Measuring Users' Satisfaction with Malaysia's Electronic Government Systems

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Abstract: The research seeks to measure users' satisfaction and identify the contributors of satisfaction. We used the end-user computing satisfaction (EUCS) model as the a priori model to measure internal end-users' satisfaction with Malaysia's electronic government systems. We gathered data from internal end-users at the level of officers and directors of Malaysia's electronic government systems. Using the structural equation modeling approach, our results show that all five first-order factors, content, accuracy, timeliness, format and ease of use, explain the contributors of satisfaction. Further, our studies provide the evidence that in Malaysia's electronic government context, end-users' satisfaction priorities are timeliness, content and accuracy. This paper makes a significant contribution by applying the Information Systems body of knowledge to measure users' satisfaction with Malaysia's electronic government systems, test and validate the EUCS model in the context of Malaysia's electronic government environment. The paper has enhanced our understanding of users' demands for interactions with business, citizens and other government personnel in the Malaysian electronic government environment.

Keywords: end-user computing satisfaction, structural equation modeling, confirmatory factor analysis, information systems, electronic government systems

1. Introduction

The last two decades has seen much attention given to the adoption of information and communication technology in organisations. In private organisations, the use of information technology has enabled the attainment of cost savings, improved communications and supported alternative channels for distribution and marketing of services that were not previously possible. It has been cited that because private organisations are motivated by the single pursuit of profits, investments in information technology are made on account of achieving strategic business goals (Chircu and Lee, 2003) and creating a competitive advantage (Rocheleau and Wu, 2002). Unlike private organisations, government organisations, however, are pushed and pulled in many directions simultaneously (Farnham and Horton, 1996) and are subject to competing goals (Kamal, 2006). Chircu and Lee (2003) highlighted that government organisations are motivated by the prime pursuit of political mission when allocating investments in information technology. Dufner et al. (2002) reported that government organisations are less concerned with the economic value of information technology investments but place an emphasis on achieving political goals, that is, through collaboration between government entities and improved citizens' access to public services. Kamal (2006) suggested that due to legal and staffing restrictions, government organisations are usually unable to attain efficiencies derived from information technology investments through automation of tasks and a reduction of headcounts; which are made possible in private organisations.

Indeed, understanding the value of information technology investments in organisations is important in that an incomplete or non-existent value assessment can lead to information technology failure (Pardo and Scholl, 2002). Measurement of the benefits reaped from deploying information technologies in organisations has always been a challenge to researchers and practitioners. Accordingly, researchers and practitioners alike have turned to surrogate measures. User satisfaction has been widely cited as a surrogate measure for success and effectiveness (McHaney et al., 1999; DeLone and McLean, 1992; Zviran and Erlich, 2003, Muylle, 2004). In the past, researchers have investigated information, Web site design, fulfilment of users' needs and support provided to end users as contributors to user satisfaction. For instance, Chen et al. (2000) studied users' satisfaction of data warehouse. They concluded that contributors to users' satisfaction include support to end users, information accuracy, format and preciseness as well as fulfilment of users' needs.

Since the 1980s, end-user computing satisfaction (EUCS) is one particular model that has been widely tested and validated in various research settings, that is, on application systems and in several countries such as the United States, Saudi Arabia, Western Europe, Taiwan, Finland, Mexico and Iran (McHaney et al., 1999, 2002; Doll et al., 2004; Heilman and Brusa, 2006; Pikkarainen et al., 2006,

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Deng et al. 2008; Azadeh et al. 2009). EUCS refers to the affective attitude towards a specific computer application of someone who interacts with the application directly (Doll and Torkzadeh, 1988). In the last two decades, end-user computing satisfaction has continuously attracted the attention and sparked the interest of the research community. Doll and Torkzadeh (1988) first hypothesised that the EUCS is a second-order two-factor model with five first-order factors. The proposed model consists of one second-order factor (satisfaction) and five first-order factors (content, accuracy, format, ease of use and timeliness). In 1994, Doll and Xia conducted a confirmatory factor analysis and concluded that the EUCS explained end-user satisfaction.

Subsequently, McHaney et al. (1999) validated the EUCS model for the use of decision support systems in a test-retest study. They used a survey approach involving 342 knowledge-workers in Taiwan. Knowledge-workers refer to those individuals whose primary work-related activities were information-based and required the use of information technology (IT) to complete those activities. The researchers validated the EUCS model and concluded that format, accuracy and ease of use were the top contributors to end-user computing satisfaction.

