"Applying TAM to E-Services Adoption: The Moderating Role of Perceived Risk"

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Abstract

Consumer adoption of e-services is an important goal for many service providers, however little is known about how different consumer segments perceive and evaluate them for adoption. The Technology Acceptance Model (TAM) explains information systems evaluation and adoption, however the Internet-delivered e-services context presents additional variance that requires supplemental measures to be added to TAM. This research extends TAM to include a perceived usage risk main effect and also tested whether perceived risk moderated several of TAM's relationships. Results indicate that higher levels of perceived risk deflated ease of use's effect and inflated subjective norm's effect on perceived usefulness and adoption intention.

1. INTRODUCTION

E-services have been defined as including "… the processes, policies, procedures, people, tools and technologies that enable enterprises to provide assisted and unassisted customer service using the Internet as a platform" [1]. These services are offered to consumers to not only provide better customer service, but also to offload labor-intensive activities from the provider to the consumer. Implementing e-services is a central strategic imperative for many consumer related businesses (ibid), and while the technology protocols are developing quickly, little is known about how consumers perceive and evaluate e-services, as well as what attributes of the human computer interface (HCI) e-service providers can use to encourage rapid consumer adoption.

One theory that can be useful in explaining user acceptance of a technology is the technology acceptance model, or TAM [2], [3]. TAM explains intention to use a technology based on its perceived usefulness and perceived ease of use. Subsequent work has extended TAM by examining the variables that help determine levels of perceived usefulness and perceived ease of use [3].

Use of e-services may also depend on factors other than perceived usefulness and perceived ease of use of the technology in question. In particular, concerns of inherent risk caused by using the public Internet infrastructure have surfaced as being salient for many potential adopters [4]. These privacy and security concerns are very real for many potential adopters and have proven to be a major inhibitor to adoption of this category of information system.

This research investigates how the risk perceptions surrounding e-services affects the system evaluation process, specifically by examining the moderating effect of perceived risk on the technology acceptance model. This paper proceeds with the following sections. First relevant literature is reviewed related to TAM, perceived risk theory, and previous research that has integrated the two literature streams. Next the research model and hypotheses are presented, followed by an explanation of the research methodology utilized. Empirical results are next presented followed by a discussion of the findings. The final section provides conclusions, and the derived theoretical and practical implications.

2. THEORY AND HYPOTHESIS

Technology acceptance

The Technology Acceptance Model [2], [3], a model based on the Theory of Reasoned Action [5], is commonly used by Information System researchers to understand and predict the acceptance of various types of information technologies. TAM predicts intention to use and actual usage behavior and is based upon both the perceived usefulness (USF) and the perceived ease of use (EOU) of the technology, with these two

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factors typically accounting for about 40% of the variance in intention to use and actual usage behavior. TAM predicts that external variables (including issues like training, the system's features, how the system was developed, etc.) that are typically thought to influence the use of a system are mediated by both USF and EOU.

TAM has subsequently been expanded to examine the antecedents of both EOU and USF. Perceived ease of use has been found to be influenced by a variety of variables, including the computer self-efficacy of the user, the system's objective usability, and the users direct experience with that system [6]. Perceived usefulness has also been found to depend on a number of determinants, including subjective norm, image, job relevance, output quality, results demonstrability, experience, and voluntariness (see [3] for a full explanation of these variables). A further extension of TAM is necessary to tailor it to web-based e-service evaluation and adoption. One factor believed to explain variance in this different context is the perceived risks and potential losses due to adoption and usage. Attention is now turned to this construct.

Perceived Risk

Bauer [7] was the first to focus attention on the perceived risk construct when he claimed that consumer behavior involves risk because the consequences of product usage cannot be anticipated with certainty, and that some consequences of product usage are likely to be unpleasant. He defined perceived risk as the combination of uncertainty plus seriousness of outcome. Similarly, Peter and Ryan [8] conceived of perceived risk (PR) as "an influence on choice decisions and may be defined as the expectation of losses associated with purchase and acts as an inhibitor to purchase behavior". Peter and Ryan [8] also conceptualized perceived risk as being composed of two distinct components, the probability of loss and consequence or importance of that loss.

Consumers consciously and unconsciously perceive risk when evaluating products and services for purchase and/or adoption. Information systems adoption has been shown to create anxiety and discomfort for consumers and employees alike [9]. The complexity of the HCI also adds to implementation and adoption problems [10]. Internet delivered computer services adds the additional uncertainties and potential dangers of the perceived unsecured transaction and delivery medium. These factors add great uncertainty to e-services adoption for consumers.

