

2004

Using Web Systems for eProcurement: An Extension of the Unified Theory of Acceptance and Use of Technology

Y. Benslimane

York University, younes@yorku.ca

M. Plaisent

University of Quebec in Montreal, michel.plaisent@uqam.ca

P. Bernard

University Consortium of the Americas, Prosper1@compuserv.com

Follow this and additional works at: <http://aisel.aisnet.org/ecis2004>

Recommended Citation

Benslimane, Y.; Plaisent, M.; and Bernard, P., "Using Web Systems for eProcurement: An Extension of the Unified Theory of Acceptance and Use of Technology" (2004). *ECIS 2004 Proceedings*. 8.

<http://aisel.aisnet.org/ecis2004/8>

This material is brought to you by the European Conference on Information Systems (ECIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ECIS 2004 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

USING WEB SYSTEMS FOR E-PROCUREMENT: AN EXTENSION OF THE UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY

Benslimane, Y., York University, 4700 Keele, Toronto, Ontario, Canada, younes@yorku.ca

Plaisent, M., University of Quebec in Montreal, 315 East Sainte-Catherine St., Montréal, Quebec,
Canada, michel.plaisent@uqam.ca

Bernard, P., University Consortium of the Americas, 5250 17th Street, Sarasota, Florida 34235
USA, Prosper1@compuserve.com

ABSTRACT

This paper is research in progress on an extension of the Unified Theory of Acceptance and Use of Technology (UTAUT) to web systems usage for e-procurement. Focusing on business-to-business transactions, this research explores an extended version of the UTAUT that integrates core drivers and deterrents of web systems usage and investigates the consequence of such usage on corporate buyers. Data collected from 136 corporate buyers from over 120 organizations helped with the validation of the instrument. Intermediary results from a cluster analysis show differences among respondents that improve our understanding web-based procurement practice.

1 INTRODUCTION

Electronic procurement (e-procurement) is the use of telecommunication networks for the identification and the selection of suppliers and the execution of transactions (Choudhury et al., 1998). It has received much attention from Information Systems (IS) researchers and practitioners because it can improve the performance of individual buyers (Barua et al., 1997; Bakos, 1997) and of buying organizations (DeLone and McLean, 2003; Mukopadhyay et al., 1995).

Traditionally, e-procurement has been supported by complex and expensive interorganizational systems and as a result, only a small fraction of business transactions has been conducted electronically (Scala and McGrath, 1993). Following the dramatic popularity of the World Wide Web, web systems have emerged as a new tool for e-procurement. These web systems typically include catalogs, ordering, payment and order tracking subsystems. They are also typically initiated by vendors and used by corporate buyers to support the procurement process of their organizations.

According to Venkatesh et al. (2003), there is a need to enhance our understanding of technology usage by examining newer applications, accounting for additional variance in usage behavior and tying it to individual usage outcomes. This paper explores an extended version of the Unified Theory of Acceptance and Use of Technology (UTAUT) that integrates core drivers and deterrents of web systems usage for e-procurement, investigates the consequence of such usage on corporate buyers and enhances the overall generalizability of the UTAUT. It is estimated that eighty to ninety percent of the transactions conducted over the Internet are business-to-business transactions (Rosen and Howard, 2000). However, little research has focused on web systems usage from the perspective of corporate buyers. The objective of this paper is to map current practices of e-procurement technologies and to enhance our understanding of web systems usage among corporate buyers.

2 THEORETICAL BACKGROUND

IS researchers have relied on several theoretical models to explain user acceptance of a new technology. Based on the theory of reasoned action, the Technology Acceptance Model (TAM) has been the most commonly applied model of IS usage and has received overall empirical support (Venkatesh et al., 2003; Taylor and Todd, 1995). Augmented and modified versions of the model have consistently shown that the core drivers of IS usage are the perceived usefulness (Davis et al., 1989; Adams et al., 1992; Taylor and Todd, 1995; Sajzna, 1996; Igbaria et al., 1997; Teo et al., 1999; Venkatesh et al., 2003; Gefen et al., 2003), the perceived ease of use (Igbaria et al., 1997; Taylor and Todd, 1995; Adams et al., 1992; Davis et al., 1989; Teo et al., 1999; Venkatesh et al., 2003; Gefen et al., 2003) and the subjective norm favoring the usage of that IS (Hartwick and Barki, 1994; Taylor and Todd, 1995; Karahanna et al., 1999; Venkatesh et al., 2003).