Xiao and Dasgupta (2002) used the EUCS to measure users' satisfaction of Web-based information systems at a large mid-Atlantic university. The sample comprised full time and part time students from a variety of industries and management levels. They found that with the exception of one item that measured sufficiency of information, the rest of the items in the model were valid.

Abdinnour-Helm et al. (2005) used the EUCS to measure users' satisfaction with a Web site in the United States. The study used students as participants in a lab simulation. They concluded that the EUCS model was valid and robust although the timeliness sub-factor might require further refinement in the future.

Somers et al. (2003) evaluated enterprise resource planning (ERP) packages and reported that content, format and ease of use were the top three contributors of end-user computing satisfaction. They concluded that the EUCS model was valid in predicting satisfaction.

Doll et al. (2004) tested and validated the EUCS model using 1,166 responses across 300 different applications. They concluded with recommendations for the use of a five first-order factor model. They cited that accuracy was more important in user-satisfaction for operating personnel than it was for managerial or professional respondents. Heilman and Brusa (2006) conducted a survey of computer use in Mexico using a Spanish version of the EUCS. They provided evidence that the EUCS model was valid and reliable outside the United States and in a language other than English. Content, format and ease of use were the top three contributors of satisfaction.

In a study measuring users' satisfaction with online banking services in Finland, Pikkarainen et al. (2006) concluded that the contributors of end-user computing satisfaction were only content, ease of use and accuracy. The study adopted a convenient sampling approach where respondents replied to questionnaires that were translated to Finnish. Wang et al. (2007) evaluated group decision support systems among undergraduates in China in an experiment and concluded that the EUCS model was valid and reliable. The top three contributors of end-user computing satisfaction were format, content and accuracy.

Deng et al. (2008) tested the EUCS model across cultures using samples in the United States, Western Europe, Saudi Arabia, India and Taiwan. For all the cultures that they examined, they found that all five factors were equivalent. There were no significant differences for content, format, accuracy and timeliness; however, there was a difference for ease of use. The finding suggests that the meaning of user satisfaction may differ between cultures.

Azadeh et al. (2009) tested the EUCS model in an Iranian power holding company and found that the model was valid and the instrument reliable. They also indicated that the type of information systems did not influence the EUCS model.

Tojib and Ly Fie (2007) developed a scale to measure users' satisfaction of the business to employee portal. They found that the scale comprising usefulness, confidentiality, ease of use, portal design and convenience of access would be appropriate for use in the business to employee portal. They

concluded that the user information satisfaction scale and EUCS scale would not be appropriate for measuring users' satisfaction in the business to employee portal.

Over the years, researchers have reiterated the importance of good measurement through testing and validation (Boudreau et al., 2001; Straub et al., 2002). However, the testing and validation of an EUCS model for electronic government systems by public officers are not apparent. Often, academics have to exercise caution in generalising about the public sector environment, as literature has cited similarities and differences between the public and private sectors (Dufner et al. 2002; Chircu and Lee, 2003; Kamal, 2006; Ward, 2006). In this article, we seek to measure end-user satisfaction in electronic government environment. In doing so, we test and validate the EUCS model in the context of electronic government systems. We hypothesise that EUCS is a valid model consisting of one second-order factor (satisfaction) and five first-order factors (content, accuracy, format, ease of use and timeliness). Further, we hypothesise that in a net-enabled environment, and in particular electronic government, timeliness, content and accuracy of information systems will be the key contributors to end-user satisfaction. We adopted a self-administered survey approach to investigate the validity and reliability of the EUCS model.

2. Research design

Research setting: The research setting for this study is the internal end-users' usage of Malaysia's electronic government systems in public offices. The context of Malaysia's electronic government was selected in recognition of the achievements that Malaysia has made thus far in the economy and in implementation of its national information technology initiatives in the last three decades. Malaysia is a peninsula in Southeastern Asia, bordering Thailand, Indonesia, Brunei, and the South China Sea. It has a total land area of 328,550 sq km. Malaysia is a middle-income country that has transformed itself since the 1970s from a producer of raw materials into an emerging multi-sector economy. Its GDP per capital is estimated at $13,300 in 2007.

