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Extending the Technology Acceptance Model by Inclusion of Perceived Risk

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Abstract

This work in progress proposes to extend the Technology Acceptance Model (TAM) as conceived by Venkatesh and Davis (2000) to include a measure of negative utility, perceived risk of service usage (Bauer, 1960). Valence Theory (Lewin, 1944) tells us that by measuring both costs and benefits of product usage we can improve our understanding of product evaluation. An investigation of the individual adoption of Internet-based e-payment systems was performed using e-billpay software as the research context. The research was performed to better understand consumer evaluations and adoption intentions of an Internet-based information system during conditions of uncertainty and perceived risk. A scale to operationalize the construct perceived risk was created and included in factor and regression analysis of the TAM2 variables, yielding a variable that significantly inhibited e-payment system evaluation and adoption intention. Preliminary results support inclusion of a measure of perceived risk when researching user acceptance of Internet-based e-payment systems. This finding may extend to other e-commerce software-based consumer services, and organizational adoption contexts. Extending TAM by inclusion of perceived risk may improve the models' predictive validity when investigating adoption of application service provider (ASP) systems, and other web-services.

Introduction

The Technology Acceptance Model (TAM) is an evaluation model based on previous attitude-intentions literature, tuned for information systems research. It has been successfully utilized to measure the perceived positive gain in utility possible from the adoption and usage of an information system. TAM's main dependent variable is the utility-based perceived usefulness of the software, defined as "The prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context." (Davis p. 985).

Valence models (Lewin, 1944; Fishbein 1967) base a product or service's evaluation on both desirable benefits (with positive valence) and undesirable costs (with negative valence). These models propose that if the benefits outweigh the costs resulting in a net positive valence, the purchase will tend to be made. It may be fruitful to apply this net valence approach to the information systems adoption context. Therefore, if the potential rewards (benefits of usage) outweigh the potential risks (costs of usage), the information system will tend to be adopted. More importantly, modeling both costs and benefits provides a more balanced investigation of systems evaluation and adoption, with both practical and theoretical implications.

Product evaluations usually involve both positive and negative outcomes (Lewin, 1944), measured as both potential gains and losses. Rogers (1962) included a measure of negative utility when he positioned complexity of system usage as an inhibitor to system evaluation and adoption. This variable was re-framed for TAM to tap the positive utility portion of this construct and named perceived ease of use. TAM then can be viewed as a positive valence model. To evaluate web-services it may prove beneficial to measure potential loses (risks) to better understand the evaluation of this class of information system.

Another measure of the negative consequences of system adoption and usage is the perceived risk of usage. Bauer (1960) defined this perceived risk as "a combination of uncertainty plus seriousness of outcome involved- associated with each category of product" (p. 391). Jacoby & Kaplan (1972) defined perceived risk as a function of uncertainty regarding the consequences of a purchasing decision. Bauer (1960) claimed that, "Consumer behavior involves risk in the sense that any action of a consumer

will produce consequences which he cannot anticipate with anything approximating certainty, and some of which are likely to be unpleasant" (p. 390). Perceived risk has been theorized as entering the buying/adoption decision when circumstances of the decision create feelings of uncertainty, discomfort and/or anxiety (Dowling & Staelin, 1994).

This literature suggests the following TAM-based research model. To test the validity of including measures of perceived costs of adoption that users of web-services perceive, the following research was performed.

Method

The TAM2 instrument with a scale to measure perceived risk was administered to 160 college of business undergraduate students after a scripted informational presentation and product demonstration of an e-billpay service. Subjects then completed an interactive hands-on product trial of the e-billpay software-based service to reduce product usage uncertainty and gain product usage experience. After this trial subjects then completed the same 7-point scaled survey instrument. Exploratory factor analysis was performed and regressions included only the variables with strong discriminant validity.

