

Towards a Model of Macao's E-Government Portal Adoption

Cora Sio Kuan Lai - Macao Polytechnic Institute, Macao PRC, coralai@ipm.edu.mo
 Guilherme Pires, University of Newcastle, Newcastle, Australia, Guilherme.Pires@newcastle.edu.au

Abstract

Electronic government is an information system (IS) that uses information and communication technology to improve public administration efficiency and policy effectiveness, to increase the convenience, performance and accessibility of government services to internal and external users. This research tests an integrated model of e-Government satisfaction that incorporates constructs from the technology acceptance model (TAM) and end-user satisfaction (EUS). The model explains a large proportion of the variance in citizen's intention-to-reuse Macao's e-Government portal. Empirical results support the hypothesis that satisfaction with the e-Government portal partially mediates the relationship between success factors and intention-to-reuse the portal. Information quality, system quality and social influence (but not perceived effectiveness) were confirmed as determinants of the adoption of, and satisfaction with Macao's e-Government portal.

Keywords: e-government portal, adoption, satisfaction,

1. Introduction

While there are many definitions with varying emphasis and completeness, Grant & Chau (2004) offer a good starting point in addressing the nature and potential of e-Government, defined as “*a broad-based transformation initiative, enabled by leveraging the capabilities of information and communication technology (ICT); (1) to develop and deliver high quality, seamless and integrated public services; (2) to enable effective constituent relationship management; and (3) to support the economic and social development goals of citizens, business, and civil society at local, state, national and international levels*” (p. 8).

Such definition recognizes that the introduction of the Internet and other ICT media as new delivery channels improves service level and reduces processing time which, integrated with a citizen / customer orientation, may result in satisfaction for individual citizens and businesses alike (Ho, 2002). Moreover, e-Government has the potential to build better relationships between the government and its constituents, beyond better service provision, through citizen empowerment and increased transparency (World Bank, 2002).

Notwithstanding the advantages, e-Government inherits the less positive characteristics of information systems (IS), including a high failure rate of information technology (IT) based projects and user adoption rates below expectations. Low adoption may be explained by the transition process of users from the traditional public service delivery process to the new e-version, and by reasons ranging from supply side imperfect dissemination of information about the new services and system complexity, to demand related user lack of proficiency in the use of e-services and resistance to innovation.

Independently of the reasons that apply in particular contexts, e-Government deployment success must depend on achieving a state of adoption that combines user satisfaction gains with the discontinuation of traditional processes. As long as users can choose between using e-Government and traditional methods to access public services, adoption can be expected to depend on external user's attitudes and perceptions. Still in its infancy, e-government currently lacks a theoretically grounded and empirically proven model to evaluate its effectiveness based on external user satisfaction.

2. Purpose and Theoretical Framework

For e-Government to realize its potential, it is imperative to have an in-depth understanding of potential users' needs, perceptions and other factors influencing e-Government uptake and build e-service around those needs and perceptions. This study seeks to identify and examine factors influencing the adoption of the e-Government portal by individual citizens in Macao.

The theoretical framework used to guide this study is an adaptation to the e-Government context of a model developed by Schaupp *et al.*, (2006) for assessing e-commerce websites. Hence the paper combines the positive examination of an existing research model applied elsewhere with interpretive inquiry into its applicability in the Asian e-Government context of Macao. The model integrates measures from the technology acceptance model or TAM (Davis, 1989; Davis *et al.*, 1989) and end user satisfaction (EUS) theories (DeLone & McLean, 1992; Doll *et al.*, 1995), examining user satisfaction when using a computer application.

Both the TAM and the EUS approaches are theoretically grounded and empirically supported (Wixom & Todd, 2005). Although providing limited

guidance about how to influence usage through design and implementation (Taylor & Todd, 1995) and assuming that all behaviour is under an individual's complete volitional control (Furneaux, 2006), TAM identifies perceived usefulness and ease of use as factors influencing IS adoption. The strength of EUS is in its ability to link design characteristics with user satisfaction (Wixom & Todd, 2005), despite of its inability to link attitude to behavior and to fully capture the significant determinants of satisfaction (Au *et al.*, 2002). It is proposed that taking both approaches into account yields a better understanding of user acceptance and adoption.

The model used in this research identifies four success factors -- information quality (IQ), system quality (SQ), perceived effectiveness (PE) and social influence (SI) -- which impact user satisfaction with a e-Government website (SAT), influencing intention to reuse (IU). IQ is defined as the degree to which information on the e-Government portal is perceived to be accurate, relevant, complete and in the format required by the user (Schaupp *et al.*, 2006). SQ is defined as the degree to which the e-Government portal is easy to use to accomplish a desired goal. It is equivalent to perceived ease-of-use (Davis, 1989) and effort expectancy (Venkatesh *et al.*, 2003) and involves three dimensions, namely access, usability and navigation (McKinney *et al.*, 2002). Access refers to the speed and availability of the website at all times. Usability refers to the extent a website is visually appealing, consistent, fun and easy to use (McKinney *et al.*, 2002). Navigation evaluates the extent to which the website allows a user to easily find needed information (Huijizingh, 2000). PE is the degree to which a user believes the website to be useful, similarly with 'perceived usefulness' (Davis *et al.*, 1989), usefulness and relativeness (Moore & Benbasat, 1991) and 'performance expectancy' (Venkatesh *et al.*, 2003). SI refers to user perception of expectations by others about their use of the website. It is primarily the same as 'social norm' (Seddon, 1997) 'subjective norm' (Thompson & Higgins, 1991) and 'image', deemed to be a significant predictor of IT adoption (Moore & Benbasat, 1991).

