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Assessing eGovernment systems success: A validation of the DeLone and McLean model of information systems success

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Abstract

With the proliferation of the Internet and World Wide Web applications, people are increasingly interacting with government to citizen (G2C) eGovernment systems. It is therefore important to measure the success of G2C eGovernment systems from the citizen's perspective. While general information systems (IS) success models have received much attention from researchers, few studies have been conducted to assess the success of eGovernment systems. The extent to which traditional IS success models can be extended to investigating eGovernment systems success remains unclear. This study provides the first empirical test of an adaptation of DeLone and McLean's IS success model in the context of G2C eGovernment. The model consists of six dimensions: information quality, system quality, service quality, use, user satisfaction, and perceived net benefit. Structural equation modeling techniques are applied to data collected by questionnaire from 119 users of G2C eGovernment systems in Taiwan. Except for the link from system quality to use, the hypothesized relationships between the six success variables are significantly or marginally supported by the data. The findings provide several important implications for eGovernment research and practice. This paper concludes by discussing limitations of the study which should be addressed in future research.

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Keywords: Electronic government (eGovernment); IS success; DeLone and McLean

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1. Introduction

Since the late 1990s, governments at all levels have launched electronic government (eGovernment) projects aimed at providing electronic information and services to citizens and businesses (Torres, Pina, & Acerete, 2005). Many governments have realized the importance of using information and communication technologies (ICT) to provide efficient and transparent government (Prattipati, 2003). Government agencies around the world have embraced the digital revolution and placed a wide range of materials on the Web including publications, databases, and actual online government services (West, 2002). eGovernment can be broadly defined as a government's use of ICT, particularly Web-based Internet applications, to enhance the access to and delivery of government information and service to citizens, business partners, employees, and other agencies and entities. The construction and management of eGovernment systems are becoming an essential element of modern public administration (Torres et al., 2005). In order to ensure eGovernment success, it is important to assess the effectiveness of eGovernment, and to take necessary action based on these assessments (Gupta & Jana, 2003). However, little is known about the success and effectiveness of public Web site systems (Torres et al., 2005).

There are three general types of eGovernment systems and services: government to government (G2G), government to citizen (G2C), and government to business (G2B). Though eGovernment has clear benefits for both businesses and governments, citizens actually receive the widest array of benefits from eGovernment (Jaeger, 2003). Thus, the focus of this study is on G2C systems. As Larsen and Rainie (2002) suggest, typical G2C services include information for research, government forms and services, public policy information, employment and business opportunities, voting information, tax filing (e.g., Wang, 2003), license registration or renewal, payment of fines, and submission of comments to government officials. As the key to making G2C eGovernment work successfully does not depend on the technology but the citizens (Akman, Ali, Mishra, & Arifoglu, 2005), this study focuses on the measures of G2C eGovernment systems success from the citizen's perspective.

In recent years, many citizens have demanded more and better services through the Internet. As governments develop systems to deliver these services, there is a need for evaluation efforts that, among other things, assess the effectiveness of their eGovernment systems. Such evaluation efforts can enable government agencies to ascertain whether they are capable of doing the required task and delivering services as expected (Gupta & Jana, 2003). For Web-based applications to be effective in the eGovernment environment, there is a need to develop and better understand the factors which best measure the success of eGovernment systems. This has also created an increased need for dependable ways to measure the success of an eGovernment system. However, eGovernment systems success is a complex concept, and its measurement is expected to be multi-dimensional in nature.

The measurement of information systems (IS) success or effectiveness has been widely investigated throughout the IS research community. Theorists, however, are still grappling with the question of which constructs best measure IS success (Rai, Lang, & Welker, 2002). DeLone and McLean (1992) comprehensively reviewed the different IS success measures and proposed a six-factor IS success model as a taxonomy and framework for measuring the

complex-dependent variables in IS research. The categories in this taxonomy are (1) system quality, (2) information quality, (3) use, (4) user satisfaction, (5) individual impact, and (6) organizational impact. Recently, DeLone and McLean (2003) discussed many of the important IS research efforts that have applied, validated, challenged, and proposed enhancements to their original model, and then proposed an updated DeLone and McLean IS success model, which depicts the relationship between system quality, information quality, service quality, use, user satisfaction, and net benefit. DeLone and McLean do not provide an empirical validation of the updated model, and suggest that further development and validation are needed. Actually, the G2C eGovernment service process fits nicely into the DeLone and McLean updated IS success model and its six success dimensions. However, continued research is needed to investigate and test a comprehensive model of eGovernment systems success based on the DeLone and McLean model.