The state of information and communication technology in Malaysia has dramatically changed over the years based on the mid-term review of Ninth Malaysia Plan covering the period 2006-2010 as reported by the Prime Minister recently. The government had put an initiative to enhance Malaysia as a multimedia and information and communication technology hub. Malaysia would continue to emphasise on areas of high potential such as shared services and outsourcing, multimedia content development and predictive analysis technology. Through expanding the network, broadband penetration increased from 11.0% per 100 household in 2005 to 15.5% per 100 household in 2007, Internet penetration increased from 7.0% per 100 household in 2005 to 19.3% per 100 household in 2007 and subscription of cellular telephone increased from 74.1 per 100 population in 2005 to 85.1 per 100 population in 2007. Major automation and development of information technology infrastructure to support the Malaysian government operation began in the early 1980s. In 1994, the National Information Technology Council (NITC) was established. The NITC advisory group was chaired by the Prime Minister to drive the use of information and communication technology as a strategic agenda for national development. In the subsequent year, the Malaysian government launched a massive electronic government (or e-government) programme. The programme is part of the Malaysian National Information Technology Agenda (NITA), a strategic framework formulated in 1996 to transform Malaysia into a knowledge-based society.

Under the e-government programme, the Malaysian government introduced seven information systems: Generic Office Environment, Human Resource Management, Project Monitoring, E-*syariah*, E-services, Electronic Labour Exchange and E-procurement (Abdul Karim and Mohd Khalid, 2003). All seven information systems are targeted at supporting the enhancement of quality of services among government offices, citizens and businesses. The Generic Office Environment Information System is an electronic office application. There are three modules in the application: Enterprise-wide Information Management System, Enterprise-wide Communication Management System and Enterprise-wide Collaboration Management System. The Generic Office Environment Information System provides a universal interface for internal public organisations' users to manage, find, retrieve and compose the information they need in their daily work. The ultimate aim of the information system is to support communication and collaboration in work functions across government organisations. The Human Resource Management Information System is a single interface for government personnel to perform human resource management functions. These include strategy formulation and review, resourcing, development, career management, performance management, separation, remuneration, benefits and rewards, employee communication and behaviour management. The

system aims to support a long-term goal of standardising human resource practices in the federal government, state government, statutory bodies and local authority services. Project Monitoring Information System is another electronic government system. The system provides a mechanism for the planning, controlling and monitoring of the Malaysian government's development projects in an integrated manner. The types of projects monitored include electronic government projects, five-year development plan projects and special projects. With a purpose to enhance the Islamic Affairs Department's effectiveness, the Malaysian government launched the E-*syariah*. E-*syariah* is targeted at enabling better monitoring and co-ordination practices of the department's agencies and improving the management of 102 *Syariah* courts. E-*syariah* comprises modules like *Syariah* Court Case Management System, Office Automation System, E-*syariah* portal, *Syarie* Lawyers Registration System and Library Management System. The fifth electronic government system in the list is E-services also known as "The Electronic Delivery of Driver and Vehicle Registration, Licensing and Summons Services, Utility Payments and Ministry of Health Online Information". With E-services, the public can already engage and expect to transact more easily with the government on police summons, Road Transport Department services such as vehicle registration and utility companies on payment of telephone, electricity and water bills via multiple delivery channels. In the long term, E-services will provide citizens with Ministry of Health's information services. Electronic Labour Exchange (acronym: ELX) is the sixth electronic government system in the list. Its purpose is to support the nation's human resources improvement initiatives and to ensure that manpower utilisation is optimised through a systematic matching of job seekers to job vacancies. To-date, this project is already fully rolled-out at the ministry's 105 sites (http://www.msc.com.my/updates/flagships.asp). The final electronic government system in the list is E-procurement. E-procurement encompasses central contract, tender and direct purchase. With E-procurement, suppliers can now obtain tender documents and submit bids online. The prime objective of E-procurement is to ensure the best value for money as well as transparency and accountability in line with established procedures in procurement.

The government appointed a lead agency to drive the implementation of each information system. Each electronic government system was designed to facilitate government internal end-users' interaction with personnel in other government agencies and with businesses and/or citizens. At the time of this study, with the exception of E-*syariah*, all other electronic government systems had already been rolled out, at least in the respective lead government agencies.

Research framework and operationalisation: We used the EUCS model as an a priori model (Figure 1) to measure internal end-users' satisfaction with Malaysia's electronic government systems. The model was selected in view of the fact that it had been tested and validated in several research settings.

