

# An E-Services Success Measurement Framework

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**Abstract**—The introduction of e-service solutions within the public sector has primarily been concerned with moving away from traditional information monopolies and hierarchies. E-service aims at increasing the convenience and accessibility of government services and information to citizens. Providing services to the public through the Web may lead to faster and more convenient access to government services with fewer errors. It also means that governmental units may realize increased efficiencies, cost reductions, and potentially better customer service. The main objectives of this work are to study and identify the success criteria of e-service delivery and to propose a comprehensive, multidimensional framework of e-services success. To examine the validity of the proposed framework, a sample of 200 e-service users were asked to assess their perspectives towards e-service delivery in some Egyptian organizations. The results showed that the proposed framework is applicable and implementable in the e-services evaluation; it also shows that the proposed framework may assist decision makers and e-service system designers to consider different criteria and measures before committing to a particular choice of e-service or to evaluate any existing e-service system.

**Index Terms**—IS success model, e-services success model, e-services success measurement framework.

## 1. Introduction

Since the late 1990s, governments at all levels had been launched electronic government (eGovernment) projects aimed at providing electronic information and services to citizens and businesses. In recent years, many citizens had been demanded more and better services through the Internet <sup>[1]</sup>. As governments developed systems to deliver these services, there is a need for evaluation efforts that assess the effectiveness of their e-service systems. In 2003, DeLone & McLean <sup>[2]</sup> developed an information systems success model; also Croom & Johnston <sup>[3]</sup> developed an e-service model to enhance internal customer service through e-procurement. In 2006, Zhang et al. <sup>[4]</sup> studied factors affecting e-service satisfaction whereas in 2007, Johnson <sup>[5]</sup> developed framework for pricing government e-services. This work focused on the updated DeLone &

McLean's <sup>[2]</sup> information systems success model in the context of e-services and proposed an e-services success measurement framework consists of three phases (design, implementation and results phases). The proposed framework examines how the five dimensions of quality (system quality; information quality; e-service quality; customer satisfaction; and net benefits) influence the success of applying e-services. In addition, this study aims at providing important guidelines when designing and implementing e-services system.

The remainder of this paper is organized as follows. Section 2 presents e-services, whereas, section 3 presents DeLone and McLean information system success model. Section 4 describes the proposed e-service success measurement framework, whereas, section 5 presents the formulation of proposed measurement framework Formulation. In Section 6, we apply this framework and in section 7 we discuss the results. Finally, we conclude with summaries of this work.

## 2. E-services

E-service research had been primarily concerned with the provision and development of service between an organization and its external customers <sup>[3]</sup>. E-service is the integration of business processes, policies, procedures, tools, technologies, and human efforts to facilitate both assisted and unassisted customer services in using the Internet and other networks <sup>[4]</sup>. Government provides services at different levels: for various governments (government-to-government), for private enterprise initiators (government-to-business) and for citizenry access (government-to-citizens). Government-to-citizens service involves all the communication or transactions between government, at various levels, and citizens. Now governments are developing the next stage of e-government by establishing the electronic service (e-service) infrastructure and organizational capacity for constituents to transact official business online <sup>[5]</sup>.

E-services provide a unique opportunity for businesses to offer new models for service design strategies and new service development. The Internet became a platform for business transactions. Enterprises

provide e-services via the Internet to generate new revenue or create new efficiencies<sup>[6]</sup>. Rust & Kannan<sup>[7]</sup> defined e-service as “the provision of service over electronic networks”. Whereas, Wang et al.,<sup>[8]</sup> defined it as “the information and services provided to the public on government web sites”. Also, Rowley<sup>[9]</sup> defined e-services as “deeds, efforts or performances whose delivery is mediated by information technology. Such e-service includes the service element of e-tailing, customer support, and service delivery”.

