Bases

The last step of the main analysis was to discover how the four trusting bases performed in the trust formation process. Prior trust literature suggests that the four trusting bases have different influences on the formation of trust (Gefen *et al.*, 2003a; Lewicki & Bunker, 1995; Lewis & Weigert, 1985; Mayer *et al.*, 1995; McKnight *et al.*, 2002a; McKnight *et al.*, 1998; Sarker *et al.*, 2003). However, few researchers test all of the four trusting bases together in one single research. Little trust research separates the construct of trust into different forms or specifies which trusting form the trusting bases impact and how they involve in the whole trust formation.

According to the TRA/TPB (Ajzen, 1985, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), as the external variables, these trusting bases affect the overall trust formation

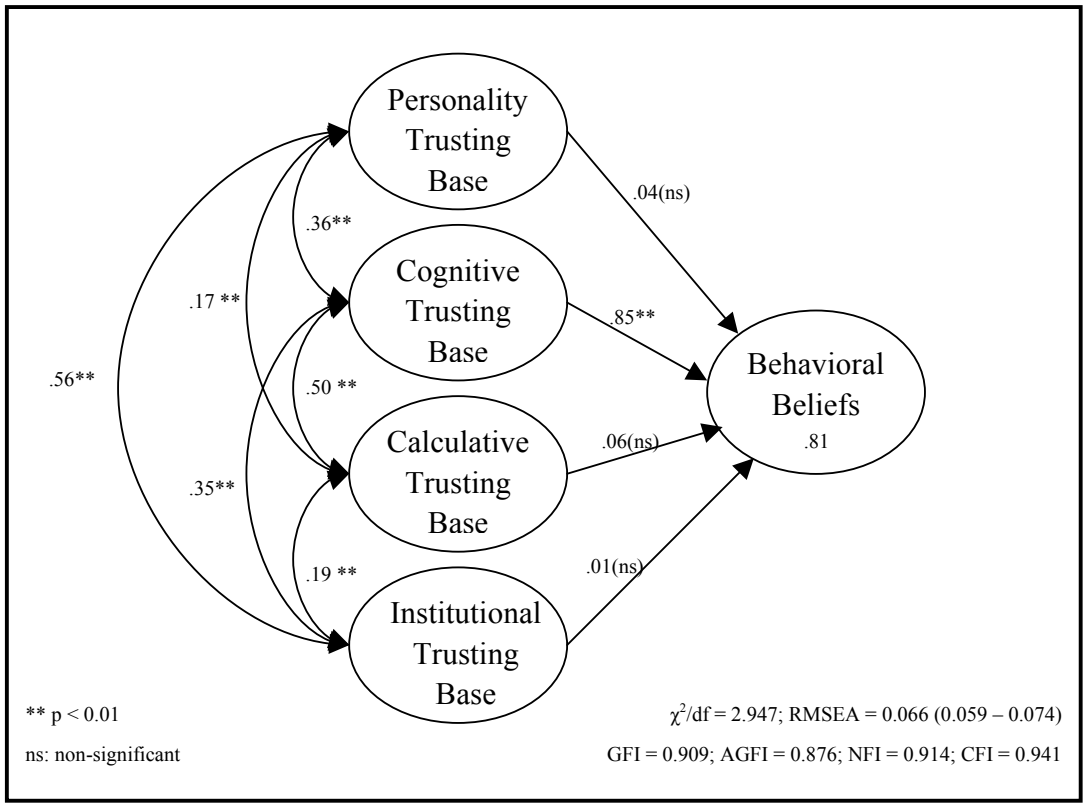
process through their influence on the lower level trusting constructs such as the three belief related constructs. Thus, an exploratory analysis was performed in this step to find the relationships between the four trusting bases and the three trusting beliefs. Specifically, structural models with paths from every trusting base to every trusting belief were created and tested with empirical data. The significant paths would indicate effects from some bases to some trusting beliefs, while non-significant ones indicate no effect between them. This type of data-driven analysis approach can only be used for exploratory analysis. A future study with new data will be needed to confirm the results of this analysis.

The regression equation modeling technique with AMOS 4 was used in this analysis. The structural models for behavioral beliefs, normative beliefs and control beliefs are presented in Figure 4.3, Figure 4.4, and Figure 4.5, respectively. The three models were tested with 443 subjects. In this step of analysis, model fit statistics were first assessed. The same fit standards used in the instrument validation were applied here to interpret how well each model fits the data. The regression paths were then analyzed to test the hypotheses and to find out how the four trusting bases actually affected the trusting beliefs. Lastly, the squared multiple correlations were examined to see if the three trusting beliefs were well explained by the four trusting bases.

First, the construct of behavioral beliefs was predicted with all of the four trusting bases. In the structural model of behavioral beliefs (Figure 4.3), the ratio of chi-square to degree of freedom ($\chi 2/df$) was below 3; GFI, NFI and CFI were all above 0.90; AGFI was above 0.80 and very close to GFI; root mean square error of approximation (RMSEA) was below 0.08. All of the indices indicate a very good model fit. The examination of the path loadings shows that only one

of the four trusting base - cognitive trusting base - had a significant effect on behavioral beliefs. The standardized loading was 0.85 ($p = 0.000$). H4a is supported. The other three trusting bases only affected the behavioral beliefs in a non-significant way ($p > 0.05$). H3a, H5a and H6a are not supported. The squared multiple correlation shows that 81% of variance in behavioral beliefs is explained by this model. Although only the cognitive trusting base actually affects behavioral beliefs, this single base can explain behavioral beliefs very well.

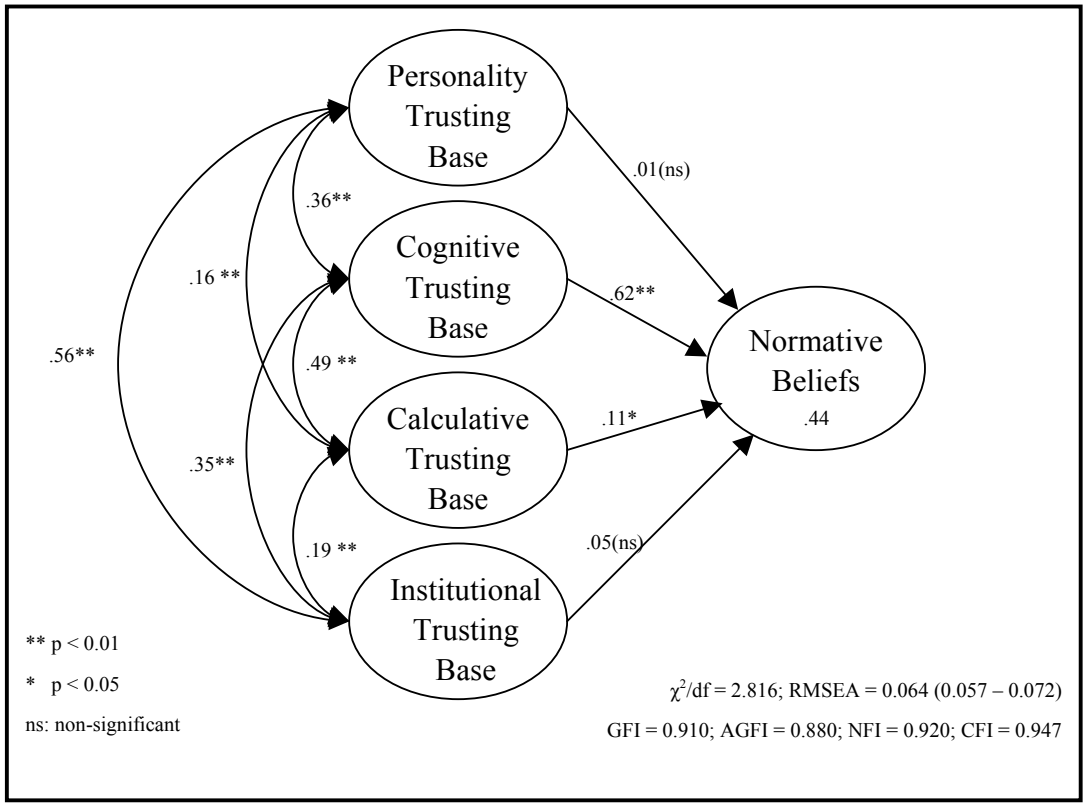
Figure 4.3: Regression Equation Model for the Formation of Behavioral Beliefs



Next, the construct of normative beliefs was predicted with the four trusting bases. This structural model (Figure 4.4) fitted the empirical data very well: $\chi 2/df$ was less than 3; GFI, NFI and CFI were all above 0.90; AGFI was 0.880 and very close to GFI; RMSEA was 0.064. Two

of the four trusting bases had significant paths to normative beliefs. One is cognitive trusting base, which had a path loading of 0.62 (p = 0.000). The other is calculative trusting base, which had a loading of 0.11 (p = 0.049). H4b and H5b are supported. Personality and institutional trusting bases non-significantly affected normative beliefs. H3b and H6b are not supported by the data. About 44% of variance in normative beliefs was explained by this model, which indicates normative beliefs are reasonably explained by cognitive and calculative trusting bases.

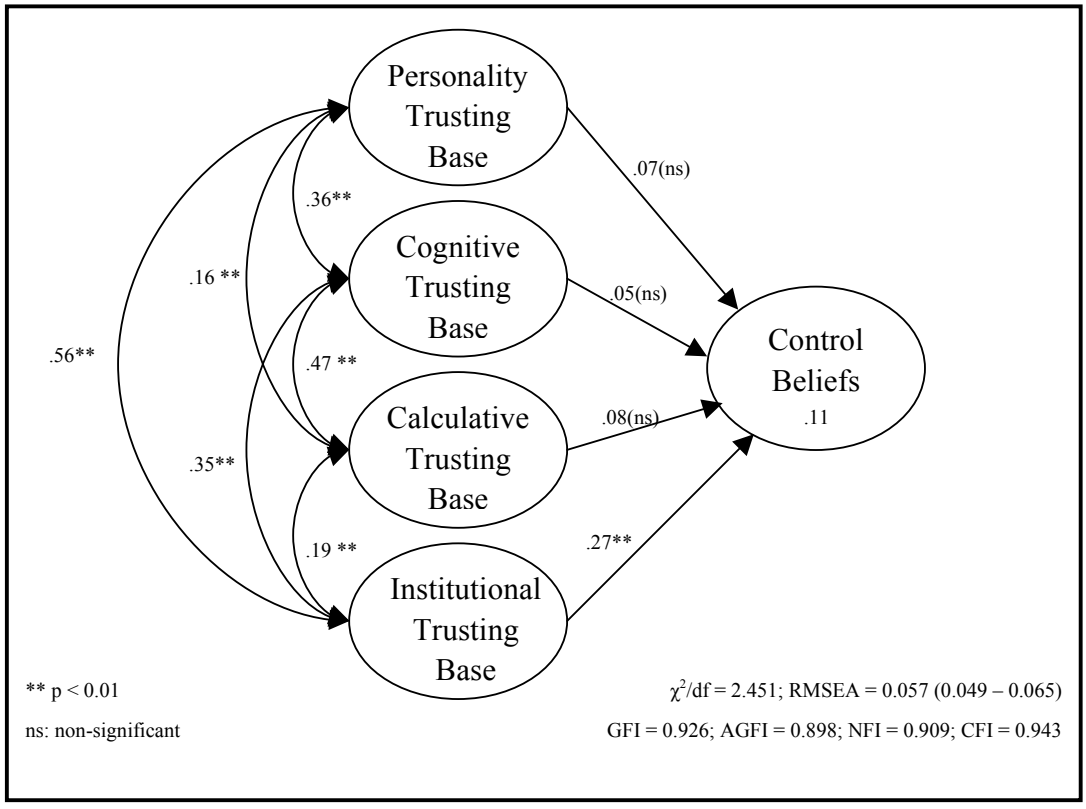
Figure 4.4: Regression Equation Model for the Formation of Normative Beliefs



Lastly, the construct of control beliefs was predicted with the four trusting bases. This structural model (Figure 4.5) also fitted the empirical data very well. The $\chi 2/df$ was 2.451. GFI, NFI and CFI were all above 0.90. AGFI was almost 0.90 and very close to GFI. RMSEA is

0.057, which indicates a very good model fit. Only one of the four trusting bases, institutional trusting base, had a significant path to control belief. The regression loading was 0.27 ($p = 0.000$). H6c is supported. The other three trusting bases had non-significant effects ($p > 0.05$) on control beliefs. H3c, H4c and H5c are not supported in this analysis. About 11% of variance in control beliefs was explained in this model. Based on the previous analyses, the relatively low variance accounted for (VAF) may be because of the measurement development limitation associated with control beliefs.

Figure 4.5: Regression Equation Model for the Formation of Control Beliefs



The review of the three structural models also suggested some relationship between personality trusting base and institutional trusting base, since the correlations between them were

always larger than 0.50. This relationship was not proposed in the comprehensive trust model. However, it has been addressed in prior trust literature. McKnight et al. (1998) proposed that people's faith in humanity and trusting stance affect their perceptions of situational normality and structural assurance in general. Their follow up empirical studies (McKnight *et al.*, 2002a, 2002b) and other IS/IT trust research (Li, Valacich, & Hess, 2004b) provided strong empirical support to this proposition. Thus, the high correlation found between personality and institutional trusting bases is theoretically explainable and accepted.

