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Abstract

A theoretical model of trust in WWW commerce systems is presented. Based on this model, an instrument called the *Trust Scale* was developed. The instrument was validated using exploratory and higher order factor analysis to identify the presence of the underlying factor, trust. In the first stage of this research, we found that trust in our WWW commerce system was lower than trust in conventional banking systems, substantiating the need for studying factors that can influence trust in WWW commerce. In the second stage, three of our four major hypotheses were validated. Our hypothesis regarding the influence of information provision on trust was substantiated. We found that information provision about the system resulted in higher trust in the system. Our hypothesis regarding the influence of task risk on trust was also substantiated. We found that trust in a system is dependent on task risk, thereby suggesting that WWW commerce systems may not be trusted for all tasks. Our hypothesis regarding the influence of an individual's *Tendency To Trust,* on trust in the system was not substantiated. Our final major hypothesis about the influence of trust on the willingness to use the system was substantiated. We found that individuals who had higher trust in the systems were more willing to accept and use the system, indicating that trust in the system will play a key role in ensuring adoption and continued use of WWW commerce systems.

Introduction

The purpose of this research was to provide a framework for studying the concept of trust in Internet and World Wide Web (WWW) based electronic commerce systems and to determine the factors that influence trust in these systems. We developed a theoretical model and definition of trust in WWW commerce systems. Based on this model, we conducted two empirical investigations to validate our theoretical model and our definition of trust. Researchers in social psychology and psychology have identified the factors that influence the development of trust in individuals. In this research we integrate these two research streams to make a case for studying trust as an important factor in successful adoption of WWW commerce.

Most business transactions are dependent on some level of trust between the two parties. In conventional business transactions, trust is based on well-known legal and financial instruments like contracts and guarantees and also on personal relationships between the two parties. That may not be the case for web transactions.

Several factors can contribute to the lack of trust in WWW commerce, specifically issues of risk, security, dependability, and competence. Risk is an important component of trust, because an individual's decision to trust is primarily important when there is some risk of negative outcomes. In a WWW commerce relationship, risk involves the probability of the individual engaging in WWW commerce facing negative outcomes like abuse of personal information or loss of financial resources from the untrustworthy behavior of the WWW commerce system. Therefore, in WWW commerce, trust is important when financial transactions or important personal information is involved. For example, most users are comfortable in using the WWW for searching for information, and will trust the information obtained from the WWW. This is because the situation is primarily of low or non-existent risk. The possibility of negative outcomes is low. The user is aware the information obtained might be flawed or incorrect, but is aware that he/she can selectively use the information received from the WWW. On the other hand, most users are less trusting about sending personal information or conducting financial transactions on the WWW. In these cases, the consequences of negative outcomes, such as the misuse of financial information by unscrupulous parties resulting in theft of money and other resources, are much greater.

Research Hypotheses and Model

We examined the impact of three variables that we have identified through literature review. These are Tendency To Trust (TTT), Risk Involved (RI), and Information Provision (IP). Also, it is necessary to identify a system that will serve as a suitable representative of WWW commerce systems. In this research we identified WWW banking as the WWW commerce system to be used as the research focus. The major reasoning behind the choice of using WWW banking systems is as follows. First, WWW banking is currently being used by several banks to provide alternative means for conducting banking transactions. Using WWW banking systems provides us with a current and relevant WWW commerce system. Second, as conventional banking systems are already accepted and trusted for conducting banking transactions, using the WWW banking system as our research system allows us to compare trust in WWW banking with an already accepted and trusted system. Furthermore, it allows us to determine if trust in the new WWW banking system is indeed lower than that in conventional banking systems. Third, in WWW banking systems all transactions are conducted over the WWW and involve the transfer of personal and financial information over the WWW. As stated by Yan et al. (1997), people consider providing personal information and conducting cash transactions as the most risky tasks. WWW banking thereby provides us with a system that is representative of risky WWW commerce systems in that the system involves financial as well as confidential personal information being transferred over the WWW. Therefore, using WWW banking systems as a research focus provides us with a system that is currently being implemented by banks, can be meaningfully compared to an existing conventional system and has all the general features of WWW commerce systems.