While IS success models have received much attention among researchers, little research has been conducted to assess the success of eGovernment systems. There is a need to investigate whether traditional information systems success models can be extended to investigating eGovernment systems success. Hence, the main purpose of this study is to develop and validate a multidimensional G2C eGovernment systems success model based on the DeLone and McLean (2003) IS success model. This paper is structured as follows. First, we review the development of IS success models. Second, based on prior studies, an eGovernment systems success model and a comprehensive set of hypotheses are proposed. Third, the methods, measures, and results of the study are presented. And, finally, theoretical and managerial implications and directions for future research are discussed. The validated eGovernment systems success model can serve as a foundation for positioning and comparing eGovernment success research, and can provide eGovernment managers with a useful framework for evaluating eGovernment systems success.

2. IS success models

DeLone and McLean (1992) comprehensively reviewed IS success measures and concluded with a model of interrelationships between six IS success variable categories: (1) system quality, (2) information quality, (3) IS use, (4) user satisfaction, (5) individual impact, and (6) organization impact (see Fig. 1). This model makes two important contributions to the understanding of IS success. First, it provides a scheme for categorizing the multitude of IS success measures which have been used in the research literature. Second, it suggests a model of temporal and causal interdependencies between the categories (McGill, Hobbs, & Klobas, 2003; Seddon, 1997). Since 1992, a number of studies have undertaken empirical investigations of the multidimensional relationships among the measures of IS success (e.g., Etezadi-Amoli and Farhoomand, 1996; Goodhue and Thompson, 1995; Guimaraes and Igbaria, 1997; Igbaria and Tan, 1997; Jurison, 1996; Li, 1997; Rai et al., 2002; Saarinen, 1996; Seddon and Kiew, 1994). Seddon and Kiew (1994) tested part of the DeLone and McLean (1992) model using a structural equation model. They replaced “use” with “usefulness” and

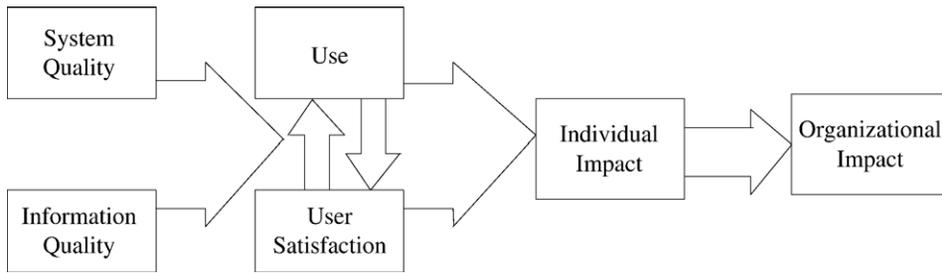


Fig. 1. DeLone and McLean's (1992) model.

added a new variable called “user involvement,” and their results partially supported the DeLone and McLean (1992) model.

Based on the DeLone and McLean (1992) model, Seddon (1997) proposed an alternative model that focuses on the causal (variance) aspects of the interrelationships among the taxonomic categories, and separates the variance model of IS success from the variance model of behavior that occurs as a result of IS success. Seddon's IS success model includes three classes of variables: (1) measures of information and system quality, (2) general perceptual measures of net benefits of IS use (i.e., perceived usefulness and user satisfaction), and (3) other measures of net benefits of IS use. To adapt his model to both volitional and non-volitional usage contexts, Seddon (1997) also claimed that IS use is a behavior rather than a success measure, and replaced DeLone and McLean's IS “use” with “perceived usefulness” which serves as a general perceptual measure of net benefits of IS use. Rai et al. (2002) empirically and theoretically assessed the DeLone and McLean (1992) and Seddon (1997) models of IS success in a quasi-voluntary IS use context, and found that both the models exhibited reasonable fit with the collected data.

DeLone and McLean (2003) propose an updated IS success model (see Fig. 2) and evaluate its usefulness in light of the dramatic changes in IS practice, especially the advent and explosive growth of eCommerce. They agree with Seddon's premise that the combination of variance and process explanations of IS success in one model can be confusing, but argue that Seddon's reformulation of the DeLone and McLean (1992) model into two partial variance models unduly complicates the success model, and defeats the intent of the original model. Based on prior studies, DeLone and McLean (2003) propose an updated model of IS success by adding a “service quality” measure as a new dimension of the IS success model, and by grouping all the “impact” measures into a single impact or benefit category called “net benefit.”