4.2.5 Summary

The comprehensive trust model proposed in this study has been verified in the above three-step analysis. This TRA/TPB-based trust model was generally well supported by the empirical data. The hypotheses testing results are summarized in Table 4.6.

The data analysis results show that trusting intention was accurately predicted by trusting attitude, subjective norm and perceived behavioral control. These three predictors, in turn, were significantly correlated with their belief foundations, namely behavioral beliefs, normative beliefs and control beliefs, respectively, although the correlation between perceived behavioral control and control beliefs was relatively low. The exploratory analysis results suggested that behavioral beliefs were mainly formed on cognitive trusting base; normative beliefs were jointly determined by cognitive and calculative trusting bases; and control beliefs were determined by institutional trusting base, which also mediated the influence from personality trust base. The behavioral beliefs and normative beliefs were well explained by the trusting bases while control beliefs were only partially explained because of some measurement limitation. The further

discussion of the results will be presented in Chapter 5 and the limitations will be addressed in Chapter 6.

Table 4.6: Hypotheses Testing Results

Hypotheses		Supported?
H1a	Trusting attitude positively affects trusting intention.	Yes
H1b	Subjective norm positively affects trusting intention.	Yes
H1c	Perceived behavioral control positively affects trusting intention.	Yes
H2a	Behavioral beliefs positively correlate to trusting attitude.	Yes
H2b	Normative beliefs positively correlate to subjective norm.	Yes
H2c	Control beliefs positively correlate to perceived behavioral control.	Yes
H3a	Personality trusting base positively affects behavioral beliefs.	No
H3b	Personality trusting base positively affects normative beliefs.	No
H3c	Personality trusting base positively affects control beliefs.	No
H4a	Cognitive trusting base positively affects behavioral beliefs.	Yes
H4b	Cognitive trusting base positively affects normative beliefs.	Yes
H4c	Cognitive trusting base positively affects control beliefs.	No
H5a	Calculative trusting base positively affects behavioral beliefs.	No
H5b	Calculative trusting base positively affects normative beliefs.	Yes
H5c	Calculative trusting base positively affects control beliefs.	No
H6a	Institutional trusting base positively affects behavioral beliefs.	No
H6b	Institutional trusting base positively affects normative beliefs.	No
H6c	Institutional trusting base positively affects control beliefs.	Yes

CHAPTER 5

DISCUSSION OF RESULTS

Chapter 4 provided the detailed procedures and the results of instrument validation and model and hypotheses testing. With a validated instrument, the empirical study generally supported the comprehensive trust model and hypotheses proposed in this research. The model was found to afford a quite accurate prediction of the intention to trust NID systems.

Chapter 5 focuses on the discussion of the above results. In this chapter, previous straightforward analysis results are summarized and interpreted. The measurement instrument is generally validated. The descriptive analysis reveals potential moderators in predicting trust in NID systems. Trusting intention is well predicted by trusting attitude, subjective norm and perceived behavioral control. Behavioral beliefs and normative beliefs provide substantive foundations for trusting attitude and subjective norm. All trusting beliefs are then formed based on different trusting bases.

Some complicated or unexpected results are further discussed. Two problematic scales identified in data analysis are discussed and possible reasons are provided. The high correlation between trusting attitude and subjective norm is explained with the internalization process of social influence. The indirect effect of personality trusting base on trusting beliefs is also supported by previous theoretical and empirical studies. Additional literature review and data analyses are performed to support the above discussions.

5.1 Discussion of Measurement Validation

A validated instrument is a prerequisite of a successful substantive research. In this study, although the measurement scales were all taken or adapted from previously validated instruments, or developed with strong theoretical foundations, necessary validity and reliability assessments were still performed according to the instrument validation guideline provided by Straub et al. (2004). With 390 valid samples, the validation analysis results showed that, in general, the instrument was acceptable in terms of manipulation validity, convergent validity, discriminant validity and internal consistency reliability.

5.1.1 Illusion of Control

The instrument validation analysis also indicated two problematic scales. One is the scale for illusion of control, which is one of the sub-constructs that represent cognitive trusting base. The scale was initially developed in this study based on the four factors that determine illusion of control, namely competition, choice, familiarity and involvement (Langer, 1975). Langer first suggested these four factors as determining a person's illusion of control in a series of studies in the context of lottery and gambling. A review of related literature shows little research has been done to operationalize or measure these four factors in a general research context, and guidelines for measurement development have not been provided in this area. Some trust researchers suggest that the illusion of control is one sub-construct of cognitive trusting base and will inflate a person's trusting beliefs (McKnight *et al.*, 1998). However, most research avoids measuring this sub-construct even when studying the cognitive trusting base construct (McKnight *et al.*, 2002a; Sarker *et al.*, 2003).

In the present study, a scale for illusion of control was initially developed. Four scale items were created as reflective observed variables in the context of NID system, each representing one of the four factors which cause a person's illusion of control. Statistical findings from this dissertation and subsequent review of the literature suggest that these items may be best represented as formative observed variables of the illusion of control. Formative observed variables are not assumed to be correlated with each other like the normal reflective scales, and therefore, they don not have to fulfill all of the validity and reliability criteria in the instrument validation analysis (Gefen *et al.*, 2000; Straub *et al.*, 2004). From this stand of point, the scale for illusion of control developed in the present study may be acceptable, but a different research design is required to evaluate this construct as formative rather than reflective.

Moreover, the construct of illusion of control is somewhat overlapping with the construct of control beliefs. A person's individual beliefs in his/her controllability in a specific situation provide foundation of their illusion of control. Some people overestimate their ability and knowledge or underestimate the external difficulties in some specific context, and build untrue control beliefs. These control beliefs become the illusion of control. Therefore, in the comprehensive trust model, it may not necessary to include illusion of control in the cognitive trusting base. The construct of control beliefs may have already taken this variance into account in the model.

5.1.2 Control Beliefs

The other problematic scale is that of control beliefs. The items posited to measure control beliefs did not achieve the desired level of internally consistent reliability and convergent

validity. Similarly to the illusion of control scale, the individual scale items of control beliefs may also be best represented as formative observed variables that are not assumed to be correlated with each other (Gefen *et al.*, 2000; Straub *et al.*, 2004). Ajzen (2002) also argued that it is not necessary that the individual items for those belief related constructs to correlate with each other since each of them may represent a different dimension of the foundations of attitude, social influence and perceived control in the situation. Consequently, these belief items are not required to be internally consistent or convergent. Therefore, the control beliefs items were accepted in the validation process. Again, a different research design would be required to evaluate this construct as formative rather than reflective.

5.2 Discussion of Descriptive Analyses

Descriptive analyses were performed for major TRA/TPB components, including trusting intention, trusting attitude, subjective norm and perceived behavioral control, viewed as a general group as well as contrasted by gender, citizenship and perceived voluntariness of system usage. Due to the limitation of the student sample, the descriptive analysis results may not be an accurate representation of trust in NID systems in the U.S. But the results indicate some possible moderating effect that could be further studied in the future.

5.2.1 Possible Moderator: Voluntariness of System Usage

Generally, the differences of the four constructs across gender were very small. The ANOVA results show that gender is not a significant factor that moderates people's attitude, subjective norm, perceived behavioral control, and ultimate intention to trust NID systems. The ANOVA between the citizen and non-citizen groups partially support the moderating effect from

the factor of citizenship. However, the present study included only 44 non-citizen subjects. The small sample size in the non-citizen group may confound the analysis results.

Two ANOVA with different coding methods were conducted to test the moderating effect of perceived voluntariness of system usage. Both analyses support that the perceived voluntariness of system usage significantly affect a person's trust in NID systems. Subjects who thought the system use would be mandatory had a higher evaluation and perceived social influence but lower perceived control in the situation, compared to those who thought of a voluntary system usage. As the result, the mandatory group had a higher intention to use the systems than the voluntary one.

In summary, the empirical data in this study shows a moderating effect from perceived voluntariness of system usage on trust in NID systems. The factor of voluntariness of system usage could be a moderator in predicting trust in NID systems. Further research is needed to specify how this moderator works in the comprehensive trust model and to provide more implications to the practice.

5.3 Discussion of Intention Prediction

The testing of the trust model and hypotheses were performed in 3 steps with the 443 subjects. First of all, trusting attitude, subjective norm and perceived behavioral control were found to be important determinants of trusting intention. Among them, trusting attitude was the primary determinant, followed by subjective norm. Perceived behavioral control had a relatively small but still significant influence on intention. The first set of hypotheses (including H1a, H1b and H1c) was well supported.

The results show that these three determinants have different contributions on an individual's intention to trust the NID systems. Ajzen (1991) states that the relative importance of attitude, subjective norm and perceived behavioral control in predicting intention may vary across behaviors and situations. According to the analysis results of this study, when people think of trusting an NID system, their own evaluation and important referents' opinions are essential. Whether they have control in this situation has only a small influence on their intention to trust.

The intention to trust NID systems can be accurately predicted by trusting attitude, subjective norm and perceived behavioral control. In the present study, about 81% of variance in trusting intention was explained by the three determinants. This is much higher than those reported in previous meta-analysis reviews of TPB (Albarracin *et al.*, 2001; Hagger *et al.*, 2002; Sheeran & Taylor, 1999; Armitage & Conner, 2001), in which the average variance of intention explained by attitude, subjective norm and perceived behavioral control ranged from 0.39 to 0.63.

The results also indicate a high correlation between trusting attitude and subjective norm. This relationship was not proposed in the present trust model or in the TRA/TPB. However, some literature on attitude change has shed light on this issue (Davis *et al.*, 1989; Kelman, 1958, 1961; Li, Hess, & Valacich, 2004a). Kelman (1958; 1961) studied how social influence changes attitude. He specified three different processes of social influence. The first process is *compliance*, in which people accept influence under some social pressure, although they themselves may not personally believe in the behavior. The second process is *identification*, in which people accept influence because they want to establish or maintain a satisfying image and

relationship within a social group. These two processes are similar in that the individual accepts the social influence on behavior but does not accept it in one's value systems. These processes can be illustrated by the direct relationship between subjective norm and trusting intention in the comprehensive trust model. The social influence affects trusting intention over and above the effect of trusting attitude. The third process of social influence is *internalization*, in which people accept influence and integrate it with their personal value systems. In this processes, social influence affects a person's behavior through changing his/her mind. In other words, this process indirectly affects intention through its effect on attitude structure. This internalization process of social influence explains the correlation between trusting attitude and subjective norm in this study.

To further understand the importance of the intention determinants in predicting trusting intention, a comparison is made among several alternative models. This comparison is based on a well-accepted trust model in IS - McKnight et al.'s initial trust model (McKnight *et al.*, 2002a). The McKnight model shares a similar theoretical foundation (i.e. the TRA) and components with the present trust model while the three intention determinants are all missing.

The McKnight model consists of four high level constructs. They are trusting intention, trusting beliefs, disposition to trust and institution-based trust. In the McKnight model, the trusting beliefs is equivalent to the behavioral beliefs in the comprehensive trust model. The disposition to trust is equivalent to the personality trusting base in the comprehensive trust model, and the institution-based trust is equivalent to the institutional trusting base in the comprehensive trust model (see Figure 2.4).

Alternative models are made by adding the three determinants (i.e., trusting attitude, subjective norm and perceived behavioral control) into the McKnight model, one at a time. The first alternative model was made by adding the construct of trusting attitude (A) into the McKnight model. As discussed in Chapter 4, it is not wise to have behavioral beliefs, trusting attitude and trusting intention in the same structural model since they are in different trust formation stages. However, to keep consistent with the original McKnight model, the construct of trusting beliefs (i.e. behavioral beliefs) and its path to trusting intention are retained when adding the construct of trusting attitude. The second alternative model was made by adding subjective norm (SN) into the first alternative model. As discussed above, subjective norm influences attitude structure based on the internalization process of social influence (Kelman, 1958, 1961). In this alternative model, paths were also added from subjective norm to attitude and its belief foundation – behavioral beliefs (Venkatesh & Davis, 2000). In the last alternative model, the construct of perceived behavioral control as well as its path to trusting intention was added. The McKnight model and the alternative models are presented in Appendix J.

The comparisons of model fit statistics and squared multiple correlations are summarized in Table 5.1 and 5.2. These comparisons illustrate the individual importance of each determinant, as well as the importance of these constructs as a whole, in predicting trusting intention.

The McKnight model had a good model fit according to the fit standards used in this study. About 61.8% of variance in trusting intention was explained by this model. When adding trusting attitude, additional 16.3% of variance in trusting intention was accounted for. Adding subjective norm and its influence to trusting beliefs (behavioral beliefs) and trusting attitude

resulted in another 3.5% of variance in intention. However, the addition of perceived behavioral control didn't significantly increase the squared multiple correlation any more. This result is consistent with previous results in Chapter 4.

