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Incorporating Perceived Risk Into The Diffusion Of Innovation Theory For The Internet And Related Innovations

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ABSTRACTS

Despite the high volume of shopping done on the Internet each day, many consumers fail to make online purchases because of continued reluctance to engage in transactions with intermediaries that are not familiar and trusted. Existing research on consumer behavior on the Internet has focused on Internet purchasing [11], [22] or on information searching through the Internet [13], [21]. Some studies stressed on ease of use, other studies concentrated on usefulness as having strong effects on Internet usage. While the effects of ease of use and enjoyment are partly supported [23], and as the field expands, it has become clear that ease of use and usefulness cannot be the only predictive criterion for an individual's adoption of a microcomputer technological innovation. This study will examine the role of perceived risk on the user satisfaction and the decision to adopt, because it is more powerful in explaining online consumers' behavior than ease of use or usefulness.

Keywords: *Diffusion of Innovation, Internet shopping, Perceived Risk,*

1. INTRODUCTION

Human Computer Interaction research has focused on ease of use as the prime determiner of user satisfaction and adoption. Studies on the acceptance of computer related technology argue that usefulness and ease of use are primary explanations of computer acceptance behavior [8], [12]. Other studies found that usefulness has consistently strong effects on Internet usage, while the effects of ease of use and enjoyment are partly supported [23].

Loshe et al. [25] found that the percentage of panelists making a purchase on the Internet increases as a function of time spent online. The study showed that the longer the amount of time spent online, the greater the chance of making a purchase online. Other studies found that more time spent online is an important predictor of online buying behavior [4].

However, as the field expands, it has become clear that ease of use and usefulness cannot be the only predictive criterion for an individual's adoption of a microcomputer technological innovation. Despite the high volume of shopping done on the Internet each day, many consumers fail to make online purchases because of continued reluctance to engage in transactions with intermediaries that are not familiar and trusted, according to a study. Human interaction with applications that have the potential to significantly affect the user's social norms must be designed and studied in terms of a broader context. This study will examine the role of perceived risk on the user satisfaction and the decision to adopt, because it is more powerful in explaining online consumers' behavior than ease of use or usefulness.

2. PERCEIVED RISKS

In order to provide a solid theoretical basis for selecting influential driving factors, this study integrates two important streams of literature: (a) the Diffusion of Innovation Theory [19] and (b) the existing knowledge surrounding perceived risk.

Pavlou [17] has shown that an important factor in e-commerce acceptance is perceived risk reduction. The research argued that there are potentially multiple types of risks; yet, it has theorized about risk at an abstract level, differentiating only between behavioral and environmental risk. The study recommended that the examination of more detailed facets of perceived risk is a promising area for future research[17]. Risk is a multidimensional construct. However, Bhatnagar et al.[5] argue that in the case of Internet shopping two types of risk--product category risk and financial risk--are predominant. Product category risk matters if one has a specific product in mind before getting on the Internet. In addition, understanding risks in online shopping requires integrating an understanding of network technologies, information security, and the potential for data appropriation and misuse.

This study deals with perceptions of online shopping risks rather than actual online shopping risks. Researchers continue to be interested in perceived risk because it is more powerful in explaining consumers' behavior as well as the theory has intuitive appeal and broad application [16]. Studies indicate that online shopping is disturbed because uncertainty and consumer's perceived risk are high. Studies found that consumers think online

transaction are risky and hesitate to use the new shopping method [6],[10].

The perceived risk is a risk identified based on an individual's impressions, instincts, experience or intuition rather than empirical analysis. Thus, this study defines Perceived Risk as the risk believed to exist by the Internet user when goods or services are acquired online, whether or not a risk actually exists. Despite the high volume of shopping done on the Internet each day, many consumers fail to make online purchases because of continued reluctance to engage in transactions with intermediaries that are not familiar and trusted. Bhatnagar et al. [5] argued that the likelihood of purchasing on the Internet decreases with increases in product risk. Other researchers found that consumers tend to trust established electronic entities like Amazon and e-Bay, which explains why some retailers have partnered with these companies to sell their products over the Web.