We adapted the EUCS instrument for use in Malaysia's electronic government systems. The original EUCS instrument was a synthesis of Ives's (1983) user-information satisfaction. It consists of twelve questions that represent a second-order two-factor model and five first-order factors (content, accuracy, format, ease of use and timeliness). There are four items in content and two items respectively in accuracy, format, ease of use and timeliness in the EUCS measurement. In our study, we issued the internal users with twelve statements on a seven-point Likert scale, where seven represents 'strongly agree' and one represents 'strongly disagree' (see Table 1 for a comparison of the original instrument and ours). The instrument was in the English language. English was retained in view of the fact that it is a second language that is widely spoken in the country. In some institutions of higher learning, English is used as a medium of instruction. In trade, English is often the more preferred language for communication.

Fifteen senior academicians participated in a pre-test. A minor amendment was made to the instrument. Subsequently, we distributed seventy questionnaires to directors and officers at three electronic government agencies in a pilot test. No modification was made to the items after the pilot test.

The study adopted a cross-sectional self-administered survey research approach. The population was all public sector personnel from Malaysia's seven electronic government lead agencies who were internal end-users of E-procurement, E-services, Generic Office Environment, Human Resource Management Information Systems, Project Monitoring Systems and Electronic Labour Exchange. E-*syariah* was omitted from the list as the system was not yet rolled out at the lead agency during the

data collection process. The target respondents for the sampling frame were executive staff who used information systems to support their interaction with citizens, businesses and other government agencies. Website and telephone directories were the source of the sampling frame.