Table 5.1: Comparison of the Variance Accounted For in Alternative Models

	Squared Multiple Correlations (SMC)			
	Institutional Trust	**Trusting Beliefs**	**Trusting Attitude**	**Trusting Intentions**
McKnight	0.310	0.158	N/A	0.618
McKnight + A	0.308	0.137	0.615	0.781
McKnight + A+ SN	0.310	0.560	0.739	0.816
McKnight + A+ SN+ PBC	0.310	0.560	0.739	0.816

A: Trusting Attitude; SN: Subjective Norm; PBC: Perceived Behavioral Control

Table 5.2: Comparison of Fit Measures for Alternative Models

	Model Fit Measures							
	χ^2/df	p	GFI	AGFI	NFI	CFI	RMSEA	
McKnight	3.060	0.000	0.917	0.885	0.940	0.959	0.068	(0.060 - 0.077)
McKnight + A	2.582	0.000	0.915	0.887	0.942	0.964	0.060	(0.052 - 0.067)
McKnight + A+ SN	2.340	0.000	0.909	0.884	0.946	0.968	0.055	(0.049 - 0.062)
McKnight + A+ SN+ PBC	2.251	0.000	0.899	0.875	0.937	0.964	0.053	(0.047 – 0.059)

A: Trusting Attitude; SN: Subjective Norm; PBC: Perceived Behavioral Control

Meanwhile, the model fit statistics were improved with addition of the three constructs, given the increasing complexity of the models. Inspection of Table 5.2 shows that when adding more determinant constructs, some absolute fit statistics (i.e. GFI and AGFI) decreased slightly while all relative fit statistics (i.e. NFI, CFI, RMSEA) were improved. Considering that the model complexity increased with the addition of the three constructs, the slight decreases of GFI and AGFI are acceptable.

Besides the individual importance of trusting attitude, subjective norm and perceived behavioral control, the comparison of the McKnight model and the three alternative models also illustrated the importance of these three constructs together as a whole trust formation level. Although McKnight et al. (2002a) stated that their initial trust model was based on the TRA framework, it is inconsistent with the TRA in that trusting intention is directly determined by trusting beliefs and external antecedents without the mediating effects of trusting attitude, subjective norm and perceived behavioral control. In this model comparison, when adding trusting attitude, subjective norm and perceived behavioral control, the relationships between two trusting antecedents and trusting intention became non-significant and a majority of influence from trusting beliefs (behavioral beliefs) on trusting intention was mediated by trusting attitude. Therefore, with this trust formation level the trust model is more theoretically sound.

5.4 Discussion of Trusting Beliefs

Next, the relationship between the three intention determinants and three trusting belief constructs are discussed. According to the TRA/TPB, beliefs provide the cognitive and affective foundations for attitude, subjective norm and perceived behavioral control (Ajzen, 2002). Previous TPB application studies always took beliefs as the indirect measures of attitude, subjective norm and perceived behavioral control, and proposed that these indirect measures should be highly correlated with their corresponding direct measures (Davis & Ajzen, 2002; Hrubes *et al.*, 2001).

In the present study, trusting attitude, subjective norm and perceived behavioral control were significantly correlated with behavioral beliefs, normative beliefs and control beliefs,

respectively. H2a, H2b and H2c were supported. The magnitudes of the correlation between trusting attitude and behavioral beliefs and that between subjective norm and normative beliefs are much higher than the average correlations ($R_{\text{attitude-behavioral beliefs}} = 0.50$; $R_{\text{SN – normative beliefs}} = 0.50$) reported in some meta-analytic reviews of TRA/TPB studies (Armitage & Conner, 2001; Albarracin *et al.*, 2001). The correlation between perceived behavioral control and control beliefs is relatively smaller than the other two and also smaller than the average correlation ($R_{\text{PBC – control beliefs}} = 0.52$) reported in the meta-analytic review (Armitage & Conner, 2001)

Separate analyses were conducted to investigate how individual belief items correlate with trusting attitude, subjective norm and perceived behavioral control. Among the three dimensions of behavioral beliefs, beliefs in benevolence and integrity have higher contributions to form trusting attitude than beliefs in competence although all of the three different behavioral beliefs significantly correlate with trusting attitude. From a practical perspective, if the U.S. government could improve the citizens' perceived benevolence, perceived competence and perceived integrity of the NID system, it is more likely that the citizens will have a positive evaluation of trusting the system. The improvements of benevolence and integrity would be more effective than improving perceived competence. For instance, the explicit goodwill statements of the system and introduction of successful examples in other countries may facilitate the citizens' intention to trust in the system.

Every individual normative belief had a high correlation with subjective norm. Different referent groups had similar level of influence on the subjects. The family influence was slightly more important than the others.

All individual control beliefs had significant correlation with control beliefs. Among them, a person's beliefs in his/her ability and knowledge about NID systems and related experiences had more contributions to the overall perceived behavioral control than this person's beliefs in the ease/difficulty of trusting the systems. From a practical perspective, governments who are intended to adopt an NID system may need to provide a public NID education or a small-group pilot test of the system. When citizens have more knowledge and related experience with the system, they are more likely to trust it and accepted it.

5.5 Discussion of Trusting Bases

The last step of the main analysis was to discover how the four trusting bases performed in the formation of trust. Prior trust literature suggested that these four trusting bases represent various trust-related considerations and that they provide the basic foundations to build trust (Gefen *et al.*, 2003a; Lewicki & Bunker, 1995; Lewis & Weigert, 1985; Li *et al.*, 2004b; McKnight *et al.*, 2002a; McKnight *et al.*, 1998; Sarker *et al.*, 2003; Mayer *et al.*, 1995). However, little research has been done to take all of the four trusting bases into account in one research context and to test them together in one study. Furthermore, little work has been done to study trust in different forms. Most trust researchers only studied how the different trusting bases affect a general trust or one form of trust. Few of them provided theoretical suggestions on how the trusting bases are involved in the whole trust formation.

The TRA states that the context-specific external variables affect the intention and behavior only through their influence on the low-level TRA/TPB components, such as the belief constructs like behavioral beliefs, normative beliefs and control beliefs (Ajzen & Fishbein,

1980). Therefore, in this study every trusting base was hypothesized to positively affect every set of beliefs (H3 – H6). Exploratory analysis was performed to find out exactly how the trusting bases form the three trusting beliefs. The results of the exploratory regression equation analyses show that all of the four trusting bases have direct or indirect effects on different trusting beliefs.

The results of the exploratory analysis illustrated that behavioral beliefs were mainly affected by cognitive trusting base (H4a). The other three bases (personality, calculative and institutional trusting bases) were only non-significantly affect behavioral beliefs. As an interpretation, a person's second-hand knowledge about the systems like system reputation and stereotyping, and his/her illusion of control over the systems provide the main foundation to the attitudinal beliefs, which represent the volitional determinant of his/her trust in NID system.

Normative beliefs were mainly affected by cognitive and calculative trusting bases (H4b, H5b). The other two trusting base (personality and institutional trusting bases) only affect normative beliefs non-significantly. Similarly, second-hand knowledge about system reputation, stereotyping and illusion of control provide primary foundation to a person's beliefs in social influences. His/her belief about benefit/cost calculation also contributes to his/her beliefs in social influence.

Control beliefs were mainly affected by institutional trusting base (H6c). The other three trusting bases (personality, cognitive and calculative trusting bases) didn't significantly affect control beliefs. This result means the institutional safeguards, like cyber laws, technique specifications and standards of the system, as well as citizens' knowledge about these safeguards

provide major foundation to their beliefs about how much they can control in trusting the NID systems.

Although personality trusting base was not found to have a direct relationship to any belief constructs, both previous trust research (McKnight *et al.*, 2002a) and statistical results in this study suggested that personality trusting base positively influences institutional trusting base and that institutional trusting base mediates much of the impact of personality trusting base on trusting beliefs.

Based on the exploratory results, trust in NID systems could be facilitated through the manipulation of some of the four trusting bases. Among the four trusting bases, personality base is formed at the very early stage of one's life and normally unchangeable. However, the other three trusting bases could be improved via government's efforts. For instance, the improvement of technical reliability, a well-developed technical standard and specification, and complete and strong legislation promoting cyber security would increase citizens' perception of situational normality and structural assurance. The successful pilot implementation in a small group and proper promotion or advertisement of the positive functions of the systems would improve the system reputation and citizens calculation of the cost/benefits associated with the NID systems. Through such efforts, government would be able to manipulate different trusting bases, on which citizens build their trusting beliefs. Finally, these efforts would improve citizens' trust in NID systems.

5.6 Summary

This chapter provided a discussion of the results and findings of this research. Further analyses were performed to support the discussion. Practical implications were also suggested based on the findings. In general, the study provided a strong support for the comprehensive trust model proposed in this research. This model was able to accurately predict trust in NID systems. The next chapter concludes this research with a discussion of the contributions and limitations of this study and by highlighting some possible areas of future research.

CHAPTER 6

CONCLUSION

Chapter 5 discussed and interpreted the data analysis results. In this chapter, this dissertation is summarized and concluded with the discussion of contributions, implications and limitations. Based on the limited student sample, people have a slightly negative intention to trust NID systems. This result may not be able to be generalized into the population level. However, this study verifies the prediction ability of the comprehensive trust model. It also provides a lot of insights into the actual prediction of people's trust in an NID system in a country. The follow-up studies are suggested to solve the limitations in this study. Other directions for future research are also suggested based on the results of this study.

6.1 Summary and Conclusion

Along with the renewed interest in adoption of NID systems in the U.S. to facilitate public services and improve national security, research on citizens' trust in NID systems is believed to be of assistance to successful NID system development, acceptance and usage. In this dissertation, a comprehensive trust model was proposed to predict citizens' intention to trust NID systems.

This comprehensive trust model was mainly based on the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and the theory of planned behavior (Ajzen, 1985, 1991). Trusting attitude, subjective norm and perceived behavioral control were used to predict trusting intention towards NID systems. These three predictors were aggregates of different trusting beliefs related to trusting NID systems. They are behavioral beliefs, normative

beliefs and control beliefs. These trusting beliefs were then formed based on a unique set of external variables in the context of trusting an NID system.

Four trusting bases were identified from trust literature and integrated into the TRA/TPB-based trust model as context-specific external variables. They are personality trusting base, cognitive trusting base, calculative trusting base and institutional trusting base. According to the TRA/TPB, the external variables only indirectly affect the formation of trust through their influences on different trusting beliefs. Hypotheses were proposed to describe the relationships between every trusting base and every trusting belief in this model. The overall model was believed to be theoretically grounded and comprehensive.

To test the comprehensive trust model, instruments were taken or adapted from prior validated instruments, or developed based on theories. The overall measurement was validated with an independent dataset before it was used in the following substantive study. It was verified to be valid and reliable in terms of manipulation validity, construct validity and reliability.

A total of 443 students were used for the main study sample. Amongst this group, perceived voluntariness of system usage has significant influence on subjects' trusting intention towards NID systems. Subjects with perceptions of mandatory system usage were more likely to trust the NID systems than those with perceptions of voluntary usage.

With the 443 subjects, the comprehensive trust model was generally supported. In the three-step model and hypotheses testing, trusting attitude, subjective norm and perceived behavioral control were found to be significant determinants of trusting intention. Perceived behavioral control had a relatively small contribution in forming the intention compared to the

other two determinants. Behavioral beliefs, normative beliefs, and control beliefs captured important considerations related to trusting attitude, subjective norm and perceived behavioral control, respectively. The exploratory analyses were conducted to discover the relationships between every trusting base and every trusting belief. The analysis results showed that behavioral beliefs were mainly formed on cognitive trusting base and normative beliefs were jointly determined by cognitive and calculative trusting bases. The control beliefs were built on institutional trusting base which also mediates the influence from personality trusting base.

In summary, the empirical study verified that this comprehensive trust model was well structured. It was strongly supported by the data and the overall model could accurately predict intention to trust NID systems. This trust model is not only theoretically sound, but also statistically strong.

6.2 Contributions and Implications

This dissertation is believed to provide contributions to both TRA/TPB theory and trust research. First of all, this dissertation is a complete application of TRA/TPB in IS. The TRA and TPB are well-accepted behavior prediction theories that have been widely used in different research fields. These theories have also been used in IS research for a long time. For instance, the technology acceptance model (TAM) proposed by Davis (1989; 1989) is an adaptation of the TRA to predict individual technology acceptance. The initial trust model proposed by McKnight et al. (2002a) is also developed from the TRA framework. However, most of the TRA/TPB applications in IS are based on parsimonious versions of the theory and miss some of the major components of the TRA/TPB framework. For example, both the TAM and the McKnight model

take beliefs as direct determinants of behavioral intention and actual behavior. Attitude towards the behavior is skipped and non-volitional influences on intention, such as subjective norm and perceived behavioral control, are omitted. These parsimonious applications of TRA/TPB may be easier to operationalize in empirical studies. However, the incomplete models may fail to capture some important variance in the empirical data.

The present trust model is based on a complete version of TRA/TPB. It takes into account both volitional determinants of trusting intention (i.e. trusting attitude) and non-volitional ones (i.e. subjective norm and perceived behavioral control). These three constructs can explain important additional variance in trusting intention over and above the parsimonious trust model proposed by McKnight et al. (2002a).