Perceived risk enters the buying/adoption decision when circumstances of the decision create feelings of uncertainty, discomfort and/or anxiety [11] conflict aroused in the consumer [12] concern and psychological discomfort [13] feelings of uncertainty [14], pain due to anxiety [15] and cognitive dissonance [16]. Cognitive dissonance arises from the evaluation of the product as having desirable benefits but potential costs, i.e. likely rewards but also incalculable risks.

This felt combination of uncertainty (probability of loss) and danger (cost of loss) make up the construct perceived risk. Perceived risk has been shown to inhibit product evaluation and adoption [11] and e-services adoption [17]. Similarly, viewing the e-services adoption using the technology acceptance model would lead us to similar expectations regarding the effects of perceived risk. Specifically, the increased feeling of psychological discomfort and anxiety caused by increased risk perceptions would cause the potential adopter to devalue perceived usefulness of the e-service, as well as downstream adoption intentions.

H1a: Higher levels of perceived risk are associated with reduced perceived usefulness

H1b: Higher levels of perceived risk are associated with reduced adoption intentions

Roselius [18] found that consumers with high levels of perceived risk reported that they would seek informal advice from friends, relatives and co-workers in attempt to reduce risk concerns to an acceptable level. Peter and Ryan [8] also found that perceived risk was associated with increased information seeking behaviors. In a meta-analysis of perceived risk research Mitchell [19] found that an outcome of perceived risk is typically increased information search and the concern for referent other's opinions.

Within attitude-intentions and technology acceptance research [20], [2] the concern for the opinion of referent others about one's actions has been referred to as subjective norm. Stated another way, subjective norms are social influences that are concerns a person has for what other people would think of them performing the behavior, essentially perceived social approval. For example, a person that thinks most of their referents (friends, family, co-workers) would approve of them purchasing a product would be more likely to purchase that product. As perceived risk associated with adoption rises, consumers are likely to believe that referent others would hold less approval of their purchasing the product or service.

H2a: Higher levels of perceived risk decrease subjective norm (i.e. perceived social approval)

In addition, it also follows that in situations of high perceived risk, subjective norms (perceived social approval) will modify the adopter's perceived usefulness of an e-service as well as the adopter's intention to adopt.

H2b: Higher levels of perceived risk reduces the relationship between the normative concerns→ perceived usefulness effect

H2c: Higher levels of perceived risk reduce the normative concerns→ adoption intention effect

Products or services that are perceived as risky are likely to be evaluated with higher caution. They may be evaluated as having high switching costs, higher complexity, steep learning curves, and hard to adopt and use. TAM's Perceived Ease of Use (EOU)… "refers to the degree to which the prospective user expects the target system to be free of effort." [21]. Therefore consumers with higher risk perceptions should view e-services as not being free of effort and therefore problematic.

Using EOU to evaluate an e-service represents an extension of its application. In addition to the usability of the service's interface, an evaluation of the entire system's likely service performance is made. The assessment of an E-services' EOU therefore, may use the HCI's usability as a proxy of overall system usability. The EOU variable then is likely measuring the usability of the entire service not solely the HCI. Consumers that perceive higher e-service risk during the trial experience are less likely to subsequently rate the service favorably as easy to use, and group mean EOU ratings should drop. Increasing concerns for usage risk are also likely to reduce the normally positive influence EOU has on perceived usefulness evaluations (USF) and adoption intention (AI). Any service that might create losses for the consumer such as financial and information privacy are not likely to be considered free of effort.

The following hypotheses are derived:

H3a: Higher levels of perceived risk cause lower e-service EOU ratings

H3b: Higher levels of perceived risk reduce the perceived EOU→ USF effect

H3c: Higher levels of perceived risk reduce the perceived EOU → AI effect

Based on the previous literature and hypotheses the following research model and methodology are derived.

3. METHODOLOGY

Two studies were performed using controlled computer lab experiments. Samples were drawn from business undergraduate populations of two large universities. Data collection used pre-validated TAM constructs [3] and a PR instrument validated by [17]. In this study, the performance, privacy and financial risk facets (probabilities of possible loss due to service usage) were used to operationalize PR. Survey items were held constant across each study and used 7-point Likert and semantic differential scales.

The first sample (N=167) of study #1 was randomly assigned a risk manipulation designed to segment the sample into three groups based on general e-payments PR. Treatment group subjects either read a risk reducing, or risk inducing fabricated web news article similar to other articles from periodicals provided as supplemental classroom material.