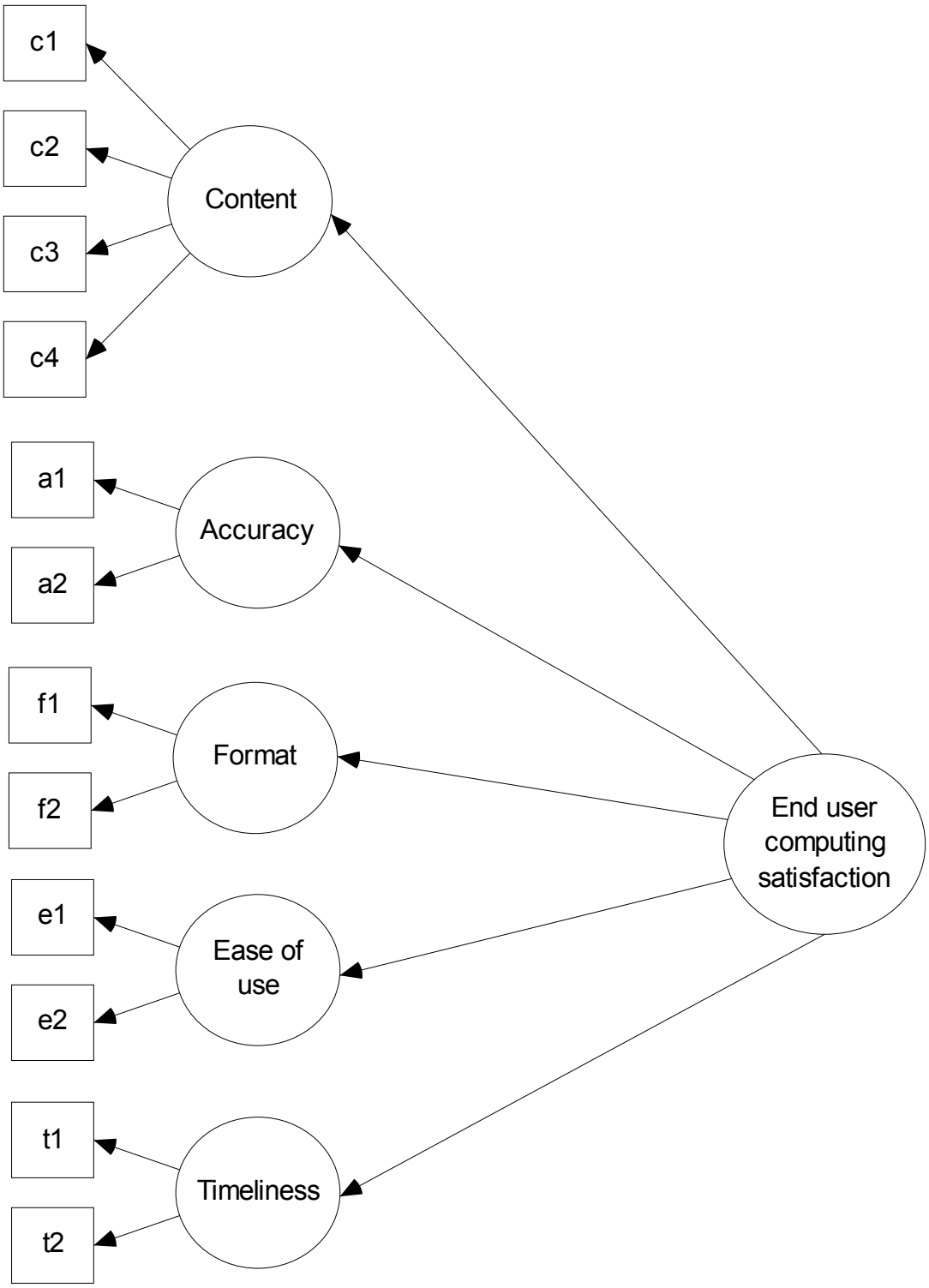

Figure 1: End-user computing model (Doll and Torkzadeh, 1988)

Table 1: Instrument comparison

Item Code	Measures	Original Instrument Items	This Study Items
C1	Content	Does the system provide the precise information you need?	The system provides the precise information I need.
C2		Does the information meet your needs?	The information content meets my needs.
C3		Does the system provide reports that seem to be just about exactly what you need?	The e-government systems provide reports that seem to be just about exactly what I need.
C4		Does the system provide sufficient information?	The e-government systems provide sufficient information.
Item Code	Measures	Original Instrument Items	This Study Items
A1	Accuracy	Is the system accurate?	The e-government system is accurate.
A2		Are you satisfied with the accuracy of the system?	I am satisfied with the accuracy of the system.
F1	Format	Do you think the output is presented in a useful format?	The output is presented in a useful format.
F2		Is the output information clear?	The information is clear.
E1	Ease of use	Is the system user-friendly?	The e-government system is user-friendly.
E2		Is the system easy to use?	The e-government system is easy to use.
T1	Timeliness	Do you get the information you need in time?	I get the information I need in time.
T2		Does the system provide up-to-date information?	The e-government system provides up-to-date information.
Scale:		Five-point Likert-type scale: 1: 'almost never' 2: 'some of the time' 3: 'about half the time' 4: 'most of the time' 5: 'almost always'	Seven-point Likert-type scale: 1: 'Strongly disagree' 7: 'Strongly agree'

We obtained the necessary approvals to conduct the study. Letters from the university faculty were personally delivered to offices of directors of each of the agencies. Meetings with contact personnel were held to explain the goal of the research and to confirm the elements of the sampling frame. A total of 437 questionnaires were distributed to contact personnel.

3. Results

We received 212 questionnaires but only 130 were usable. The usable response rate was 29.7%, a rate consistent with many information systems studies. Reasons for non-usable responses were: officers did not yet use the systems as their operational unit had just been established and no access to systems was available during the data collection process; officers were not at the office during the period of data collection; and officers had recently been transferred to another agency.

We used SPSS Version 13 to generate simple statistics. A *t*-test was conducted to check for non-response bias and there were no significant differences. *T*-tests were also conducted to check for differences in end-users' gender and two groups of education level. There were no significant differences in gender and education level. A one-way ANOVA was performed for end-users' ages. Three groups were identified: (1) below twenty-nine years old (2) between thirty and thirty-nine years old and (3) more than forty years old. The analysis of variance revealed non-significant differences among these age groups.

The majority of the respondents were at least thirty years of age. In terms of education level, 76.9% had at least a Bachelor's degree. A high proportion occupied management and technical positions. The high proportion of respondents with college education and occupying management and technical positions further testified that they would be able to perform the evaluation.

We also analysed the descriptive statistics of the measurement. We found that the mean values for each item were well above 4.0, indicating that internal end-users in the electronic government environment rated the electronic government systems favourably.

