Title	Perceptions of information system success in the public sector: Webmasters at the steering wheel?
Author(s)	Scott, Murray
Publication Date	2012
Publication Information	Sørum, H., Medaglia, R., Andersen, K., Scott, M., and DeLone, W. (2012) 'Perceptions of information system success in the public sector: Webmasters at the steering wheel?'. Transforming Government: People, Process and Policy, 6 (3):239-257.
Publisher	Emerald
Item record	http://hdl.handle.net/10379/3236

Perceptions of Information System Success in the Public Sector:
Webmasters at the Steering Wheel?

Hanne Sørum
The Norwegian School of Information Technology,
Oslo, Norway

Rony Medaglia and Kim Normann Andersen
Department of IT Management, Copenhagen Business School,
Copenhagen, Denmark

Murray Scott
Discipline of Business Information Systems, J. E. Cairnes School of Business & Economics,
National University of Ireland Galway, Ireland
Galway, Ireland

William H. DeLone
Department of Information Technology, Kogod School of Business, American University
Washington, DC, USA

Abstract

Purpose - This study explores the relationships between constructs of Information System (IS) success in the public sector, as perceived by webmaster intermediaries, and investigates how user testing affects these relationships.

Design/methodology/approach - Questionnaire, online survey with webmasters in Denmark and Norway that participated in the public sector web award contests organized by the government. N=1,237, n=541 (response rate 40%).

Findings - The frequency with which webmasters carry out user testing affects their perceptions of IS success, with those who conduct no user testing displaying the weakest associations among success variables. Findings also suggest that webmasters who do little or no user testing conveniently assume that citizen users are satisfied, while webmasters that are more knowledgeable of the user experience have a greater perception of levels of success.

Research limitations/implications - There is a need for supplementing the study with longitudinal data. Secondly, more research could be done on the explanatory variables behind one of the main findings of this study: webmasters who know their users tend not to see a correlation between website quality and user satisfaction. Lastly, there is a need to focus on the difference in significant associations between IS quality, user satisfaction and net benefits, and whether and how unique features of public organizations impact perceptions of success.

Practical implications - The fact that the majority of webmasters do not perform any type of user testing triggers a reflection on the need for such important intermediaries to enhance

their feedback channels. User involvement in assessing IS success cannot be overlooked, especially considering that user empowerment in the design, implementation, and evaluation of information systems matches a window of opportunity originating in the ongoing growth of web interactivity.

Originality/value - This study is one of the few that investigates constructs of IS success in the public sector, and arguably the first one that focuses on the impacts of user testing on the relationships between constructs of IS success in a public setting.

Keywords Intermediaries; DeLone and McLean IS success model; public sector; webmasters; user testing.

Paper type Research paper

1. Introduction

User involvement and testing are widely viewed as being critical to the improvement of Information Systems (IS) (Mumford and Ward 1968; Bansler 1989; Iivari and Lyytinen 1998; Sharp, Rogers et al. 2007). The possibility of having real users participate in providing feedback for developing and refining the IS they are intended to use is even more important in a public sector setting, where it is taxpayers' money that finances the main service providers. In the era of public sector e-services, this materializes, for instance, in a spread of government-run and private contests of public websites where prizes are awarded for categories, such as design and usability (Sørum, Medaglia et al. 2009), which are assessed by both users and usability experts/consultants.

This study is interested in exploring what webmasters of public sector websites know about their users and how they link improvement in technology artifacts, information, and services with possible associated benefits for the users. Drawing on the DeLone and McLean model of IS success (DeLone and McLean 1992; DeLone and McLean 2003), this paper investigates how webmasters identify the impact of information, system, and service quality on user satisfaction and user benefits in a sample of public agency websites in Denmark and Norway. This investigation aims at shedding light not only on the perception of IS success by key stakeholders, such as public agency webmasters, but also on whether performing user testing makes any difference to the perceptions of webmasters in the relationship between IS quality factors and perceived user benefits and satisfaction. Our study is driven by two research questions: (1) *What are the relationships between constructs of IS success in the public sector, as perceived by webmaster intermediaries*, and (2) *How does user testing affect these relationships?*

The uniqueness of this study is twofold. First, while there is a wealth of studies investigating IS success using the DeLone and McLean model, very few do so in a public sector setting. This research seeks to add to the body of knowledge by investigating which unique features within the public sector affect success. Second, by assessing the role of user testing in the relationships between the constructs of the DeLone and McLean model of IS success, we begin this investigation by challenging the assumption that user testing matters.

Understanding the role of intermediaries in delivering public sector services is key to comprehending the shift in the division of labor between government and companies (Al-Sobhi, Weerakkody et al. 2010). Despite the emerging transformation by external intermediaries, we take the position that webmasters still have a key role in the choices of

design and implementation of new website functionalities, while content provision is delivered by the individual public department/ worker intermediaries and end-users, for instance, through interaction via Web 2.0 (Van der Walt and Van Brakel 2000; Hendricks 2007). Thus, there is a need to investigate how webmasters connect internal information and service resources with the external demand from citizens. We work from the assumption that public sector webmasters have a key role to play in delivering online services. There are several possible implications on the design of websites, and the creation of public single-entry points to the public sector engaging the state-individual relationship (Ranerup 2011).

The article is structured as follows. The next section anchors the study in the body of IS literature and outlines the research framework. The background information on the cases chosen in Denmark and Norway is then presented, where we argue for their relevance as objects of study. After describing the research method and data collection, the results of data analysis are reported and discussed. The concluding section sums up the findings, highlights the contribution of this study to research and practice through IS success factors in a public sector setting, and identifies possible avenues of future research.

2. Previous research

Market rivalry between competing companies is fueled by constant intermediation and re-intermediation processes in the value chains (Porter 2001). Although there is no unidirectional evidence indicating that better and more robust web design leads to more sales and profit, the transformation towards the digital economy is orchestrated by crawlers, mark-ups, and other types of intermediaries aiming at creating the best and fastest match between customer preferences and the supply of goods and services (Bakos 1998). In theory, the consumers' choice of online products and services will eventually value good website design, products, and services. By contrast, public sector websites are supply- and cost-driven, with the webmaster as a key player in designing the user interface and as the intermediary between citizens and in-house content providers.