Although some researchers claim that service quality is merely a subset of the model's systems quality, the changes in the role of IS over the last decade argue for a separate variable called the “service quality” dimension (DeLone & McLean, 2003). On the other hand, while researchers have suggested several IS impact measures, such as individual impacts (DeLone & McLean, 1992; Torkzadeh & Doll, 1999), work group impacts (Myers, Kappelman, & Prybutok, 1998), organizational impacts (DeLone & McLean, 1992; Mahmood & Mann, 1993), interorganizational impacts (Clemons & Row, 1993), consumer impacts (Brynjolfsson, 1996), and societal impacts (Seddon, 1997), DeLone and McLean (2003) move in the opposite

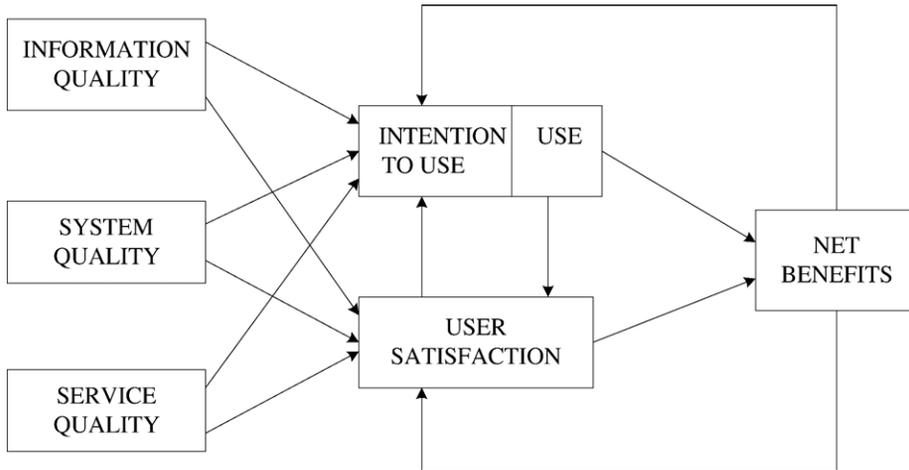


Fig. 2. DeLone and McLean's (2003) updated IS success model.

direction and group all of the impact measures into a single net benefits variable, to avoid complicating the model with more success measures. Given that system usage continues to be used as a dependent variable in a number of empirical studies (Gelderman, 1998; Goodhue & Thompson, 1995; Guimaraes & Igarria, 1997; Igarria & Tan, 1997; Igarria, Zinatelli, Gragg, & Cavaye, 1997; Rai et al., 2002; Taylor & Todd, 1995; Yuthas & Young, 1998), and takes on a new importance in Internet-based system success measurements, where system use is voluntary, “system usage” and the alternative “intention to use” are still considered as important measures of IS success in the updated DeLone and McLean model. Within the G2C eGovernment context, citizens use an Internet-based application to search information and conduct transactions (e.g., tax filing and payment of fines). This Internet-based application is an IS phenomenon that lends itself to being studied using the updated IS success model. DeLone and McLean (2003) also suggest that further development, challenge, and validation of their model are needed. Thus, we assume that the updated IS success model can be adapted to the system success measurement in the G2C eGovernment context.

3. Research model and hypotheses

In accordance with DeLone and McLean (2003), this study proposes a comprehensive, multidimensional model of eGovernment systems success (see Fig. 3), which suggests that information quality, system quality, service quality, use, user satisfaction, and perceived net benefit are success variables in eGovernment systems. As mentioned earlier, system usage continues to be used as an IS success variable in a number of empirical studies and continues to be developed and tested by IS researchers (Compeau & Higgins, 1995; Doll & Torkzadeh, 1998; Downing, 1999; Gelderman, 1998; Goodhue & Thompson, 1995; Igarria & Tan, 1997; Igarria et al., 1997; Liu & Arnett, 2000; McGill et al., 2003; Molla & Licker, 2001; Rai et al.,

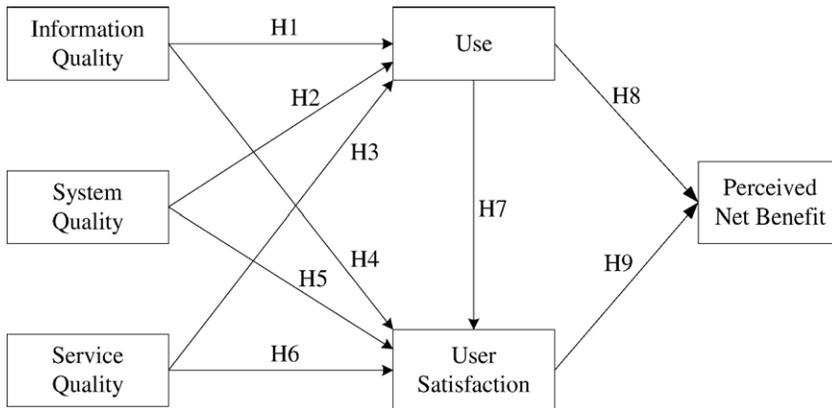


Fig. 3. Research model.