Our hypotheses are listed below. Hypotheses 2 through 8 are modeled in Figure 1. TTT stands for Tendency To Trust:

H1: Trust in WWW commerce systems is lower than trust in conventional commerce systems.

H2: Trust in the system will be higher for high information provision subjects than for low information provision subjects.

H3: Trust in the WWW banking system will be lower for high-risk tasks than for low risk tasks.

H4: Individuals with high TTT will have more trust in the system as compared to individuals with low TTT.

H5: Trust in the system due to information provision will be higher for individuals with low TTT than for ones with high TTT.

H6: Trust in the system for a high risk task is lower for individuals with low TTT than for ones with high TTT.

H7: Trust in the system due to information provision will be higher for the high-risk task than for the low risk task.

H8: Individual's with higher trust in the system will be more willing to adopt the system as compared to individuals with lower trust.

For detail theoretical foundation of these hypotheses, see Kini (1999). Due to its specific terminology, further explanation is given here for H2. In classifying knowledge about a system, we can differentiate between three stages of knowledge. The first stage is *awareness knowledge*, which is knowledge that the system exists. The second stage is *how-to knowledge*, which is knowledge about how to use a system properly. The third stage is *principles' knowledge*, which is knowledge about the functioning principles underlying how the system works These three stages represent increasing knowledge about the system. The first two stages represent basic knowledge about the system and the third stage represents detailed knowledge about the system. Information provision corresponding to the three stages of knowledge contributes to the system adoption decision process by affecting the knowledge-based trust of the individual, thereby resulting in increased trust. In this research, we used these three stages of knowledge to distinguish our information provision treatments. Principles knowledge is key in developing trust in the system. Providing *principles knowledge* about the key determinants of trust will enable the individual to develop knowledge based trust in the system. We classify the provision of *principles' knowledge* as the high information provision treatment. The provision of *awareness* and *how-to* knowledge is classified as the low information provision treatment.

Research Methodology and Procedures

Since this is one of the first studies on trust in WWW commerce systems, a suitable instrument to measure trust could not be found. The first task was to develop and validate an instrument that could be used to measure our dependent variable, trust in a WWW commerce system.

Based on previous research, we define trust as follows: "*Trust in a WWW commerce system is an individual's belief in the <u>security</u>, <u>competence</u>, and <u>dependability</u> of the system under conditions of risk.*" Important dimensions of this definition are underlined.

Questions were constructed to measure the major components of each dimension. This was achieved by subdividing each dimension into smaller components based on theory and definition of the terms. Security is defined as freedom from danger of loss. Security issues can relate to confidentiality, theft, and information modification. In most research on security, researchers have identified four major issues: Theft, Data Modification, Impersonation, and Privacy, which are important problems in Internet and WWW security (Bhimani 1996, Kalakota and Whinston 1996). Thus, for our scale, questions were designed to reflect each of these issues of security. Dependability is defined as a confidence that the system can be relied on, or that one can confer duties on the system that will be carried out successfully. The components identified for dependability were reliability, error-free, consistency, and availability (Muir 1994, Rempel et al. 1985, McKnight and Chervany 1996). Competence is defined as having requisite skills or qualities to perform the job. The components identified for competence were expertise, skill, knowledge, and capability (Muir 1994, Barber 1983, Mayer et al. 1995). Thus, a total of 12 components were identified as the basis for developing the scale.

Based on our theory and definition of trust a questionnaire was designed. The items were designed to reflect the 12 components of the three dimensions of trust. Items to be included in the questionnaire were created by studying previously validated instruments designed to measure trust (Wrightsman 1991). Suitable items from these instruments were identified. Some were modified to fit the definition of each dimension's components. Additional items were created. The questions used for measuring trust dealt with an individual's belief in each of these components.