We conducted reliability analysis. The internal consistency measures of Cronbach's alphas for each factor were: content=0.905; accuracy=0.888; format=0.789; ease of use=0.882; and timeliness=0.828. Reliability for the overall 12-item instrument was 0.947, which compares favourably with an overall alpha of 0.90 achieved by McHaney et al. (2002) and 0.92 in the original Doll and Torkzadeh (1988) study. Individual item-total correlations are all significant, ranging from a low of 0.370 to a high of 0.871.
We used AMOS Version 5.0 to estimate the confirmatory and structural equation model. The a priori factor structure in Figure 1 was tested.

Convergent validity is established if the loadings of the measures to their respective constructs are at least 0.60 (Bagozzi and Yi, 1988). All of the twelve items had loadings of at least 0.767 or higher and were statistically significant ($t > |2.00|$), suggesting good construct validity similar to that of previous studies (Table 2). The proportion of the variance (R-square) in the observed variables that was accounted for by its latent variables ranged from 0.452 to 0.903, providing evidence of acceptable reliability for all individual items.

Table 2: Standardised parameter estimates

ItemCode	Factor loading	R-square (reliability)
C1	0.90	0.452
C2	0.80	0.638
C3	0.95	0.903
C4	0.92	0.845
A1	0.89	0.790
A2	0.89	0.795
F1	0.77	0.588
F2	0.85	0.785
E1	0.90	0.808
E2	0.89	0.785
T1	0.83	0.686
T2	0.85	0.716

Table 3 presents the goodness-of-fit indices for this study and compares them with the values reported in previous studies. The absolute indices (GFI=0.92, AGFI=0.861, RMSR=0.048) compare favourably with earlier studies (McHaney et al., 1999, 2002; Somers et al., 2003; Heilman and Brusa, 2006). Other indices (CFI=0.98, RMSEA=0.068) also compare favourably with those obtained by Abdinnour-Helm et al. (2005). This study has shown that the five factors, i.e. content, accuracy, format, ease of use and timeliness explain the EUCS model. In other words, the research provides further support for the five first-order factors and one second-order factor, i.e. the EUCS model.

Table 3: Goodness-of-fit indices

	Recommended value	This study	Wang et al. (2007)	Pikkarainen et al. (2006)	Heilman and Brusa (2006)	Abdinnour-Helm et al. (2003)	Doll et al. (2004) (all cases only)	Somers et al. (2003)	McHaney et al. (2002)	McHaney et al. (1999)	Doll and Xia (1994)
Chi-square (d.f.)	-	72.09 (45)	74.38	30.09	153.99	61.08 (48)	377 (49)	385.33 (49)	115.6 (44)	145.15 (44)	185.81 (50)
	Recommended value	This study	Wang et al. (2007)	Pikkarainen et al. (2006)	Heilman and Brusa (2006)	Abdinnour-Helm et al. (2003)	Doll et al. (2004) (all cases only)	Somers et al. (2003)	McHaney et al. (2002)	McHaney et al. (1999)	Doll and Xia (1994)
Chi-square/d.f.	2<Value<5	1.602	1.907	1.368	3.14	1.27	7.69	7.86	2.62	3.30	3.72
Comparative fit index (CFI)	>0.90	0.98	0.97	0.98	0.97	0.99	0.96	n.r.	n.r.	n.r.	n.r.
Normed fit index (NFI)	>0.90	0.949	n.r.	0.90	0.95	n.r.	n.r	0.88	0.98	0.899	0.94

Goodness-of-fit index (GFI)	>0.90	0.920	n.r.	0.97	0.91	n.r.	n.r	0.87	0.98	0.866	0.929
Adjusted goodness-of-fit index (AGFI)	>0.90	0.861	n.r.	n.r.	0.85	n.r.	n.r	0.80	0.91	0.762	0.889
Root mean square residual (RMSR)	<0.05	0.048	n.r.	n.r.	n.r.	n.r.	n.r	0.034	0.04	0.051	0.035
Root mean square error of approximation (RMSEA)	<0.08	0.068	0.077	0.044	n.r.	0.04	0.076	n.r.	n.r.	n.r.	n.r.

d.f.: degree of freedom; n.r.: not reported

Table 4 shows structural coefficients and R-square values for the latent variables. The structural coefficients for this study are significant, ranging from ease of use 0.638 to timeliness 0.957. The values are encouraging in comparison with those of Wang et al. (2007), which ranged from 0.62 for ease of use to 0.93 for format, and those of Pikkarainen et al. (2006), which obtained 0.71 for accuracy and 0.81 for content.