2002; Taylor & Todd, 1995). DeLone and McLean (2003) contend that use and intention to use are alternatives in their model, and that intention to use may be a more acceptable variable in the context of mandatory usage. However, citizens' use of G2C systems is entirely voluntary, and system use is an actual behavior which has been considered as the variable closer in meaning to success than behavioral intention to use. Thus, this study adopts use instead of intention to use as an eGovernment systems success measure.

Most researchers agree with DeLone and McLean's (2003) suggestion that service quality, properly measured, deserves to be included along with system quality and information quality as a component of IS success. Seddon (1997) and DeLone and McLean (2003) have also come to a compromise on the use of net benefit as an IS success measure. However, "the challenge for the researcher is to define clearly and carefully the stakeholders and context in which net benefit are to be measured" (DeLone & McLean, 2003, p. 23). Different stakeholders may have different opinions as to what constitutes a benefit to them (Seddon, Staples, Patnayakuni, & Bowtell, 1999). Since the focus of this study is on the measurement of G2C systems success from the perspective of citizens, net benefit in this study refers to the citizen-perceived net benefit evaluation of a specific G2C system. Citizens and taxpayers may feel that they are not getting benefit for their money, and would like this benefit to be reflected in terms of cost and/or time savings and better eGovernment systems performance. Thus, "perceived net benefit" appears to be an important success measure of G2C systems.

The hypothesized relationship between use, user satisfaction, and the three quality variables is based on the theoretical and empirical work reported by DeLone and McLean (2003). As they suggest, use and user satisfaction are closely interrelated. Positive experience with "use" will lead to greater "user satisfaction" in the DeLone and McLean model; and because of usage and user satisfaction, a certain net benefit will occur. DeLone and McLean also assume that the positive (or negative) net benefit from the perspective of the stakeholder of the system will influence and reinforce (or decrease) the subsequent use and user satisfaction. To avoid model complexity and to reflect the cross-sectional nature of this study, the feedback links from net benefit to both use and user satisfaction were excluded.

As DeLone and McLean (2003) note, IS success is a multidimensional and interdependent construct and it is therefore necessary to study the interrelationships among, or to control for, those dimensions. Also, the success model needs further development and validation before it could serve as a basis for the selection of appropriate IS measures. Thus, the following nine hypotheses were tested:

- H1.** Information quality will positively affect use in the G2C eGovernment context.
- H2.** System quality will positively affect use in the G2C eGovernment context.
- H3.** Service quality will positively affect use in the G2C eGovernment context.
- H4.** Information quality will positively affect user satisfaction in the G2C eGovernment context.
- H5.** System quality will positively affect user satisfaction in the G2C eGovernment context.
- H6.** Service quality will positively affect user satisfaction in the G2C eGovernment context.
- H7.** Use will positively affect user satisfaction in the G2C eGovernment context.
- H8.** Use will positively affect perceived net benefit in the G2C eGovernment context.
- H9.** User satisfaction will positively affect perceived net benefit in the G2C eGovernment context.

4. Research design and method

4.1. Measures of the constructs

To ensure the content validity of the scales used in the study, the items selected for the constructs should represent the concepts about which generalizations are to be made. Hence the items selected for the constructs in this study were mainly adapted from prior studies to ensure content validity. Two items, selected from Doll and Torkzadeh's (1988) ease-of-use scale and adapted to specify the G2C eGovernment system, were used in this study to measure system quality. Three items for the information quality construct were adapted from Doll and Torkzadeh (1988) to capture the two attributes of information quality of a G2C system: content and timeliness. Three items, selected from Wang and Tang's (2003) EC-SERVQUAL scale, were used to measure the service quality construct. Use was measured by a two-item measure adapted from previous studies (Heo & Han, 2003; Rai et al., 2002). Traditionally, user satisfaction has been measured indirectly through information quality, system quality, service quality, and other variables (cf. Bailey and Pearson, 1983; Doll and Torkzadeh, 1988; Doll, Xia, & Torkzadeh, 1994; Ives, Olson, & Baroudi, 1983; Kettinger and Lee, 1994; Rai et al., 2002). However, the concept of eGovernment systems success has been adapted, based on the DeLone and McLean (2003) model of IS success, to develop a causal relationship between the indirect measures of user satisfaction (i.e., system quality, information quality, and service quality) and the overall level of user satisfaction. Thus, the items to measure user satisfaction were taken from