Usefulness, ease of use and subjective norm as perceived by the corporate buyers are expected to play an important role in web systems usage. However, when applied to Internet-based application for e-procurement, theoretical models used to explain user acceptance should take into consideration specific variables that can inhibit the use of web systems. The two major concerns discussed in Internet-based IS literature are the perceived lack of security for web-based transactions (Gefen et al. 2003; Loh and Ong, 1998; Koziur, 1997; Zwass, 1996), and the perceived lack of reliability of the network (Metcalf, 1997; Baentsch et al., 1997; Zwass, 1996). This paper presents a model that integrates the security and reliability issues expected to affect web systems usage for e-procurement.

Once they adopt an IS that supports their tasks, users can expect to improve their performance on the job. DeLone and McLean (2003 and 1992) have shown that the benefits at the individual level can be gauged using a wide range of measures referring to both effectiveness and efficiency. IT effectiveness

has been measured through indicators such as "better information", "better understanding of the decision context", "the number of alternatives considered", "decision correctness" whereas IT efficiency has been measured through indicators such as "time to perform task" and "time to decision".

3 RESEARCH MODEL AND CONSTRUCT MEASUREMENTS

The model shown in Figure 1 helps explain and predict the some major antecedents and consequences of web systems usage. Each construct and its measurement are discussed below. As far as it was feasible, pre-existing instruments based on seven point Likert scales (1= Strongly Disagree and 7= Strongly Agree) were used because, normally, they have been tested for reliability and validity properties.

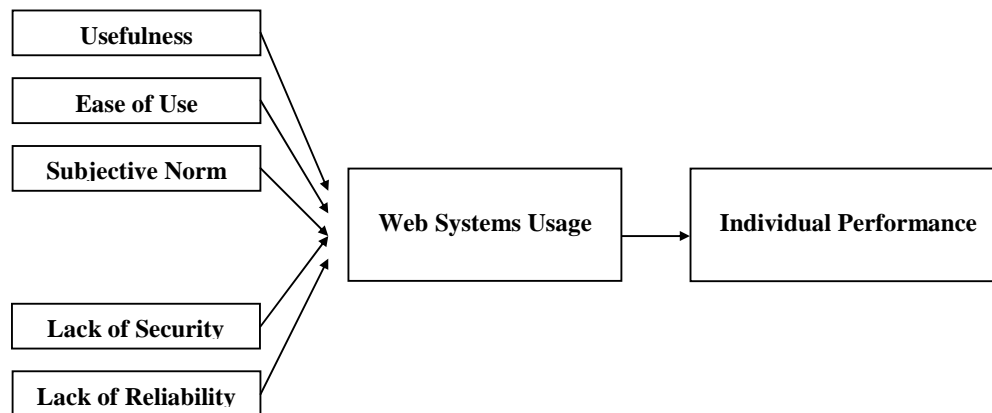


Figure 1 Research model

3.1 Web system usage (USE)

In accordance with supply chain management literature, this analysis of web systems usage distinguished straight re-buys (also called routine purchases) from modified re-buys or new buys (also called non-routine purchases) as each type of purchase involves a different usage of the web systems. Routine purchases require little or no additional information to be completed, whereas non-routine purchases require that corporate buyers first search for information about the input, about its price and about potential suppliers before selecting a supplier and executing the transaction (Novack and Simco, 1991). For each type of purchase, an adaptation of Massetti and Zmud's (1996) instrument helped measure web systems usage in terms of importance of number of purchases, of dollar amount of purchases and of percentage of suppliers considered.

3.2 Perceived usefulness (PU)

Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p.320). Perceived usefulness should be positively related to web systems usage. The measurement scale adopted in this study was adapted from the four item-scale used by Karahanna et al. (1999).

3.3 Perceived ease of use (PEU)

Perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p.320). Perceived ease of use should also be positively related to web systems usage. The three-item measurement scale used here was adapted from the one adopted by Adams et al., (1992) and refined by Segars and Grover (1993).

3.4 Subjective norm (SN)

Subjective norm is defined in terms of social influences that lie at the heart of the diffusion process of web systems usage. Normative pressure favoring the use of web systems should too be positively related to actual use of such systems. A three-item measurement scale adapted from Hartwick and Barki (1994) and Karahanna et al. (1999) was used to measure the construct.