R-square values range from ease of use 0.407 to timeliness 0.916. These values are in a similar range to those of McHaney et al. (1999), whose range was from 0.40 for ease of use to 0.91 for content. The top three contributors of end-user computing satisfaction for this study and previous studies are highlighted in bold.

4. Discussion and conclusion

Since the 1980s, there has been tremendous interest in, and enthusiasm for, end-user computing satisfaction research worldwide. Researchers have tested and validated the EUCS model in many countries and in different settings. Research findings have varied in different study contexts (Doll and Xia, 1994; McHaney et al., 1999, 2002; Somers et al., 2003; Doll et al., 2004; Abdinnour-Helm et al., 2005; Heilman and Brusa, 2006; Pikkarainen et al., 2006; Wang et al., 2007; Azadeh et al. 2009). Except for the online banking environment, all five first-order factors have consistently explained the contributors of end-users' satisfaction. In ERP, computer use and online banking environments, content dominated as the top contributor and key priority for end-user satisfaction.

Table 4: Structural coefficients and construct reliability

	This study		Wang et al. (2007)		Pikkarainen et al. (2006)		Heilman and Brusa (2006)		Doll et al. (2004) (all cases only)		Somers et al. (2003)		McHaney et al. (2002)		McHaney et al. (1999)		Doll and Xia (1994)	
	β	*R*-square	β	*R*-square	β	*R*-square	β	*R*-square	β	*R*-square	β	*R*-square	β	*R*-square	β	*R*-square	β	*R*-square
Content	**0.939**	**0.882**	**0.83**	n.r.	**0.81**	n.r.	**0.897**	n.r.	**0.78**	**0.85**	**0.972**	**0.95**	0.74	0.55	**0.955**	**0.91**	**0.912**	**0.68**
Accuracy	**0.914**	**0.835**	**0.82**	n.r.	**0.71**	n.r.	0.85	n.r.	0.59	0.56	0.784	0.62	**0.80**	**0.64**	**0.77**	**0.59**	0.822	0.73
Format	0.899	0.809	**0.93**	n.r.	-	n.r.	**0.874**	n.r.	**0.68**	**0.86**	**0.938**	**0.88**	**0.90**	**0.80**	**0.855**	**0.73**	**0.993**	**0.53**
Ease of use	0.638	0.407	0.62	n.r.	**0.73**	n.r.	**0.852**	n.r.	**0.75**	**0.52**	**0.869**	**0.76**	**0.78**	**0.62**	0.629	0.40	0.719	0.68
Timeliness	**0.957**	**0.916**	0.76	n.r.	-	n.r.	0.85	n.r.	0.69	0.76	0.842	0.71	0.72	0.52	0.712	0.51	**0.883**	**0.76**

(β): Standard structural coefficients, (*R*-square): Construct reliability

n.r.: not reported

-: is not a contributor of end-user computing satisfaction

Researchers have also shown that EUCS varied across cultures and may mean differently from one group to another group (Doll et al. 2004; Deng et al. 2008). We began by measuring end-user satisfaction. We hypothesised that EUCS is a valid model consisting of one second-order factor (satisfaction) and five first-order factors (content, accuracy, format, ease of use and timeliness). Further, we hypothesised that in a net-enabled environment, and in particular electronic government, timeliness, content and accuracy of information systems will be the key contributors to end-user satisfaction. We used a self-administered survey approach to measure user satisfaction and test our hypothesis in an electronic government environment. We have chosen the electronic government

context because researchers in the past have argued that there were differences between the public and private environments. We have selected Malaysia as the context of our study because of its geographical location and its position as an emerging economy that continues to attract foreign investors. Contrary to some past studies that showed differences, our results demonstrate that in the Malaysian electronic government systems context, the EUCS is a valid and reliable model consisting of one second-order factor (satisfaction) and five first-order factors (content, accuracy, format, ease of use and timeliness). Unlike past studies, our findings show that ***timeliness*** emerged as the top contributor for end-user satisfaction. Timeliness in the instrument indicates the internal users' ability to access and receive up-to-date electronic government system information in a speedy fashion. This information is used to serve other government personnel, citizens, businesses and the general public on inquiries and/or on demanded services. In a net-enabled and wired environment, these stakeholders are now highly accustomed to accessing and receiving information immediately. Likewise, they would expect government officers to fulfil their requests in a manner that could match the speed of the information that they now have. This suggests that in a net-enabled environment, internal end-users derive satisfaction from having the ability to access and receive information speedily from the electronic government systems as they strive to provide quality services to other government agencies, citizens and businesses alike and to match these expectations.