SAT and IU are the outcome measures used in the present study. SAT is the degree to which the user is satisfied with the e-Government portal (Schaupp *et al.*, 2006). Overall, the study proposes that user perceptions about the e-Government portal, in terms of SI and the quality of the content, of the delivery system and of SAT, influence the perceived quality and attitude towards the portal.

Based on the model, the following research questions are examined:

- RQ1: What are the factors affecting user satisfaction with the e-Government portal?
- RQ2: What are the factors influencing the adoption of the e-Government portal by individual citizens?
- RQ3: What are some potential relationships of the identified factors in the explanation of portal acceptance by Macao citizens?

The following four hypotheses were developed from the literature to address the questions:

- H1: The effect of IQ on IU is mediated by SAT
 - H1a: IQ is positively related to IU.
 - H1b: IQ is directly related to SAT.
 - H1c: SAT significantly predicts IU after controlling for IQ.
- H2: The effect of SQ on IU is mediated by SAT.
 - H2a: SQ is positively related to IU.
 - H2b: SQ is directly related to SAT.
 - H2c: SAT significantly predicts IU after controlling for SQ.
- H3: SAT is a mediator in the effect of SI on IU.
 - H3a: SI is directly related to IU.
 - H3b: SI is directly related to SAT.
 - H3c: SAT significantly predicts IU after controlling for SI.
- H4: SAT is a mediator in the effect of PE on IU.
 - H4a: PE is directly related to IU.
 - H4b: PE is directly related to SAT.
 - H4c: SAT significantly predicts IU after controlling for PE.
- H5: Together with SAT, the success factor (IQ, SQ, SI) is a good predictor of IU.

3. Methodology

A web questionnaire was used as an instrument to examine factors influencing the adoption of e-Government by individual citizens and develop a citizen-centric e-Government website evaluation model capable to assess e-Government performance. This section provides the details about the population and sampling, survey development, data collection procedure and data analysis method.

3.1 Population and Sampling

This cross-sectional study is an ex post evaluation of Macao's e-Government portal, three years after its inauguration (Doherty & King, 2004). Using non-probability sampling, the web survey method was used to collect data from the target population - the set of all individual (non-business) users of Macao e-Government Portal, 18 years or older who

self-reported to have used the portal more than once – estimated to exceed 260,000 (RTHK, 2007) portal users.

3.2 Survey Development

The instrument for this research is an adaptation of instruments previously tested and rated 'very good' to 'excellent' for reliability, shown in Table 1. The questionnaire consisted of two parts. The first part collected demographic information about the respondents. The second part consisted of 38 random ordered items and one reversed coded question for repeat users of the e-Government portal.

Table 1 Source of Scales and Their Reliabilities

	Construct	Source of Scale	Dimensions	Cronbach's Alpha
Success	Information quality	Doll & Torkzadeh's, 1988)		0.92
	System quality	Cheung & Lee, 2005; McKinney <i>et al.</i> , 2002	Access	0.8
			Usability	0.97
			Navigation	0.86
	Perceived Effectiveness	Carter & Belanger, 2005; Gefen <i>et al.</i> , 2002		0.8827
	Social influence	Venkatesh <i>et al.</i> , 2003		0.92
Outcomes	Intention-to-reuse	Carter & Belanger, 2005; Gefen <i>et al.</i> , 2002		0.9195
	Portal satisfaction	Cheung & Lee, 2005; McKinney <i>et al.</i> , 2002		0.98

All scales were phrased as questions on a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The satisfaction construct used a five-point semantic scale. A series of statements were asked to gauge the degree of satisfaction from 'very dissatisfied' to 'very satisfied', 'very displeased' to 'very pleased', 'frustrated' to 'contented' and 'disappointed' to 'delighted'. With the exception of the satisfaction construct, items in the survey website were randomly presented as a means to reduce common method bias and potential monotonous responses (Hu *et al.*, 1999).

3.3 Questionnaire Pretest

To ensure the reliability and validity of the questionnaire, the survey instrument was pre-tested in three stages and then pilot tested. In the first stage, two experienced IS consultants to the Macao's government evaluated the items, as suggested by Thomas (2004), to assess whether each question was clearly linked to the objective and whether any

omitted topics should have been included. In the second stage, two academic experts in quantitative research reviewed the questionnaire for content validity, to ensure that the correct data would be collected. In the last stage, a focus group comprising 12 non-experts and potential participants from a local community group was carried out.

Hosted in questionpro.com, a pilot study involving 23 participants was then carried out using convenience sampling. All constructs exhibited an internal consistency level near or exceeding 0.7 Cronbach's alpha (Nunnally, 1978) and the instrument was deemed reliable and valid.

3.4 Survey Administration

A web-link to the survey was made available on the e-Government portal and the questionnaire was posted on the web-hosting QuestionPro.com website for publicizing the research and collecting data using self-selection sampling (Ticehurst & Veal, 2000) from respondents. In addition, an information letter about the purpose of the survey was sent to four local organizations and community groups requesting their participation in the survey. Potential participants were notified of the existence of this anonymous and self-administered web survey questionnaire either through their self-initiated contact with the website hosting the questionnaire, or by email via the referred organizations consenting to forwarded invitations to members. Willing respondents were able to access the website and complete the questionnaire through Internet. Data collection took place between August 15 and September 16, 2007.