3.5 Perceived lack of security (PLS)

The perceived lack of security refers to the uncertainty about the hazards of using Internet-based systems for e-procurement. From the buyer's perspective, this lack of security creates a potential for a loss and should therefore have a negative effect on web systems usage. Since no acceptable existing instrument could be located, a new measure based on existing literature (Kosiur, 1997) and on previous instruments was developed for this study. The measurement scales are based on Jarvenpaa et al., (1999) and Palvia (1996).

3.6 Perceived lack of reliability (PLR)

The perceived lack of reliability is defined in terms of the Internet-based systems faulty functioning due to data packet loss (Metcalf, 1997), unpredictable delay and downtime (Baentsch et al., 1997; Zwass, 1996). This lack of reliability is expected to have a negative effect on web systems usage. The measure was adapted from Goodhue (1998).

3.7 Individual performance (IPERF)

Individual performance refers to the efficiency and effectiveness on the job resulting from web systems usage. Efficiency was measured in terms of reduced search costs and processing time whereas effectiveness was measured in terms of decision correctness. Web systems usage for the identification and the selection of suppliers can help corporate buyers reduce their search costs, allowing them to carry out their tasks more quickly and/or to better select their suppliers (Bakos, 1997; Barua et al., 1997). A three-item scale adapted from Barua et al., (1997) and Choudhury et al., (1998) was used to measure the improved performance resulting from web systems usage.

4 METHODOLOGY

4.1 Research design and source for data

A survey was used to map current practices of Internet-based e-procurement and collect data on the antecedents and consequences of web systems usage. A questionnaire was sent to all 988 corporate buyers members of the "Corporation des Approvisionneurs" in the province of Quebec, an organization affiliated to the Purchasing Management Association of Canada. A total of 136 usable questionnaires were completed and returned for a response rate of approximately 13.7%. The sample spanned corporate buyers from over 120 organizations, mostly for-profit corporations doing business in a wide range of industries. The sample also captures nonprofit organizations, including universities and government departments.

4.2 Questionnaire validation

As mentioned previously, the instrument used in this research is based on prior research. It was further pilot-tested with five corporate buyers, one consultant in electronic commerce and four IS researchers for completeness and readability. Their suggestions helped develop the final questionnaire. Prior to data analysis, the constructs under study were examined for validity and reliability.

The validity of the scale was assessed using a factor analysis. The principal components method was used to extract the seven factors needed to test the research model. A factor loading greater than .50 with the theoretically correct sign was required for the assignment of an item to a factor. The varimax rotation method was used to ease the interpretation of the extracted factors. One item (PLS1) related to the perceived lack of security had to be deleted as it loaded on the incorrect factor. For the rest, the results of the factor analysis confirmed the validity of the scale. The score for each retained factor equaled the mean score of its retained items. The reliability of the scale was assessed using the Cronbach's alpha. No item significantly deflated alpha, so all the remaining items were kept. The Cronbach's alpha for the constructs under study varied from .76 to .95 showing a high level of reliability of the scales. Table 1 and 2 summarize the validity and the reliability analyses performed.

5 INTERMEDIARY RESULTS AND CONCLUSIONS

5.1 Method of analysis

Cluster analysis is commonly used to group individuals or entities based on their attributes, the resulting clusters should then exhibit a high internal homogeneity and high external heterogeneity. The solutions derived must be scrutinized for validation through profile analysis (Hair et al.; 1995). In this research, cluster analysis was used to identify patterns that can enhance our understanding of web systems usage among corporate buyers. The validation of the solution was based on the pre-specified research model.

5.2 Intermediary results and conclusions

Table 3 presents the data related to the two-cluster solution. It shows the size of each cluster and the mean score obtained on each construct within each final cluster. It shows also the results from the Mann-Whitney tests¹ used to test the significance of the differences in scores between clusters. Findings from the two-solution cluster analysis support the proposed research model. Two groups of web systems users are identified, each one having a distinctive profile on the set of constructs under