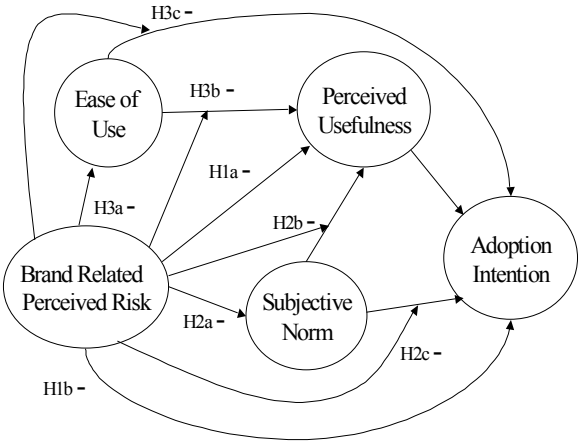

Figure 1: Research Model

These news articles were based on actual published content from reputable Internet news services, however the content was modified to exaggerate the claims. Pilot tests indicated this treatment created significant between groups difference in e-payments risk perceptions ($F(2,91) = 50.1$, $p < .001$). Additionally pilot test debriefing sessions strongly indicated the articles had excellent face validity with subjects typically surprised the articles were fabricated.

The treatment to reduce e-payments PR extolled the excellent track record of e-payments service providers

and discussed the strong security protocols in-place. In contrast, the risk inducing treatment warned of rampant e-payments fraud occurring with web-based credit cards, e-checks, and electronic funds transfers. The control group read a neutral article on notebook computer prices.

After the risk manipulation subjects were shown a slideshow explaining the e-billpay service, individually read web-based vendor material, and then completed an interactive hands-on shopping trial using demonstration software. They viewed a checking register changing as bills were viewed and paid, and performed financial analysis using a task sheet that ensured subjects tried out all the major features of the software. After this trial, subjects completed a survey that included the TAM and PR items.

Study 1 included a second sample (N = 227) drawn from the same population and administered the same methodology except with no risk manipulation. Study #2 (sample 3) was employed to replicate sample 2 findings.

First an effort to validate direct causal effects of PR was made; next an investigation of the moderating influence of PR on TAM's variables and relationships was performed. To aid hypothesis testing of the proposed moderated relationships and further investigate differential perceptions for consumer segments, samples 2 and 3 were segmented into three PR categories – high, mid-level and low. Low and high PR groups included subjects more than one standard deviation from the mean, typically each approximately 16% of the distribution. The mid-level group was therefore defined as that portion of the sample (typically approximately 66%) that fell within one standard deviation above and below the overall group mean. ANOVA was performed to identify differential group means for each research variable at each PR level (low, mid, high). Multiple regression was used to identify changes in effect strengths in TAM relations at each level of PR. Bivariate and hierarchical regressions were also utilized to test bilinear interaction effects.

In summary the studies were designed to measure the antecedents and inhibitors to e-service USF perceptions and AI at varying levels of PR. An e-billpay context was chosen as subjects had little knowledge and experience with them (< 5% of the sample) and TAM predicts that subjective norm is salient when subjects have little experience with the technology.

4. RESULTS

STUDY #1

In the first study subjects were randomly assigned to either a risk inducing treatment, a risk reducing treatment or no treatment. A manipulation check immediately after the treatment indicated group e-payments risk perceptions significantly differed, $F(2,165) = 30.1$, $p < .001$. Follow-up t-tests using a Bonferroni correction indicated that the low and high-risk groups were significantly different ($p < .001$) as were the low risk and control group ($p = .022$). After subjects read brand related material and performed the hands-on system evaluation, the treatment groups regressed towards the mean and reported only marginally different post-trial e-service perceived risk (PR) as indicated in table 1 below.

Table 1 Sample #1 Correlation Matrix and ANOVA Results

	ICR	1	2	3	4	5
1. Adoption Intention (AI)	.95	1				
2. Usefulness (USF)	.92	0.716	1			
3. Ease of Use (EOU)	.91	0.575	0.633	1		
4. Subjective Norm (SN)	.79	0.353	0.375	0.194	1	
5. Perceived Risk (PR)	.93	-0.471	-0.363	-0.365	-0.293	1

Variable	Group	Mean	SD	F-score	P-score
Adoption Intention	Risk Reduced	4.44	1.69	0.01	0.987
	control group	4.46	1.49		
	Risk Induced	4.41	1.49		
Ease of Use	Risk Reduced	5.40	1.07	0.64	0.531
	control group	5.35	1.17		
	Risk Induced	5.57	1.01		
Usefulness	Risk Reduced	5.09	1.40	0.04	0.957
	control group	5.10	1.28		
	Risk Induced	5.16	1.20		
Subj. Norm	Risk Reduced	3.63	1.19	0.12	0.890
	control group	3.74	1.15		
	Risk Induced	3.66	1.27		
Perceived Risk	Risk Reduced	3.18	1.09	10.94	<.001
	control group	3.72	1.14		
	Risk Induced	4.12	0.88		
Risk reduced group N=57,control group N=57, risk induced group N=53					

As a result, support of H1, H2a and H3a was not found, as there was no significant difference in the group means for perceived usefulness (USF), adoption intention (AI), subjective norm (SN) or ease of use (EOU). Table 2, indicated that these seemingly similar groups showed a shift in significant antecedents to USF and AI.