### 3. DeLone and McLean Information System Success Model

Despite the large number of empirical studies in information system (IS) success, what exactly is meant by “IS success” has never been clear. The problem is compounded because *success* is a multidimensional concept that can be assessed at different levels (such as technical, individual, group, organizational) and using a number of not necessarily complementary criteria such as economic, financial, behavioral and perceptual<sup>[10]</sup>.

#### 3.1. DeLone and McLean Model Description

In 1992, DeLone and McLean<sup>[11]</sup> comprehensively reviewed IS success measures and concluded with a model of interrelationships between six IS success variable categories: ‘system quality’; ‘information quality’; ‘use’; ‘user satisfaction’; ‘individual impact’ and ‘organizational impact’ as shown in figure 1.

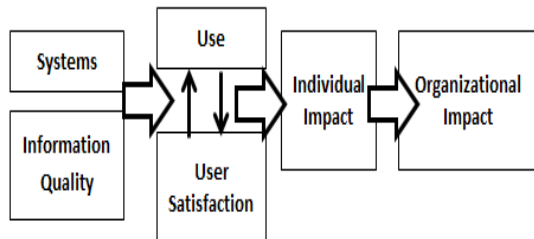


Fig 1: DeLone and McLean's 1992 Model

Later, DeLone & McLean<sup>[2]</sup> introduced an update to their IS success model. Figure 2 shows the main changes concerned quality and service quality. They defined their model dimension as follows:

- Systems quality: measured by adaptability; availability; reliability; response time; and usability
- Information quality: measured by completeness; ease of understanding; personalization; relevance; and security
- Service quality: measured by assurance; empathy; and responsiveness
- Use: measured by nature of use; navigation patterns; number of site visits; and number of transactions executed
- User satisfaction: measured by repeat purchases; repeat visits; and user surveys

- Net benefits: measured by cost savings; expanded markets; incremental additional sales; reduced search costs; and time savings

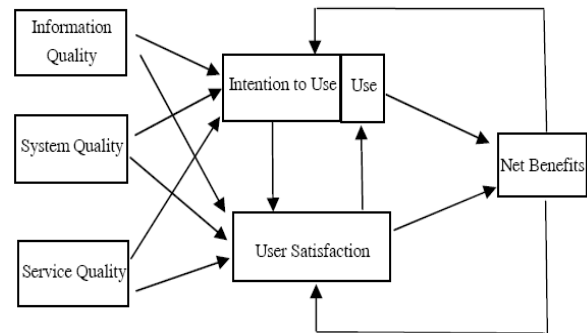


Fig 2: The updated DeLone and McLean's 2003 Model

Many empirical studies supported the updated DeLone and McLean (D&M) model<sup>[1],[12-15]</sup>.

### 4. Dimensions of Proposed e-service Success Measurement Framework

The increasing investment for the development and provision of e-services by numerous private enterprises and public organizations, which had been resulted in a wide availability of various kinds of e-services in many countries, and at the same time the low level of usage of them in comparison with expectations and the quality problems reported by<sup>[16-18]</sup> and they did a considerable research in the area of e-service evaluation and quality. In accordance with D&M<sup>[2]</sup> model, this study proposes a comprehensive, multidimensional framework of e-services systems success. The measures used in this work were adapted primarily from previous researches; the dimensions of proposed e-services success measurement framework are shown in figure 3. In reality, every study has interpreted and classified information quality system criteria conform to its context, the proposed e-services success measurement framework consists of forty four measures (thirty measures used to assess degree of success in design phase, eight measures used to assess degree of success in implementation phase and six measures used to assess degree of success in results phase) as follows:

#### 4.1. Design Phase

##### 4.1.1. Measures of System Quality

Ten items were selected to measure system quality, which covered the functionality and desired characteristics of the e-service. These items were selected from the previous studies done by<sup>[1],[19-31]</sup>. The selected system quality measures are: website design; reliability; response time; usability; adaptability; trust; usefulness; availability; maintainability; and navigation.