Secondly, this dissertation is also important for trust research. It provides a comprehensive understanding of trust. Trust is a multidimensional construct with traditionally diverse and inconsistent definition. A clear and complete definition of trust has long been expected to enable the comparison of different trust research and facilitate the advance of the overall trust research. In this research, trust was defined with a TRA/TPB-based model including multiple constructs, each of which represents individual dimension of trust. Basically, trust has four forms: trusting beliefs, trusting attitude, trusting intention and trusting behavior. According to the TRA/TPB, trusting behavior is largely determined by trusting intention which is then jointly determined by trusting attitude, subjective norm and perceived behavioral control. These three determinants of intention are aggregates of different trusting beliefs, which are in turn, built on context-specific external variables, such as personality, cognitive processes, institutional

structures, and so on. The four forms of trust and the other trust related constructs, as well as the relationships among them, provide a comprehensive definition of trust. This definition encompasses various trust definitions used in previous studies. It enables us to compare the results of prior trust research and benefit the cumulative tradition in this research area.

The third contribution is that context-specific external variables – the four trusting bases – have been identified and integrated into the trust model to predict trust in NID systems. According to Ajzen and Fishbein (1980), although these external variables are out of the TRA/TPB framework, it is critical to identify a unique set of external variables in the context of NID systems, so that the very basic foundation of trusting intention can be completely captured and the intention itself can be more accurately predicted. In this research, four trusting bases from trust literature are found applicable in this research context. Prior research didn't include all of the four trusting base together and specify how these trusting bases are involved in a multi-form trust formation process. Exploratory analyses were conducted in this study and revealed that every trusting base has direct or indirect effect on each set of trusting beliefs, and that all of the four bases, together, can explain plenty of variance in the trusting beliefs. Moreover, these trusting bases have been represented by operationalizable sub-constructs, which provide implications on how to manipulate these trusting bases and facilitate trust in NID systems.

In sum, the trust model proposed in this research is a theoretically grounded and comprehensive model that has a powerful ability to predict trust in NID systems. This model can also be generalized into other information technology contexts and used to predict user trust in those specific information systems.

Besides the contributions to the theories and trust literature, this dissertation also provides implications to practitioners – the governments who are planning to adopt NID systems.

First of all, the comprehensive trust model helps governments understand how people form trust towards the systems. With this model, governments can easily predict the citizens' trust before they actually implement the systems and easily find out whether most citizens are ready to accept the systems or why they reject them. Since trust in the systems is an important condition in system acceptance and success, the early prediction of trust can avoid the potential failure in actual use. As a result, a great deal of financial costs and efforts will be saved, and the potential social side effects will be avoided. More importantly, by understanding how people form trust and what factors are crucial in their trust formation, governments can customize the NID systems from the early development stage. They can find out citizens' actual needs and concerns and take care of them in the development process of the NID systems. This customized system will be much easier to accept and should be more successful compared to the generally designed systems.

Trust is a subjective perception, but it is not groundless. The comprehensive trust model suggests that citizens' trust in NID systems is fundamentally based on trust related personality factors, cognitive processes related to NID systems and the illusion of control in the situation, beliefs in whether governments benefit from untrustworthy usage of the systems, and the perceptions of situational normality and the existence of necessary structural assurances. Governments who intend to adopt the NID systems could facilitate the formation of positive trust by manipulating some of the factors people form trust on. For instance, the systems could be first

implemented in a small group of people. The pilot usage would identify the potential problems and the governments can fix them before the full implementation. If the pilot usage succeeds, the positive results should be widely publicized and advertised to improve the reputation of the systems. On addition, complete technical standards and specifications should be developed and documented. The specific regulations and laws of cyber security should be published to avoid any abuse of the systems and personal information. The promotion of these technical and legal assurances would also improve citizens' trust in the systems. Moreover, public education of the NID systems is also necessary. Sometimes, distrust is a result of ignorance. A basic level of knowledge about what the NID systems look like and how they work would help people to build their trust perceptions.

6.3 Limitations

Although a lot of contributions and implications are described above, this research also has some limitations, like every other study.

One limitation in this research is the use of student subjects. The comprehensive trust model is aimed at explaining and predicting trusting intention towards NID systems. When an NID system is implemented in a country, it would be used by all citizens in that country, consisting of people differing in occupation, age, background and so on. Obviously, the college student sample does not represent all of the variances in population. Limitations exist in generalizing the results of this study. However, the major purpose of this study was to verify the structure of the proposed trust model and to test hypothesized relationships in the model, and to see how well the model can predict intention. From this perspective, the student sample works

well. The results of this study show that the proposed trust model is well supported and powerful at predicting trust in NID systems. When the actual prediction of citizens' trust is conducted by a government before the implementation of an NID system, a broader sample with more varieties should be used.

Another limitation is the analysis of the four trusting bases. Since no prior research and theory specified how the four trusting bases are involved in a multi-form trust formation, exploratory analyses were conducted to discover the relationships between every trusting base and every trusting belief. To some extent, the results of the exploratory analyses are data-driven. They reflect all variances in the present dataset. However, they cannot differentiate the variance of interest and confound variances. Further literature review is needed to find the theoretical support or explanation of the exploratory analysis results. A confirmative analysis with a broader sample is also necessary to verify these results.

6.4 Follow-Up Studies and Future Directions

This dissertation proposes a comprehensive trust model to predict trust in NID systems and initially tests it with a limited sample. Some follow-up studies and research in other directions could be conducted in the future.

Follow-up studies are needed to deal with the limitations identified above. First of all, further literature review has to be done to find theoretical support and explanation of the exploratory analysis results about the trusting bases. Confirmative analysis with new dataset is also needed to verify these results. Second, new studies are needed to test the proposed trust model with a broader sample, which includes people with different occupations and in different

age levels. Studies with broader samples that represent more variance in population will have higher generalizability and will provide more practical implications to governments who are planning to adopt NID systems. They are more valuable both in research and in practice.

Third, the current study used reflective scales to measure every construct. However, statistical findings from this study and subsequent review of the literature suggest that two constructs – illusion of control and control beliefs – may be formative constructs. Further research with different research designs is needed to evaluate these two constructs as formative rather than reflective.

Besides, detailed research could be done on part of the comprehensive trust model. The trust model proposed in this dissertation is big and complicated. The present study just tests the structure and prediction ability of the model in general. Some follow-up research is also needed to specify every part of the model in detail. For example, in this study, trusting attitude, subjective norm and perceived behavioral control are verified to be important determinants of trusting intention. But how do these three determinants interact with each other? How does the subjective norm affect the trusting attitude in different ways? Why doesn't perceived behavioral control affect trusting intention as strongly as the other two determinants? These questions should be studied further in detail. This dissertation only studies the relationships between trusting bases and trusting beliefs at an exploratory level. Further confirmatory study is also needed to verify these relationships. Also, specific research can focus on every trusting base and study how to manipulate these trusting bases and achieve desirable trust.

Moreover, some comparison research can be conducted among different trust models. In this dissertation, the comprehensive trust model has been proved to be theoretically grounded, comprehensive and powerful enough to predict trust by itself. Future study can compare this trust model to other competing models in terms of parsimony, ease of operation, prediction power, and so on. The comparison study may provide more insights into the application of the models.

Although the comprehensive trust model is proposed and tested in the context of NID systems, it can be generalized and used in common IT/IS contexts. Future research can also be conducted in different IT/IS contexts and predict user trust in the new information technologies or systems. These studies will facilitate the success of system development, acceptance and adoption.

Last but not least, future research can be conducted on long-term trust. The present dissertation and the comprehensive trust model focus on the initial trust developed before direct interaction with the trusting object and before actual trusting behaviors. However, prior TRA/TPB research suggests that past behavior may affect behavioral intention or new behavior (Albarracin *et al.*, 2001; Hagger *et al.*, 2002; Sheeran & Taylor, 1999). Some trust research also suggests that the experiences and results of actual trusting behavior may affect the future trust perceptions or beliefs, and therefore affect future trust (Mayer *et al.*, 1995). Thus, longitudinal studies are needed to research the feedback of the actual trust behaviors and the dynamic trust in the long term.

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Appendices

Appendix A: Experimental Script

Experimental Procedures:

- Research study will be conducted in the regular lab sessions of a sophomore-level MIS course.
- Subjects will enter the laboratory and sign their names to a sign-up sheet.
- Subjects will be asked to log into the computers.
- The experimenter reads the following verbal consent script to all of the subjects

Hello. My name is _____. I am PhD candidate in the MIS department.

Today, we are doing an experiment to predict people's trust toward national identification systems. I am asking you to participate by completing one online survey, which will take about 10 minutes, reading and searching information about the national identification systems, which will take about 20 minutes, then, completing another online survey, which will take about 10 minutes.

The data collected from this survey will be ***strictly confidential****, and your name will not be recorded. Also, your participation is completely voluntary. You are free to not answer any questions you may find objectionable, and may withdraw from the study at any time without penalty, just by letting us know that you would not like to continue any further. This research has been reviewed and approved by the Institutional Review Board at WSU. If you have any questions or concerns about this research project, you can contact the WSU IRB at (509) 335-9661 or me, _____, at xxxxx@wsu.edu*

If you have any problems during the experiment, please raise your hand, and one of the assistants will come to you. Please do not run any other applications or talk with other students during the experiment. When you are finished with the entire study, you can leave the room quietly. Thank you for your participation.

Are there any questions about the study so far?

[Wait for questions.]

Have all subjects complete the pre-survey

Ok, now we can continue. Here is the URL for the pre-survey.

[The URL of Pre-survey is shown via projector.]

You can take your time and read every question carefully. Your serious answers on the questions are very important to this research. You will have approximately 10 minutes to

complete the pre-survey. When you are done and submit it, you will see a thank-you page. Please stop there and wait for the other people to finish. Then we will move to next step together.

[Give 10 minutes to complete the pre-survey.]

- Have all subjects read the NID lecture (see Appendix B) and search NID information online

Ok, Thank you for taking the pre-survey. Now, I will like you to read an online PowerPoint lecture about NID systems and search for more information about this topic yourself. Here is the URL for the lecture.

[The URL of the NID lecture is shown via projector.]

Please read the lecture very carefully. You have approximately 10 minutes to read this lecture. When you are done, we can search for more NID related information via the Internet. You have another 10 minutes for searching and reading the information you get. Here is a list of search engines and keywords you can use. You can choose any of these engines and search for any of these keywords.

[Provide the search engines and keywords on the board]

Search Engines:	Keywords:
www.google.com	National Identification
www.altavista.com	National Identity Systems (NID systems)
www.yahoo.com	National ID Cards
www.aol.com	National Security and Privacy

[Give 20 minutes to read the NID lecture and to search for more NID information.]

- Have all subjects take the post survey

If you are done with the NID lecture and information searching, I'd like you to take the post-survey at this URL.

[The URL of the post-survey is shown via projector.]

Again, you can take your time and read every question carefully. Your serious answers on the questions are very important to this research. You will have approximately 10 minutes to complete the post-survey. When you are done and submit it, you will see a thank-you page. At that moment, you are done with the whole experiment. Thank you very much for your participation.

Appendix B: NID Systems Lecture – PowerPoint Slides

National Identification Systems (NIDS)

Introduction

National identification (NID) systems are not a new idea. They have long been advocated in many countries around the world as a means to facilitate public services, enhance national security, guard against illegal immigrants, and so on. They are already in use in most European countries, Hong Kong, Malaysia, Singapore and Thailand. This idea has also been advocated in the U.S. for a long time. But the American has consistently rejected this idea from 1971.

Now, you may be wondering what does a NID system look like? How does it work? Why some of the people like it, but other people don't? And how's the future of the NID systems? The purpose of this lecture is to answer these questions to you.

What is a NIDS?

- A Combination of government-issued identifications

  NIDS have been used or proposed for handling routine administrative transactions between government agencies and citizens, with benefits claimed in the areas of convenience, cost savings or fraud reduction. NIDS could combine the functions of a driver's license, social security registration, immigration documents, and other government-issued identification.

- Two aspects of NIDS

  On one hand, NIDS is a type of information system consisting of information verification technology, database, scanning technology, and so on. On the other hand, this information system is developed, administered and maintained by some governmental agencies.

What is a NIDS? (cont.)

- NIDS can either be mandatory or voluntary

  NIDS can either be mandatory or voluntary. In a mandatory scheme, everyone is required to carry and present a card when asked; not doing so is an offense. In a voluntary scheme, those who do not have a card will be subjected to additional background checks while those with a card can more easily obtain services or pass security checkpoints.

Technological Components

- **An identity verification system**

  Before a card can be issued, there must be some means of assuring that the person receiving the card is who he or she claims to be. Because of this, any ID system is only as good as its ability to verify an identity in the first place. The issuance of the ID is accompanied by the entry of the person's 'unique identifier', such as fingerprint or retinal image, that can be read by a scanning machine and matched with the person presenting the card to confirm his/her identity.

- **A database**

  A NID database stores basic information about the person identified: weight, height, hair and eye color, address, etc. It may also contain some personal record, such as credit history or criminal history.

Technological Components (cont.)

- **A card**

  While the card is the most visible of these components, without the other components working together, the card is not especially useful. Different information is included in the NID cards from different countries. However, some basic information such as name, date of birth, sex, address, photograph, etc. are common among cards. Biometric data such as fingerprints and retina scans can help in verifying that the card actually belongs to the cardholder.

- **A card verification system**

  Finally, a massive card verification system is needed to connect the cardholders with their records in the database.

How does a NIDS work?