Both within the research and the practitioner community involved in the public sector IS, there is an increasing awareness of the need for shared knowledge on the measurement of success of IS investments in the public sector. Virtually every public agency is nowadays expected to invest to some degree in establishing a web presence. Heavy investments in the establishment of a website, and on its continuous improvements and updates required by users, however, often fail to be evaluated against well-grounded measures of success.

In the literature on the uptake of government e-services, various studies have identified gaps between the citizen readiness and demand for services, and the supply from government. Barriers, such as the lack of security, the fear of loss of privacy, and the lack of infrastructure, have been identified as reasons for citizens not using the often quite generous list of free online services. Consequently, international and national policy institutions, such as the OECD, the UN, and the UK Cabinet Office, publish annual reports where a list of barriers and drivers are identified for different nations (United Nations Public Administration OECD 2009; Network 2010). Paradoxically, even though there is an increasing awareness of the need to include not only the user perspective, but also a range of public values in assessing the success of IS in the public sector (Scott, DeLone et al. 2009), we are short on knowledge of how webmasters view IS success and to what extent they gather knowledge of their users and other stakeholders' viewpoints.

Since the early 1980s, IS researchers have put an increasing effort into identifying IS success factors and building empirically-based models for understanding what makes an information system successful. In their seminal work, DeLone and McLean (1992) performed a comprehensive review of studies on IS success published in the previous decade, and proposed a comprehensive model, including six components of IS success: system quality, information quality, use, user satisfaction, individual impact, and organizational impact.

An overwhelming and still expanding body of literature has put effort into empirically testing the multidimensional relationships in the DeLone and McLean model (Goodhue and Thompson 1995; Saarinen 1996; Rai and Welker 2002). The original model has been challenged by proposals of refinement and integration. These focus on the constructs of use, as opposed to usefulness and user involvement (Seddon and Kiew 1994), or aim at extending the individual and organizational impacts of IS to a wider range of measures of net benefits of IS use and perceived usefulness (Seddon 1997).

The rapid growth of eCommerce was one of the triggering factors that led to an update of the 1992 DeLone and McLean model of IS success (DeLone and McLean 2003). The updated model introduced the construct of service quality, replacing the variables of individual and organizational impacts with the construct of net benefits, and including impacts at different levels of analysis (e.g., workgroups, industries, and societies) (Petter, DeLone et al. 2008).

Surprisingly few studies have looked at the multidimensional relationships explaining success of IS in a governmental setting, however (Rosacker and Olson 2008; Angelopoulos, Kitsios et al. 2010). Research efforts have been aimed, for instance, mainly at assessing government website: sophistication and quality (Choudrie, Ghinea et al. 2004; Moon and Norris 2005; de Jong and Lentz 2006; Barnes and Vidgen 2007; Panopoulou, Tambouris et al. 2008), usability (Huang 2003; Becker 2005), and interactivity (Criado and Ramilo 2003). As a result, these approaches provide only a glimpse of IS success in settings where information resource managers bridge content provision and use without facing market competition factors.

Despite the awareness that user factors, such as perceived ease of use, compatibility, and trustworthiness, are important factors affecting citizens' intention to use an e-government service (Carter and Bélanger 2005; Teo, Srivastava et al. 2008), there is a research gap concerning the role of user testing in public IS success. Rosacker and Olson (2008), for instance, focus on factors related to success of public IS concerning project management. Prybutok et al. (2008) introduced the DeLone and McLean model into a government context by investigating leadership and IS quality, and the effect on net benefits in eGovernment environments. In their study, net benefits were measured with items incorporating user satisfaction, and individual and organizational performance. The findings reveal that leadership is positively related to IS quality, and IS quality and leadership are positively related to net benefits. Wang and Liao (2008) tested an adaptation of the DeLone and McLean's IS success model in the context of government citizen services. They drew on the six constructs of the model, information quality, system quality, service quality, use, user satisfaction, and perceived net benefits, to collect data on users of government IS in Taiwan. Their findings show that 1) information quality, system quality, and service quality positively affect user satisfaction, 2) that use positively affects user satisfaction and the perceived net benefits, and 3) that user satisfaction positively affects perceived net benefits.

Recently, Scott et al. (2009) proposed a balanced success model, an extension of the DeLone and McLean 2003 model, tailored for the public sector, that aims at developing a measure of net benefits centered on the perspective of the citizen. The model draws on the paradigm of Public Value (Moore 1995), and evaluates the impact of IS quality (information quality, systems quality and service quality) on eGovernment success by exploring what citizens define as being important in the success of eGovernment services and which aspects of IS quality affect eGovernment success.

3. Research Framework

The research framework for this paper has been developed to capture how frequently webmasters conduct user testing, the type of user testing, and how webmasters perceive the relationship between key IS Success constructs: information quality, system quality, and service quality, leading to user satisfaction and net benefits. Figure 1 contains the schema for

the proposed research framework, drawing on the DeLone and McLean Model of IS success (2003).

From the eGovernment supply side, important contributors to website quality improvements and general IS success are: the service provider, government organizations, and back-office support. In this study, webmasters are described as being key contributors in delivering eGovernment services, and act as an immediate interface between service provider and service receipt. As such, they have a unique perspective on the effectiveness of eGovernment as a channel for providing successful services and useful information to users. The users of government websites are assumed to be citizens, businesses, and the government itself. Various tasks and interactions may take place, depending on the goal to be completed, the purpose of the website visit, and usage.