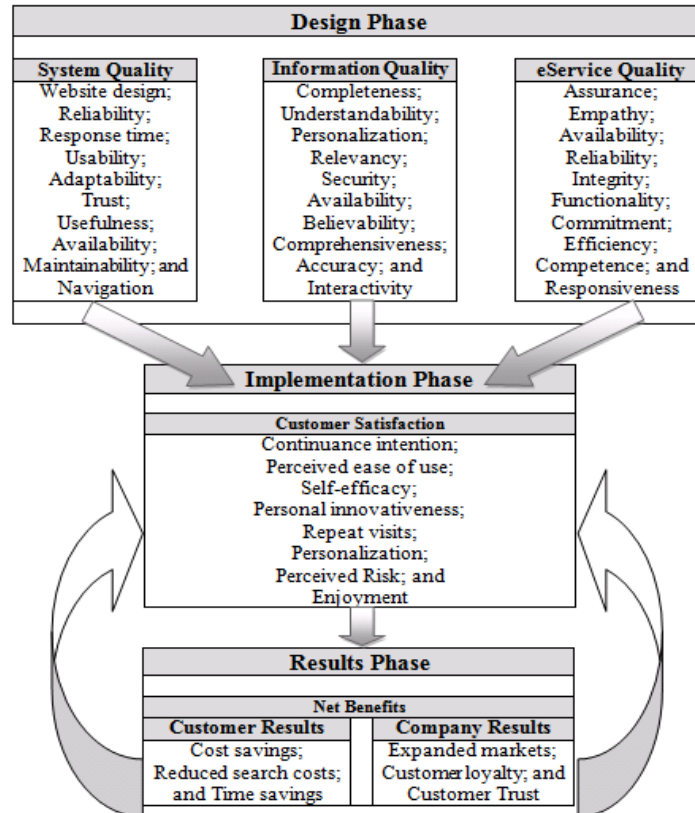


Fig 3: Dimensions of proposed e-services success measurement framework

#### 4.1.2. Measures of Information Quality

Ten items were selected to measure information quality, which were measures of the characteristics of information provided by government Web sites. These items were selected from the previous studies done by [1],[13-14],[20],[27],[30],[32-34]. The selected information quality measures are: completeness; understandability; personalization; relevancy; security; availability; believability; comprehensiveness; accuracy; and interactivity.

#### 4.1.3. Measures of e-service Quality

Ten items were selected to measure e-service quality from the previous studies done by [3],[20],[35-41]. The selected e-service quality measures are: assurance; empathy; availability; reliability; integrity; functionality; commitment; efficiency; competence; and responsiveness.

#### 4.2. Implementation Phase

##### 4.2.1 Measures of Customer Satisfaction

The intent of these measures is to measure customer satisfaction by assessing whether customers like e-service enough to use it again. These measures are relevant only for e-services that are supplied several times. Eight items were selected to measure customer satisfaction from the previous studies done [20],[23],[25-26],[31],[40],[42-46].

These measures are: continuance intention; perceived ease of use; self-efficacy; personal innovativeness; repeat visits; personalization; perceived risk; and enjoyment.

#### 4.3. Results Phase

##### 4.3.1 Measures of Net Benefits

E-service is offering a large number of benefits, based on the advantages of using e-service we can classify them in two main categories: customer benefits and company benefits as follows:

- Customer results: cost savings; reduced search costs; and time savings.
- Company results: expanded markets; customer loyalty; and customer trust.

The six measures were selected from the previous studies done by [1],[20],[23],[40],[47-50].