- Registration process

There are at least two distinct processes in a functioning NIDS. First is a one-time registration process in which everyone is required to present themselves to the authorities along with their existing identification documentation, such as birth certificate or citizenship papers. If the authorities believe the documentation is valid, they create an individually identified entry in a database and issue the person a card which, in most systems, would be linked to this entry.

How does a NIDS work? (cont.)

- Authentication

The second process is authentication. This occurs whenever the cardholder is required to show the card to verify his or her identity. A first check is made to ensure that the card actually belongs to the person presenting it. This is done by comparing the information on the card with the person, for example by visual comparison of the cardholder with the photograph on the card, or by digital comparison of a live finger scan with the finger print recorded on the card. If there is a satisfactory match, the card is used as a link to a database. A second check then determines whether there is anything on file that raises suspicion about the cardholder. If not, the person can proceed.

Advantages

- Enhance the public service

  For example: improving the accuracy of public health information; etc.

- Enhance national security
  - helping confirm the alibis of criminal suspects;
  - fighting terrorism;
  - Guarding against illegal immigrants; etc.

Potential Problem 1

- Effectiveness?

  Does the system work effectively? Using biometric data such as fingerprints and retina scans can help in verifying that the card actually belongs to the cardholder. However, this is not 100% reliable. There is always a margin of variation between the original sample obtained during registration and any subsequent sample used at the point of authentication. Another problem is, The issuance of a high-security ID card is based on the presentation of low-security documents. For example, if you show your convincing passport or birth certificate, you can obtain an ID card, even you are a terrorist.

Potential Problem 2

- Security?

  Is the system secure? As more and more smart cards are put into operation, more and more people know how to break them. If the card is used to check the information against a central database, then the security of this database becomes crucial. It must be accessible nationwide in order to support security checkpoints all over the country. Therefore it will have to be on some network, probably the Internet or telephone system. The security necessary to prevent people from breaking into such a sensitive networked system may be hard to achieve.

Potential Problem 3

- Invasions of privacy and civil liberties

  The system may invade privacy and civil liberties. NIDS would allow individuals to be easily tracked. Somebody think People who are easily and constantly tracked by a central authority are not free people. A NIDS would make everyone vulnerable to the problem of incorrect data in the database. If the data on the card or in the database is incorrect, then innocent people will be victimized even through they have no fault themselves.

Potential Problem 4

- Cost

  Another potential problem could be the cost. the more secure a card is, the greater its value, and the greater the incentive and reward for breaking the card. Any card or device in the public's hands long enough will be cracked. The more secure the card, the more expensive it will be to roll out, and the more costly will be its eventual failure.

- And others...

Appendix C: Survey Instrument

Personality trusting base:

Sub-Construct Name	Item Name in Analysis	Item Description
Faith in Benevolence	PTB_B1	In general, people really do care about the well-being of others.
	PTB_B2	The typical person is sincerely concerned about the problems of others.
	PTB_B3	Most of the time, people care enough to try to be helpful, rather than just looking out for themselves.
Faith in Integrity	PTB_I1	In general, most folks keep their promises.
	PTB_I2	I think people generally try to back up their words with their actions.
	PTB_I3	Most people are honest in their dealings with others.
Faith in Competence	PTB_C1	I believe that most professional people do a very good job at their work.
	PTB_C2	Most professionals are very knowledgeable in their chosen field.
	PTB_C3	A large majority of professional people is competent in their area of expertise.
Trusting Stance	PTB_TS1	I usually trust people until they give me a reason not to trust them.
	PTB_TS2	I generally give people the benefit of the doubt when I first meet them.
	PTB_TS3	My typical approach is to trust new acquaintances until they prove I should not trust them.

Cognitive trusting base:

Sub-Construct Name	Item Name in Analysis	Item Description
Reputation	REP1	NID systems have a reputation for being competent.
	REP2	NID systems are recognized for being reliable.
	REP3	NID systems are known for working in the citizens' best interest.
Stereotyping	STEREO1	Information systems for governmental use have strong integrity.
	STEREO2	Information systems for governmental use are typically competent.
	STEREO3	Information systems for governmental use are concerned with my well-being.
Illusion of Control	ILLUS1	There is no other organization or group that can decide to adopt an NID system in the U.S., except the citizens.
	ILLUS2	There is no other way to protect citizens' identity and enhance national security like what the NID systems would do.
	ILLUS3	I am comfortable with most information systems for governmental use.
	ILLUS4	The citizens, including me, would be fully involved in deciding whether an NID system will be used in the U.S.

Calculative trusting base:

Sub-Construct Name	Item Name in Analysis	Item Description
Cost vs. Benefit	CAL1	The NID system, as well as the related government agents, has nothing to gain by being dishonesty in its interactions with me.
	CAL2	The NID system, as well as the related government agents, has nothing to gain by not caring about me.
	CAL3	The NID system, as well as the related government agents, has nothing to gain by being incompetent in its works.

Institutional trusting base:

Sub-Construct Name	Item Name in Analysis	Item Description
Situation Normality in General1	IT_SNG1	I feel good about how things go when I am using information systems.
	IT_SNG2	I am comfortable using information systems.
Situation Normality in Benevolence	IT_SNB1	I feel that most information systems would be employed for the users' best interests.
	IT_SNB2	Most information systems are helpful.
	IT_SNB3	Most information systems are employed for user well-being.
Situation Normality in Integrity	IT_SNI1	I am comfortable relying on data from information systems.
	IT_SNI2	I feel fine using information systems since they are generally reliable and accurate.
	IT_SNI3	I always feel confident that I can rely on information systems to carry out requests that I have specified.
Situation Normality in Competence	IT_SNC1	In general, information systems are competently administered.
	IT_SNC2	Most information systems are capable of meeting user needs.
	IT_SNC3	I feel that most information systems can meet the requirements for which they were designed.
Structural Assurance	IT_SA1	There are enough safeguards to make me feel comfortable when using information systems.
	IT_SA2	I feel assured that technological structures are adequate at protecting me from any problems with information systems.
	IT_SA3	I feel confident that technological advances make it safe for me to use information systems.
	IT_SA4	In general, information systems are robust and safe.

Behavioral beliefs:

Sub-Construct Name	Item Name in Analysis	Item Description
Belief in Benevolence	TB_BB1	I believe that an NID system would be employed in my best interest.
	TB_BB2	If I required help, the NID system would do its best to help me.
	TB_BB3	The NID system would be concerned about my well-being, not just its own.
Belief in Integrity	TB_BI1	The NID system would be truthful in its dealings with me.
	TB_BI2	I would characterize the NID system as honest.
	TB_BI3	The NID system would keep its commitments.
	TB_BI4	The NID system would be sincere and genuine.
Belief in Competence	TB_BC1	The NID system is competent and effective in storing personal information about citizens.
	TB_BC2	The NID system would perform its role of storing personal information about citizens very well.
	TB_BC3	Overall, the NID system would be a capable and proficient means for identifying citizens.
	TB_BC4	In general, the NID system would have sufficient information about citizens.

Normative beliefs:

Sub-Construct Name	Item Name in Analysis	Item Description
Normative Belief	TB_N1	I think/believe that my family would encourage me to trust the NID system.
	TB_N2	I think/believe that my friends would encourage me to trust the NID system.
	TB_N3	I think/believe that my classmates would encourage me to trust the NID system.
	TB_N4	I think/believe that my other acquaintances would encourage me to trust the NID system.

Control beliefs:

Sub-Construct Name	Item Name in Analysis	Item Description
Control Belief	TB_C1	In general, I feel confident that my skills, abilities, and knowledge will allow me to make a good decision on whether to trust NID systems.
	TB_C2	My other experiences, or my families/friends' experiences increase my confidence in deciding whether to trust NID systems.
	TB_C3	It takes a great effort for me to decide whether to trust NID systems.

Trusting attitude:

Sub-Actions	Item Name in Analysis	Item Description
Advocating systems	TA_A	Promoting the NID system will have favorable consequences.
Providing Information	TA_P	Providing my personal information to the NID system will lead to favorable consequences.
Using Cards	TA_U	My use of the NID card will lead to favorable consequences.

Subjective norm:

Sub-Actions	Item Name in Analysis	Item Description
Advocating systems	SN_A	I believe that most people who are important to me will think I should support the NID system.
Providing Information	SN_P	I believe that most people who are important to me will think I should provide personal information to the NID database.
Using Cards	SN_U	I believe that most people who are important to me will think I should use an NID card.

Perceived behavioral control:

Sub-Actions	Item Name in Analysis	Item Description
Advocating systems	PBC_A	I have full personal control over whether I should or should not support the NID system.
Providing Information	PBC_P	I have full personal control over whether I should or should not provide personal information to the NID system.
Using Cards	PBC_U	I have full personal control over whether I should or should not use an NID card.

Trusting intention:

Sub-Construct Name	Item Name in Analysis	Item Description
General Willingness	TI_GW1	I would feel comfortable depending on an NID system.
	TI_GW2	I can always rely on an NID system.
	TI_GW3	I feel that I could count on an NID system.
Probability to Advocating systems	TI_A1	I would feel comfortable supporting the adoption of an NID system in the U.S.
	TI_A2	I would not hesitate to promote the adoption of an NID system in the U.S.
	TI_A3	I would publicize the NID systems to my family, friends, and acquaintances.
Probability to Providing Information	TI_P1	I would be willing to provide general personal information like my name, address, and phone number to the NID system.
	TI_P2	Providing my age, gender, origin, education, and occupation to the NID system would not bother me.
	TI_P3	I would be comfortable providing my social security number, photo, fingerprint, and personal records to the NID database.
Probability to Using Cards	TI_U1	I would feel comfortable using an NID card.
	TI_U2	I would not hesitate to use an NID card.
	TI_U3	I would feel secure in using an NID card.

Appendix D: Frequency Analysis of the Self-Report Items: Second-Hand Knowledge on NID Systems

Q1		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	.3	.3	.3
	2	1	.3	.3	.5
	3	5	1.3	1.3	1.8
	4	6	1.5	1.5	3.3
	5	76	19.5	19.5	22.8
	6	168	43.1	43.1	65.9
	7	133	34.1	34.1	100.0
	Total	390	100.0	100.0	

Q2		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	.3	.3	.3
	3	7	1.8	1.8	2.1
	4	27	6.9	6.9	9.0
	5	120	30.8	30.8	39.7
	6	163	41.8	41.8	81.5
	7	72	18.5	18.5	100.0
	Total	390	100.0	100.0	

Q3		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	.3	.3	.3
	2	2	.5	.5	.8
	3	6	1.5	1.5	2.3
	4	17	4.4	4.4	6.7
	5	101	25.9	25.9	32.6
	6	169	43.3	43.3	75.9
	7	94	24.1	24.1	100.0
	Total	390	100.0	100.0	

Q4		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	7	1.8	1.8	1.8
	4	10	2.6	2.6	4.4
	5	75	19.2	19.2	23.6
	6	177	45.4	45.4	69.0
	7	121	31.0	31.0	100.0
	Total	390	100.0	100.0	

Appendix E: Exploratory Factor Analysis

1. EFA for Trusting Intention

	Factors
	1
TI_GW1	.912
TI_GW2	.886
TI_GW3	.920
TI_A1	.929
TI_A2	.845
TI_A3	.804
TI_P1	.813
TI_P2	.822
TI_P3	.837
TI_U1	.928
TI_U2	.914
TI_U3	.925

2. EFA for Trusting Attitude

	Factors
	1
TA_A	.868
TA_P	.927
TA_U	.928

3. EFA for Subjective Norm

	Factors
	1
SN_A	.965
SN_P	.971
SN_U	.963

4. EFA for Perceived Behavioral Control

	Factors
	1
PBC_A	.814
PBC_P	.927
PBC_U	.887

5. EFA for Behavioral Beliefs

Construct	Item	Factors (Eigenvalue > 1)		Factors (3 Factors)		
		1	2	1	2	3
Behavioral Beliefs in Benevolence	TB_BB1	.912	-.075	.010	.071	.874
	TB_BB2	.883	.008	.096	.123	.779
	TB_BB3	.976	-.144	.170	-.033	.805
Behavioral Beliefs in Integrity	TB_BI1	.866	.067	.700	.006	.276
	TB_BI2	.774	.170	.891	.038	.035
	TB_BI3	.722	.213	.939	.059	-.053
	TB_BI4	.791	.122	.844	.007	.088
Behavioral Beliefs in Competence	TB_BC1	.162	.746	.065	.746	.123
	TB_BC2	.036	.877	-.149	.916	.177
	TB_BC3	.048	.876	.054	.859	.024
	TB_BC4	-.077	.907	.165	.838	-.185