Thirty questions were developed, with 13 questions on security, 9 questions on dependability and 8 questions on competence. In order to refine the scale and establish its content validity, the questionnaire was distributed to 9 judges who were asked to assess the suitability of the questions and to indicate questions that were ambiguous. Upon their recommendations, 18 questions were eliminated based on the fact that some of them measured the same construct as another question, or that the wording of the questions was ambiguous. The remaining 12 questions were then assessed to see if they fit into one of the 12 components defined previously. The 9 judges then reassessed the refined questionnaire and suggested minor modifications. After incorporating their suggestions, a general discussion with the judges indicated that the modified questionnaire was a reasonable scale to measure trust. Thus the final scale had 12 questions, 4 questions for each dimension of trust. The dimensions of trust and the 4 components of each dimension are summarized in Table 1 below.

Table 1. The Three Dimensions of Trust and Their Components

Dimensions of Trust	Components	Item No.
Security	Theft	I1
	Privacy	I5
	Impersonation	I12
	Modification	I8
Dependability	Reliable	I3
	Error Free	I10
	Available	I6
	Consistent	I9
Competence	Expertise	I2
	Knowledge	I4
	Skill	I10
	Capability	I7

The research was conducted in two stages. In the first stage, the focus was on establishing the validity of our scale and testing hypothesis 1. For this stage, the independent variable was the type of the system. It had two levels: WWW banking and conventional Banking.

In the second stage, an experiment was designed to study the influence of the three factors identified in our research model on trust in the system (Hypotheses 2 to 7). The experiment also was designed to study the affect of trust in the system on the individual's willingness to use the system (Hypothesis 8).

In order to demonstrate the features of WWW banking, a prototype was designed to simulate an on-line WWW banking system. The system simulated the features of the WWW bank, as it would appear to individuals' conducting transactions during an actual on-line session. The screens were developed to demonstrate the various features of the bank. All screens were hyperlinked so as to simulate the experience of an on-line session with the bank.

The independent variable *information provision* was manipulated at two levels, high and low. The information provided was designed to answer questions such as "What is the system", "What are the features", and "How does it work" which are the main concerns of the individual about the system. In the low information provision treatment, the subjects were provided with *awareness-knowledge* and *how-to knowledge* information. The information provided was designed to answer the questions about the features of the system and how to use the system. In the high information provision treatment, in addition to *awareness* and *how-to knowledge* information, subjects were provided with *principles-knowledge* information (Rogers 1995) which is information that deals with the functioning principles underlying how the system

works. The principles-knowledge information was designed to provide the subjects with information about the system security, system performance, and competence of the system and its personnel, that is the three dimensions of trust in the system.

The independent variable *risk involved* in the task was manipulated at two levels, low risk and high risk. The low risk task involves only information acquisition over the WWW. The subjects were shown a prototype bank on the Internet that has facilities for checking account balances and other services like requesting applications for opening accounts and applying for loans. The high risk task involves the conduction of financial transactions over the WWW. The subjects were shown a prototype bank on the WWW that could be used for conducting all banking transactions like paying bills and transferring money between accounts.

The independent variable *TTT* had two levels, high TTT and low TTT. In order to measure TTT, we used a validated scale called the Interpersonal Trust Scale (ITS) developed by Rotter (1971). This scale measures the intrinsic tendency of individuals to trust others, and has been validated in several studies. The subjects are assigned to the two treatments based on their scores on this scale.

Subjects were junior level business students at a public university. They were informed that the study was to investigate WWW commerce systems feasibility. The subjects were informed that they would get extra course credit for participating in the study. The subjects were then administered the Tendency To Trust scale and were instructed to answer all questions. After the subjects had completed the questionnaire, they were instructed that the next stage of the study would be conducted the next week.

The subjects' responses to the TTT scale were then recorded and the subjects were classified into low and high TTT categories based on their scores, creating two groups. The subjects were then randomly assigned to four groups, thereby creating 8 randomly assigned groups for the second part of the study.

In the second part of the study, the subjects were informed of their classification into four groups and were assigned dates and times that their group would meet. In order to ensure that there were no scheduling conflicts, the sessions were conducted right after the class ended, in the same classroom.

The research was designed as a factorial ANOVA with three between group factors. The three factors are the independent variables discussed previously. The experiment was designed as a 2 X 2 X 2 factorial and the factorial matrix is presented below in Figure 2.

Summary and Discussion of the Results

In this research, we proposed 8 hypotheses that were empirically tested using two experiments. Results of the experiments are summarized in Table 2. As can be seen from the table, 4 of our hypotheses were validated and 4 were not.