	USE	PU	PEU	IPERF	SN	PLR	PLS
USER1	.931						
USER2	.903						
USER3	.635						
USENR1	.867						
USENR2	.888						
USENR3	.587						
IPERF1				.841			
IPERF2				.827			
IPERF3				.602			
PU1		.869					
PU2		.861					
PU3		.826					
PU4		.862					
PEU1			.867				
PEU2			.906				
PEU3			.904				
SN1					.875		
SN2					.782		
SN3					.856		
PLS1							
PLS2							.512
PLS3							.883
PLS4							.867
PLR1						.592	
PLR2						.752	
PLR3						.839	

Table 1 Validity analysis (Rotated matrix showing absolute values $\geq .50$)

	Number of items	Cronbach's α	Mean	St. deviation
USE	6	.92	2.66	1.39
PU	4	.92	5.28	1.39
PEU	3	.95	5.43	1.33
SN	3	.88	5.14	1.43
PLS	3	.76	4.26	1.28
PLR	3	.77	4.27	1.32
IPERF	3	.83	5.29	1.44

Table 2 Reliability analysis and descriptive statistics

¹ Non parametric test were used because of the non-normal distribution of the data

	USE	PU	PEU	SN	PLS	PLR	IPERF
Cluster 1 (N1 = 55)	2.17	4.35	4.82	4.36	4.94	5.02	4.58
Cluster 2 (N2 = 81)	3.00	5.92	5.95	5.67	3.80	3.77	5.77
Mann-Whitney U	1363.5	772.5	1217	995.5	1103	1023	1071
Asymp. Sign. (2-tailed)	.000	.000	.000	.000	.000	.000	.000

Table 3 Results from the two-cluster analysis

study. As predicted, users from one cluster, in this case from cluster 2, reported a significantly higher level of web systems usage (Mean = 3.00) and rated significantly higher their level of usefulness (Mean = 5.92), of ease of use (Mean = 5.95) and of normative pressure to use them (Mean = 5.67). They also reported a significantly lower level of lack of security (Mean = 3.80) and of lack of reliability (Mean = 3.77) for such systems. They finally reported a significantly higher performance (Mean = 5.77) on the job resulting from web systems usage. Conversely, respondents from the other cluster (cluster 1) reported a significantly lower level of web systems usage (Mean = 2.17) and rated significantly lower their level of usefulness (Mean = 4.35), of ease of use (Mean = 4.82) and of normative pressure to use them (Mean = 4.36). They also rated significantly higher the level of lack of security (Mean = 4.94) and of lack of reliability (Mean = 5.02) for such systems and finally reported a significantly lower performance on the job (Mean = 4.58) resulting from the use of such systems.

The two-cluster solution led to a classification of corporate buyers with significant and theoretically correct differences on the constructs under study. The data show that corporate buyers' usage of web systems depends on perceived usefulness, perceived ease of use and subjective norm. These results corroborate the findings of previous UTAUT-related research (Venkatesh et al., 2003; Gefen et al., 2003; Karahanna et al., 1999; Teo et al., 1999; Igbaria et al., 1997; Sajzna, 1996; Taylor and Todd, 1995; Adams et al., 1992; Davis et al., 1989). The data show also that corporate buyers' perception of web systems lack of security and lack of reliability affect negatively usage their level of usage. Such findings support previous work in this area (Gefen et al. 2003; Loh and Ong, 1998; Koziur, 1997; Zwass, 1996; Metcalfe, 1997; Baentsch et al., 1997). This research finally addresses one of the directions for future research underlined by Venkatesh et al. (2003) as it ties web systems usage to an improved performance on the job, hence corroborating previous research on the consequences of IS usage (DeLone and McLean, 1992 and 2003; Bakos, 1997; Barua et al., 1997).

The contribution of this research is two-fold. The first contribution is to research. To the best of our knowledge, the study, which involved 136 corporate buyers from over 120 organizations, is one of the first rigorous studies that examined antecedents and consequences of web systems usage in the context of business-to-business transactions. This research further extends the UTAUT by integrating constructs that provide a richer understanding of e-commerce applications adoption and usage. The second contribution is to practice, as this research gives buyers and vendors insights on web systems usage for electronic commerce purposes. It demonstrates that, web systems support the procurement process and that buyers who are encouraged to use them can improve their performance on the job. This research also lead to an improved understanding of the antecedents and the consequences of web systems usability as it helps elaborate guidelines for the implementation of successful web systems.