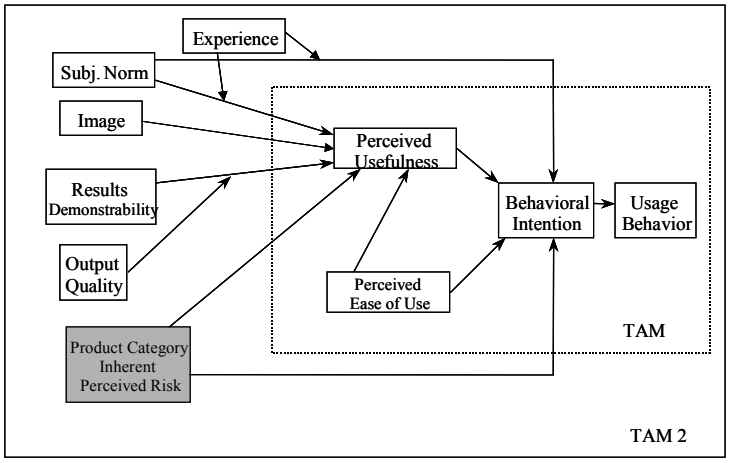

Figure 1. Research Model

Results

Preliminary results in table 1 below indicated that before the product trial subjects usefulness (utility) evaluations were significantly affected by concerns for the product's ease of use, normative influences, and product usage based perceived risk. After the hands-on trial, this same evaluation was affected only by the models' normative concerns and the product's ease of use. Thus usefulness evaluations for this sample and context were no longer based on product usage perceived risk.

Adoption intentions results in table 2 were significantly affected by normative concerns, perceived risk and the product's perceived usefulness. Post trial adoption intentions were significantly influenced by all four modeled exogenous variables. Thus usability concerns significantly affected adoption intentions only after subject's gained experience interacting with the Internet-based software. Concern for product inherent perceived risk was persistent and significant, and reduced by the product trial. In most cases model predictive validity was only marginally improved by inclusion of the perceived risk variable, however this may be an artifact of the sample and context.

Table 1. Regressions of Perceived Usefulness

Perceived Usefulness	Adj R^2	Adj R^2	Ease of Use			Subjective Norm			Perceived Risk			Image		
	w/o PR	w/PR	Beta	t	Sig.	Beta	t	Sig.	Beta	t	Sig.	Beta	t	Sig.
Pre-trial	.28	.37	.34	4.21	.000	.28	3.04	.003	-.17	-2.18	.031	.07	.82	.414
Post-trial	.64	.64	.56	7.21	.000	.31	3.87	.000	.04	0.62	.538	.03	.31	.754

Table 2. Regressions of Adoption Intention

Adoption Intention	Adj R^2	Adj R^2	Ease of Use			Subjective Norm			Perceived Risk			Perceived Usefulness		
	w/o PR	w/PR	Beta	t	Sig.	Beta	t	Sig.	Beta	t	Sig.	Beta	t	Sig.
Pre-trial	.52	.57	-0.08	-1.15	.253	.15	2.29	.024	-.34	-5.10	.000	.53	7.2	.000
Post-trial	.74	.75	0.28	3.73	.000	.14	2.63	.009	-.10	-2.10	.038	.56	7.71	.000

Table 3. ANOVA for Trial Effects

Trial Effects on Major Variables	Pre-trial		Post-trial		Paired Samples	
	Mean	SD	Mean	SD	T-score	Sig.
Perceived Usefulness	5.19	1.03	4.85	1.32	4.64	.000
Adoption Intentions	5.06	1.33	4.77	1.51	4.11	.000
Perceived Risk	3.34	1.13	3.30	1.13	0.46	.648
Perceived Ease of Use	5.34	0.77	5.01	1.18	3.79	.000

A pre-post trial comparison of perceived risk levels indicated no significant reduction after the product trial which did not confirm the theorized relationship (Roselius, 1971). System evaluations and adoption intentions lowered after product trial

indicating a lower valence assigned to the e-billpay service. Results suggest a differential influence of perceived risk during utility evaluations and adoption decision-making. During the evaluation of system usefulness, concern for perceived risk was significant only before product trial, while the adoption intention choice was significantly affected by concerns for perceived risk both before and after product trial.

Conclusion

These results suggest research of user acceptance of Internet-based e-commerce services, may benefit by the inclusion of an operationalization of perceived risk by improving our understanding of evaluation and adoption patterns. For this sample and context however, predictive validity was only marginally improved by the inclusion of a measure of perceived usage risk. From a practical perspective understanding the psychology beneath web-based system evaluation and the effect of product trial can enable improved web-systems design. Future research should attempt to manipulate perceived risk to better understand its influence and fit within TAM. With the projected growth of Internet-based ASP's and web-services, a multi-dimensional measure of adopter's uncertainty and perceived risk should enrich information systems adoption research.

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