Figure 1. Visualization of the research framework in this study
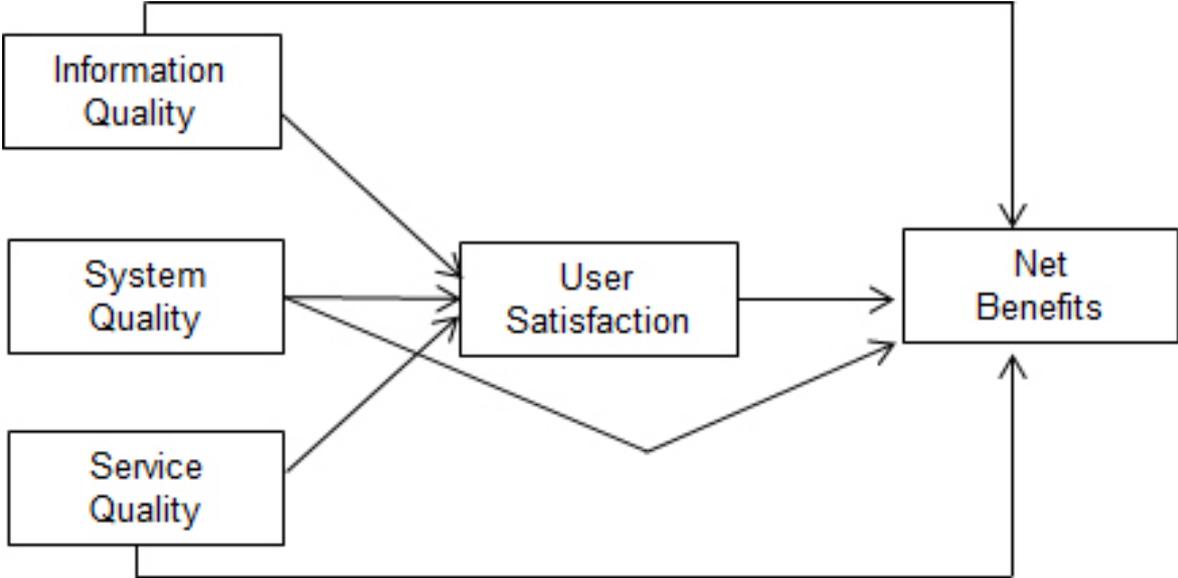
Website quality is measured by information quality, system quality, and service quality, and is under the control of the service provider. The construct of information quality captures the content of the system/website, and concerns aspects such as accuracy, personalization, and relevance of the information. System quality concerns the overall quality of the system that the users interact with, and focuses on aspects such as usability and ease of use. Service quality is measured by the overall service level delivered by the service provider, including aspects such as empathy for the users and trust. User satisfaction is measured by measuring how satisfied the users of a given system or website are perceived to be. In our study, we investigated the webmasters' perception of user satisfaction, since they act as a pivotal figure in delivering eGovernment information and services. In order to explore the net benefits of IS success, we included constructs of user benefits, such as time and cost savings, trust, and interaction with government. Table 1 provides details of important dimensions and the related literature for each of the constructs used in the framework.

Table 1. Operationalization of the research framework

Quality aspects	Dimensions of website quality	References
Information quality	Presence of updated information, current information, relevant information, clear and understandable information, trustable information, adapted information, detailed information.	(Seddon and Kiew 1996; Lee, Strong et al. 2002; McKinney, Yoon et al. 2002)

System quality	Ease of use, intuitiveness and clarity of navigation structure, visual design, download time, accessibility requirements, secure use, integration with internal data feeding & processing, integration with external data feeding & processing, use of updated technology.	(Seddon and Kiew 1996; McKinney, Yoon et al. 2002; Wang and Liao 2008)
Service quality	Helpfulness and willingness to solve users' problems, empathy for users, and trust.	(Pitt, Watson et al. 1995; Pitt, Watson et al. 1997; Barnes and Vidgen 2003; Teo, Srivastava et al. 2008)
User satisfaction	The overall satisfaction of the user including perceptions of website efficiency and meeting users' expectations.	(Seddon and Kiew 1996)
User benefits	Improved information and services, effective communication, 24 hour accessibility, as well as cost and time savings.	(Reddick 2006; Prybutok, Zhang et al. 2008; Wang and Liao 2008; Scott, DeLone et al. 2009)

When measuring the success of IS systems, user satisfaction and net benefits are perceived as being highly important. Net benefits can be assessed at various levels and from different perspectives. While we find that the users who may achieve user benefits for their personal interest are driven by use and user satisfaction, the service provider/organization (demand side) may also obtain success, which can be measured by organizational efficiency and effectiveness.

4. Case Choice and Research Method

In order to address the research questions, a self-administered online survey was designed to capture constructs of IS success, as perceived by public sector webmasters in Denmark and Norway. Both of these small countries each have a population of approximately five million. The government plays a large role in their economies, employing about one third of the total workforce. The two countries have a history of commitment to ambitious IT policies, resulting in a strong record of being ranked among the top countries in the world as far as digital readiness in general, and eGovernment maturity in particular (see Table 2). Similar to other countries, Scandinavian countries have experienced a shift in the channels of communication within both the public and private sector. In 2010, 90% of all households in Norway had Internet access, and 81% used the Internet for communication with the public sector.

Most public organizations have their own website, or are linked to another website. Most organizations update and maintain the information by themselves, and have the daily responsibility for contact with various stakeholders. The technological solutions (e.g., websites) are developed autonomously or by an external company. In most cases, it is the organization's own responsibility to provide website content and various digital services that aim at benefiting the users or the organization itself, in addition to responsiveness and daily contact with website users.