### 5. Proposed Measurement Framework Formulation

The degree of e-service success can be formulated as a function of the degree of satisfactions along the three phases as follows:

- Degree of e-service success (DS) = Degree of satisfactions for the three phase (DSP)

$$DS = \sum_{i=1}^3 ((DSP)_i) \times I_i \quad \dots (1)$$

- Degree of satisfactions for each phase (DSP) = Degree of satisfactions for each dimension in each phase (DSD)

$$(DSP)_i = \frac{1}{n} \left[ \sum_{j=1}^n ((DSD)_j) \right] \quad \dots (2)$$

- Degree of satisfactions for each dimension in each phase (DSD) = Degree of satisfactions for each measure in each dimension in each phase (DSM)

$$(DSD)_j = \frac{1}{m} \left[ \sum_{k=1}^m ((DSM)_k) \right] \quad \dots (3)$$

The general form of degree of e-service success (DS) can be derived by substituting equations 2 and 3 in equation 1 as follows:

$$DS = \sum_{i=1}^3 \left( \frac{1}{n} \sum_{j=1}^n \left( \frac{1}{m} \sum_{k=1}^m ((DSM)_{ijk}) \right) \right) \times I_i \quad \dots (4)$$

Where:

**I<sub>i</sub>** = degree (percentage) of importance for each phase;

**n** = number of dimensions in each phase;

**m** = number of measures in each dimension.

## 6. Case Study

To examine the validity of the proposed measurement framework, case study was taken from e-services users with at least one year experiences in e-service applications.

### 6.1. Evaluation tool

In this work, a questionnaire was used as an evaluation tool; it was derived using the suggested measures. Several professors and IS professionals were

interviewed to modify the statements and the construction of the questionnaire. They also asked to assign the degree (percentage) of importance for each phase. The degrees of importance are as follows: Design phase 60%; Implementation phase 20% and Results phase 20%. The final version of the questionnaire consists of one hundred and sixteen statements (28; 28; 28; 20 & 12 statements for systems quality; information quality; service quality; user satisfaction and net benefits dimensions). Appendix (A) shows sample of questionnaire statements.

### 6.2. Research sample and data collection

This work used quota sample. Quota sample is a convenience sample in which the size of the sample does not reflect the population as a whole. To assure the participants quick and correct response, the questionnaire copies submitted to managers in ten organizations, two hundred participants were selected as a research sample. Participants' experiences with e-services were used only to select research sample.

The participants were asked to visit three predefined websites offer e-services and indicate the extent of their agreement or disagreement on a five-point Likert-type scale (1- completely agree, 2- agree, 3- don't know, 4- disagree & 5 - completely disagree).

To reveal the participants' opinions regarding to the measurement framework dimensions, the evaluation on each dimension were grouped and the degree of satisfactions for each dimension was calculated as shown in Table 1. 35.7 % of the participants completely agree with framework statements and measures, 25.1% agree; 19.7% don't know; 10.9% disagree and 8.6% completely disagree. A summary for all results are shown in Appendix (B).

Table (1): Summary of Results

Phases	Dimensions	Completely agree	Agree	Don't know	Disagree	Completely disagree
Design Phase	System Quality	3.62	2.63	2.01	1.03	0.71
	Information Quality	3.63	2.54	1.99	1.05	0.79
	e-service Quality	3.59	2.57	2.01	1.06	0.77
Implementation Phase	Customer Satisfaction	3.53	2.34	2.13	1.01	0.99
Results Phase	Net Benefits	3.58	2.62	1.78	1.22	0.8

## 7. Results and Analysis

The aim of the case study was to check the proposed framework validity not to test the predefined websites usability. Pearson correlation was used to examine is there any correlation between the proposed framework components? The results show that the correlation coefficients are more than 0.7; it means that there is a strong positive correlation between framework components as shown in tables 2&3.