References

- Adams, D., Nelson, R. and Todd, P. 1992. Perceived Usefulness, Ease of Use and Usage of IT: A Replication. *MIS Quarterly*, 16, 2, 227-247.
- Baentsch, M., Baum, L. and Molter, G. 1997. Enhancing the Web's Infrastructure. *IEEE Internet Computing*, March-April, 18-27

- Bakos, J.Y. 1997. Reducing Buyer Search Costs: Implications for Electronic Marketplaces. *Management Science*, 43, 12, 1676-1692.
- Barua, A. and Lee, B. 1997. An Economic Analysis of the Introduction of an EDI System. *Information Systems Research*, 8, 4, 398-422.
- Choudhury, V., Hartzel, K.S. and Konsynski, B. 1998. Uses and Consequences of Electronic Markets: An Empirical Investigation in the Aircraft Parts Industry. *MIS Quarterly*, 22, 4, 471-507.
- Davis, F.D. 1989. Perceived Usefulness, Ease of Use and User Acceptance of IT. *MIS Quarterly*, 13, 3, 319-340.
- Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35, 8, 982-1003.
- DeLone, W.H. and McLean, E.R. 2003. The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information System*, 19, 4 (Spring 2003), 9-30.
- DeLone, W.H. and McLean, E.R. 1992. Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research*, 3, 1, 60-95
- Gefen, D., Karahanna, E. and Straub, D.W. 2003. Trust and TAM in Online Shopping: An Integrated Model. *MIS Quarterly*, 27, 1, 51-90
- Goodhue, D.L. 1998. Development and Measurement Validity of Task-Technology Fit Instrument for User Evaluations of IS. *Decision Science*, 29, 1, 105-137.
- Hair, J.E. et al. 1995. *Multivariate Data Analysis*, NY: MacMillan.
- Hartwick, J. and Barki, H. 1994. Explaining the Role of User Participation in IS Use. *Management Science*, 40, 4, 440-465.
- Igbaria, M., Zinatelli, N., Cragg, P. and Cavaye, A.L.M. 1997. Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model. *MIS Quarterly*, 279-301.
- Jarvenpaa, S. L. and Tractinsky, N. 1999. Consumer Trust in an Internet Store. *Journal of Computer Mediated Communication*, 5, 2, 1-30.
- Karahanna, E., Straub, D.W. and Chervany, N.L. 1999. IT Adoption across Time. *MIS Quarterly*, 23, 2, 183-213.
- Kosiur, D. 1997. *Understanding Electronic Commerce*. Redmond: Microsoft Press.
- Loh, L. and Ong, Y.S. 1998. The Adoption of Internet-Based Stock Trading: A Conceptual Framework and Empirical Results. *Journal of Information Technology*, 13, 81-94.
- Massetti, B. and Zmud, R.W. 1996. Measuring the Extent of EDI Usage in Complex Organizations: Strategies and Illustrative Examples. *MIS Quarterly*, 331-345.
- Metcalfe, B. 1997. What's Wrong with the Internet. *IEEE Internet Computing*, March-April, 6-16.
- Mukopadhyay, T., Kekre, S. and Kalathur, S. 1995. Business Value of IT: A Study of EDI. *MIS Quarterly*, 137-157.
- Novack, R.A. and Simco, S.W. 1991. The Industrial Procurement Process. *Journal of Business Logistics*, 12, 1, 145-165.
- Rosen K.T. and Howard A.L. 2000. E-Retail: Gold Rush or Fool's Gold? *California Management Review*, 42, 3, 72-100.
- Scala, S. and McGrath, R. 1993. Advantages and Disadvantages of EDI. *Information and Management*, 25, 85-91.
- Segars, A. and Grover, V. 1993. Re-Examining Perceived Ease of Use and Usefulness: A Confirmatory Factor Analysis. *MIS Quarterly*. Dec., 517-525.
- Szajna, B. 1996. Empirical Evaluation of the Revised Technology Acceptance model. *Management Science*, 42, 1, 85-92.
- Taylor, S. and Todd, P. 1995. Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research*, 6, 2, 144-176.
- Thong, J.Y.L. 1999. An Integrated Model of IS Adoption in Small Businesses. *Journal of MIS*, 15, 4, 187-204.
- Venkatesch, V., Morris, M.G., Davis, B.G. and Davis, F.D. 2003. User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27, 3, 425-478

Zwass, V. 1996. Electronic Commerce: Structure and Issues. *International Journal of Electronic Commerce*, 1, 1, 3-23.