Table 2. International Rankings of eGovernment: Denmark and Norway

	Denmark	Norway
United Nations (2010)	7	6
OECD (2009)	3	1

In order to ensure a high website quality level, 600-700 public websites in Norway and Denmark have been ranked on a yearly basis since 2001 organized by the government in both countries. The ranking results are made publicly available on the Internet for comparison. The criteria used in the evaluations (i.e., the quality aspects measured) carried out in these web awards are largely rooted in long-term strategies and plans stated by the government. For instance, the eNorway 2009 plan supports government policy for economic growth, as well as increased value creation, prosperity, welfare development, and change in the sector. There are three main target areas for public websites: (1) citizens as individuals, (2) innovation and growth in business and industry, and (3) a coordinated and user-adapted public sector. The public sector's stated aim is that everyone will have an opportunity to participate in the digital community, and have the same access to digital information and services. The evaluation process in Norway and Denmark focuses on how the website/service actually appears on the screen, and the criteria are mainly grounded on standardized objective measures, which, to a large extent, assess technical aspects (Sørum, Medaglia et al. 2009).

The design of the survey instrument in this study has drawn on the operationalization of the DeLone and McLean IS success model in an eGovernment context (Scott, DeLone et al. 2009). Each construct was operationalized with a set of questions to be answered by webmasters, e.g., "To what extent do you consider that the organization's website provides updated information to the users?". In addition, the survey included questions not only on the extent to which webmasters know the users, e.g., "Please indicate to what extent your organization knows the needs of users and their expectations from the website,", and in the extent to which they perceive users to be satisfied, on how they perceive the extent there are net benefits (e.g., "According to your assessment, to what extent does the website provide time savings to users?"), but also on how frequently they perform user testing and with what methods. Respondents answered each item using a 5-point Likert scale, varying from "very low degree" to "very high degree." The following number of questions was to measure each of the constructs: information quality: 7; system quality: 9; service quality: 3, user satisfaction: 4, and user benefits: 5 questions. The items used to measure each construct were drawn from seminal studies in the area and where possible used established metrics adapted for the eGovernment context. The key references used in the construction of instruments for this study are presented in Table 1. In order to investigate the correlations in this study, we looked at the mean score for each of the constructs, and created a new variable (used in the analysis) based on the score of each of the questions.

In the development of the questionnaire, experienced webmasters from municipalities, and a university library were initially invited to provide comments and suggestions for improvements in the online survey. A pilot test was then conducted over a period of six months, including a sample of 33 European E-Government Award finalists. The pilot test led to minor revisions of questions and layout issues. An invitation to participate in the survey was finally e-mailed to 1,237 public sector organizations in Norway and Denmark in the period November to December, 2010. The respondents received an email with an introductory letter that informed them about the purpose of the study, and a web link to the online questionnaire. It was clearly stated in the email that the respondent should be the webmaster (or a person in a similar position) in the organization. Email addresses of the respondents were collected manually by visiting each website. All of the public organizations selected had participated in a yearly national web award arranged by the governments in Norway and Denmark in 2009.

Within the first two weeks we received 464 completed questionnaires and then, after two weeks, a reminder email was sent to all potential respondents. Those who had already participated were thanked for their participation, and those who had not answered the

questionnaire were encouraged to complete the survey within a week. After four weeks the survey was closed with 541 useful responses, representing a response rate of 44%, of which 22 respondents did not fill in background data.

Table 3. Profile of the survey respondents (webmasters)

Length of employment as webmaster	Less than a year ago: 64 1-2 years ago: 94 3-5 years ago: 144 More than 5 years ago: 217
Gender	Female: 271 Male: 248
Age	25 years or younger: 1 26-35 years: 100 36-45 years: 197 46-55 years: 139 56-65 years: 81 More than 65 years: 1
Highest completed level of education	No higher education: 22 Professional certification/training: 55 Bachelor's degree or equivalent: 216 Master's degree, equivalent or higher: 226
Education courses related to information/communication	Yes: 343 No: 176
Education courses related to IT/web technology	Yes: 154 No: 365

Table 3 above shows the details of the respondent profiles. Most of the webmasters have a relatively long affiliation with the organization: 217 of the 541 respondents have been the webmaster in their organization for more than five years. The respondents are quite mature, with two thirds older than 36 years of age. Regarding training and education, the respondents overall have training in communication but little training in IT/technology. 22 of the respondents did not fill in the background information, and therefore the total number shown in Table 3 is 519, not 541.

In order to conduct an analysis of non-response bias, the reliability results for various constructs were compared among early, middle and late responses. No significant differences were found lending credibility to the data set along with the high response rate gathered (44%). Furthermore, the majority of the respondents were reported to have been in their position as a webmaster for more than three years (including 217 being in the position for more than five years) lending experience and further credibility to their perspective as survey participants. The survey protected the anonymity of the respondent and there were no factors due to bias related to incentives (e.g. economic earnings) that could impact the response, other than access to a summary report of the survey. In addition, the survey instrument was based on a reliable set of IS success items tested within the literature to measure the items in the questionnaire.

The methodology used in this study has a number of limitations. First, while Denmark and Norway are uniquely relevant cases for their high technology penetration and commitment to IT policies, findings from these two countries, nevertheless, can be generalized only to some extent, and would need to be corroborated with data from different study settings, e.g., countries with greater digital divides, and different degrees of government IT policy

commitment. Second, the sample choice of webmasters who have participated in the official government web awards may also affect finding generalizability. On the one hand, this choice would support the argument that the sample includes websites (and webmasters) that put the most effort into fulfilling criteria of excellence in implementing digital public services. On the other hand, for the same reason, the sample choice cannot ensure that webmasters that do not participate in web awards would show the same attitudes as the ones measured in this study.

5. Findings

Our analysis of the webmasters' frequency of user testing shows a diverse rather than a unified or unidirectional pattern. Less than half (46.8%) of the 541 webmasters conducted some type of user testing (N=253). Table 4 displays the frequency and type of user testing carried out by the 253 respondents that answered yes to the question on whether their organization conducted user evaluation and testing of their website. The sum of values is greater than 253, as respondents could indicate more than one method of user testing.