6. EFA for Normative Beliefs

	Factors
	1
TB_N1	.857
TB_N2	.946
TB_N3	.916
TB_N4	.926

7. EFA for Control Beliefs

	Factors	
	1	2
TB_C1	.862	-.055
TB_C2	.856	.056
TB_C3	.000	.998

8. EFA for Personality Trusting Base

Construct	Item	Factors (Eigenvalue > 1)			Factors (4 Factors)			
		1	2	3	1	2	3	4
Faith in Benevolence	PTB_B1	.774	-.020	.047	-.022	.064	.048	.854
	PTB_B2	.846	-.120	-.035	-.054	-.025	-.032	.959
	PTB_B3	.830	-.061	.006	.244	-.024	.011	.679
Faith in Competence	PTB_C1	.031	.881	.022	.024	.887	.014	.013
	PTB_C2	-.024	.938	.010	.000	.942	.001	-.026
	PTB_C3	.029	.901	-.003	.019	.907	-.012	.015
Faith in Integrity	PTB_I1	.769	.050	-.022	.882	-.041	-.010	.049
	PTB_I2	.649	.177	-.023	.848	.081	-.014	-.051
	PTB_I3	.690	.119	.115	.689	.059	.123	.135
Trusting Stance	PTB_TS1	.059	-.056	.897	.130	-.068	.894	-.047
	PTB_TS2	-.049	.074	.873	-.134	.103	.866	.071
	PTB_TS3	.002	-.015	.921	.021	-.011	.917	-.011

9. EFA for Cognitive Trusting Base

Construct	Item	Factors (Eigenvalue > 1)		
		1	2	3
Reputation	REP1	-.047	.039	.886
	REP2	-.012	.050	.871
	REP3	.124	.013	.830
Stereotyping	STEREO1	.673	-.087	.262
	STEREO2	.650	-.108	.290
	STEREO3	.807	-.034	-.019
Illusion of Control	ILLUS1	-.037	.888	.060
	ILLUS2	.641	.216	-.049
	ILLUS3	.817	.033	-.102
	ILLUS4	.068	.835	.028

10. EFA for Calculative Trusting Base (Eigenvalue > 1)

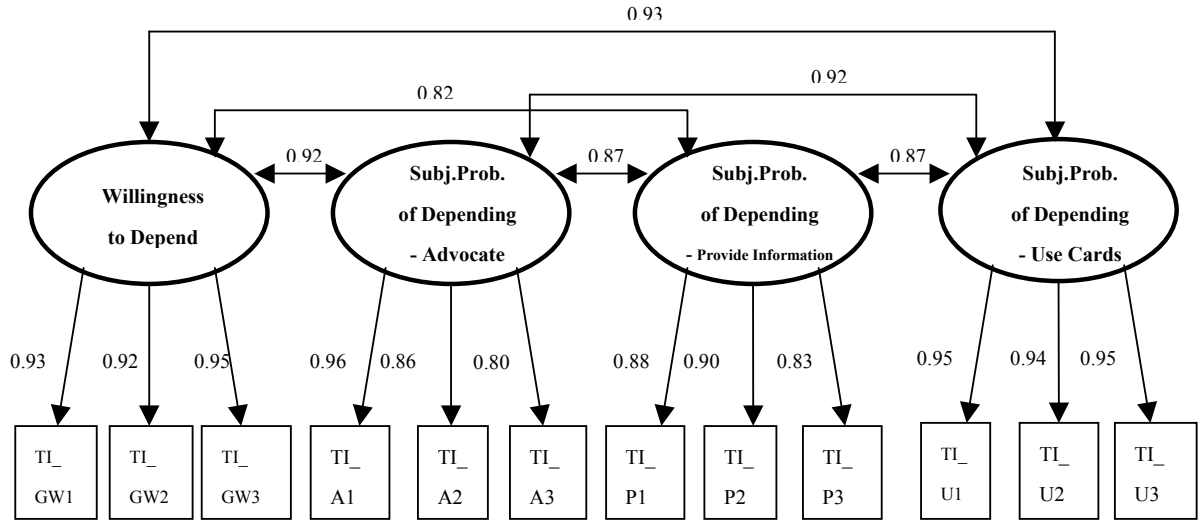
Construct	Item	Factors
		1
Cost vs. Benefit	CAL1	.849
	CAL2	.891
	CAL3	.732

11. EFA for Institutional Trusting Base

Construct	Item	Factors (Eigenvalue > 1)		Factors (5 Factors)				
		1	2	1	2	3	4	5
Situational Normality - General	IT_SNG1	.765	-.038	.053	.048	.862	-.018	-.042
	IT_SNG2	.813	-.082	.033	-.004	.874	.016	-.086
Situational Normality - Benevolence	IT_SNB1	.712	.087	.017	.171	.231	.647	.063
	IT_SNB2	.888	-.166	.196	-.109	.165	.632	-.089
	IT_SNB3	.732	.051	.025	.067	-.145	.883	-.138
Situational Normality - Integrity	IT_SNI1	.648	.179	-.113	.022	.186	.113	-.796
	IT_SNI2	.626	.266	.087	.125	.081	.047	-.723
	IT_SNI3	.630	.176	.317	.074	-.078	.091	-.573
Situational Normality - Competence	IT_SNC1	.657	.137	.613	.115	.048	-.103	-.320
	IT_SNC2	.856	-.071	.740	.009	.092	.185	-.020
	IT_SNC3	.820	.003	.657	.108	.166	.223	.077
Structural Assurance	IT_SA1	.091	.775	-.119	.794	.128	.118	.020
	IT_SA2	-.062	.941	-.041	.915	-.066	-.021	-.078
	IT_SA3	.033	.881	.041	.887	.004	-.005	-.006
	IT_SA4	.071	.821	.150	.835	-.014	-.036	.014

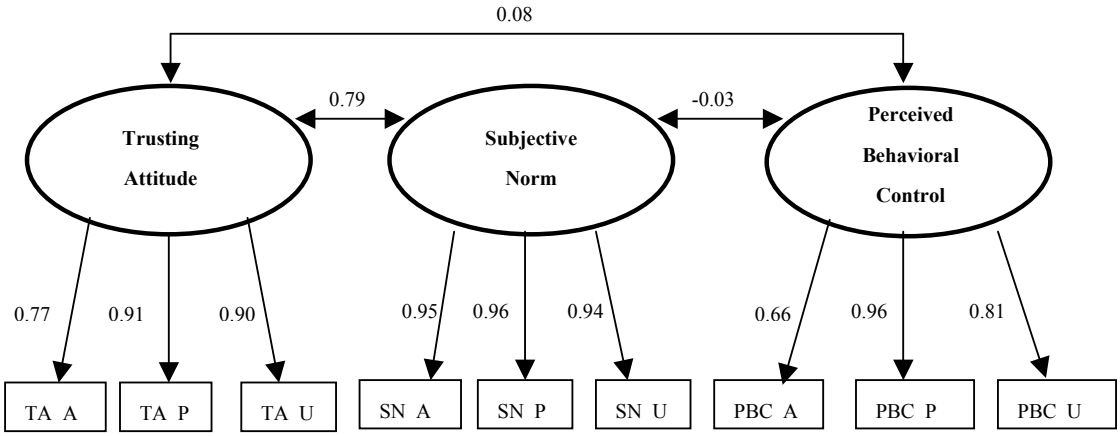
Appendix F: Measurement Models

1. Trusting Intentions Sub-Model:



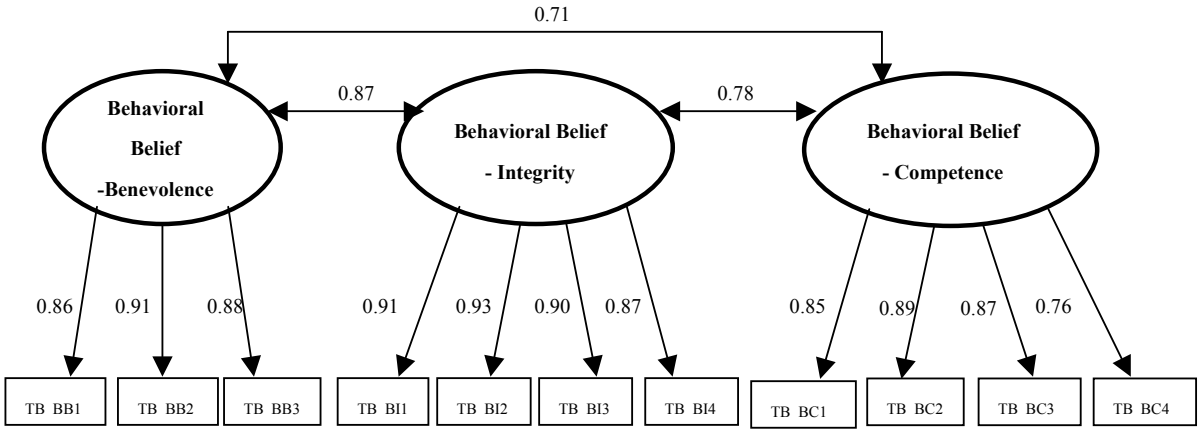
χ^2 = 180.247; df = 48; χ^2 /df = 3.755; P = 0.000;
RMSEA = 0.084; GFI = 0.926; AGFI = 0.879; NFI = 0.970; CFI = 0.978

2. Intention Determinants Sub-Model:



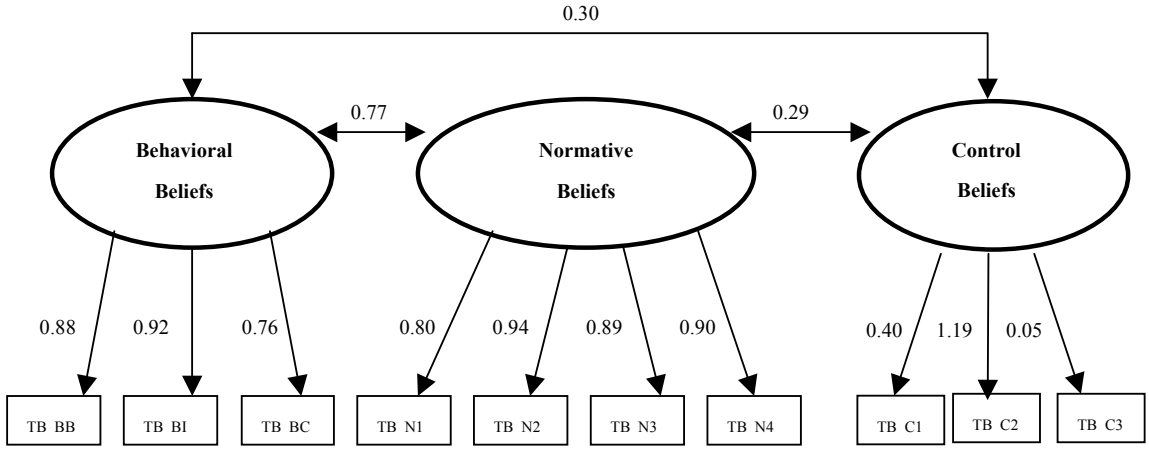
χ^2 = 37.972; df = 24; χ^2 /df = 1.582; P = 0.035;
RMSEA = 0.039; GFI = 0.980; AGFI = 0.962; NFI = 0.988; CFI = 0.995

3. Behavioral Beliefs Measurement Model:



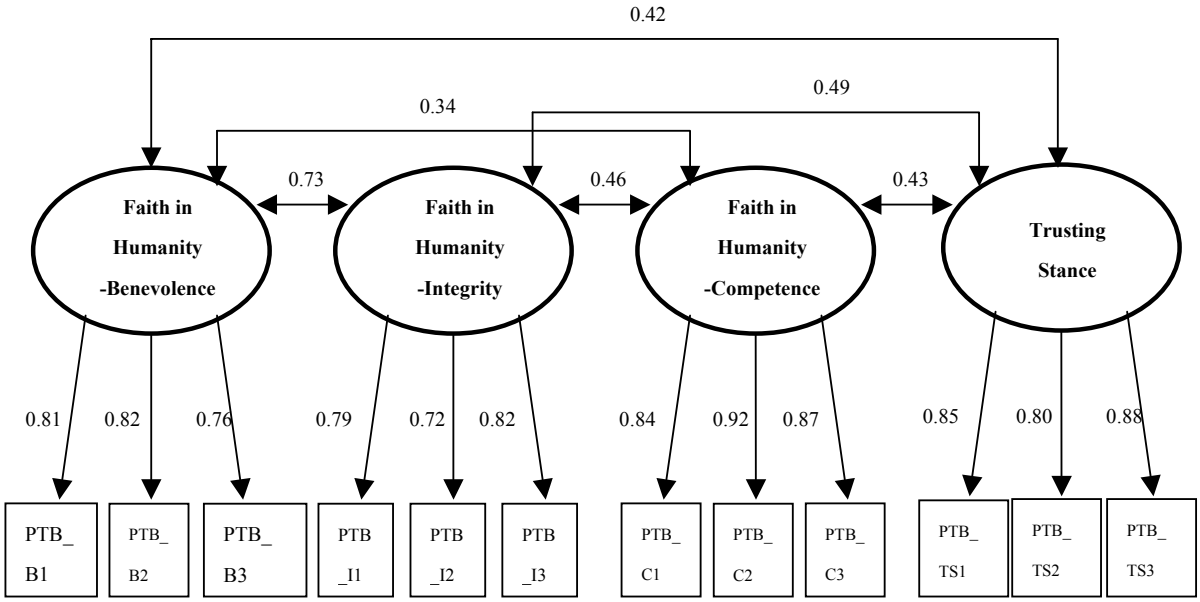
χ^2 = 195.961; df = 41; χ^2 /df = 4.780; P = 0.000;
RMSEA = 0.099; GFI = 0.917; AGFI = 0.866; NFI = 0.954; CFI = 0.963