previous measures of overall level of user satisfaction or Web customer satisfaction (e.g., Doll & Torkzadeh, 1988; Palvia, 1996; Rai et al., 2002; Wang, Tang, & Tang, 2001). Perceived net benefit was assessed by two-item measures adapted from Etezadi-Amoli and Farhoomand's (1996) user performance scale. Each item was adapted to specifically reference eGovernment systems. Likert scales (1–7), with anchors ranging from “strongly disagree” to “strongly agree,” were used for all questions. After the pretesting of the measures, these items were modified to fit the eGovernment context studied. Appendix A lists the items used in this study.

4.2. Data collection procedure

The data used to test the research model were obtained from a sample of experienced users of various G2C eGovernment applications. To increase the generalizability of the results, the respondents were spread across six popular G2C systems in Taiwan: Taiwan Railways (www.railway.gov.tw), an electronic motor vehicle and driver IS (www.mvdis.gov.tw), tax filing (tax.nat.gov.tw), a virtual employment services center (www.ejob.gov.tw), an eGovernment portal (www.gov.tw), and a tourism bureau (www.taiwan.net.tw). Respondents were first asked whether they had ever used the abovementioned eGovernment systems, and if they replied in the affirmative, they were asked to participate in the survey. The questionnaire requested the respondents to relate the last time they had used the eGovernment system and to answer the remaining questions accordingly. That is, respondents were asked to write down the name of the last eGovernment system they had used. The respondents were then instructed in the questionnaire to answer the questions by assessing the system. For each question, respondents were asked to circle the response which best described their level of agreement. A total of 119 usable responses were obtained. Approximately, 58% of the respondents were male. Detailed descriptive statistics relating to the respondents' characteristics are shown in Table 1.

5. Results

5.1. Measurement model

A first-order confirmatory factor analysis using LISREL 8.3 was conducted to test the measurement model. The similarity between the original and the model-reproduced covariance matrix is referred to as the fit of the model. Seven common model-fit measures were used to assess the model's overall goodness of fit: the ratio of χ^2 to degrees-of-freedom (df), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normalized fit index (NFI), comparative fit index (CFI), root mean square residual (RMSR), and root mean square error of approximation (RMSEA). As shown in Table 2, all the model-fit indices exceeded their respective common acceptance levels suggested by previous research, thus demonstrating that the measurement model exhibited a fairly good fit with the data collected ($\chi^2=90.28$ with $df=62$, GFI=0.91, AGFI=0.84, NFI=0.92, CFI=0.97, RMSR=0.085, RMSEA=0.062).

Table 1
Characteristics of the respondents

Characteristic	Number	Percentage
Gender		
Female	50	42.0
Male	69	58.0
Age		
<20	6	5.0
21–30	91	76.5
31–40	19	16.0
41–50	2	1.7
>51	1	0.8
Education		
High school	4	3.4
Undergraduate	57	47.9
Graduate	58	48.7
Industry		
Student	49	41.2
Manufacturing	17	14.3
Service	31	26.1
Government agencies	6	5.0
Education and research	16	13.4
G2C system used		
Taiwan railway (www.railway.gov.tw)	39	32.8
Electronic motor vehicle and driver IS (www.mvdis.gov.tw)	15	12.6
Tax filing (tax.nat.gov.tw)	27	22.7
Virtual employment services center (www.ejob.gov.tw)	21	17.6
eGovernment portal (www.gov.tw)	9	7.6
Tourism bureau (www.taiwan.net.tw)	8	6.7

Therefore, we could proceed to evaluate the psychometric properties of the measurement model in terms of reliability, convergent validity, and discriminant validity.

The reliability and convergent validity of the factors were estimated by the composite reliability and average variance extracted (see Table 3). The composite reliabilities can be calculated as follows: (square of the summation of the factor loadings)/{(square of the

Table 2
Fit indices for measurement and structural models

Fit indices	Recommended value	Measurement model	Structural model
χ^2/df	≤ 3.00	1.46	1.43
GFI	≥ 0.90	0.91	0.91
AGFI	≥ 0.80	0.84	0.85
NFI	≥ 0.90	0.92	0.92
CFI	≥ 0.90	0.97	0.97
RMSR	≤ 0.10	0.085	0.090
RMSEA	≤ 0.08	0.062	0.060