Table 4. Methods and frequency of user testing (N=253)

Type of testing	Frequency of testing				
	Several times during the last year	Once during the last year	1-2 times during the last two years	More than two years ago	Total
Representative users solve realistic tasks	13% (n=14)	28% (n=31)	28% (n=31)	32% (n=35)	101% (n=111)
Online user satisfaction survey(s)	13% (n=16)	31% (n=40)	23% (n=29)	33% (n=42)	100% (n=127)
User satisfaction survey(s) via telephone, in person or by e-mail	16% (n=7)	23% (n=10)	32% (n=14)	30% (n=13)	100% (n=44)
Focus groups/ interviews with users	15% (n=12)	22% (n=18)	28% (n=23)	35% (n=29)	100% (n=82)
Eye-tracking laboratory test	11% (n=2)	39% (n=7)	17% (n=3)	33% (n=6)	100% (n=18)

The most frequently used method of collecting feedback from users is through online user satisfaction surveys (N=127). This type of data collection provides an overall impression of the extent to which users are satisfied, and vague patterns of how, to what extent, and where there is potential for quality improvements. Online satisfaction surveys are followed in popularity by methods involving representative users in solving tasks (N=111) in order to gain knowledge on user behavior in a setting that simulates everyday use.

Even though there are various ways of conducting testing in order to observe and evaluate user performance, the results given in online surveys may, at best, give direct input to improvements of quality. 82 of the respondents noted that traditional focus groups and interviews with users were a way of facilitating rich in-depth explanations for why users perform as they do. One side of the coin is what people (users) actually do and how they perform, while the other side concerns the extent to which they are satisfied and how they interact with a website. The least frequently used method of user testing is eye-tracking technology. One reason may be that eye-tracking is a relatively expensive technology, often used only by professional usability experts/consultants. The technology is often used in conjunction with other methods, such as involving representative users in solving realistic tasks.

Overall, the findings indicate that there is a large potential for involving users to a greater extent in order to improve the quality interaction with public websites. One explanation for this may be that the public organizations find the annual quality ranking of public websites satisfactory or sufficient in terms of feedback, even though these web awards generally involve real users to a low extent.

In order to begin analyzing our research framework, an initial examination of reliability analysis was performed for each construct using Cronbach's Alpha for composite constructs. The results, presented in Table 5, indicate good internal consistency among the items representing each construct of success.

Table 5. Reliability analyses for the construct

Constructs of success	Cronbach's Alpha
Information quality	.868
System quality	.837
Service quality	.739
User benefits	.859
User satisfaction	.749

Table 6 presents descriptive statistics on the constructs success (N=541) and shows that the mean score varies from 4.0213 (information quality) being the highest, to 3.5822 (system quality) being the lowest. The mean of service quality is almost the same as information quality. In general, webmasters give their websites high grades on quality.

Table 6. Descriptive statistics on the constructs of IS success

Constructs of success	Mean	Std. Deviation
Information quality	4.0213	.55923
System quality	3.5822	.60673
Service quality	4.0467	.57266
User satisfaction	3.7530	.55589
User benefits	3.6694	.67579

In order to investigate the proposed relationships perceived by webmasters between constructs of IS success in the public sector, correlation analyses (Pearson) were performed. In accordance with the research framework, the strengths of the correlations between the constructs of information, system, and service quality, with both user satisfaction and user benefits are presented in Table 7, based on responses for all respondents included in the analysis (N=541).

Table 7. Correlation test results between the IS success constructs (N=541)

Constructs of success	User satisfaction	User benefits
Information quality	.540**	.553**
System quality	.464**	.491**
Service quality	.733**	.432**
User satisfaction	1	.481**

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

These findings underline the importance of IT quality in governmental websites. Overall, the correlations between the constructs of IS success vary between .432 (service quality and user benefits) and .733 (service quality and user satisfaction). Following the interpretation of

Cohen (1988), these correlation test scores reveal a medium level of correlation strength between the constructs of success.

In order to investigate the impacts of user testing, as defined by research question two of this study, the correlations among IS success constructs were retested on differing sub-samples selected based on frequency of user testing. The data displayed in Table 8 reveals the results from correlation tests conducted with five differing samples of webmasters, ranging from those who indicated that they conducted user testing several times in the last year to those who have never performed user testing. These correlation results on the whole provide significant associations among success constructs thus again supporting the efficacy of the DeLone and McLean IS success model in the eGovernment context. Subtle variations in the strengths of these associations can be observed however when presented according to frequency of user testing. Although exploratory, the correlation results from the sample that never conduct user testing display on balance a lower level of significance across most of the proposed associations. Similarly, in four of the proposed relationships it is observed that the strength of correlation is highest in the sample that conducted user testing the most frequently when compared to the other samples.

Table 8. IS success and frequency of user testing

Relation-ships	All the respon-dents (N=541)	Never performed user testing	More than two years ago	1-2 times during the last two years	Once during the last year	Several times during the last year
InfQ→User satisfaction	.540**	.458**	.621**	.707**	.436**	.569**
SyQ→User satisfaction	.464**	.343**	.611**	.532**	.471**	.646**
SeQ→User satisfaction	.733**	.718**	.688**	.851**	.682**	.865**
InfQ→Net benefits	.553**	.505**	.619**	.502**	.524**	.626**
SyQ→Net benefits	.491**	.462**	.581**	.257*	.574**	.643**
SeQ→Net benefits	.432**	.364**	.469**	.546**	.464**	.463**
User satisfaction →Net benefits	.481**	.397**	.526**	.554**	.556**	.418

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

In order to summarize the findings of this study and the impacts of user testing, Figure 2 displays the correlations presented in Table 7 and Table 8.
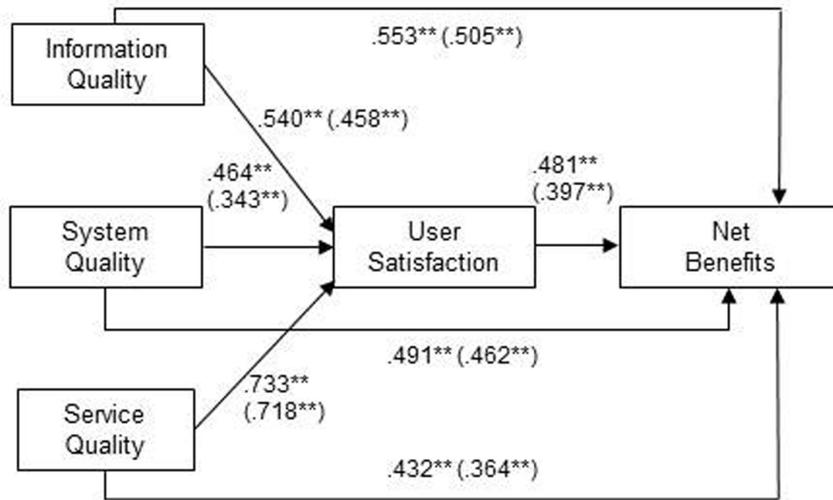
Figure 2. Summary of findings.