Our empirical results show that our subjects did not trust the WWW banking system as much as a conventional system. Generalizing these results, one may conclude that trust in WWW commerce systems is not yet fully achieved. Does this lack of trust means that the users will not accept WWW commerce systems? Or, does it indicate that we are at the early stages of a sociotechnical paradigm shift? We believe that the latter is the case.

Our results indicates that information provision fosters trust by aligning users perception of the system with that of the system developers, ensuring that the expectations of the systems are in line with what the system was designed to deliver. Our findings are encouraging in that the results indicate that trust in the system can be increased by providing information designed to increase trust. Establishing the significance of information provision on trust raises several interesting new considerations. The first consideration is how the information should be presented so as to be effective in delivering the message and thereby accentuating the influence on trust. Research is needed to address how information presentation modes, the amount of information presented, and the content of the information affect trust. Even if the information presented is honest, complete, and accurate, it may not be understood by users if the presentation mode and organization is not designed well, and thereby not affect trust in the system. Also, it will be important to understand the amount of information that needs to be presented so as to achieve the desired benefit of increasing trust. Also, the content of the information should be carefully considered.

As indicated by our results, the risk involved in the task has a significant affect on trust in the system. As the risks involved in the task increases, the trust in the system diminishes. Individuals are less willing to trust when the consequences of negative outcomes are rather significant. In the extreme case, this can indicate that developing WWW commerce systems may not be suitable for all kinds of commerce, especially when the risk involved is great. This suggests that when the risk involved is greater, effective trust management will play a key role in influencing adoption. It is our opinion that the

presence of situational cues that signal the low probability of harmful consequences or the guarantee of protection from negative consequences can go a long way in diminishing the effect of task risk. Such situational cues can include provision of money back guarantees, provision of free trial periods, and ensuring backing by reputed institutions. Thus, task risk will play an important role in affecting the trust in the system and how it should be managed.

Our findings show that TTT does not have a significant impact on trust, in fact it is extremely negligible. In an attempt to understand these results, we examined previous experimental research on TTT. We measured TTT using the Interpersonal Trust Scale (ITS) developed by Rotter (1971). As defined by Rotter, this scale was designed to measure an individual's expectancy that the word, promise, or verbal or written statement of an individual or group can be relied upon. This conception of trust is derived from social learning theory (Rotter 1954), and predicts that an individual develops an expectancy about the behavior of others in certain situations. Rotter designed the test to sample expectancies over a broad range of situations, since expectancies differ across situations. Based on this, he classified people as having different levels of generalized trust based on there past interpersonal experiences. However, as cautioned by Stack (1978), the presence of these different levels by themselves do not determine whether a person will trust or mistrust in any specific situation. He cites Mischel (1968) in justifying this, as the difficulty of relating any internal, inferred characteristic such as a trait to some observable behavior. Our results seem to indicate that for WWW based systems, TTT cannot determine a persons trust or mistrust in a system. It appears that TTT is not a good indicator of the behavior of persons when engaging in WWW commerce.

Hypothesis 5 postulated that low TTT individuals will be affected more by information provision than high TTT individuals. To the contrary, our empirical results show no interaction between IP and TTT. This indicates that information provision is not dependent on the levels of TTT. This can be explained as follows. TTT is an ingrained characteristic of the individual that has been developed over a period of time. Therefore, information provision should not affect an individual's TTT. It will have the same affect on both high and low TTT individuals. While information provision has a positive impact on trust, TTT does not act as a mediator variable and both high and low TTT individual's show the same behavior with information provision. Thus, we can conclude that information provision affects individuals regardless of their personality traits or their generalized tendency to trust

As for Hypothesis 6, our results indicate that for low risk tasks, individual's with low TTT have a slightly higher trust score than the ones with high TTT. However, for high-risk tasks, individual's with high TTT have a much larger score than individual's with low TTT. These results seems to indicate the TTT is situation specific. As the risk of the task increases, individuals will be more cautious in placing their trust. The generalized trust seems to affect trust score in the hypothesized manner. However, for low risk tasks, people do not perceive the need to feel at risk and therefore do not rely on their generalized trust to make decisions. This indicates that TTT is important only when the stakes are high. or when the individual perceives that he/she is in a position that can have significant negative outcomes. Based on this analysis, we suggest that TTT indeed may be a significant factor in high risk or unique tasks, where the user perceives that there is a significant risk. In such situations, the generalized trusting tendency seems to affect behavior, with people with higher TTT tend to have more trust that people with lower TTT. However, it should be emphasized that this contention has not been empirically validated and further experimental research is needed to fully understand the relationship between TTT and trust in WWW commerce systems.