2.1 THE ADOPTION THEORY

Research on Diffusion of Innovation Theory has developed over the last 100 years. There have been a number of studies applied to understand end-user as a technology. Among the studies that have been proposed and examined are: the Bass Diffusion Model [3], the Theory of Planned Behavior (TPB) was an extenuation of TRA theory by Ajzen [1], and Technology Acceptance Model (TAM), originated by Davis [9] and the Diffusion of Innovation Theory [19].

2.2 BASS DIFFUSION MODEL

Bass [3] proposed and tested an epidemiological model for the diffusion of innovation. The Bass Model shows how a new product or idea spreads through the user community. A no uniform innovation diffusion model for forecasting first adoptions of a new product is proposed. An extension of the Bass model, the proposed model overcomes three limitations of the existing single-adoption diffusion models. After its conception, an innovation spreads slowly at first - usually through the work of change agents, who actively promote it - then picks up speed as more and more people adopt it. Eventually it reaches a saturation level, where virtually everyone who is going to adopt the innovation has done so. A key point, early in the process, is called take-off. After the forward thinking change agents have adopted the innovation, they work to communicate it to others in the society.

2.3 THEORY OF PLANNED BEHAVIOR (TPB)

Theory of Planned Behavior (TPB) was an extenuation of TRA theory by Ajzen [1] to study the adoption intention of people on innovation. Similar to TRA, TPB except an additional construct, Perceived Behavioral Control (PBC), has been added. TPB was derived with the knowledge from TRA, namely that the behavior of a person is affected by person's intention to perform something. Crucial for predicting the behavior of an end-user and a user's acceptance of a system is the knowledge of what attributes or beliefs lie behind a person to construct or formulate the intention. TPB defines intentions in terms of three beliefs structure: attitude (predisposition toward a particular object, event, or act, that is subsequently manifested in actual behavior), and behavior control, which is the perception of internal or external constraints affecting the behavior[3].

2.4 THE TECHNOLOGY ACCEPTANCE MODEL (TAM)

Among the studies that have been proposed and examined to evaluate the diffusion of invasion is the Technology Acceptance Model (TAM). TAM was developed by Davis [9] to explain computer-usage behavior. The theoretical basis of the model was Fishbein and Ajzen [1] Theory of Reasoned action (TRA). TAM has been used in many different researches for it's parsimonious, IT-specific, and designed to provide sufficient explanation for and a prediction of a diverse user population's acceptance of a wide array of IT within various organizational context. TAM is a dominate model for investigating user technology acceptance, has a fairly satisfactory empirical support for its overall explanatory power, and has posited individual causal links across a considerable variety of technologies, users, and organizational contexts. TAM provides a quick and inexpensive way to gather general information about individuals' perceptions of a system [14].

2.5 THE DIFFUSION OF INVASION (DOI)

Everett Rogers formed a foundation for understanding innovations and why people adopt them. Rogers [19] proposed that rates of adoption can be explained by five categories of variables: (a) Perceived attributes of the innovation; (b) Type of innovation decision; (c) Communication channels; (d) Nature of the social system; and (e) Extent of change agents' efforts. The innovation characteristics listed by Rogers were mainly drawn from diffusion studies on technological innovations [18].

Rogers placed adopters into five groups: (a) Innovators, (b) Early Adopters, (c) Early Majority, (d) Late Majority, and (e) Laggards [18].He also theorized that these five groups were distributed in a "normal" curve. Rogers defined five characteristics of innovations. These characteristics are:

1. Relative advantage: The degree to which an innovation is perceived as better than the idea it supersedes.
2. Compatibility: The degree to which an innovation is perceived as being consistent with the existing values, past experiences, and media of potential adopters.
3. Complexity: The degree to which an innovation is

perceived as difficult to understand and use.

4. Trialability: The degree to which an innovation may be experimented with on a limited basis.
5. Observability: The degree to which the results of an innovation are observable to others.

3. RESEARCH HYPOTHESIS

The global nature of the Internet, combined with the nature of the communications that it can convey, makes it a perfect vehicle for fraud schemes, and a medium for hacking and carrying attacks on just about any website or network that is accessible from the Internet. As the Internet becomes essential in everyday life, and as Internet security incidents escalate, it created concern for the safety and security as confidential data and sensitive information are launched into the World Wide Web.