Figure 2 displays the key findings from this study aligned to the two main research questions. First, the correlation results from the complete sample are displayed in the research framework providing evidence of the validity of the DeLone and McLean model when examining success in the eGovernment context. Second, the correlation results from the sub-sample that conducted no user testing are presented in the parentheses. The results from these tests provide an initial assessment of research question two and an insight into the impact of user testing on perceptions of success. The sample that conducted no user testing demonstrate a significantly lower correlation among the constructs of IS success. The impact of no user testing is therefore relatively negative on the constructs of IS success identified by this study.

6. Discussion and Conclusion

6.1 Research Synthesis

This paper aims at answering two research questions: (1) *What are the relationships between constructs of IS success in the public sector, as perceived by webmaster intermediaries*, and (2) *How does user testing affect these relationships?* We collected data from webmasters in Denmark and Norway that participated in the official web award contests organized by the government. The identification of webmasters as important eGovernment intermediaries and the analysis of the impacts of user testing on webmaster perceptions of success are important unique contributions of this research. This study also contributes to the understanding of IS success constructs in a public sector setting. More importantly, this study contributes to the literature on the impact of user testing on the relationships between constructs of IS success based on the perception of webmasters.

Previous research has shown that there are external factors that affect the importance of the constructs of the DeLone and McLean IS success model. For instance, the degree of centralization of computing in an organization makes a difference in the degree of importance of each construct of IS success. Heo and Han (2003) use the DeLone and McLean model of IS success to investigate firms with different characteristics. The authors find that organizations that have centralized computing tend to place more emphasis on system quality for IS success, while organizations that have decentralized computing emphasize information quality. However, the role of user testing on the perceptions of the relationship between IS success constructs for eGovernment websites has remained unexplored.

Our study shows that less or no user testing results in a perception of weaker correlation between constructs of IS quality (information quality, system quality, and service quality) and user satisfaction. This finding suggests that the less webmasters know about their users

(by performing user testing), the less they tend to see a correlation between IS quality and user satisfaction. Such findings can be considered as an attempt to fill the research gap in IS research concerning the investigation of IS success constructs in a public sector setting, and particularly concerning the role of user involvement in the design, implementation, and testing of government IS.

Although not conclusive, this study would seem to indicate that frequency of user testing results in variations among the perceptions of success among webmasters, with those who conduct no user testing displaying the weakest associations among success variables. Varying correlation strengths is an important contribution in relation to user testing and indicates that future research in this area is necessary to further probe the need for user feedback in developing an institutional understanding of eGovernment success.

These findings also seem to suggest that webmasters who do little or no user testing conveniently assume that citizen users are satisfied, while webmasters that are more knowledgeable of the user experience have a greater perception of levels of success. This interpretation implies that webmasters who do not conduct user testing are poor judges of user satisfaction and user benefits. One possible explanation for this could be that webmasters do not conceptualize or factor in the citizens' end benefits. In other words, webmasters do not 'travel' to the world of the users, and do not deem it necessary to explore end user benefits.

6.2 Implications for Practitioners

Findings from this study have implications for practitioners. In a government setting, we can distinguish between the public decision-makers who influence the allocation of resources for IT projects, and the intermediaries who supervise the operational element of IT implementation vis-à-vis the citizens, such as webmasters. Top level decision-makers, such as politicians, usually rely on measures of IT benefits, measures that they do not directly contribute to creating. User satisfaction, for example, is only one popular measure of IS success among many that is referred to in justifying allocation or re-location of resources for IT projects. Other measures include the number of unique visitors and other data on traffic that public websites can provide. However, the use of these measures is not without risk when it is made too simplistically. For instance, the amount of traffic registered on a website cannot be considered as a reliable measure of success if the service provided by the public agency aims at avoiding citizen contact, instead of maximizing it, such as in the case of e.g., a public portal for filing taxes. This study helps decision-makers understand the constructs underlying IS success by providing deeper insight into their nature and their relationships.

The main contribution of the study for practitioners that work as intermediaries, such as webmasters, concerns the role of user testing in assessing IS success. The fact that the majority of webmasters do not perform any type of user testing should trigger a reflection on the need for such important intermediaries to enhance their feedback channels. It is paradoxical that, on the one hand, there is a growing rhetoric on the need for developing, refining, and using rich measures of IS success, such as user satisfaction, while, on the other hand, data show that the effectiveness of the crucial end-user part of IS investment is only left to be assessed by webmasters' perceptions. This is even more problematic when considering that, as our study shows, intermediaries have different perceptions of the relationships between IS quality measures and user satisfaction, depending on the degree to which they perform user testing.

Moreover, the role of user involvement in assessing IS success cannot be overlooked, especially considering that user empowerment in the design, implementation, and evaluation of information systems matches a window of opportunity originating in the ongoing growth of web interactivity. For example, the emergence and spread of Web 2.0 tools calls for an increased focus on the role of citizens as users in understanding IS success factors, and maximizing the value of IS investments in the public sector.