Please see table 2

PR evaluations did not affect USF ratings but were a direct causal deterrent strongly to adoption (supporting H1b). The EOU→USF effect reduced in importance as risk levels grew (supporting H3a). The EOU→AI effect disappeared as PR increased (supporting H3c), however the non-significance of this effect for the control group may also be explained by its collinearity with USF (VIF = 1.95, shared variance = 48.8%). The SN→USF effect rather than reducing in salience increased becoming significant for the risk-induced group. This can be interpreted that for this sample USF ratings remained strong regardless of PR and as risk perceptions increased, consumers believed that referents would continue to perceive the service as useful and therefore endorse them. This emerging effect was opposite the hypothesized direction. Additionally the hypothesized SN→AI path was not significant, indicating that for this sample consideration for referents opinion was not a factor in making the adoption decision perhaps because group mean PR never rose above the neutral level.

A shift in the AI antecedents is shown. The low PR group based AI on the familiar EOU and USF, however the control and high PR group shifted antecedents to a combination of the potential reward (productivity gain from adoption and usage) and potential risk (financial, performance, and privacy risks of adoption and usage). These results suggest that consumers performed a risk/reward, cost/benefit analysis as theorized by [22]. Chow tests confirmed that the regression results significantly differed for each group with the low PR group differing from the control group (F = 2.63) and the high group (F = 4.08). Results suggested that the relationships within TAM functioned differently for consumer segments, based on dissimilar risk perceptions. Based on these intriguing results the study was replicated and further analyzed. Those results are presented next.

SAMPLE #2

While the risk manipulations created significant between groups variance, they were not strong enough to maximally differentiate post-trial evaluations. Therefore, rather than utilize experimental manipulations sample 2 was split into three groups with high and low PR categories formed using subjects +/- 1 standard deviation from the group mean. Jaccard et al. [23] report this as an appropriate strategy to evaluate the effects of an independent variable on a criterion at low, medium and high values of a moderating variable. Table 3 indicates significant between groups difference on each research variable, enabling further in-depth analysis of likely market segments. ANOVA results support H1a, H1b, H2a and H3a as these divergent groups reported significantly reduced USF, AI, SN and EOU values as PR grew.

Table 3: Study #1 Sample 2 Correlation Matrix and ANOVA Results

	ICR	1	2	3	4	5
1. Adoption Intention (AI)	.94	1				
2. Usefulness (USF)	.88	0.646	1			
3. Ease of Use (EOU)	.84	0.565	0.657	1		
4. Subjective Norm (SN)	.73	0.415	0.426	0.304	1	
5. Perceived Risk (PR)	.97	-0.477	-0.401	-0.467	-0.215	1

Variable	Group	Mean	SD	F-score	P-score
Adoption Intention	Low PR	5.50	1.28	20.50	<.000
	Mid-level PR	4.37	1.35		
	High PR	3.56	1.40		
Ease of Use	Low PR	6.04	0.76	16.56	<.000
	Mid-level PR	5.44	0.81		
	High PR	4.96	1.00		
Usefulness	Low PR	5.80	0.98	9.69	<.000
	Mid-level PR	5.15	1.05		
	High PR	4.80	1.00		
Subj. Norm	Low PR	4.18	1.46	3.88	0.022
	Mid-level PR	3.68	1.17		
	High PR	3.47	0.90		
Perceived Risk	Low PR	1.84	0.35	319.00	<.000
	Mid-level PR	3.52	0.63		
	High PR	5.12	0.45		

Low PR group N = 42, Mid-level PR group N=151, High PR group N=34

Table 4 indicates the e-services EOU→USF effect was again significant at each risk level for sample 2, and regression weights reduced only for the high PR group. The EOU→AI effect was again only significant for the low PR group, suggesting support for H3c. EOU was collinear with USF for the mid-level PR group (VIF = 1.84, shared variance = 45.7%) and the high PR group (VIF = 2.024, shared variance = 50.6%) and may have suppressed the EOU→PR effect for those sub samples. The SN→USF effect for this sample grew in salience for this sample as PR increased, confirming sample 1 results. Sample 2 subjects also reported that they believed their referents would think they should adopt the e-billpay service, and this SN→AI effect inflated when risk perceptions increased indicating a potential moderating effect opposite the hypothesized direction. The moderated effect may have not been verified for the high PR group due to its small sample size as table 5 results indicated that when study 1 samples were pooled, this effect again emerged.