Table (2): Correlation Coefficients for design phase

Dimensions	System Quality	Information Quality	e-service Quality
System Quality		0.998997	0.999773
Information Quality	0.998997		0.999697
e-service Quality	0.999773	0.999697	

Table (3): Correlation Coefficients for design phase

Phases	Design phase	Implementation phase	Results phase
Design phase		0.99005	0.962293
Implementation phase	0.99005		0.930672
Results phase	0.962293	0.930672	

The proposed framework had been used to assess the degree of e-services success from the participants' perspective using equations from (1) to (3) or the general form in equation (4) as follows:

$$\begin{aligned}
 \text{DSD}_1 (\text{System quality dimension}) &= 2.50 \\
 \text{DSD}_2 (\text{Information quality dimension}) &= 2.48 \\
 \text{DSD}_3 (\text{Service quality dimension}) &= 2.48 \\
 \text{DSD}_4 (\text{Customer satisfaction dimension}) &= 2.43 \\
 \text{DSD}_5 (\text{Net benefits dimension}) &= 2.74
 \end{aligned}$$

Degree of satisfactions for each phase (DSP)

$$\begin{aligned}
 \text{DSP}_1 (\text{Design phase}) &= 2.48 \text{ (49.6 \%)} \\
 \text{DSP}_2 (\text{Implementation phase}) &= 2.48 \text{ (49.6 \%)} \\
 \text{DSP}_3 (\text{Results phase}) &= 2.74 \text{ (54.8 \%)}
 \end{aligned}$$

The general degree of e-service success (DS)

$$\begin{aligned}
 \text{DS} &= (2.48 \times 0.6) + (2.48 \times 0.2) + (2.74 \times 0.2) \\
 &= 2.532 \text{ (51 \%)}
 \end{aligned}$$

The results show that the degree of e-service success depends on the degree of customer satisfactions. It also show that customers satisfied on design and implementation phases by 49.6 % and in results phase by 54.8%. Total satisfactions of using the tested websites (e-service success) is 51%, it means that there is an opportunity to improve website usages to increase customer satisfactions for e-service.

## 8. Conclusion

This work proposes a framework for evaluating e-service application success. The work modified D&M 2003 by canceling one dimension (intention to use) and adding many measures to assess the other five dimensions. It doesn't focus on single dimensions of IS success as <sup>[18],[51-52]</sup>. Instead, it describes the probability of success during e-service life cycle (from design to results). The case study showed that the proposed framework is applicable and implementable in the e-services evaluation process, it also showed that the proposed framework may assist decision makers and e-service system designers to consider different criteria and measures before committing to a particular choice of e-service or to evaluate any existing e-service system. The findings obtained from the case study show several conclusions. First, the design phase has a strong and significant influence on other phases, and as consequence, the overall degree of success of e-service. Thus, e-service system designers should make full use of the proposed measures to increase user satisfaction

and behavioral intention to use e-service. Second, because e-service lacks physical contact, e-service system designers should focus on methods that attract and encourage participations in using e-service. They also should actively seek methods of improving system and service quality, since these factors significantly affect user satisfaction. Finally, the proposed framework of e-services systems success derived in this work can be used as a reference for e-service planning and improvements. Future studies can validate these results by replicating this study with specific type of e-service (e-procurement, e-shopping, e-banking, etc...) and consequently the degree of importance for each type. Also, it is required to increase sample size to avoid any participants' biasness and be able to generalize the results.

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**Appendix (A): Sample of Questionnaire statements**

Statement	Agreements				
Dimension: Measures for system quality	1	2	3	4	5
In the e-service system website everything is easy to understand.					
The e-service system website is simple to use, even when using it for the first time.					
It is easy to find the information I need from the e-service system website.					
The structure and contents of the e-service system website are easy to understand.					
Dimension: Measures for information quality	1	2	3	4	5
The output information of the e-service website is complete and secure.					
Information contains necessary topics to complete related task.					
The e-service website provides information precisely according to my need.					
The output information of the e-service website is easy to understand.					
Dimension: Measures for e-service quality	1	2	3	4	5
Security and privacy policies are accessible.					
The website contains company details.					
The website's retailer is widely known for having a good reputation.					
The technical functions of e-service website are secured.					
Dimension: Measures for customer satisfaction	1	2	3	4	5
I intend to continue using e-service rather than discontinue it use.					
I recommend e-services website to others.					
I find the e-services website to be flexible to interact with.					
It is easy for me to become skillful at using e-services website.					
Dimension: Measures for Net benefits	1	2	3	4	5
Reduces overhead costs such as benefits administration.					
Reduces operation time.					
Allows searches of large volumes of different products and services.					
Customers can quickly find answers to their most frequently asked questions on e-service website.					