Table 3
Reliability, average variance extracted, and discriminant validity

Factor/reliability	Information quality (IQ)	System quality (SQ)	Service quality (SV)	Use (U)	User satisfaction (US)	Perceived net benefit (NB)
IQ	0.74					
SQ	0.27	0.77				
SV	0.19	0.35	0.67			
U	0.15	0.10	0.14	0.77		
US	0.47	0.45	0.35	0.31	0.79	
NB	0.23	0.16	0.11	0.31	0.29	0.67
Composite reliability	0.90	0.87	0.86	0.87	0.88	0.80

Diagonal elements are the average variance extracted. Off-diagonal elements are the shared variance.

summation of the factor loadings)+(summation of error variables)}. The interpretation of the resultant coefficient is similar to that of Cronbach's alpha, except that it also takes into account the actual factor loadings rather than assuming that each item is equally weighted in the composite load determination. The composite reliability for all the factors in the measurement model was above 0.80. The average variances extracted were all above the recommended 0.50 level (Hair, Anderson, Tatham, & Black, 1992), which meant that more than one-half of the variances observed in the items were accounted for by their hypothesized factors. Convergent validity can also be evaluated by examining the factor loadings from the confirmatory factor analysis (see Table 4). Following Hair et al.'s (1992) recommendation, factor loadings greater than 0.50 were considered to be very significant. All of the factor loadings of the items in the research model were greater than 0.70. Thus, all factors in the measurement model had adequate reliability and convergent validity.

To examine discriminant validity, we compared the shared variances between factors with the average variance extracted of the individual factors (Fornell & Larcker, 1981). This analysis showed that the shared variances between factors were lower than the average variance extracted of the individual factors, which confirmed the discriminant validity (see Table 3). In summary, the measurement model demonstrated adequate reliability, convergent validity, and discriminant validity.

5.2. Structural model

We used a similar set of fit indices to examine the structural model (see Table 2). Comparison of all fit indices with their corresponding recommended values provided evidence of a good model fit ($\chi^2=93.11$ with $df=65$, GFI=0.91, AGFI=0.85, NFI=0.92, CFI=0.97, RMSR=0.090, RMSEA=0.060). Thus, we could proceed to examine the path coefficients of the structural model.

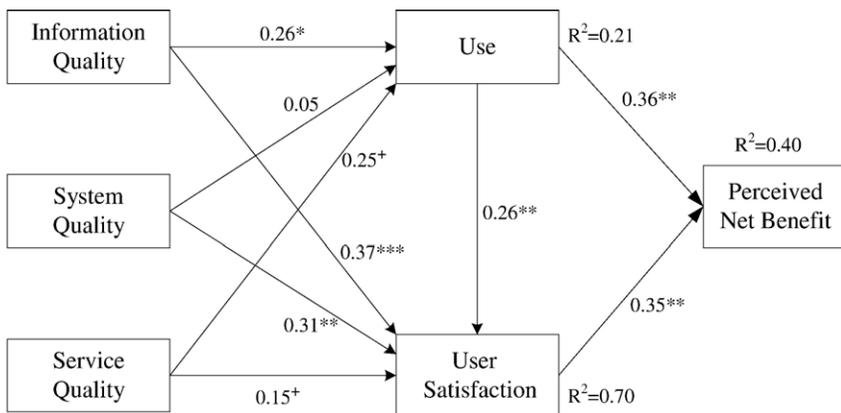
Properties of the causal paths, including standardized path coefficients, p -values, and variance explained for each equation in the hypothesized model, are presented in Fig. 4. As expected, information quality had a significant influence on both use and user satisfaction. Thus, H1 and H4 were supported ($\gamma=0.26$ and $\gamma=0.37$, respectively). The influences of

Table 4
Factor loadings, *t* values, and error terms

Construct and item	Factor loading	<i>t</i> value	Error terms
Information quality			
IQ1	0.81	*	0.34
IQ2	0.88	10.93	0.23
IQ3	0.89	11.09	0.21
System quality			
SQ1	0.84	*	0.29
SQ2	0.91	9.27	0.17
Service quality			
SV1	0.80	*	0.36
SV2	0.80	9.09	0.36
SV3	0.86	9.16	0.26
Use			
U1	0.86	*	0.26
U2	0.89	7.66	0.21
User satisfaction			
US1	0.96	*	0.08
US2	0.81	11.26	0.34
Perceived net benefit			
NB1	0.86	*	0.26
NB2	0.77	6.34	0.41

* *t* values for these parameters were not available because they were fixed for scaling purposes.