Please see table 4

Unlike sample #1 where PR was manipulated higher, sample 2 PR concerns significantly inhibited adoption for the mid-level PR group only, and not for the high-

risk group. While this sub-sample was too small to provide stable results, this finding suggests that higher risk concerns naturally found in consumer sub-samples did not directly inhibit adoption.

To increase the research model's predictive power, and specifically the sample size for the high and low PR groups, the samples were combined and split into three groups using the aforementioned methodology. These results shown in table 5 indicate support for H3b and H3c as EOU reduced in salience as a predictor for USF and AI as PR increased, again suggesting a moderated relationship. Normative concerns here clearly grew in salience as risk perceptions increased and became a stronger predictor of TAM's criterion variables. The PR main effect significantly inhibited USF (supporting H1a), however only affected AI for the mid-level PR group. This again suggests that PR was not a significant concern when group mean levels are low, and may only indirectly effect adoption when PR levels are high (>1 standard deviation over the group mean, here 5.12 on a 7-point scale)

Please see table 5

Chow tests again confirmed that the low and high PR groups had significantly different regression results (F = 3.14). The above analysis suggests that PR level moderated several of TAM's relationships and is now further investigated using bivariate and hierarchical regression.

Please see table 6

Table 6 uses linear bivariate regression analysis to evaluate whether EOU and SN were useful in predicting TAM's criterion variables, and to measure changes in effect size at different levels of PR. Regression coefficients are reported as a measure of effect size and generally reflect changes in Pearson product-moment correlation coefficients as risk levels changed. Results partially support H3b and H3c as the EOU →USF and EOU→AI effects generally weakened as risk levels increased. The unexpected strengthening of the SN→USF and SN→AI effects as risk perception levels increased is clearly shown here. This may be interpreted as an increase in perceived peer pressure as risk levels increased. Even at high PR the e-service was evaluated as useful and the increasing salience of SN may represent subjects rationalizing that others would support adoption of a risky system that is useful.

To further examine the potential moderating effect of perceived risk separate hierarchical regressions, shown in table 7, were performed using the Jaccard et. al. [23] suggested methodology for testing linear moderator effects. For each analysis the predictor (SN or EOU) and the moderator (PR) were jointly entered at step 1 of the equation, and the interaction term was entered at step 2. Consistent with Cohen and Cohen's [24] recommendations, regression coefficients for the main effects of predictor variables were obtained from step 1 in each analysis, whereas coefficients for the interaction terms were obtained from step 2.

Please see table 7

The F values shown indicate the significance and strength of the incremental R^2 for the interaction term testing for the presence of a (bilinear) relationship. Results confirmed previous findings as PR did significantly strengthen SN influence on USF, however a significant bilinear interaction was not found for the SN→AI effect indicating either the absence of this moderated relationship or that it is not monotonic.

While previous results indicated the EOU→USF relationship weakened as perceived risk rose; this moderated relationship was not supported here. While H3b was not supported, evidence for H3c was. The EOU→AI relationship significantly weakened for sample 1 and the combined study #1 sample. The negative sign for the interaction term indicates that as PR increased, the effect of EOU on AI weakened, meaning that the e-service's usability is less of a predictor of adoption as risk levels increase. The main effect of PR was also confirmed for each sample supporting H1a and H1b.

In summary results suggested that the PR main effect significantly inhibited USF and AI and also moderated the SN→ USF and the EOU→AI relationships. Study #2 is now presented to confirm these results.

STUDY #2

Study #2 replicated the sample 2 methodology with one small procedural change. Rather than witness an Information Systems professor's slideshow presentation of product category information, subjects individually read pre-trial informative material from a vendor's website.

Group mean levels for each research variable at each level of PR as shown in table 8 supported H1, H2a and H3a as each variable significantly reduced as risk perceptions increased.

Table 8 Sample 3 Correlation Matrix and ANOVA

	ICR	1	2	3	4	5
1. Adoption Intention (AI)	.90	1				
2. Usefulness (USF)	.76	0.688	1			
3. Ease of Use (EOU)	.88	0.446	0.529	1		
4. Subjective Norm (SN)	.88	0.605	0.654	0.360	1	
5. Perceived Risk (PR)	.88	-0.368	-0.330	-0.364	-0.225	1

Variable	Group	Mean	SD	F-score	P-score
Adoption Intention	Low PR	4.74	1.42	21.95	<.001
	Mid-level PR	3.98	1.30		
	High PR	2.95	1.63		
Ease of Use	Low PR	6.04	0.71	22.48	<.001
	Mid-level PR	5.35	0.89		
	High PR	4.77	1.46		
Usefulness	Low PR	5.28	0.98	22.59	<.001
	Mid-level PR	4.74	0.98		
	High PR	3.88	1.47		
Subj. Norm	Low PR	4.18	1.45	9.74	<.001
	Mid-level PR	3.89	1.14		
	High PR	3.14	1.45		
Perceived Risk	Low PR	2.41	0.35	547.70	<.001
	Mid-level PR	3.92	0.49		
	High PR	5.28	0.36		