Communication innovations such as the Internet have special characteristics that make their diffusion process different from other innovations [24], [20].None of the adoption models considered perceived risk as a variable that can influence the diffusion of Internet based innovation. Perceived risk information should be considered as it may add another perspective on the adoption process of Internet and related innovations.

H01: Perceived level of Internet security has direct effect on perception of risk.
H02: The Internet users' decision to conduct transaction online is influenced by the perceived risk.

4. RESEARCH METHODOLOGY

This study is guided by Rogers' Diffusion of Innovation Theory [19]. To bring an understanding of the complex issue of evaluating the effectiveness of perceived risk on the diffusion of the Internet based innovation, and to extend experience and add strength to what is already known through previous research, a descriptive approach is conducted by designing a survey, and distributing it nationwide via emails.

Table 1: Research Variables Measured

Variable #	Variable	Type of construct	Instrument Source
1	Relative Advantage	Interaction	1*
2	Perceived Risk	Predicted Use	2**
3	Ease of Use	Interaction	1*
4	Perceived Security Control	Predicted Use	2**
5	Compatibility	Interaction	1*
6	Observably	Social	1*
7	Trialability	Interaction	1*

1* : Moore & Benbasat (1991)
2** : Cheung & Lee (2000)

The goal of surveying is to investigate, whether or not; the perceived risk is a significant independent predictor variable for predicting using the Internet for the purpose of information or purchasing online (see Table 1). The variables were adopted from Moore & Benbasat [15] and Cheung & Lee [7]. Two sets of the instrument were distributed; one for evaluating perceived risk on predicting using the Internet for informational purposes, and the second for evaluating perceived risk on predicting using the Internet for purchasing purposes.

To test the internal consistency and reliability of the instrument, the pilot test included a stage to calculate the internal consistency reliability coefficient. All the items of the instrument have been tested thoroughly. First a split-half reliability analyses was performed on the items adopted from Moore and Benbasat [15] instrument. A second split-half reliability analyses was performed on the items adopted from Cheung and Lee [7] instrument. Finally, a split-half reliability analyses were performed on all of the instrument's items (see Table 2 for the tests the findings).

The instrument's constructs Cronbach's alpha reliability coefficient was also calculated. The calculations were done in several steps. The first step was calculating the Cronbach's alpha for the full instrument. The second step was calculating the Cronbach's alpha for the items adopted from Moore and Benbasat. The third step was calculating the Cronbach's alpha for the items adopted from Cheung and Lee instrument. The results are illustrated in Table 3.

Table 2: Split-half Reliability Analysis

Variable	Moore & Benbasat Items	Cheung & Lee Items	Full Instrument
Total Number of Items	20	7	27
Number of Items part 1	10	4	14
Number of Items part 2	10	3	13
Number of Cases	40	40	40
Confidence Interval	95%	95%	95%
Correlation between forms	0.6603	0.8354	0.754
Guttman Split-half	0.7915	0.8911	0.8327
Spearman-Brown Equal-length	0.7954	0.9103	0.8598
Spearman-Brown Unqual-length	0.7954	0.9118	0.8599
Alpha for part 1	0.846	0.8121	0.8989
Alpha for part 2	0.9324	0.7872	0.9095

The fourth and final step was calculating the Cronbach's alpha reliability coefficients for each

independent variable of the instrument. The Cronbach's alpha reliability coefficient calculation shows that all constructs maintain internal consistency reliability. It is found that all scales were above 0.80 (see Table 4).

Table 3: Cronbach Alpha Reliability Coefficients

Variable	Number of items	Number of cases	P value	Cronbach's alpha
Full Instrument	27	40	<0.01	0.9291
Moore & Benbasat Items	20	40	<0.01	0.9288
Cheung & Lee Items	7	40	<0.01	0.7555

Table 4: Instrument's Constructs Cronbach Alpha Reliability coefficients at 95% coefficient Level

Variables	Number of items	Number of cases	P value	Cronbach's alpha
Voluntariness	2	40	<0.01	0.849
Relative advantage	5	40	<0.01	0.9742
Compatibility	3	40	<0.01	0.8716
Ease of use	4	40	<0.01	0.9525
Demonstrability	4	40	<0.01	0.9499
Visibility	2	40	<0.01	0.8618
Security	2	40	<0.01	0.9281
Risk	2	40	<0.01	0.9027

5. DISCUSSION AND CONCLUSION

Tables 5 and 6 present the results of the questions concerning the study sample's computer and Internet skill levels. And Tables 7 present the study sample's online purchasing. In general, the study sample did not regularly use the Internet for purchasing.