4. Trusting Beliefs Sub-Model:



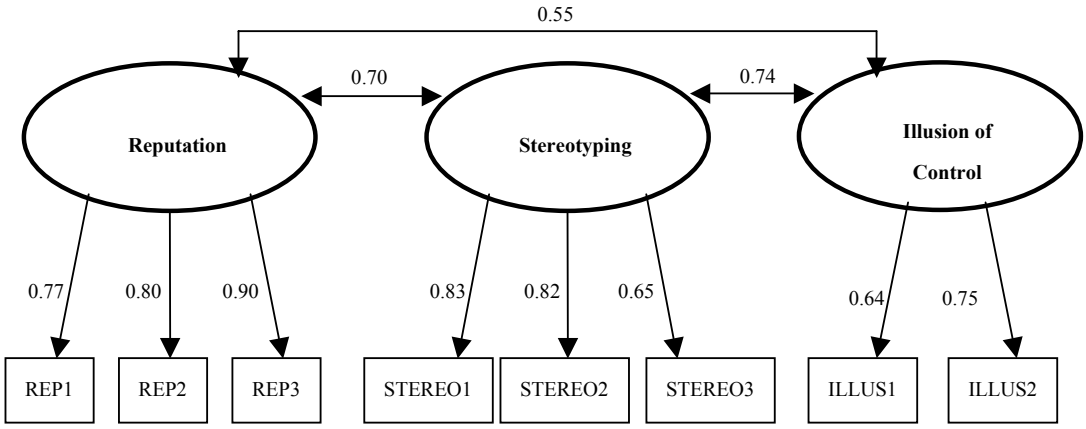
χ^2 = 99.912; df = 32; χ^2 /df = 3.122; P = 0.000;
RMSEA = 0.74; GFI = 0.949; AGFI = 0.913; NFI = 0.962; CFI = 0.973

5. Personality Trusting Base Measurement Model:



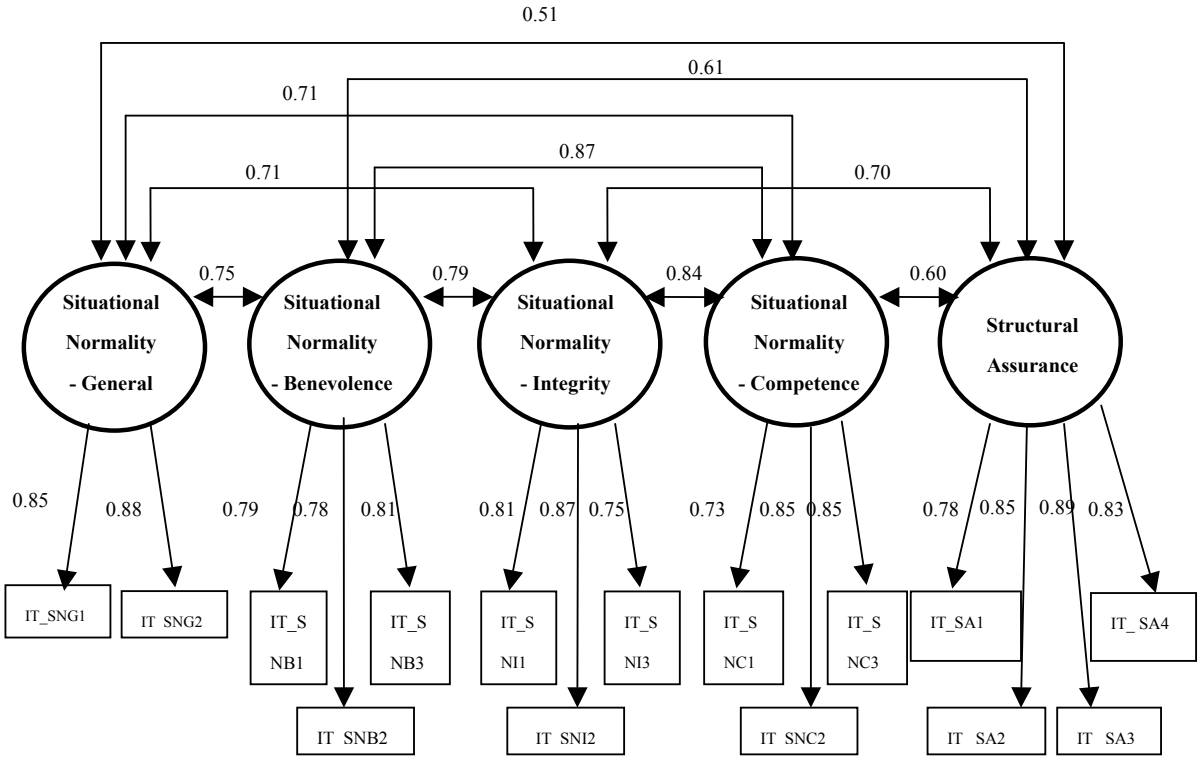
χ^2 = 128.190; df = 48; χ^2 /df = 2.671; P = 0.000;
RMSEA = 0.066; GFI = 0.949; AGFI = 0.918; NFI = 0.954; CFI = 0.971

6. Cognitive Trusting Base Measurement Model:



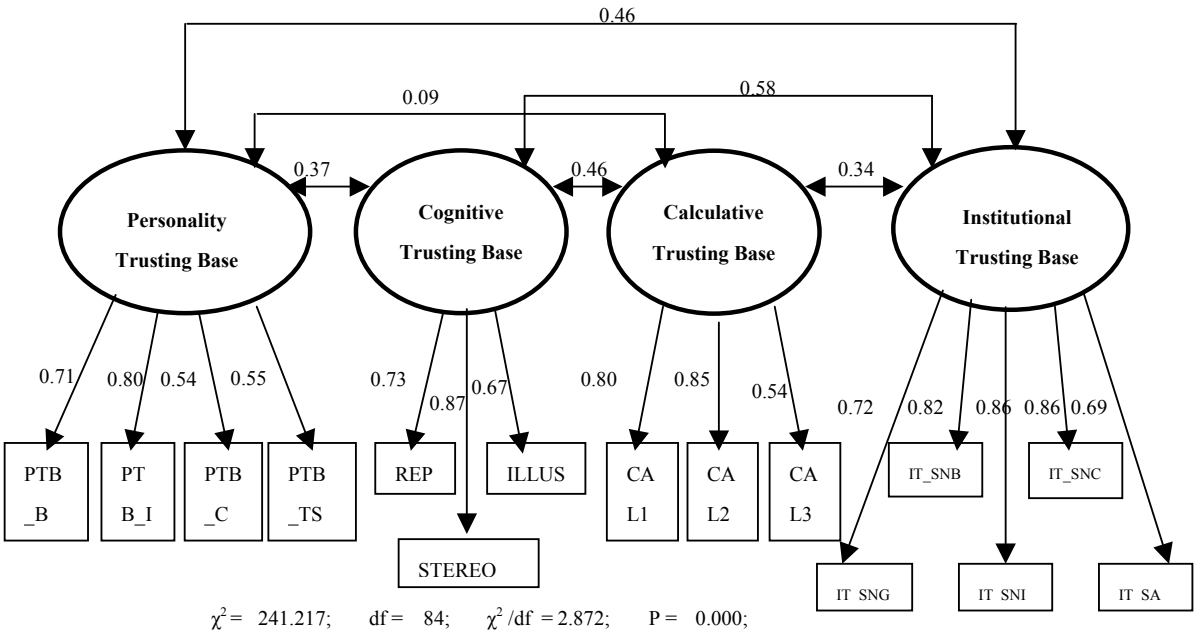
χ^2 = 43.192; df = 17; χ^2 /df = 2.541; P = 0.000;
RMSEA = 0.063; GFI = 0.974; AGFI = 0.946; NFI = 0.970; CFI = 0.981

7. Institution-Based Trust Measurement Model:



χ^2 = 293.128; df = 80; χ^2 /df = 3.664; P = 0.000;
RMSEA = 0.083; GFI = 0.909; AGFI = 0.863; NFI = 0.930; CFI = 0.948

8. Trusting Bases Sub-Model:



χ^2 = 241.217; df = 84; χ^2 /df = 2.872; P = 0.000;
RMSEA = 0.069; GFI = 0.921; AGFI = 0.887; NFI = 0.909; CFI = 0.938

Appendix G: Standardized Loadings of Scale Items

Measurement Model	Items	Loadings	p	Standard Error		Measurement Model	Items	Loadings	p	Standard Error
Trusting Intention Sub-Model	TI_GW1	.93	.000	-		Personality Trusting Base Measurement Model	PTB_B1	.81	.000	-
	TI_GW2	.92	.000	.027			PTB_B2	.82	.000	.061
	TI_GW3	.95	.000	.025			PTB_B3	.76	.000	.061
	TI_A1	.96	.000	-			PTB_I1	.79	.000	.061
	TI_A2	.86	.000	.031			PTB_I2	.72	.000	.067
	TI_A3	.80	.000	.034			PTB_I3	.82	.000	-
	TI_P1	.88	.000	.037			PTB_C1	.84	.000	.040
	TI_P2	.90	.000	-			PTB_C2	.92	.000	-
	TI_P3	.83	.000	.040			PTB_C3	.87	.000	.040
	TI_U1	.95	.000	-			PTB_TS1	.85	.000	.048
	TI_U2	.94	.000	.025			PTB_TS2	.80	.000	.045
	TI_U3	.95	.000	.023			PTB_TS3	.88	.000	-
Intention Determinants Sub-Model	TA_A	.77	.000	.040		Cognitive Trusting Base Measurement Model	REP1	.77	.000	.046
	TA_P	.91	.000	-			REP2	.80	.000	.050
	TA_U	.90	.000	.038			REP3	.90	.000	-
	SN_A	.95	.000	-			STEREO1	.83	.000	-
	SN_P	.96	.000	.024			STEREO2	.82	.000	.054
	SN_U	.94	.000	.026			STEREO3	.65	.000	.068
	PBC_A	.66	.000	.046			ILLUS1	.64	.000	-
	PBC_P	.96	.000	-			ILLUS4	.75	.000	.120
	PBC_U	.81	.000	.050		Institutional Trusting Base Measurement Model	IT_SNG1	.85	.000	.051
Behavioral Beliefs Measurement Model	TB_BB1	.86	.000	-			IT_SNG2	.88	.000	-
	TB_BB2	.91	.000	.038			IT_SNB1	.79	.000	.056
	TB_BB3	.88	.000	.041			IT_SNB2	.78	.000	.050
	TB_BI1	.91	.000	.032			IT_SNB3	.81	.000	-
	TB_BI2	.93	.000	-			IT_SNI1	.81	.000	.046
	TB_BI3	.90	.000	.031			IT_SNI2	.87	.000	-
	TB_BI4	.87	.000	.034			IT_SNI3	.75	.000	.052
	TB_BC1	.85	.000	.043			IT_SNC1	.73	.000	.055
	TB_BC2	.89	.000	.042			IT_SNC2	.85	.000	-
	TB_BC3	.87	.000	-			IT_SNC3	.85	.000	.046
	TB_BC4	.76	.000	.044			IT_SA1	.78	.000	.048
Trusting Beliefs Measurement Model*	TB_N1	.80	.000	.041			IT_SA2	.85	.000	.044
	TB_N2	.94	.000	-			IT_SA3	.89	.000	-
	TB_N3	.89	.000	.031			IT_SA4	.83	.000	.043
	TB_N4	.90	.000	.031		Trusting Bases Sub-Model*	CAL1	.80	.000	-
	TB_C1	.40	.006	.116			CAL2	.85	.000	.074
	TB_C2	1.19	.000	-			CAL3	.54	.000	.067
	TB_C3	.05	.244	.041						

- Item is set as perfect measure of the latent variable, therefore no standard error.

* The bundled item loadings are not presented here.