service quality on use and user satisfaction were not significant at $p < 0.05$, but significant at $p < 0.1$. Thus, H3 and H6 were marginally supported ($\gamma = 0.25$ and $\gamma = 0.15$, respectively). System quality had a significant impact on user satisfaction, but had no significant effect on use. H5 was supported ($\gamma = 0.31$) while H2 was rejected ($\gamma = 0.05$). Consequently, information



+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Fig. 4. Hypotheses testing results.

quality exhibited a stronger effect than system quality and service quality on use and user satisfaction, respectively. In addition, use had a significant influence on both user satisfaction and perceived net benefit. H7 and H8 were supported ($\beta=0.26$ and $\beta=0.36$, respectively). Finally, user satisfaction appeared to be a significant determinant of perceived net benefit. H9 was supported ($\beta=0.35$).

Altogether, this model accounted for 40% of the variance in perceived net benefit, with use exerting a stronger direct effect than user satisfaction on perceived net benefit. Seventy percent of the variance in user satisfaction was explained by information quality, system quality, service quality, and use, while 21% of the variance in use was explained by information quality, system quality, and service quality. The direct and total effect of user satisfaction on perceived net benefit was 0.35. However, the direct and total effects of use on perceived net benefit were 0.36 and 0.45, respectively. Thus, use exhibited stronger direct and total effects on perceived net benefit than user satisfaction. Among the three quality-related constructs, information quality had the strongest total effect on perceived net benefit. The direct, indirect, and total effects of information quality, system quality, service quality, use, and user satisfaction on perceived net benefit are summarized in Table 5.

6. Discussion

This study presents and validates a model of eGovernment systems success based on the DeLone and McLean (2003) updated IS success model, which captures the multidimensional and interdependent nature of G2C eGovernment systems success. The results indicate that information quality, system quality, service quality, use, user satisfaction, and perceived net benefit are valid measures of eGovernment system success. Apart from the link from system quality to use, the hypothesized relationships between the six success variables were significantly or marginally supported.

This research provides several important implications for eGovernment system success research and management. According to the proposed model, perceived net benefit is considered to be a closer measure of eGovernment systems success than the other five success measures. Perceived net benefit should develop if the formation of perceived quality, system use, and user satisfaction is appropriately managed. Thus, management attention might more

Table 5
The direct, indirect, and total effect of dominants on perceived net benefit

	Direct effect			Indirect effect			Total effect		
	U	US	NB	U	US	NB	U	US	NB
IQ	0.26	0.37		0.07	0.25		0.26	0.44	0.25
SQ	0.05	0.31		0.01	0.13		0.05	0.32	0.13
SV	0.25	0.15		0.06	0.16		0.25	0.21	0.16
U		0.26	0.36			0.09		0.26	0.45
US			0.35						0.35

fruitfully focus on the development of these psychological and behavioral processes. In order to increase citizen-perceived net benefit, eGovernment authorities need to develop G2C eGovernment systems with good information quality, system quality, and service quality, which, in turn, will influence citizen system usage behavior and satisfaction evaluation, and the corresponding perceived net benefit. In this model, system use was found to have the strongest direct and total effect on perceived net benefit, indicating the importance of system use in promoting citizen-perceived net benefit. Simply saying that increased use will yield more benefits, without considering the nature of this use, is insufficient (DeLone & McLean, 2003), as system use is a necessary condition of yielding benefits to citizens.

The findings clearly indicate that the total effects of information quality on use, user satisfaction, and perceived net benefit are substantially greater than those of system quality and service quality. That is, in the context of G2C eGovernment, beliefs about information quality have a more dominant influence on use, user satisfaction, and perceived net benefit than beliefs about system quality and service quality. This means that eGovernment authorities should pay much more attention to promoting the information quality of eGovernment systems.

With the advent and development of eGovernment systems research, measuring multiple eGovernment system success variables continues to be important. This model provides a rich portrayal of the dynamics surrounding quality measures, satisfaction evaluation, usage, and user-perceived net benefits. The results show that citizens perceive the benefit of a G2C system because they have used it and felt satisfied with its information, system quality, and service quality. While system usage and user satisfaction are commonly acknowledged as useful proxy measures of system success (Bailey & Pearson 1983; Doll & Torkzadeh, 1988, 1998; Downing, 1999; Ives et al., 1983), this study suggests that user-perceived net benefit can be considered as the variable closer in meaning to success than system usage and user satisfaction. This research also confirms that use, user satisfaction, and perceived net benefit are complementary yet distinct constructs, and that use is partially mediated through user satisfaction in its influence on the perceived net benefit of an eGovernment system.