Table 5: Computer Skill Level of Participants

Computer skill level	Frequency	Percent
Don't use computers	0	0
Low	0	0
Less than average	2	1.42
Average	44	31.21
Better than average	47	33.33
High	48	34.04
Total	141	100.00%

Table 6: Internet Skill Level of Participants

Internet skill level	Frequency	Percent
Don't use	0	0
Low	6	4.26
Less than average	12	8.51
Average	44	31.21
Better than average	38	26.95
High	41	29.08
Total	141	100.00%

Table 7: Online purchasing of Participants

Online purchasing	Frequency	Percent
Don't use	46	32.62
Rarely use	37	26.24
Occasionally use	43	30.5
Frequently use	15	10.64
Total	141	100.00%

H01: Perceived Level of Security has direct effect on Perception of Risk.

The descriptive statistics of scores for users' perceived level of Internet security and user's perceived risk are summarized in Table 8. The mean score for the users' perceived risk is 4.18 with a standard deviation of 1.19, in a scale of 1 to 7. And the mean score for the perceived level of Internet security is 5.26 with a standard deviation of 0.60. Figure 1 and figure 2 provide more intuitive demonstrations of the score distributions.

Table 8: Statistics of Scores for Perception of Risk and the level of Internet security

	SZ	FQ	TQ	MD	MN	SD
Perceived Risk	141	3.5	5.0	4.5	4.18	1.19
Level of security	141	4.80	5.50	5.20	5.26	0.60

SZ: Sample size MD: Median
FQ: First quartile MN: Mean
TQ: Third quartile SD: St.Dev

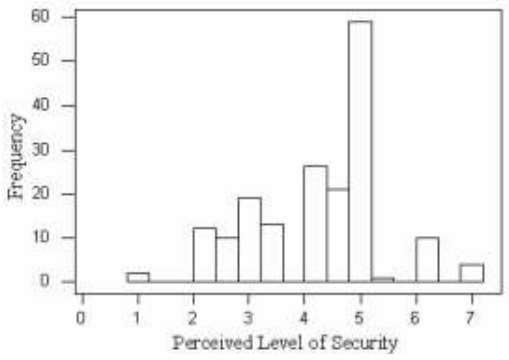

Figure 1: Histogram of the Users' Perceived Risk

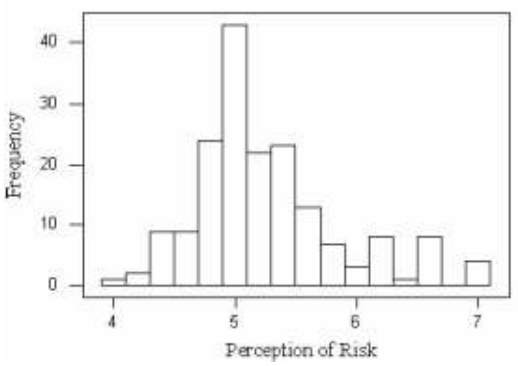

Figure 2: Histogram of the Perceived Level of Internet Security

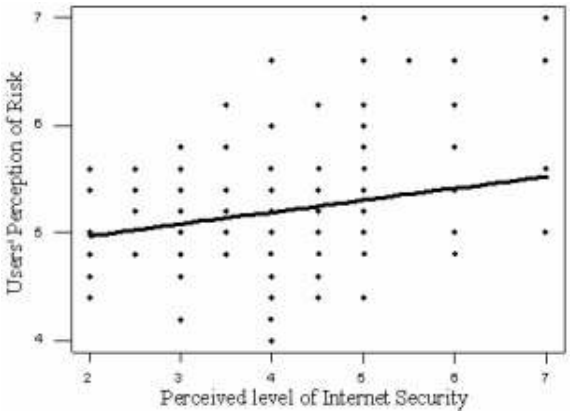

Figure 3: Perceived level of Security and Users' Perception of Risk Correlation Diagram

To seek the association between the perceived level of Internet security the users' perceived risk, a correlation analysis was conducted. The Pearson correlation coefficient between perceived level of Internet security the users' perceived risk, a correlation is found to be 0.21 and the corresponding P-value is 0.004 or 0.4%. This means the positive correlation between the two measurements is statistically significant though it is not strong (see figure 3).