Data processing and analysis was performed using SPSS 13.0. To ensure the accuracy and completeness of data, invalid responses were excluded, including those with more than one-third missing values. Perception scales were replaced with the median for every remaining responses with missing values. The negatively worded item (PU3) was recoded.

4. Data Analysis and Findings

The web-questionnaire was visited 1932 times, with 849 attempts to answer the questionnaire. In addition to 25 responses from once-users and 103 from non-users, 460 usable web-survey questionnaires were received from repeat users (the sample), for a total 588 questionnaires. Table 2 depicts the characteristics of the sample.

Table 2 Frequency Distributions of Demographic Variables of Repeated Users

<i>Variables</i>		<i>Frequency</i>	<i>%</i>	<i>Variables</i>		<i>Frequency</i>	<i>%</i>
Gender				Macao Resident			
	male	243	52.83		yes	440	95.65
	female	217	47.17		no	20	4.35
	Total	460	100		Total	460	100
Age Group				Internet Usage			
	18-27	223	48.48		at least once a day	368	80
	28-37	118	25.65		several times a week	82	17.83
	38-47	78	16.96		once each week	1	0.22
	48-57	25	5.43		several times a months	4	0.87
	>=58	2	0.43		once a month	3	0.65
	Total	446	96.96		less than once a month	2	0.43
	Missing	14	3.04		Total	460	100
	Total	460	100				
Occupation				Internet Experience			
	public servant	138	30		< 1 yr	1	0.22
	other	4	0.87		1 - 3 yr	84	18.26
	Prof./exec/man agerial	91	19.78		4-6 yr	99	21.52
	clerical/service worker	85	18.48		7-9 yr	147	31.96
	production worker	1	0.22		>=10 yr	128	27.83
	self-employed	14	3.04		Total	459	99.78
	student	115	25		Missing	1	0.22
	homemaker	4	0.87		Total	460	100
	unemployed	8	1.74				
	Total	460	100				
Education Level				Government Portal			
	primary school	1	0.22		1 or 2 times a year	32	6.96
	secondary	49	10.65		several times a year	166	36.09
	college	126	27.39		once a month	70	15.22
	>=University	278	60.43		once a week	76	16.52
	Total	454	98.7		more than once a week	116	25.22
	Missing	6	1.3		Total	460	100
	Total	460	100				

Table 3 - VARIMAX Rotated Loading, Reliability and Overall Reliability of 24 Items Instrument

Construct	Manifest Variable	FACTOR				
		SQ	IQ	SAT	SI	UI
SAT	satisfied			0.68		
	delighted			0.72		
	pleased			0.79		
	contented			0.77		
SQ	simple layout	0.66				
	ease of use	0.76				
	clear design	0.71				
	user friendly	0.74				
	ease to go back and forth	0.64				
	locate information with a few click	0.55				
	easy to navigate	0.78				
SI	influential people				0.61	
	important people				0.63	
	senior management of SAR				0.72	
	Macao SAR government				0.62	
UI	Intend to use					0.71
	predict to use					0.79
IQ	relevance		0.63			
	applicable		0.7			
	sufficient information		0.53			
	information accuracy		0.76			
	accuracy		0.75			
	timely		0.66			
	up-to-dated		0.67			
Sum of Square (eigenvalue)		4.29	4.2	2.95	2.27	1.64
Percentage of trace		17.86	17.49	12.3	9.46	6.82

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.

Overall Reliability of 24 Items Instrument

Valid N	%	Cronbach's Alpha	N of Items
460	100	0.94	24

Being incongruent with the profile of Macao's population distribution, the respondents in the sample were found to be mostly young, Macao residents, highly educated, experienced and frequent users of the Internet. The gender and age distributions were similar to the Internet user profile gathered for the Macao Internet Usage Survey (Cheong, 2007). Another Internet Usage study indicating that the higher the education, the more frequent the Internet usage (China.com.cn, 2006) is also supported.

4.1 Principal Component Analysis

Exploratory factor analysis was conducted to examine the factor structure of the 38 items in the questionnaire. The ratio of sample size to number of scale items was 16:4, exceeding the minimum 10:1 ratio recommended by Kerlinger (Doll & Torkzadeh, 1988). The extraction technique was principal component factoring with Varimax-rotation.

After proceeding to iterative factor analysis and item deletion, the number of items was reduced to 24 in the final instrument (as shown in Table 3), with an overall reliability of 0.94, representing 63.93% of the variance of the dataset with five factors, one less than the Schaupp *et al.*, (2006) integrated model used as the basis for this study. The missing factor is PE. This finding matches a recent study of e-government services adoption in Macao (Lee & Lei, 2007) and Mao *et al.*, (2005 cited in Schepers & Wetzels, 2007) who conclude that PE is less important than perceived ease of use in non-Western culture.

Table 4 shows that accuracy, relevance, completeness and timeliness are valid sub-dimensions of IQ while usability and navigation are important proportions of SQ. Calculated by using the means of the items that belonged to the scale, descriptive statistics for the composite scale are reported in table 5.

The research findings reveal that Macao's repeat users were satisfied with the e-government portal. Comparing with SQ, users were less satisfied with the information and service provided within the portal.