Appendix H: Pairwise Discriminant Analysis

1. Trusting Intention Sub-Model	χ^2_{df}
Original Model	$\chi^2_{48} = 180.247$
Combining Probability of Advocate with Probability of Provide Information	$\chi^2_{51} = 307.887$
Combining Probability of Advocate with Probability of Use Card	$\chi^2_{51} = 327.771$
Combining Probability of Advocate with General Willingness	$\chi^2_{51} = 322.221$
Combining Probability of Provide Information with Probability of Use Card	$\chi^2_{51} = 340.920$
Combining Probability of Provide Information with General Willingness	$\chi^2_{51} = 422.989$
Combining Probability of Use Card with General Willingness	$\chi^2_{51} = 358.133$
2. Intention Determinant Sub-Model	χ^2_{df}
Original Model	$\chi^2_{24} = 37.972$
Combining Trusting Attitude with Subjective Norm	$\chi^2_{26} = 321.243$
Combining Trusting Attitude with Perceived Behavioral Control	$\chi^2_{26} = 615.858$
Combining Subjective Norm with Perceived Behavioral Control	$\chi^2_{26} = 619.767$
3. Behavioral Beliefs Measurement Model	χ^2_{df}
Original Model	$\chi^2_{41} = 195.961$
Combining Beliefs in Benevolence with Beliefs in Integrity	$\chi^2_{43} = 376.322$
Combining Beliefs in Benevolence with Beliefs in Competence	$\chi^2_{43} = 620.050$
Combining Beliefs in Integrity with Beliefs in Competence	$\chi^2_{43} = 575.969$
4. Trusting Beliefs Sub-Model	χ^2_{df}
Original Model	$\chi^2_{32} = 99.912$
Combining Behavioral Beliefs with Normative Beliefs	$\chi^2_{34} = 392.888$
Combining Behavioral Beliefs with Control Beliefs	$\chi^2_{34} = 197.695$
Combining Normative Beliefs with Control Beliefs	$\chi^2_{34} = 203.677$
5. Personality Trusting Base Measurement Model	χ^2_{df}
Original Model	$\chi^2_{48} = 128.190$
Combining Faith in Benevolence with Faith in Integrity	$\chi^2_{51} = 258.667$
Combining Faith in Benevolence with Faith in Competence	$\chi^2_{51} = 669.321$
Combining Faith in Benevolence with Trusting Stance	$\chi^2_{51} = 602.947$
Combining Faith in Integrity with Faith in Competence	$\chi^2_{51} = 584.002$
Combining Faith in Integrity with Trusting Stance	$\chi^2_{51} = 544.910$
Combining Faith in Competence with Trusting Stance	$\chi^2_{51} = 680.199$
6. Cognitive Trusting Base Measurement Model	χ^2_{df}
Original Model	$\chi^2_{17} = 43.192$
Combining Reputation with Stereotyping	$\chi^2_{19} = 247.649$
Combining Reputation with Illusion of Control	$\chi^2_{19} = 152.916$
Combining Stereotyping with Illusion of Control	$\chi^2_{19} = 74.318$
7. Institutional Trusting Base Measurement Model	χ^2_{df}
Original Model	$\chi^2_{80} = 293.128$
Combining Situational Normality (SN) in General with SN in Benevolence	$\chi^2_{84} = 411.167$
Combining SN in General with SN in Integrity	$\chi^2_{84} = 452.458$
Combining SN in General with SN in Competence	$\chi^2_{84} = 440.669$
Combining SN in General with SN in Structural Assurance (SA)	$\chi^2_{84} = 658.970$
Combining SN in Benevolence with SN in Integrity	$\chi^2_{84} = 406.009$

Combining SN in Benevolence with SN in Competence	$\chi^2_{84} = 351.915$
Combining SN in Benevolence with SA	$\chi^2_{84} = 720.205$
Combining SN in Integrity with SN in Competence	$\chi^2_{84} = 380.577$
Combining SN in Integrity with SA	$\chi^2_{84} = 649.709$
Combining SN in Competence with SA	$\chi^2_{84} = 766.780$
8. Trusting Bases Sub-Model	χ^2_{df}
Original Model	$\chi^2_{84} = 241.217$
Combining Personality Trusting Base with Cognitive Trusting Base	$\chi^2_{87} = 523.306$
Combining Personality Trusting Base with Calculative Trusting Base	$\chi^2_{87} = 634.478$
Combining Personality Trusting Base with Institutional Trusting Base	$\chi^2_{87} = 471.687$
Combining Cognitive Trusting Base with Calculative Trusting Base	$\chi^2_{87} = 484.688$
Combining Cognitive Trusting Base with Institutional Trusting Base	$\chi^2_{87} = 498.958$
Combining Calculative Trusting Base with Institutional Trusting Base	$\chi^2_{87} = 562.892$

Appendix I: ANOVA for Gender, Citizen and Perceived Voluntariness of System Usage

1. ANOVA for Gender

		Sum of Squares	df	Mean Square	F	Sig.
TA	Between Groups	1.192	1	1.192	.576	.448
	Within Groups	912.134	441	2.068		
	Total	913.326	442			
SN	Between Groups	1.112	1	1.112	.508	.476
	Within Groups	964.501	441	2.187		
	Total	965.613	442			
PBC	Between Groups	.573	1	.573	.225	.636
	Within Groups	1123.159	441	2.547		
	Total	1123.732	442			
TI	Between Groups	.031	1	.031	.013	.908
	Within Groups	1006.265	441	2.282		
	Total	1006.295	442			

2. ANOVA for Citizen

		Sum of Squares	df	Mean Square	F	Sig.
TA	Between Groups	9.935	1	9.935	4.850	.028
	Within Groups	903.391	441	2.049		
	Total	913.326	442			
SN	Between Groups	7.620	1	7.620	3.508	.062
	Within Groups	957.993	441	2.172		
	Total	965.613	442			
PBC	Between Groups	.053	1	.053	.021	.886
	Within Groups	1123.679	441	2.548		
	Total	1123.732	442			
TI	Between Groups	3.188	1	3.188	1.402	.237
	Within Groups	1003.107	441	2.275		
	Total	1006.295	442			

3. ANOVA 1 for Perceived Voluntariness of System Usage

(Note: Responses of 1, 2 and 3 indicate voluntary usage; responses of 4 indicate neutral; and responses of 5, 6 and 7 indicate mandatory usage.)

		Sum of Squares	df	Mean Square	F	Sig.
TA	Between Groups	67.280	2	33.640	17.495	.000
	Within Groups	846.046	440	1.923		
	Total	913.326	442			
SN	Between Groups	103.319	2	51.660	26.360	.000
	Within Groups	862.293	440	1.960		
	Total	965.613	442			
PBC	Between Groups	10.963	2	5.482	2.168	.116
	Within Groups	1112.768	440	2.529		
	Total	1123.732	442			
TI	Between Groups	86.299	2	43.150	20.637	.000
	Within Groups	919.996	440	2.091		
	Total	1006.295	442			

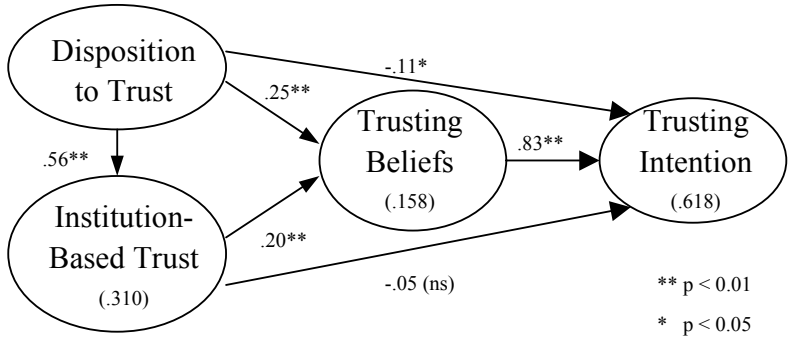
4. ANOVA 2 for Perceived Voluntariness of System Usage

(Note: Responses of 1 and 2 indicate voluntary usage; responses of 3, 4 and 5 indicate neutral; and responses of 6 and 7 indicate mandatory usage.)

		Sum of Squares	df	Mean Square	F	Sig.
TA	Between Groups	71.151	2	35.576	18.587	.000
	Within Groups	842.175	440	1.914		
	Total	913.326	442			
SN	Between Groups	98.050	2	49.025	24.864	.000
	Within Groups	867.562	440	1.972		
	Total	965.613	442			
PBC	Between Groups	12.985	2	6.492	2.572	.078
	Within Groups	1110.747	440	2.524		
	Total	1123.732	442			
TI	Between Groups	91.075	2	45.537	21.893	.000
	Within Groups	915.220	440	2.080		
	Total	1006.295	442			

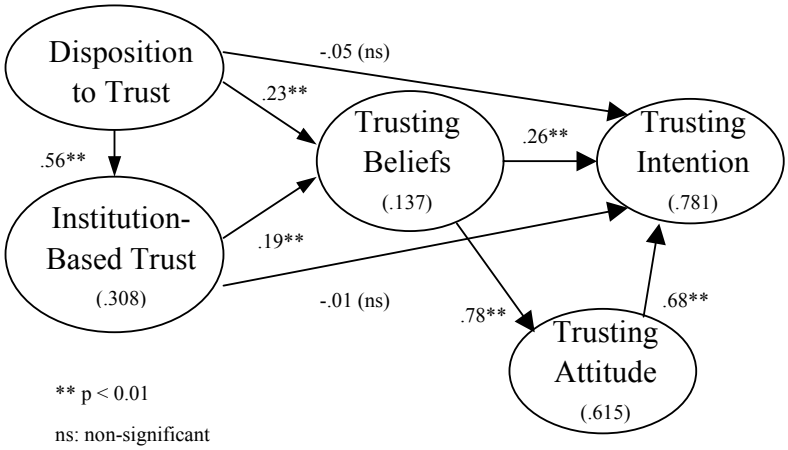
Appendix J: Alternative Models Based on McKnight Model

1. McKnight Model:



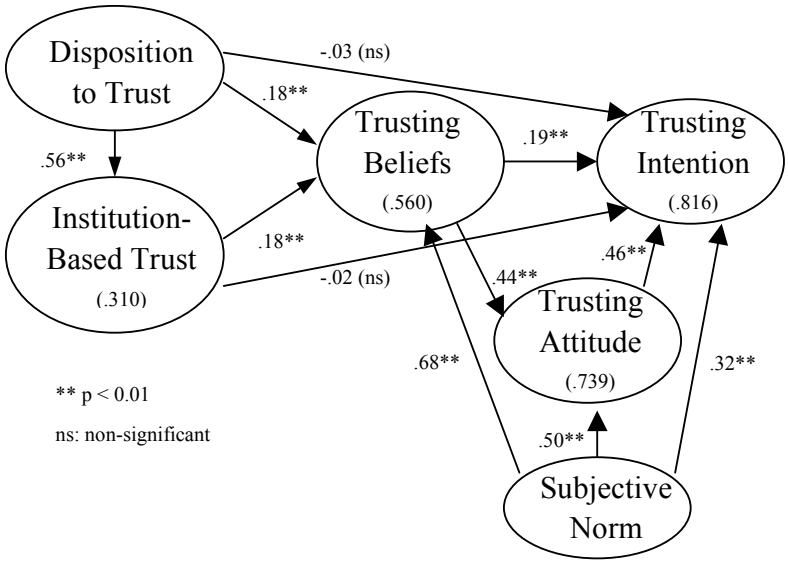
χ^2 = 299.926; df = 98; χ^2 /df = 3.060; P = 0.000;
RMSEA = 0.068; GFI = 0.917; AGFI = 0.885; NFI = 0.940; CFI = 0.959

2. Alternative Model 1: McKnight Model + Trusting Attitude



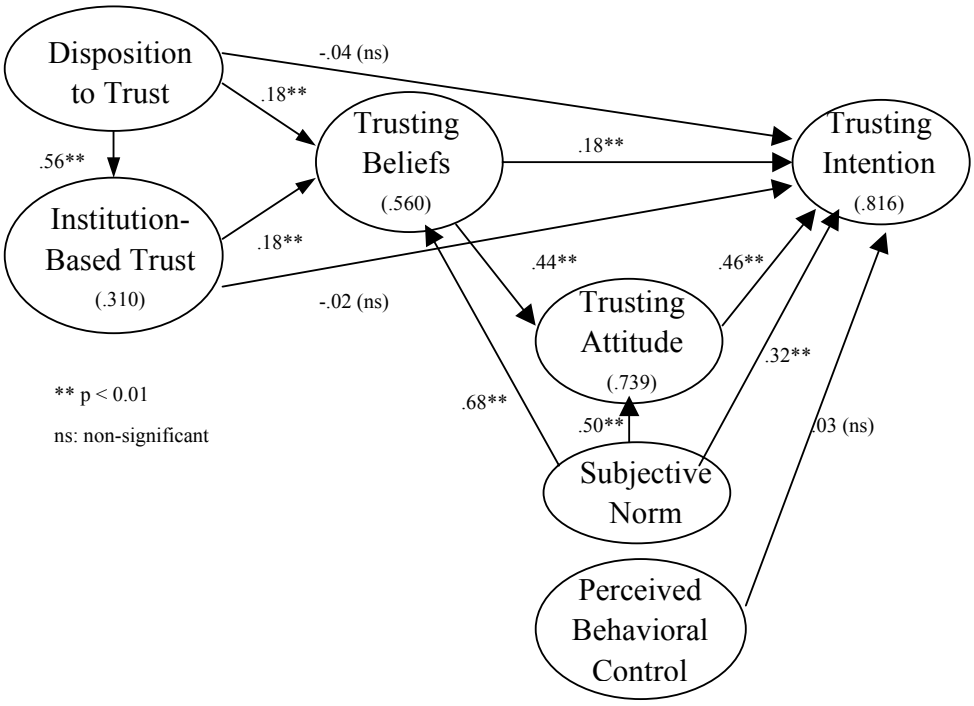
χ^2 = 371.759; df = 144; χ^2 /df = 2.582; P = 0.000;
RMSEA = 0.060; GFI = 0.915; AGFI = 0.887; NFI = 0.942; CFI = 0.964

3. Alternative Model 2: McKnight Model + Trusting Attitude + Subjective Norm



χ^2 = 463.322; df = 198; χ^2 /df = 2.340; P = 0.000;
RMSEA = 0.055; GFI = 0.909; AGFI = 0.884; NFI = 0.946; CFI = 0.968

4. Alternative Model 3: McKnight Model + Trusting Attitude + Subjective Norm + Perceived Behavioral Control



χ^2 = 591.999; df = 263; χ^2 /df = 2.251; P = 0.000;
RMSEA = 0.053; GFI = 0.899; AGFI = 0.875; NFI = 0.937; CFI = 0.964