Low PR group N=58, Mid-level PR group N=203, High PR group N=46

Table 9 indicates that the EOU→USF relationship diminished slightly as PR increased. EOU was not a significant predictor of AI for this sample, however not due to collinearity problems, and approached significance for the low PR group in a similar pattern as previously reported. The SN→USF and SN→AI relationships again strengthened when PR increased. The overall main effect of PR was significant however specifically inhibited AI for the mid-level risk group only, again suggesting an upper threshold for a PR→AI main effect.

Please see table 9

Bivariate regressions were again analyzed to identify a change in effect strength for different risk levels and are presented below. The EOU→USF and EOU→AI relationships appear curvilinear while the effect of SN on USF and AI appear to rise.

Hierarchical regressions were again performed using the Jaccard et al. [23] and Cohen and Cohen [24] methodologies. A significant bilinear interaction was again found for the SN→USF and SN→AI relationships. Unlike study 1 however, where an EOU→AI main effect and a negative PR*EOU→AI interaction was found, here only a main effect was evident.

5. DISCUSSION

This research tested for main effects of perceived risk (PR) and whether it moderated relationships within TAM. PR effects were investigated at three levels, as a main effect of ANOVA and regression models, as a sample segmentation variable, and as a moderating variable. When modeled as a main effect using ANOVA, PR significantly lowered group mean levels for EOU, USF, AI, and SN. When modeled as a direct causal antecedent of USF and AI using bivariate and multiple regression analyses, PR was a significant inhibitor. After segmenting the sample into low, mid and high PR groups, a deeper understanding of PR's causal effect was gained. In many situations PR was not a significant predictor of USF or AI for one consumer segment but was a significant predictor for another.

As an example, when modeled as a predictor of USF, PR was salient most often when risk levels were either low or high. Subjects that had an opinion about the inherent riskiness of the e-service (were non-neutral on a 7-point scale), based USF in part on this risk evaluation. The neutral groups likely had no opinion regarding e-service usage risk and therefore this concern was not considered to be salient. When modeled as a moderator of the EOU→USF effects, evidence was found indicating that increasing levels of PR deflated the EOU→USF relationship. Analysis of bivariate and multiple regression coefficients suggested that the EOU→USF relationship weakened as PR grew however this relationship could not be confirmed with a hierarchical regression analysis.

TAM is a general model that predicts adoption intentions for information systems (IS). When applying TAM to the web-delivered e-services consumer adoption context, additional variables are likely to account for variance in TAM's criterion variables. It is important to understand how different consumer segments perceive and evaluate e-services, so that the human computer interface (HCI) and demonstration software can be designed to provide the environment that maximally encourages adoption.

From an IS research perspective, it is also important to search for moderating variables that turn simple main effects into more insightful conditional relationships. Evidence presented suggests that a deeper understanding of USF and AI is possible when interactions are sought out. If TAM or other adoption models are to be successfully applied in contexts other than originally envisioned (the employee adoption of company owned software) it is imperative to understand how new contexts conditionalize long-standing theorized relationships.

Consumer perceptions, evaluations and adoption intentions were shown to differ depending on perceptions of inherent usage risks. Results suggested that the salience of the HCI's EOU reduced as a predictor of adoption when risk perceptions increased. This suggests that consumer "brand related" risk perceptions need to be reduced to an acceptable state before the benefits of an easy to use HCI can be realized.

Additionally, normative concerns grew in importance as a predictor variable as risk concerns rose. It was hypothesized that normative concerns would drop as risk perceptions rose, as the system evaluator would likely not think their referents would recommend their usage. The opposite interaction occurred, as risk levels increased salience of referents opinions increased. These findings may be interpreted as a confirmation of the perceived risk research by Mitchell and Vassiliades [19] whose meta-analysis reported that increased levels of perceived risk lead to information search and reliance on trusted others for assistance in evaluative judgments.

It becomes imperative then to acknowledge the importance of referent and expert opinions during system evaluation and adoption. Future designs of e-service trial experiences should enable consumers to gain advice from impartial industry experts, and enable consumers to easily gain access to personal sources for synchronous and asynchronous endorsement. This may be implemented simply by enabling consumers to "tell a friend" by emailing a URL from within specific module of the trial experience, or by enabling simultaneous group evaluation.