Table 4: Mean, Standard Deviation, Internal Reliability and Correlation Coefficients for the Latent Constructs

Component	No. Items	Mean	S.D.	IQ	SQ	SI	IU	SAT	
Success Factors									
1	IQ	7	3.18	0.65	0.88				
2	SQ	7	3.21	0.67	0.66	0.89			
3	SI	4	2.89	0.63	0.55	0.52	0.7		
Success Measures									
4	IU	2	3.17	0.63	0.47	0.41	0.36	0.61	
5	SAT	4	3.77	0.68	0.67	0.64	0.54	0.42	0.9
Correlation is significant at the 0.01 level (2-tailed).									
Cronbach Alpha is shown on the diagonal in boldface									

4.2 Assessing for reliability and validity

Scale reliability was assessed using Cronbach's coefficient alpha analysis. It was expected that the various items should correlate positively, although not perfectly. Relative to reliability, the 24-item instrument had an overall coefficient alpha of 0.94 (Table 3), showing that all the items measured the same construct as intended. In addition, Table 4 shows the reliabilities of five summated scales were between 0.9 (SAT) and 0.61(IU). All scales exceeded the 0.70 threshold except for IU (0.61),

which is still an acceptable level for newly developed constructs (Hair *et al.*, 2006).

As for validity, content validity of the instrument was established, through literature and expert reviews (Straub, 1989), including pre-testing and pilot-testing, to ensure that all aspects of the construct are measured. In addition, assessments of convergent, discriminant and criterion-related validity were made using factor and correlation analyses, making certain the instrument only correlated with the expected variables. In factor analysis, significant loading of all the items on the single factor indicated unidimensionality while no cross-loading items supported discriminate validity of the instrument (Wang *et al.*, 2001). These results were confirmed using the correlation approach reported in Table 5.

Using Doll & Tokzadeh's (1988) approach, criterion-related validity was assessed to examine the correlation between total scores on the instrument (sum of 20 items) and the measure of global rating of satisfaction (sum of SAT items). The 20 items instrument had an acceptable criterion-related validity of $r = 0.72$ and $p < .001$, meaning that the instrument is capable of measuring user satisfaction.

In summary, the observed convergent and discriminate reliability and criterion validity jointly suggest that the psychometric properties for the measurement model are sufficient strong for further analysis. After demonstrating the goodness of the measure, hypotheses testing was conducted with user perceptions as independent variables, portal satisfaction (SAT) as mediator and usage intention (IU) as the dependent variable.

4.3 Hypothesis Testing

Hypotheses were tested to examine the factors affecting e-Government portal satisfaction and adoption. Following Baron & Kenny (1986)'s procedures, mediation analyses were conducted to understand how user perceptions affect adoption. As a complement to Baron and Kenny's (1986) causal steps mediation approach, Sobel Statistics (1982, cited in Preacher and Hayes, 2004) and bootstrapping (Precher & Hayes, 2004) were also adopted to compare and estimate the indirect effect. defined as the reduction of the effect of the independent variable on the outcome (Kenny, 2006). In addition, an exploratory multiple regression analysis was carried out to better understand the mechanism underlining the adoption of an e-government portal, a relationship not previously examined (H5 listed earlier).

Table 5: Correlation Matrix of Measurement Model (n = 460)

	ECS2	ECS3	ECS4	ECS5	ECS6	ECSB	ECSC	USA1	USA2	USA4	USA5	NAV1	NAV2	NAV3	SI1	SI2	SI3	SI4	SAT1	SAT4	SAT2	SAT3	IU1	IU2	
ECS2	1																								
ECS3	0.58	1																							
ECS4	0.52	0.49	1																						
ECS5	0.53	0.6	0.43	1																					
ECS6	0.49	0.55	0.39	0.71	1																				
ECSB	0.56	0.65	0.48	0.6	0.53	1																			
ECSC	0.55	0.49	0.4	0.5	0.53	0.5	1																		
USA1	0.36	0.32	0.37	0.29	0.26	0.32	0.27	1																	
USA2	0.4	0.49	0.32	0.43	0.38	0.46	0.32	0.46	1																
USA4	0.42	0.41	0.33	0.45	0.43	0.41	0.37	0.53	0.6	1															
USA5	0.5	0.5	0.39	0.44	0.46	0.53	0.4	0.49	0.68	0.65	1														
NAV1	0.39	0.42	0.29	0.39	0.37	0.46	0.32	0.38	0.6	0.49	0.58	1													
NAV2	0.5	0.53	0.42	0.38	0.38	0.5	0.34	0.47	0.49	0.43	0.49	0.44	1												
NAV3	0.48	0.42	0.33	0.38	0.4	0.4	0.34	0.5	0.65	0.59	0.67	0.56	0.58	1											
SI1	0.34	0.37	0.3	0.33	0.28	0.41	0.28	0.24	0.31	0.33	0.32	0.32	0.35	0.28	1										
SI2	0.32	0.33	0.3	0.25	0.28	0.34	0.34	0.28	0.27	0.21	0.26	0.21	0.31	0.26	0.43	1									
SI3	0.26	0.24	0.29	0.25	0.26	0.31	0.32	0.26	0.24	0.28	0.26	0.3	0.33	0.27	0.35	0.29	1								
SI4	0.31	0.33	0.26	0.37	0.29	0.41	0.32	0.29	0.31	0.37	0.36	0.27	0.3	0.3	0.38	0.34	0.41	1							
SAT1	0.52	0.47	0.42	0.45	0.45	0.52	0.39	0.34	0.46	0.51	0.51	0.46	0.44	0.44	0.37	0.33	0.32	0.38	1						
SAT4	0.51	0.48	0.42	0.48	0.43	0.51	0.45	0.37	0.48	0.49	0.5	0.46	0.43	0.48	0.34	0.37	0.34	0.4	0.7	1					
SAT2	0.5	0.45	0.38	0.47	0.44	0.49	0.39	0.33	0.44	0.42	0.44	0.45	0.42	0.43	0.36	0.27	0.3	0.35	0.64	0.7	1				
SAT3	0.49	0.5	0.41	0.47	0.43	0.48	0.38	0.34	0.48	0.41	0.48	0.44	0.42	0.44	0.33	0.33	0.3	0.43	0.65	0.7	0.77	1			
IU1	0.27	0.23	0.26	0.28	0.26	0.26	0.25	0.2	0.18	0.2	0.23	0.22	0.25	0.22	0.28	0.27	0.08	0.21	0.29	0.28	0.33	0.27	1		
IU2	0.43	0.39	0.3	0.34	0.37	0.38	0.32	0.28	0.29	0.3	0.32	0.35	0.37	0.36	0.31	0.28	0.09	0.27	0.31	0.36	0.34	0.34	0.44	1	