6.3 Implications for Future Research

Our research also opens a potential road forward for future research. The first suggested stream of research could be to focus on extending the statistical analysis and supplementing the study with longitudinal data. Using the DeLone and McLean model with data from a single survey clearly calls for additional research on the feedback loops in the model using, for example, longitudinal data from webmasters. Moreover, research that allows for a more explicit use of exogenous and endogenous data would be welcomed. For example, we assumed in our study that webmasters have some discretion over the design and implementation of websites; but webmasters might only be in charge of incremental maintenance, while it might be that computer scientists and system analysts are in charge of the actual web service development instead.

A second stream of research should focus on the explanatory variables behind one of the main findings of this study: webmasters who know their users tend not to see a correlation between website quality and user satisfaction. This first insight into the problematic area of the relationship between the presence of user testing and constructs of IS success in a government setting should be further investigated e.g., using qualitative methods, such as interviews and focus groups with users and webmasters.

A third challenge would be in furthering research on the difference in significant association between IS quality, and user satisfaction and net benefits. A possible explanation for this difference is that while citizens may value time-saving benefits in availing themselves of online services, they still may not find the experience of using online services particularly enjoyable or satisfying. The citizen's experience of interaction with the public sector is complex – some uses can be functional or utilitarian, for example, in paying a fine or requesting a service; alternatively, citizens have increasing opportunities to engage in initiatives designed to engage and encourage their participation in democratic endeavors. The variation in possible interactions necessarily contributes to varying value perceptions in citizens. Some uses result in basic benefits, such as time or cost savings, whilst others may contribute to more hedonistic or complex value perceptions. This research therefore demonstrates the importance of reflecting on this variation by using multi-dimensional success measures to effectively capture value. Future research should continue to focus on developing measures that reflect this variation in perception.

The fourth area for future research could further explore how unique features of public organizations impact perceptions of success. There is a need to understand the extent to which organization size, degree of centralization, government type (local, central, municipal), and government capacity factors (such as technical, financial and political) impact the perceptions of success within the organization. Such a research project could draw on the exploratory framework developed by Moon and Norris (2005), but would extend knowledge in this area by comparing across different government types (local, central and municipal). There is a need to further explore what has been close to virgin research areas since the URBIS/UC Irvine studies (Danziger, Dutton et al. 1982) on the effects of organizational characteristics and government type on public sector success.

References

Al-Sobhi, F., Weerakkody, V. and Mustaffa, M. (2010), "An exploratory study on the role of intermediaries in delivering public services in Madinah City: Case of Saudi Arabia", *Transforming Government: People, Process and Policy,* Vol. 4 No. 1, pp. 14-36.

Angelopoulos, S., Kitsios, F. and Papadopoulos, T. (2010), "New service development in e-government: identifying critical success factors", T*ransforming Government: People, Process and Policy,* Vol 4 No. 1, pp. 95-118.

Bakos, Y. (1998), "The emerging role of electronic marketplaces on the Internet", *Communications of the ACM,* Vol. 41 No. 8, pp. 35-42.

Bansler, J. (1989). "Systems Development Research in Scandinavia: Three Theoretical Schools", *Scandinavian Journal of Information Systems,* Vol. 1 No. 1, pp. 3-20.

Barnes, S. and Vidgen, R. (2003), "Measuring web site quality improvements: a case study of the forum on strategic management knowledge exchange", *Industrial Management & Data Systems,* Vol. 103 No. 5, pp. 297-309.

Barnes, S. J. and Vidgen, R. (2007), "Interactive E-Government: Evaluating the Web Site of the UK Inland Revenue", *International Journal of Electronic Government Research,* Vol. 2 No 1, pp. 42-46

Becker, S. A. (2005), "E-government usability for older adults", *Communications of the ACM,* Vol. 48 No. 2, pp. 102–104.

Carter, L. and Bélanger, F. (2005), "The utilization of e-government services: citizen trust, innovation and acceptance factors", *Information Systems Journal*, Vol. 15 No. 1, pp. 5-25.

Choudrie, J., Ghinea, G. and Weerakkody, V. (2004), "Evaluating global e-government sites: a view using web diagnostic tools", *Electronic Journal of e-Government,* Vol. 2 No. 2, pp. 105–114.

Cohen, J. (1988), Statistical power analysis for the behavioral sciences, Hillsdale, NJ: Erlbaum.

Criado, J. I. and Ramilo, M. C. (2003), "E-government in practice: An analysis of Web site orientation to the citizens in Spanish municipalities", *International Journal of Public Sector Management*, Vol. 16 No. 3, pp. 191-218.

Danziger, J. N., Dutton, W. H., Kling, R., Kraemer, K. L. (1982). *Computers and Politics: High Technology in American Local Government*. New York, Columbia University Press.

de Jong, M. and Lentz, L. (2006), "Scenario evaluation of municipal Web sites: Development and use of an expert-focused evaluation tool", *Government Information Quarterly,* Vol. 23 No. 2, pp. 191-206.

DeLone, W. H. and McLean, E. R. (1992), "Information Systems Success: The Quest for the Dependent Variable" *Information Systems Research*, Vol. 3 No. 1, pp. 60-95.

DeLone, W. H. and McLean, E. R. (2003), "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update", *Journal of Management Information Systems*, Vol. 19 No. 4, pp. 9-30.

Goodhue, D. L. and Thompson, R. L. (1995), "Task-technology fit and individual performance." *MIS Quarterly*, Vol. 19 No. 2, pp. 213–236.

Hendricks, A. (2007), "Webmasters, web policies, and academic libraries: a survey" *Library Hi Tech*, Vol. 25 No. 1, pp. 136 - 146.

Heo, J. and Han I. (2003), "Performance measure of information systems (IS) in evolving computing environments: an empirical investigation" *Information & Management*, Vol. 40 No. 4, pp. 243–256.

Huang, C. J. (2003), "Usability of E-Government Web-Sites for People with Disabilities", Proceedings of the 36th Annual Hawaii International Conference on System Sciences (HICSS'03)

Iivari, J. and Lyytinen, K. (1998), "Research on Information Systems Development in Scandinavia – Unity in Plurality", *Scandinavian Journal of Information Systems*, Vol. 10 No. 1, pp. 135-186.