Trailing behind timeliness are content, accuracy and format, respectively. These aspects cover information that is sufficient, meeting the users' needs, precise, accurate, useful and clear from the users' perspective. In a net-enabled environment, government officers have become dependent on systems to support them in fulfilment of stakeholders' expectations. These officers need to be credible in their dealings and demonstrate transparency and accountability. Internal users will not be effective in their dealings if the electronic government systems lack these critical aspects of information. The results suggest that besides timeliness, content, accuracy and format of information are essential factors for internal end-users' satisfaction in facilitating their interactions with others in the electronic government environment. Ease of use may not be as key a priority in comparison with timeliness in the electronic government environment.

Achieving the desired service level requires seamless capability and interoperability between government and citizens/businesses as well as between government agencies that is facilitated by integration of application systems. Klischeski and Scholl (2006) suggested the need for a further understanding in information quality towards integration and interoperability in electronic government. Gulledge (2006) stated that there are several strategies for integration of systems: point-to-point, database-to-database, data warehouse, enterprise application integration and application server integration. One of the service level areas is consistent uptime of electronic government systems to enable critical information to reach its destination (citizen, businesses and other government agencies) online and in real time. This requires commitment in terms of fulfiling service quality from technical functions in government agencies. The same goes for information technology (IT) outsourcers for government agencies. Both functional and technical support personnel in government operations must strive to ensure only relevant and accurate information remains on the system and it must be consistently updated and be readily available in information systems for users in electronic environments. The importance of content in an electronic environment cannot be overstated (Whitson and Davis, 2001). Government agencies could emulate the private sector in managing content. Effective content management should fulfil the needs of all stakeholders. It has been suggested that three views be adopted for proper content management (Tyrva¨inen, 2006). Information view is concerned with the semantics of the content, how the content is represented and how it is made accessible to users (Tyrva¨inen, 2006). User view refers to the relationship between content and users, including both users creating and maintaining content and users reading and using the content (Tyrva¨inen, 2006). System view covers various systems in which the content resides, the systems that are made accessible to the users and the granularity of content used for processing and storage (Tyrva¨inen, 2006).

In terms of theoretical contribution, our paper has demonstrated the relevance of application of the Information Systems body of knowledge in the electronic government context. We have shown that the EUCS model is valid and its measures are reliable for internal end-users of Malaysian electronic government systems. The factors in the model, i.e. timeliness, content, accuracy, format and ease of use, have contributed to users' satisfaction. Further, we have identified timeliness, content and accuracy as the top three most important contributors and the priorities of users of Malaysia's electronic government systems. The study has presented an analysis of the factors in the model and

compared them with those of previous research in other study contexts. The paper has provided the empirical support for previous studies in EUCS and enhanced our understanding of users' demands for interactions with business, citizens and other government personnel in the electronic government environment. Further, with regards to end-user computing satisfaction, the findings of this research support previous suggestions made by Dufner et al. (2002), Chircu and Lee (2003), Kamal (2006) and Ward (2006) that there are similarities and differences between the public and private sectors. In terms of practical contribution, there is evidence to support public officers' use of the model in Malaysia's electronic government context in the English language whose native language is not English.

We acknowledge three limitations of the study. Firstly, the sample size was 130. With a larger sample size, we would have been able to conduct a comparison of the different electronic government systems, respondent positions, language used and agencies. Secondly, the perspective of the research was that of public officers in Malaysia's electronic government environment. Thirdly, our study had considered only end-users from lead agencies in the electronic government environment. Most of these end-users were themselves responsible for driving the electronic government implementation in respective lead agencies. Although the respondents' participation in the research was voluntary, their evaluations of the electronic government systems could have been motivated by their own personal needs to demonstrate to themselves, their superiors or other agencies that they had delivered positive results. The government had allocated huge amount of investments in these projects when they first started and the expectations for these personnel to have success in the projects to commensurate with the reputation accorded as lead agencies were indeed high. This research has raised an important question: "Could the results have been different in other electronic government agencies (that are not designated as lead agencies) or with other respondents' characteristics?" Future studies should look at the perspectives of citizens and businesses, other government agencies, state governments and local municipalities.

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