** Correlation is significant at the 0.01 level (2-tailed).

Mediation Analyses

Success factors (IQ, IQ and SI) were the independent variables, SAT was the mediator and IU the dependent variable. Several regression analyses were performed to test [condition 1] significance of the total effect of the independent variable on the dependent variable; [condition 2] significance of the effect of the independent variable on the mediator; and [condition 3] that the mediator significantly predicts the dependent variable, controlling for independent variable.

H1: The effect of IQ on IU is mediated by SAT

Using Baron and Kenny (1986)'s causal steps, the results were:

H1a) IQ significantly predicted IU (b=0.49, p < 0.01: Condition 1 was met).

H1b) IQ significantly predicted SAT (b=0.65, p < 0.01: Condition 2 was met).

H1c) IQ and SAT significantly predicted IU (b=0.21, p < 0.01 and b=0.35, p < 0.01: Condition 3 was met).

The three sub-hypotheses were supported. When IU is regressed on both SAT and IQ, the mediator significantly predicts IU, while the predictive utility of the independent variable is reduced from b=0.49 to b=0.35; SAT and IQ together explained 24.1 percent of the variance in IU (significant based on the ANOVA table F(1, 458)=72.67, P<0.01). That is, holding IQ constant, the effect of SAT on IU and the direct effect of IQ on IU were significant.

The Sobel and bootstrap tests supported the mediation. The former estimated the existence of the indirect effect (Z=3.43, P<.001) and the estimated indirect effect of IQ on IU through SAT was 0.13. The latter confirmed an indirect effect between .04 and 0.22 at a 95% confidence level. The indirect effect is significantly different from zero at p < 0.01 (two tailed). The overall conclusion is that SAT mediates the relationship between IQ and IU. Hypothesis 1 is supported.

H2: The effect of SQ on IU is mediated by SAT.

H2a) SQ significantly predicted IU (b=0.41, p < 0.01: Condition 1 was met);

H2b) SQ significantly predicted SAT (b=0.60, p < 0.01: Condition 2 was met);

H2c) Both SQ and SAT significantly predicted IU (b=0.30, p < 0.01 and b=0.23, p < 0.05); the positive relationship between SQ and IU (b=0.41) is smaller after controlling for SAT (b=0.23) with R-square =0.21; condition 3 was met).

The entire Baron and Kenny's criteria for mediation were established and all three sub-hypotheses were supported. Results provided evidence that SAT mediates the effect of SQ on IU. The indirect effect is .18 using the Sobel test (Z =4.88, p < 0.01); the bootstrap estimate is that the indirect effect lies between .10 and 0.26, at 95% confidence level. The indirect effect is significantly different from zero. The overall conclusion is that SAT mediates the relationship between SQ and IU. Hypothesis 2 is supported.

H3: SAT is a mediator in the effect of SI on IU.

H3a) SI significantly predicted IU (b=0.38, p < 0.01: Condition 1 was met);
 H3b) SI significantly predicted SAT (b=0.54, p < 0.01: Condition 2 was met);
 H3c) SAT and SI significantly predicted IU (b=0.35, p < 0.01 and b=0.20, p < 0.01). SI predictive utility fell from b=0.38 to b=0.20. R-square =0.20; condition 3 was met).

All three sub-hypotheses were supported and the three conditions were met. The partial effect of SAT on IU is statistically significant after controlling for SI and the direct effect of SI on IU is statistically significant. The indirect effect is .19 using the Sobel Test (Z=5.85, p < 0.01); the bootstrap estimate is that the indirect effect lies between .11 and 0.26, at 95% confidence level. The indirect effect is significantly different from zero. The overall conclusion is that SAT mediates the relationship between SI and IU. Hypothesis 3 is supported.

H4: SAT is a mediator in the effect of PE on IU.

This hypothesis was not supported, as Perceived Effectiveness was not a construct of the measurement model of this research.

Exploratory Multiple Regression Analysis

Since support for H1 to H3 took into account the effect of one independent variable, multiple regression analysis was performed to explore whether SAT is the significant predictor of IU in the presence multiple independent variables IQ, SQ, PE, SI and to determine the strengths of effect of the independent variables on the dependent variable (identified as H5). The objective was to better understand the mechanism underlining adoption of the e-Government portal.