Hypothesis 7 postulated that information provision would result in increased trust for the high-risk task as compared to the low risk task. This is again based on the fact that when the risk involved is greater, individuals are less willing to trust easily. The more information provided the more the increase in trust. In high-risk tasks, most individuals are inclined to adopt an attitude of distrust until trust can be developed. The provision of positive information affects knowledge-based trust, and results in increased trust. For high-risk tasks this increase should be large because the initial position is that of distrust. For low risk tasks, individuals are more willing to trust, because the possibility of negative outcomes is not that large. Therefore, the base level of trust for the two levels of risk will be different and information provision should result in a larger increase for the higher risk tasks. Our experimental results indicate the presence of a slight interaction between RI and IP.

Finally, our results indicate that subjects who had higher trust in the system were more willing to adopt the system. The significance of trust in willingness to use the system raises interesting questions about the demographics of current and potential users of WWW commerce systems. WWW commerce systems have made huge inroads into our lives as alternative ways to conduct commerce. Many individuals now use WWW commerce systems for tasks such as banking, trading stocks and buying and selling commodities through on-line auctions. There have been several surveys conducted to determine

the demographics of WWW commerce users. Most surveys find that even though a lot of people use the WWW, not many are actually purchasing products. The findings of these surveys are in line with theoretical predictions from innovation adoption literature and our predictions about the significance of trust in influencing adoption.

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Table 2 Summary of the Results

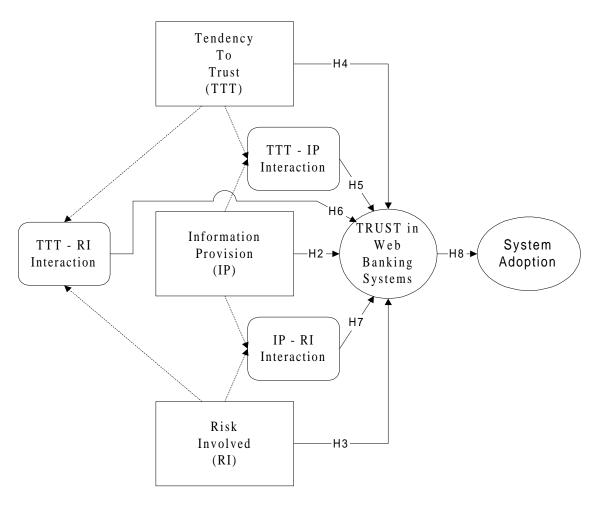| Hypothesis No.	Premise	Validated?
H1	**Trust Between Systems**	**Yes**
H2	**Affect of Information**	**Yes**
H3	**Affect of Information**	**Yes**
H4	Affect of Tendency to Trust	No
H5	Interaction of Information and TTT	No
H6	Interaction of Risk and TTT	No
H7	Interaction of Risk and Information	No
H8	**Affect of Trust on Adoption**	**Yes**

.

Figure 1: Research Model for Studying Trust in WWW Commerce

		Information Provision			
		A_1 (High)		**A_2 (Low)**	
	Risk Involved	**C_1 (High)**	**C_2 (Low)**	**C_1 (High)**	**C_2 (Low)**
Tendency To Trust	**B_1 (High)**	$A_1B_1C_1$	$A_1B_1C_2$	$A_2B_1C_1$	$A_2B_1C_2$
	B_2 (Low)	$A_1B_2C_1$	$A_1B_2C_2$	$A_2B_2C_1$	$A_2B_2C_2$

Figure 2.   Experimental Design Used for Studying Trust