H02: The Internet users' decision to conduct transaction online is influenced by the perceived risk

To allow a relative comparison between independent variable constructs in a regression model, regression weights are reported in standardized form. A full regression model including all seven independent variable constructs was tested against a reduced regression model containing only those constructs with significant regression weights. The reduced model is accepted if a reduced regression model does not differ significantly in variance in comparison to a full regression model. F statistic is used to test the difference in regression models as follows:

$$F = \frac{(R^2_{Full\,Model} - R^2_{Reduced\,Model})/(P_1 - P_2)}{(1 - R^2_{Full\,Model})/(N - P_1 - 1)}$$

Table 9 presents the regression analysis results for predicting using the Internet for informational purposes. Results indicate that the reduced regression model with two of the seven constructs significantly predicted the dependent variable (F=1.0, no significant difference in the models). Perceived Risk and Perception of Security were significant independent predictor variables for predicting using the Internet for informational purposes.

Table 10 presents the regression analysis results for predicting willingness to use the Internet for purchasing. Results indicate that the reduced regression model with three of the seven constructs significantly predicted the dependent variable (F=2.00, no significant difference in the models). Perception of Risk, ease of use, and Perceived Level of Security were significant independent predictor variables for predicting willingness to use the Internet for purchasing.

Table 9: Full Versus Reduced Regression Models for Predicting Using the Internet for Informational Purposes

Variables	Beta	t	p	R	R2
Full Model:				0.67	0.45
Relative advantage	0.1	1.25	0.21		
Perception of Risk	0.33	4.51	0.0001		
Ease of use	0.06	0.69	0.49		
Perceived Level of Security	0.32	3.32	0.001		
Compatibility	0.02	0.82	0.42		
Observably	0.1	2.05	0.04		
Trialability	0.09	1.95	0.05		
Reduced Model:				0.65	0.43
Perception of Risk	0.53	7.04	0.0001		
Perceived Level of Security	0.21	2.83	0.005		

6. SUMMERY

Existing research on consumer behavior on the Internet has focused on Internet purchasing [11], [22] or on information searching through the Internet [13], [21].

Table 10: Full Versus Reduced Regression Models for Predicting Willingness to Use the Internet for purchasing.

Variables	Beta	t	p	R	R2
Full Model:				0.59	0.35
Relative advantage	0.11	1.29	0.2		
Perceived Risk	0.18	2.21	0.03		
Ease of use	0.3	3.32	0.002		
Result demonstrability	0.04	1.31	0.19		
Perceived Level of Security	0.19	1.74	0.08		
Observably	0.11	2.12	0.04		
Trialability	0.08	1.48	0.14		
Reduced Model:				0.57	0.33
Perception of Risk	0.25	3.8	0.0001		
Ease of use	0.28	3.81	0.0001		
Perceived Level of Security	0.33	2.98	0.003		

Even though some researchers suggested that pre-purchase information could lower a consumer's risk, there have been few studies associated with consumer perceived risk that uses this information [11].The Diffusion of Innovation Theory [19] defined five characteristics of innovations (Relative advantage, Compatibility, Complexity, Trialability and Observability). This study however, besides Rogers five variable, examines whether perceived risks is a significant independent predictor variable for predicting using the Internet for purchasing or information purposes.

Results indicate that there exists a positive correlation between the perception of Internet security and the perceived risk. In addition, the perceived risks of Internet "Usage" for purchasing or information purposes was found to be a significant independent predictor variable. This means that despite good Internet infrastructure, many Internet users perceive high risks of Internet usage. The security of online transaction system is important to increase online for purchasing. This means that E-commerce is related to the stability and reliability of the whole system. Therefore, this study concludes that perceived risk should be incorporated to the DOI for the Internet related innovations.

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