H5: Together with SAT, the success factor (IQ, SQ, SI) is a good predictor of IU.

The analysis (table 6), shows that SAT (b = .14, p <.05) and IQ (b=0.28, p < 0.01) significantly predict IU while the effects of SQ (b=0.10, p > 0.05) and SI (b=0.10, p > 0.05) became insignificant in the presence of three success factors and SAT.

The suggestion is that the effects of SQ and SI on IU are a complete mediation (becoming zero after controlling for IU), whereas the effect of IQ is a partial mediation (its effect is reduced but different from zero) when the mediator is controlled (Kenny, 2006). IQ is deemed the best predictor due to its higher standardized regression coefficient. That is, when all three success factors were taken into consideration concurrently to predict e-Government portal adoption, only IQ and SAT were significant.

The models explained 25.3% of the variance and the overall model was significant (F (4,455) =38.47, p<.001).

Table 6: Multiple Regression - Using Success Factors to Predict Intention-to-reuse

	Unstandardized Coefficients		Std. Coefficients	t	Sig.	Collinearity Statistics		Statistics
	B	Std. Err.	Beta			Tolerance	VIF	
Constant	1.85	0.16		11.5	0			
SAT	0.14	0.06	0.13	2.17	0.03	0.46	2.19	R Square =0.2527
SQ	0.1	0.06	0.1	1.68	0.09	0.48	2.08	Adjusted R Square =0.2462
SI	0.1	0.05	0.09	1.75	0.08	0.63	1.6	F= 38.47
IQ	0.28	0.06	0.27	4.36	0	0.43	2.3	P<0.01

Dependent Variable: IU

Finally, the multiple regression assumptions of normality, linearity and homoscedasticity and independence of residuals were tested and the integrity of the assumptions is not questioned. Hypothesis 5 is partially support as the exploratory regression analysis found the SAT effect significant in the presence of IQ, SQ and SI; however, the later two became insignificant in the presence of IQ and SAT. IQ, among the success factors, was the most significant predictor of e-Government portal acceptance.

5. Conclusion and Implications

This research tested an integrated model of e-Government satisfaction that incorporated constructs from the technology acceptance model (TAM) and end-user satisfaction (EUS). The model was found to explain a large proportion (63.93%) of the variance in citizen’s IU. Empirical results provided support for the hypothesis that SAT partially mediates the relationship between success factors and IU. IQ, SQ and SI (but not PE) were confirmed as determinants of the adoption of, and satisfaction with the e-Government portal.

This study provides empirically evidence that IQ, SQ and SI are factors influencing potential users’ adoption of an e-government portal. IQ is the most important element of SAT in Macao (research question 1) while SAT is a significant predictor of IU (research question 2), a conclusion, endorsed in the literature (McKinney *et al.* 2002) a. The result suggests that portal satisfaction is a requirement for intention-to-reuse the portal. A ‘good’ portal from a web designer’s eye might not be able to attract users’ adoption. There are three directions to pursuit to

enhance potential users' satisfaction and encourage users' usage. First, IQ was found to be the most significant predictor of SAT and adoption among the three perceptual measures. This is consistent with the findings of Taiwan's electronic tendering systems adoption study that users' overall satisfaction, explained by perceived usefulness and information accuracy, significantly affects their intention to adopt and actual usages (Chu *et al.*, 2004). Given the importance of IQ, attention needs to be on attributes like content relevance, scope and accuracy. An empirically study of e-government in Thailand supports the finding that accuracy, relevance and completeness dimensions are more significant than timeliness (Wangpipatwong *et al.*, 2005).

Second, SQ was found the second important adoption factor, in congruency with the argument that user's IU is related to SAT, perceived performance of the website (in terms of time) and the requirement for confidential information (Rao *et al.*, 2006). Because perceived ease-of-use is a significant predictor of citizens' IU an e-government service, frustration may ensue from difficult navigability and poorly organized information content (Carter & Belanger, 2005).

Third, SI was found to be a significant determinant of SAT and adoption. This result is coherent with other e-government studies. Both Gefen *et al.*, (2002)'s government online tax service study in the USA and Chu *et al.*, (2004)'s government tendering system in Taiwan find that SI is a significant predictor of usage adoption. It is possible that users' perception can be affected by means of SI and eventually influence usage intention.

As for the third research question, when all the variables were included in the regression SQ and SI became insignificant in predicting IU, whereas the effect of IQ was still positive, significant and larger than SAT. This is in line with Shrouf & Bolger (2002)'s claim that one possible explanation for partial mediation is that the independent variable has a specific and direct effect on the dependent variable, in addition to an indirect effect through the mediator. Users' perception of the reliability of the information available in the portal plays a vital role in influencing IU. Overall, the study found that IQ, SQ and SI are significant predictors of SAT, itself a significant predictor of IU.

In terms of theoretical implications, empirical testing of existing measures in ICT adoption and user satisfaction in an Asian e-Government context provide evidence that the determinants of portal satisfaction vary and are dependent on the goal and objectives set for the portal. The findings support the importance of portal design in terms of IQ and SQ, without overlooking the impact of SI as a direct and positive influencer of SAT.

Macao is influenced by Chinese culture and this study is one of the first empirically testing ICT adoption scales and user satisfaction scales in an Asian e-Government portal context. In terms of ICT adoption, it was found that not all measures hold true in Macao. SI, IQ and SQ were found to be a significant predictor of e-Government adoption. But this is not the case of PE. For practitioners, it is suggested that the focus of attention should be extended from system characteristics only (engineering), to take a user perspective into account. Strengthening collaboration and communication with users is central to e-Government portal adoption.