Future research might include an examination of how other TAM variables not included in this research are affected by perceived risk. Another obvious extension of this research is to test these same questions on other populations. While it was deemed suitable to draw samples from student populations because they represent an important market for e-service vendors, further insight into risk perceptions and their moderating effects might be revealed on samples consisting of older adults. Access to different samples and e-service contexts with differential inherent risk levels may reveal further insights into diverse information system evaluation and adoption intention processes; enabling further theory refinement.

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Table 2 Sample #1 Regression Results

		Full Sample		PR Reduced Group		Control Group		PR Induced Group	
		PR $\overline{X}$ = 3.57, N=167		PR $\overline{X}$ = 3.18, N=57		PR $\overline{X}$ = 3.72, N=57		PR $\overline{X}$ = 4.12, N=53	
DV	IV	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score	If	P-score
Perceived Usefulness	Ease of Use	.659	**<.001**	.745	**<.001**	.698	**<.001**	.535	**<.001**
	Subj. Norm	.260	**<.001**	.158	.220	.186	.113	.371	**.001**
	Perceived Risk	-.106	.150	-.158	.311	-.068	.565	-.164	.319
		Model Adj R^2 = .464		Model Adj R^2 = .470		Model Adj R^2 = .485		Model Adj R^2 = .401	
DV	IV	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score
Adoption Intention	Ease of Use	.233	**.017**	.657	**<.001**	.051	.767	.054	.757
	Usefulness	.617	**<.001**	.617	**<.001**	.645	**<.001**	.522	**.002**
	Subj. Norm	.090	.218	.084	.442	.081	.560	.079	.539
	Perceived Risk	-.287	**<.001**	.015	.905	-.298	**.036**	-.724	**<.001**
		Model Adj R^2 = .571		Model Adj R^2 = .739		Model Adj R^2 = .476		Model Adj R^2 = .528	

Table 4 Sample #3 Regression Results

		Full Sample		Low PR Group		Mid-Level PR Group		High PR Group	
		PR $\overline{X}$ = 3.45, N=227		PR $\overline{X}$ = 1.84, N=42		PR $\overline{X}$ = 3.52, N=151		PR $\overline{X}$ = 5.12, N=34	
DV	IV	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score
Perceived Usefulness	Ease of Use	.649	**<.001**	.396	**.036**	.719	**<.001**	.549	**.001**
	Subj. Norm	.214	**<.001**	.083	.385	.247	**<.001**	.331	**.034**
	Perceived Risk	-.096	.069	-.946	**.019**	-.159	.126	-.244	.394
		Model Adj R^2 = .448		Model Adj R^2 = .254		Model Adj R^2 = .501		Model Adj R^2 = .520	
DV	IV	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score
Adoption Intention	Ease of Use	.273	**.012**	.572	**.012**	.178	.218	.207	.454
	Usefulness	.527	**<.001**	.612	**.002**	.537	**<.001**	.604	**.044**
	Subj. Norm	.187	**.003**	.149	.173	.179	**.029**	.324	.211
	Perceived Risk	-.277	**<.001**	.473	.317	-.318	**.033**	.028	.950
		Model Adj R^2 = .500		Model Adj R^2 = .449		Model Adj R^2 = .395		Model Adj R^2 = .386	

Table 5 Combined Sample 1 and 2 Regression Results

		Full Sample		Low PR Group		Mid-Level PR Group		High PR Group	
		PR $\overline{X}$ = 3.54, N=394		PR $\overline{X}$ = 1.91, N=76		PR $\overline{X}$ = 3.62, N=255		PR $\overline{X}$ = 5.15, N=63	
DV	IV	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score
Perceived Usefulness	Ease of Use	.653	**<.001**	.714	**<.001**	.681	**<.001**	.460	**<.001**
	Subj. Norm	.233	**<.001**	.087	.201	.250	**<.001**	.504	**<.001**
	Perceived Risk	-.103	**.016**	-.499	**.037**	-.217	**.016**	-.604	**.016**
		Model Adj R^2 = .480		Model Adj R^2 = .467		Model Adj R^2 = .435		Model Adj R^2 = .544	
DV	IV	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score	Reg. Coeff.	P-score
Adoption Intention	Ease of Use	.259	**<.001**	.547	**.001**	.232	**.015**	.133	.399
	Usefulness	.571	**<.001**	.587	**<.001**	.587	**<.001**	.428	**.020**
	Subj. Norm	.145	**.002**	.116	.147	.128	**.031**	.428	**.026**
	Perceived Risk	-.272	**<.001**	.263	.349	-.366	**.001**	-.053	.880
		Model Adj R^2 = .534		Model Adj R^2 = .560		Model Adj R^2 = .459		Model Adj R^2 = .366	