Appendix (B): Results

% of importance			Measure	Completely agree	Agree	Don't know	Disagree	Completely disagree	Net results
Design Phase	System quality	20 %	Website design	3.9	2.2	2.1	1.0	0.8	2.49
			Navigation	3.3	3.0	2.0	1.0	0.7	2.48
			Trust	4.0	2.2	2.0	1.1	0.7	2.51
			Usability	3.3	3.0	2.0	1.0	0.7	2.48
			Reliability	3.5	2.8	2.0	1.0	0.7	2.49
			Response time	3.7	2.7	1.9	1.0	0.7	2.51
			Availability	3.0	3.0	2.0	1.0	1.0	2.40
			Adaptability	4.3	2.2	2.0	1.2	0.3	2.60
			Usefulness	3.2	3.0	2.0	1.0	0.8	2.45
	Information quality	20 %	Maintainability	4.0	2.2	2.1	1.0	0.7	2.52
			Completeness	3.9	2.2	2.0	1.1	0.8	2.49
			Understandability	3.9	2.2	2.0	1.0	0.9	2.48
			Personalization	3.3	3.0	2.0	1.0	0.7	2.48
			Relevancy	4.0	2.1	2.0	1.2	0.7	2.50
			Security	3.5	2.8	2.0	1.0	0.7	2.49
			Availability	3.4	2.9	1.9	1.1	0.7	2.48
			Believability	3.7	2.2	2.0	1.1	1.0	2.43
			Comprehensiveness	3.3	3.0	2.0	1.0	0.7	2.48
	E-service quality	20 %	Accuracy	3.3	3.0	2.0	1.0	0.7	2.48
			Interactivity	4.0	2.0	2.0	1.0	1.0	2.47
			Assurance	4.0	2.2	2.1	1.0	0.7	2.52
			Empathy	3.3	3.0	2.0	1.0	0.7	2.48
			Availability	3.3	3.0	2.0	1.0	0.7	2.48
			Reliability	3.7	2.1	2.0	1.2	1.0	2.42
			Integrity	3.2	3.0	2.0	1.0	0.8	2.45
			Functionality	3.7	2.3	2.0	1.2	0.8	2.46
			Commitment	3.3	3.0	2.0	1.0	0.7	2.48
Implementation Phase	Customer satisfaction	20 %	Efficiency	4.0	2.1	2.0	1.1	0.8	2.49
			Competence	3.4	2.8	2.0	1.0	0.8	2.47
			Responsiveness	4.0	2.2	2.0	1.1	0.7	2.51
			Continuance intention	3.3	2.8	2.0	1.0	0.9	2.44
			Perceived ease of use	4.0	2.0	2.0	1.0	1.0	2.47
			Self-efficacy	3.6	2.2	2.1	1.1	1.0	2.42
			Personal innovativeness	3.0	3.0	2.0	1.0	1.0	2.40
			Repeat visits	4.0	2.0	2.0	1.0	1.0	2.47
			Personalization	3.0	2.0	3.0	1.0	1.0	2.33
			Perceived Risk	3.3	2.7	2.0	1.0	1.0	2.42
Enjoyment	4.0	2.0	2.0	1.0	1.0	2.47			

Results Phase	Net benefits	20 %	Customer Results:					
			Cost savings	3.0	4.0	2.0	2.0	2.87
			Reduced search costs	4.5	2.0	2.0	1.0	2.63
			Time savings	3.5	4.0	2.0	2.0	3.03
			Company Results:					
			Expanded markets	3.0	3.0	2.0	1.0	2.40
			Customer loyalty	3.5	3.0	2.0	2.0	2.77
			Customer Trust	4.0	3.0	2.0	1.0	2.73