In practical terms, this research found that e-government portal management is not only a technical but also a social political issue. Increased SAT might ensue if the focus is on SI (the construct with the lowest mean score), commonly the subject of oversight in the relevant literature. This agrees with the argument that developing user satisfaction is conducive to effective utilization and acceptance (Malhotra & Galletta, 1999). A web portal is not an ordinary website. It provides an integrated gateway for external constituents and internal government personnel to obtain online information and service delivery (Gant *et al.*, 2002). Hence, strategies and practice must be made to understand users' needs and to improve perceived and effective portal performance.

Given the importance of SI, managerial actions should aim at improving e-Government portal acceptance by individual users and government employees. This might be achieved by combining the development of a support program directed at managing internal resistance to cultural change with a program of integrated marketing communications focused on promoting user awareness of the portal and inherent benefits. In addition, it appears sensible to actively seek citizen input and feedback on how to improve the design of the e-Government portal. Estranged from the development process, potential users may lack in-depth understanding of portal capabilities, with negative implications for portal adoption.

Finally, portal management needs to establish a mechanism that ensures ease-of-use and currency and accuracy of the supplied information (e.g. removal of inconsistent information between web-pages). The findings also indicate that the content an e-government portal that is perceived to be easier to manage is likely to indirectly facilitate citizens' adoption intention and satisfaction. The updating of information in a timely fashion is a major concern for the e-Government portal in Macao.

In terms of the limitations of this study and further research, using the self-selection sampling method has the merit to capture actual users of Macao's e-Government portal, but generalization to Macao's

population may be compromised. Since the research promoted access to target respondents by engaging with four local organizations or community groups (including one higher education institution), the sample may reflect participation by institutional members. This is why 25% of the sample consisted of graduates. Another limitation is that IU is subjective to respondents' statement of their intentions. No objective measures were used. Since data was collected for one only portal over a short period of time, different portals, portals at different stages of development and different time periods may have yielded different responses.

Finally, SPSS was used to examine the relationships between the dependent and independent variables, but this analytical tool does not allow for interrelationships to be estimated simultaneously. The study was able to explain 63.93% of the variance. This might be improved if additional variables suggested in the literature (e.g. compatibility, trust and perceived ease of use) are incorporated into the research model.

References

- Au, N., Ngai, E. W. T. and Cheng, T. C. E. (2002) A critical review of end-user information system satisfaction research and a new research framework, *Omega*, **30**, 6, 451-478.
- Baron, R. and Kenny, D. (1986) The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations, *Journal of personality and social psychology*, **51**, 1173-82.
- Boyer, K., Olson, J., Calantone, R. and Jackson, E. (2002) Print versus electronic surveys: a comparison of two data collection methodologies, *Journal of Operations Management*, **20**, 357-73.
- Carter, L. and Belanger, F. (2005) The utilization of e-government services: citizen trust, innovation and acceptance factors, *Information Systems Journal*, **15**, 1, 5-25.
- Cheong, W. (2007) *Macau Internet Usage Report*, accessed Aug.20, 2007, http://www.rthk.org.hk/mediadigest/20070215_7_6_121332.html.
- China.com.cn (2006) *High Internet Usage Rate Among the Young People in Macau*, accessed Aug 24, 2007, <http://big5.china.com.cn/chinese/TCC/1101125.htm>.
- Chu, P. Hsiao, N., Lee, F. and Chen, C. (2004) Exploring success factors for Taiwan's government electronic tendering system: behavioral perspectives from end users, *Government Information Quarterly*, **21**, 2, 219-34.
- Davis, F. (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quarterly*, **13**, 340-51.
- Davis, F., Bagozzi, R. and Warshaw, P. (1989) User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, *Management Science*, **35**, 8, 982.
- DeLone, W. and McLean, E. (1992) Information Systems Success: The quest for the dependent variable, *Information Systems Research*, **3**, 1, 60-95.
- Doherty, N. and King, M. (2004) The Treatment of Organisational Issues in Systems Development Projects: The Implications for the Evaluation of Information Technology Investments, *Electronic Journal of Information Systems Evaluation*, **4**, 1, 1.
- Doll, W., Raghunathan, T., Jeen-Su, L. and Gupta, Y. (1995) A Confirmatory Factor Analysis of the User Information Satisfaction Instrument, *Information Systems Research*, **6**, 2, 177-88.
- Doll, W. and Torkzadeh, G. (1988) The measurement of end-user computing satisfaction, *MIS Quarterly*, **12**, 2, 259-74.
- Furneaux, B. (2006) *Theories used in IS research : Technology Acceptance Model*, accessed Aug. 6, 2007, <http://www.istheory.yorku.ca/>.
- Gant, J., Gant, D. and Sprague, R. (2002) Web portal functionality and state government e-service, In *Proceedings of the 35th Annual Hawaii International Conference on System Sciences*, Los Alamitos, CA, 1627-36.
- Gefen, D., Warkentin, M., Pavlou, P. and Rose, G. (2002) EGovernment Adoption, In *Proceedings of the 8th Americas Conference on Information Systems*, 569-76.
- Grant, G. and Chau, D. (2004) Developing a Generic Framework for E-Government, *Journal of Global Information Management*, **13**, 1, 1-30.
- Hair, J., Black, W., Babin, B., Anderson, R. and Tatham, R. (2006) *Multivariate data analysis*, Pearson, Upper Saddle River, NJ.
- Ho, A. (2002) Reinventing local governments and the e-government initiative, *Public Administration Review*, **62**, 4, 434-44.
- Hu, P., Chau, P., Liu Sheng, O. and Tam, K. (1999) Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology, *Journal of Management Information Systems*, **16**, 2, 91-112.
- Huizingh, E. (2000) The content and design of web site: an empirical study, *Information and Management*, **27**, 3, 123-34.
- Kenny, D. (2006) *Mediation*, accessed Sep 14, 2007, <http://davidkenny.net/cm/mediate.htm>.
- Lee, C. and Lei, U. (2007) Adoption of eGovernment Services in Macao, In *Proceedings of the 1st International Conference on Theory and Practice of Electronic Governance*, Macao.
- Malhotra, Y. and Galletta, D. (1999) Extending the technology acceptance model to account for social influence: theoretical bases and empirical validation, In *32nd HICSS*, Hawaii, 1-14.
- McKinney, V., Yoon, K. and Zahedi, F. (2002) The measurement of Web-customer satisfaction: An expectation and disconfirmation approach, *Information Systems Research*, **13**, 3, 296-315.
- Moore, G. and Benbasat, I. (1991) Development of an Instrument to Measure the Perceptions of