Lee, Y., Strong, D., Kahn, B. and Wang, R. (2002), "AIMQ: a methodology for information quality assessment", *Information & Management*, Vol. 40 No. 2, pp. 133-146.

McKinney, V., Yoon, K. and Zahedi, F. (2002), "The Measurement of Web-Customer Satisfaction: An Expectation and Disconfirmation Approach", *Information Systems Research*, Vol. 13 No. 3, pp. 296-315.

Moon, M. J. and Norris, D. F. (2005), "Does managerial orientation matter? The adoption of reinventing government and e-government at the municipal level", *Information Systems Journal,* Vol. 15 No. 1, pp. 43-60.

Moore, M. (1995), Creating Public Value - Strategic Management in Government, Cambridge, Harvard University Press.

Mumford, E. and Ward, T. B. (1968), Computers: Planning for People, London, Batsford.

Network, U. N. P. A. (2010). E-Government Survey 2010: Leveraging e-government at a time of financial and economic crisis, New York: United Nations.

OECD (2009), *Rethinking E-Government Services: User-Centred Approaches*, Paris, OECD.

Panopoulou, E., Tambouris, E. and Tarabanis, K. (2008), "A framework for evaluating web sites of public authorities", *Aslib Proceedings*, Vol. 60 No. 5, pp. 517-546.

Petter, S., DeLone, W. H. and McLean, E. R., (2008), "Measuring information systems success: models, dimensions, measures, and interrelationships", *European Journal of Information Systems*, Vol. 17 No. 3, pp. 236-263.

Pitt, L. F., Watson, R. and Kavan, C. B., (1995), "Service Quality: A Measure of IS Effectiveness", *MIS Quarterly*, Vol. 19 No. 2, pp. 173-187.

Pitt, L. F., Watson, R. and Kavan, C. B, (1997), "Measuring Information Systems Service Quality: Concerns for a Complete Canvas", *MIS Quarterly*, Vol. 21 No. 2, pp. 209-221.

Porter, M. E. (2001), "Strategy and the Internet", *Harvard Business Review*, Vol. 79 No. 3, pp. 62-78.

Prybutok, V., Zhang, X. and Ryan, S. D. (2008), "Evaluating leadership, IT quality, and net benefits in an e-government environment", *Information & Management*, Vol. 45 No. 4, pp. 143-152.

Rai, A., Lang, S. S. and Welker, R. B. (2002), "Assessing the Validity of IS Success Models: An Empirical Test and Theoretical Analysis", *Information Systems Research*, Vol. 13 No. 1, pp. 50-69.

Ranerup, A. (2011), "The emergent development of public portals moulding the state-individual relationship", *Transforming Government: People, Process and Policy*, Vol. 5 No. 2, p. 185 - 200.

Reddick, C. G. (2006), "Information resource managers and E-government effectiveness: A survey of Texas state agencies", *Government Information Quarterly*, Vol. 23 No. 2, pp. 249-266.

Rosacker, K. M. and Olson, D. L. (2008), "Public sector information system critical success factors", *Transforming Government: People, Process and Policy*, Vol. 2 No. 1, pp. 60-70.

Saarinen, T. (1996), "An expanded instrument for evaluating information system success", *Information & Management,* Vol 31 No. 2, pp. 103-118.

Scott, M., DeLone, W. H. and Golden, W. (2009), "Understanding Net Benefits: A Citizen-Based Perspective on eGovernment Success", *International Conference on Information Systems (ICIS)*. Phoenix, USA.

Seddon, P. B. (1997), "A Respecification and Extension of the DeLone and McLean Model of IS Success", *Information Systems Research*, Vol. 8 No. 3, pp. 240-253.

Seddon, P. B. and Kiew, M. Y. (1996), "A partial test and development of the DeLone and McLean model of IS success", *Australasian Journal of Information Systems*, Vol. 4 No. 1, pp. 90-109.

Sharp, H., Rogers, Y. and Preece, J. (2007), Interaction Design: Beyond Human-Computer Interaction, New York, Wiley.

Sørum, H., Medaglia, R. and Andersen, K. N. (2009), Assessment of Website Quality: Scandinavian Web Awards Right on Track? In Wimmer et al., eds., *Proceedings of the 8th International Conference on Electronic Government* (EGOV), Linz, Austria, pp. 198-209. Berlin: Springer-Verlag.

Teo, T. S. H., Srivastava, S. C. and Jiang, L. (2008), "Trust and Electronic Government Success: An Empirical Study", *Journal of Management Information Systems*, Vol. 25 No. 3, pp. 99-131.

Van der Walt, P. and Van Brakel, P. (2000), "Task Analysis of the Webmaster: Results of an Empirical Study", *ASLIB Proceedings*, pp. 20-38.

Wang, Y.-S. and Liao, Y.-W. (2008), "Assessing eGovernment systems success: A validation of the DeLone and McLean model of information systems success", *Government Information Quarterly,* Vol. 25 No. 4, pp. 717-733.

APPENDIX

Online survey questionnaire

Information quality
  Updated information
  Current information
  Relevant information
  Clear and understandable information
  Trustable information
  Adapted information
  Detailed information

System quality
  Easy to use
  Intuitiveness and clarity of navigation structure
  Visual design
  Download time
  Accessibility requirements
  Secure use
  Integration with internal data feeding and processing
  Integration with external data feeding and processing
  Use of updated technology

Service quality
  Helpfulness in solving user's problems
  Empathy for user's
  Trust

User satisfaction
  Short response time for general inquiries
  Short response time to users with specific problems
  Services that meets the user's expectations
  Satisfaction in general

User benefits
  Improved information and services

Effective communication
24 hour accessibility
Cost savings
Time savings

Corresponding author

Kim Normann Andersen can be contacted at: andersen@cbs.dk