It is worth noting that the effect of system quality on use was not significant. This may be because citizens have higher computer self-efficacy and Internet experience in the Internet age, and the system quality or ease of use of an eGovernment system is not critical for citizens in determining whether to use the system or not. Thus, respondents showed more concern about information quality (e.g., usefulness) and service quality (e.g., transaction safety) than on system quality (e.g., ease of use). Given that the usage of G2C eGovernment systems is completely voluntary, and that the target user group consists of a large number of people from diverse backgrounds, the findings of this study suggest that, in order to attract more people to use G2C systems and make them satisfied with the systems, it is not enough to simplify system interaction. It is of paramount importance to develop G2C systems that provide high-quality information and service including sufficient and up-to-date information, security and privacy protection, and personalized service.

This empirical result also emphasizes the importance of assuming a multidimensional, interdependent analytical approach. It is imperative for eGovernment authorities to lay

stress on various system success levels. Information quality, system quality, and service quality belong to the system development level; while system use, user satisfaction, and perceived net benefit belong to the effectiveness-influence level (DeLone & McLean, 2003). Establishing strategies to improve only one success variable is therefore an incomplete strategy if the effects of the others are not considered. The results of this study encourage eGovernment authorities to include measures for information quality, system quality, service quality, system use, user satisfaction, and perceived net benefit in their valuation techniques of eGovernment system success. This study has provided reliable and valid measures of these constructs. If concise success measures with good psychometric properties are periodically administered to a representative set of citizens, eGovernment authorities can enhance their understanding of the levels of citizen-perceived net benefit and its antecedents, and take necessary corrective actions to improve their systems. Researchers can also use the validated model as the foundation for the development of comprehensive eGovernment systems success measures and theories, the exploration of relationships between the proposed constructs, and the comparison of eGovernment success empirical studies.

7. Conclusion and limitations

This research was conducted in response to a call for the continuous challenge and test of IS success models in different contexts (DeLone & McLean, 2003; Rai et al., 2002). Based on the DeLone and McLean (2003) updated IS success model, we proposed and validated a comprehensive, multidimensional model of eGovernment systems success, which considers six success measures that are information quality, system quality, service quality, use, user satisfaction, and perceived net benefit. Except for the link from system quality to use, the hypothesized relationships between the six success variables were significantly or marginally supported by the data. The findings of this study provide several important implications for eGovernment research and practice.

Even though the rigorous procedure allowed us to develop and validate a model of eGovernment system success, this empirical study has several limitations which could be addressed in future research. First, the investigation of eGovernment systems success models is relatively new to eGovernment researchers. The discussed findings and their implications were obtained from one single study that examined some particular eGovernment systems and targeted a specific citizen group in Taiwan. Thus, caution needs to be taken when generalizing these findings and in discussion of other eGovernment categories or user groups. It is imperative that the proposed model be validated in different user populations and different eGovernment contexts, especially in G2B and G2G contexts. In addition, the sample size used is another limitation of this study. A cross-cultural validation using a large sample gathered elsewhere is required for greater generalization of the proposed model. Second, the fact that this study did not incorporate all net benefit measures raises some concern. The study merely measured the net benefit construct from a citizen-perceived perspective. Thus, developing and testing net benefit measures on the

governmental or societal level (e.g., return on investment) are useful directions to further examine the validity of this model. However, future researchers will still need to clearly and carefully define the stakeholders and context in which net benefits are to be measured (DeLone & McLean, 2003). Finally, as this study was conducted with a snapshot research approach, the feedback links from net benefit to use and user satisfaction were excluded from this study. Additional research efforts are needed to evaluate the validity of the investigated model. Longitudinal evidence might enhance our understanding of the causality and interrelationships between variables of eGovernment systems success.

Appendix A. Survey items used in this study

Information quality

IQ1 The eGovernment system provides the precise information you need.

IQ2 The eGovernment system provides sufficient information.

IQ3 The eGovernment system provides up-to-date information.

System quality

SQ1 The eGovernment system is user friendly.

SQ2 The eGovernment system is easy to use.

Service quality

SV1 When you have a problem, the eGovernment system service shows a sincere interest in solving it.

SV2 You feel safe in your transactions with the eGovernment system service.

SV3 The eGovernment system service gives you individual attention.

Use

U1 You are dependent on the eGovernment system.

U2 The frequency of use with the eGovernment system is high.

User satisfaction

US1 You are satisfied with this eGovernment system.

US2 The eGovernment system has met your expectations.

Perceived net benefit

NB1 The eGovernment system makes my job easier.

NB2 The eGovernment system saves me time.

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