- Adopting an Information Technology Innovation, *Information Systems Research*, **2**, 3, 192-222.
- Nunnally, J. (1978) *Psychometric Theory*, McGraw-Hill, New York.
- Pikkarainen, K., Pikkarainen, T., Karjaluoto, H. and Pahnla, S. (2006) The measurement of end-user computing satisfaction of online banking services: empirical evidence from Finland, *International Journal of Bank Marketing*, **24**, 3,
- Preacher, K. and Hayes, A. (2004) SPSS and SAS procedures for estimating indirect effects in simple mediation models *Behavior Research Methods, Instruments, & Computers*, **36**, 4, 717-31.
- Rao, H., Chai, S., Herath, T. and Park, I. (2006) Repeated Use of E-Gov Web Sites: A Satisfaction and Confidentiality Perspective, *International Journal of Electronic Government Research*, **2**, 3, 1-22.
- RTHK (2007) *The current status of Internet in Macau (in Chinese)*, accessed Aug. 24,2007, http://www.rthk.org.hk/mediadigest/20070215_7_6_121332.html.
- Schepers, J. and Wetzel, M. (2007) A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects, *Information & Management*, **44**, 1, 90-103.
- Schaupp, L., Fan, W. and Belanger, F. (2006) Determining success for different website goals, In *Proceedings of the 39th Hawaii International Conference on System Sciences (HICSS'06)*, Hawaii, 1-10.
- Seddon, P. B. (1997) A respecification and extension of the DeLone and McLean's model of IS success, *Information Systems Research*, **8**, 3, 240-253.
- Shrout, P. E. and Bolger, N. (2002) Mediation in experimental and nonexperimental studies: new procedures and recommendations, *Psychological methods*, **7**, 4, 422-445.
- Straub, D. W. (1989) Validating Instruments in MIS Research, *MIS Quarterly*, **13**, 2, 147-169.
- Taylor, S. and Todd, P. A. (1995) Understanding Information Technology Usage: A Test of Competing Models, *Information Systems Research*, **6**, 2, 144-176.
- Thomas, S. J. (2004) *Using web and paper questionnaires for data-based decision making - from design to interpretation of the results*, Corwin Press, Thousand Oaks, CA.
- Thompson, R. L. and Higgins, C. A. (1991) Personal computing: Toward a conceptual model of utilization, *MIS Quarterly*, **15**, 1, 125.
- Ticehurst, G. W. and Veal, A. J. (2000) *Business Research Methods - a managerial approach*, Pearson Education, Frenchs Forest, New South Wales.
- Venkatesh, V., Morris, G. and Davis, F. D. (2003) User acceptance of information technology: towards a unified view, *MIS Quarterly*, **27**, 3, 425-478.
- Wang, Y. S., Tang, T. I. and Tang, J. T. E. (2001) An instrument for measuring customer satisfaction toward we sites that market digital products and service, *Journal of Electronic Commerce Research*, **2**, 3, 89-102.
- Wangpipatwong, S., Chutimaskul, W. and Papisratorn, B. (2005) Factors Influencing the Adoption of Thai eGovernment Websites: Information Quality and System Quality Approach, In *Proceedings of the Fourth International Conference on eBusiness*, Bangkok,
- Wixom, B. H. and Todd, P. A. (2005) A theoretical integration of user satisfaction and technology acceptance, *Information Systems Research*, **16**, 1, 85-102.
- World Bank (2002) *The e-Government Handbook for developing countries*, Centre for Democracy & Technology, World Bank, assessed Aug. 2,2006, www.infodev.org

Copyright © 2009 by the International Business Information Management Association (IBIMA). All rights reserved. Authors retain copyright for their manuscripts and provide this journal with a publication permission agreement as a part of IBIMA copyright agreement. IBIMA may not necessarily agree with the content of the manuscript. The content and proofreading of this manuscript as well as and any errors are the sole responsibility of its author(s). No part or all of this work should be copied or reproduced in digital, hard, or any other format for commercial use without written permission. To purchase reprints of this article please e-mail: admin@ibima.org.