Table 6 Study #1 Bivariate Regression Coefficients

	Perceived Risk Level		
EOU-->USF	Low	Mid-Level	High
Sample 1	.892***	.762***	.590***
Sample 2	.529**	.853***	.704***
Sample 1 & 2	.787***	.788***	.643***
SN-->USF			
Sample 1	.444**	.378**	.394**
Sample 2	ns.	.381***	.577**
Sample 1 & 2	.183*	.356***	.718***

	Perceived Risk Level		
EOU--> AI	Low	Mid-Level	High
Sample 1	1.230***	.652***	.611**
Sample 2	.920***	.792***	.750**
Sample 1 & 2	1.008***	.801***	.513**
SN--> AI			
Sample 1	.554**	.436*	.391*
Sample 2	.310*	.437***	.766**
Sample 1 & 2	.269*	.390***	.788***

* = p <.05, ** = p <.01, *** = p <.001

Table 7 Study #1 Hierarchical Regression Results

		DV = Perceived Usefulness			DV = Adoption Intention		
		B	Incremental R^2	F test	B	Incremental R^2	F test
Subjective Norm	Subj. Norm. (SN)	.317***			.306***		
Sample 1	Perceived Risk (PR)	-.323***	.201		-.562***	.263	
	SN x PR	.118(.084)	.010	2.00	.139(.078)	.010	2.17
Sample 2	Subj. Norm. (SN)	.316***			.396***		
	Perceived Risk (PR)	-.314***	.276		-.535***	.324	
	SN x PR	.143**	.029	9.31**	.061	.000	.00
Samples	Subj. Norm. (SN)	.317***			.359***		
1&2 Combined	Perceived Risk (PR)	-.318***	.243		-.539***	.297	
	SN x PR	.124***	.019	10.00**	.076	.003	1.67
Ease of Use	Ease of Use (EOU)	.688***			.667***		
Sample 1	Perceived Risk (PR)	-.177*	.414		-.421***	.402	
	EOU x PR	-.066	.010	.54	-.168**	.010	5.75*
Sample 2	Ease of Use (EOU)	.725***			.722***		
	Perceived Risk (PR)	-.177*	.438		-.358***	.372	
	EOU x PR	.031	.029	-.71	-.071	.000	.00
Samples	Ease of Use (EOU)	.704***			.693***		
1&2 Combined	Perceived Risk (PR)	-.147***	.429		-.383***	.387	
	EOU x PR	-.024	-.001	-.68	-.124**	.010	6.47*

* = p <.05, ** = p <.01, *** = p <.001

Table 9 Sample 3 Regression Results

Sample 3		**Full Control Group**		**Low Level PR**		**Mid Level PR**		**High Level PR**	
		N = 310		N = 58 (18.7%)		N = 204 (65.8%)		N = 48 (15.5%)	
		$\bar{X}$ = 3.85 SD = .95		$\bar{X}$ = 2.41 (<= 2.9)		$\bar{X}$ = 3.93 (2.91-4.79)		$\bar{X}$ = 5.28 (>= 4.8)	
DV	IV	Reg. Coeff.	p.	Reg. Coeff.	p.	Reg. Coeff.	p.	Reg. Coeff.	p.
Perceived Usefulness	EOU	.335	**<.001**	.347	**.043**	.287	**<.001**	.289	**.007**
	SN	.457	**<.001**	.230	**.007**	.477	**<.001**	.617	**<.001**
	PR	-.122	**.017**	-.469	.182	-.011	.920	.485	.184
		Model Adj R2 = .528		Model Adj R2 = .291		Model Adj R2 = .444		Model Adj R2 = .660	

		Full Control Group		**Low Level PR**		**Mid Level PR**		**High Level PR**	
		N = 310		N = 58 (18.7%)		N = 204 (65.8%)		N = 48 (15.5%)	
		$\bar{X}$ = 3.85 SD = .95		$\bar{X}$ = 2.41 (<= 2.9)		$\bar{X}$ = 3.93 (2.91-4.79)		$\bar{X}$ = 5.28 (>= 4.8)	
DV	IV	Reg. Coeff.	p.	Reg. Coeff.	p.	Reg. Coeff.	p.	Reg. Coeff.	p.
Adoption Intention	EOU	.091	.176	.444	.076	.043	.617	.074	.556
	USF	.568	**<.001**	.577	**.004**	.576	**<.001**	.347	**.054**
	SN	.308	**<.001**	.128	.306	.333	**<.001**	.564	**.001**
	PR	-.240	**<.001**	-.422	.400	-.275	**.052**	-.063	.878
		Model Adj R2 = .546		Model Adj R2 = .366		Model Adj R2 = .454		Model Adj R2 = .648	