

Applying DeLone and McLean information systems success model in the evaluation of e-government initiatives: a literature review

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Abstract

This paper is a review of existing literature on the use of DeLone and McLean's (1992, 2003) information systems success model in evaluating e-government initiatives. Electronic governments' practices are universally acknowledged to aid service delivery to the citizens. The e-government evaluation is considered important because of the enormous investment by governments to deliver effective services. E-government evaluation is complex both in theory and practice and the debate amongst researchers is not only in the evaluation complexity but also about the most appropriate approach to use. The DeLone and McLean information systems success model is one of the most widely used for measuring information systems' success. Many studies have utilised this model to evaluate the success of information systems over the years. This paper confirms that the model has been applied in various IS domains, but in e-government evaluation the usage is low; e-government is seen as being at a cross-roads between various research domains such as computer science and information systems. The analysis established that even when the model is applied in e-government, some of the dimensions are selected and combined with others closely related to the study.

Keywords: DeLone and McLean Model, e-government success evaluation, e-government; information systems success

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1. Introduction

Governments across the world have embraced the implementation of electronic government systems with the aim of realising many benefits, for themselves as providers of public services as well as for the citizens who are the users of the services (Weerakkody, Irani, Lee, Hindi, & Osman, 2016). E-government is commonly defined as the use of information and communication technologies (ICTs) by the government, to deliver services and information to the citizens, the business community and all other branches of government (Nam, 2014).

E-government initiatives have become effective tools for governance reforms in confronting public service-related challenges. This has resulted in an increase in transparency, reduction in corruption, improved efficiency, reduction in administrative cost, and overall better quality of life for citizens (Ali, Hoque, & Alam, 2018). Deng, Karunasena, & Xu, (2018) observed that the rapid development of e-Governments projects all over the world has created an urgent need for continuous evaluation. In addition, e-government initiatives consume a significant amount of public funds hence concerned government agencies should be able to justify some form of return on investment.

It is therefore essential that such major government initiatives undergo post-implementation assessment. Shan, Wang, Wang, Hao, & Hua (2011:174) assert that, based on the outcome of the results; government could take necessary and relevant action. This kind of evaluation can assist government agencies to establish whether or not they are performing the required tasks and delivering effective and efficient services to meet the citizens' expectation.

The evaluation of an information system's success is considered an important aspect of the information system field both in practice and research. E-government project evaluation helps to identify the strengths, weaknesses and best practices for both local and international integration. However, the approaches used for the evaluation have changed over the years, as context, purpose and IT impact evolve (Delone & Mclean, 2016). Although various information success models have been applied in

different contexts, in the area of e-government insufficient research has been carried out to identify the success of e-government measures from citizens' perspectives.

Belanger & Carter (2012) analysed 30 e-government peer reviewed journals, and only two used citizen- based data, confirming that the impact of e-government on the citizens has not been well researched. From the e-government research available, little is known about the impact and result of e-government projects or their capacity to bring about real changes in organisation that would improve public service delivery. Luna-Reyes *et al.*, (2012) acknowledge that efforts have been made to evaluate different dimensions of electronic government systems. Most of the areas covered have focused on the impact of e-government on employees (Gable, Sedera, & Chan, 2008; Scott, H., & Golden, 2009 ; Stefanovic, Marjanovic, Delic, Culibrk, & Lalic, 2016) on government-to-citizen systems (Wang & Liao, 2008), and e-government websites (Teo, Srivastava & Jiang, 2008; Huang & Benyoucef, 2014; Verkijika & De Wet, 2018)

Scott, Delone, & Golden (2016) point out that more research needs to be done to ascertain the impact and results of e-government projects. The e-government success measurements are not well understood by the research communities as well as by practitioners. More research focusing on the holistic approach of examining e-government initiatives from the citizens' perspective, as the users of the system, needs to be carried out.

Rana, Dwivedi, Williams & Lal, (2015:42) acknowledge that DeLone and McLean's IS model has gained much attention among researchers, but point out that not much research has been done on the evaluation of the success of e-government systems, using the IS model. This review provides an understanding of the extent to which DeLone and McLean's information system success model is being utilised in the evaluation of e-government initiatives.

2. Purpose

This literature review seeks to answer the following research questions: (1) what is the extent of the use of DeLone and Mclean's IS success model in e-government

evaluation research? (2) Are the six dimensions of DeLone and McLean's IS model being used in e-government evaluation research? (3) What are the challenges of using the D&M Model in evaluating e-government information systems?

3. Theoretical background

The evaluation of information systems (IS) success has been discussed widely in the field of information systems. (Shan *et al.*, 2011:176) point out that the evaluation of e-government projects pinpoints strengths and weaknesses, tracks national progress and moves toward an inclusive information society. Moreover, the rapid development in e-government has created an urgent need for continuous performance evaluation of e-government projects in the world (Alcaide-muñoz & Bolívar, 2015).

Wang, Wang, Lin & Tsai, (2019) note that research in the field of information systems' (IS) success has been informed by a number of models which include: the original D&M IS success model, which was a comprehensive review of different IS models (Delone & Mclean, 1992); the updated D&M IS success model comprising six dimensions (Delone & Mclean, 2003); e-commerce systems' success model adopted from a D&M updated model (Wang, 2008); model of e-government systems success based on the updated D&M model IS success model (Wang & Liao, 2008); modified D&M IS success model introduced educational equality instead of net benefit (Zheng & Liang, 2017); and modified D&M IS success model for the assessment of cloud e-bookcase system (Chiu, Chao, Kao, Pu, & Huang, 2016).

This review is mainly informed by the use of DeLone & McLean's (2003) updated information success model which was introduced by DeLone and McLean in 1992. In their search for information systems' success measures, they found a wide variety of measures in different studies. However, after comprehensively reviewing literature in 180 empirical studies, they grouped the IS success dimensions into six main categories: (1) systems quality (2) information quality (3) use (4) user satisfaction (5) individual impact and (6) organisational impact (Delone & Mclean, 1992). Later, the model received considerable criticism by Seddon (1997). Among other things, the

author claimed that the model is confusing because it mixes processes and casual explanations of information systems.

Ten years later, DeLone and McLean published an updated version of the IS success model, which added service quality as a new dimension of measuring IS success, and they merged organisational and individual impacts into a single impact variable called “net benefit” (Stefanovic *et al.*, 2016). The emphasis of the DeLone & McLean, (2003) updated model is on the importance of measuring the success of information systems. The model comprises six dimensions of success. Ondego & Moturi (2016) state that the model can be used to show a causal relationship: how ICT project implementation affects IS quality, and in turn affects the perceived benefits.

Stefanovic *et al.* (2016:19) point out that the D&M model is the most widely used model in evaluating IS success, and that it has been used to measure the success of various information systems. The model has been used in the assessment of e-government projects, as e-government systems are considered to be an aspect of information systems. Within the e-government context, citizens use web-based applications to search for government information, and to conduct transactions. This web-based application is an information system phenomenon that is best evaluated using the IS success model. According to DeLone & McLean's (2003) model, there are six attributes of successful information systems, which are multidimensional and closely interrelated, as illustrated in Figure 1 below:

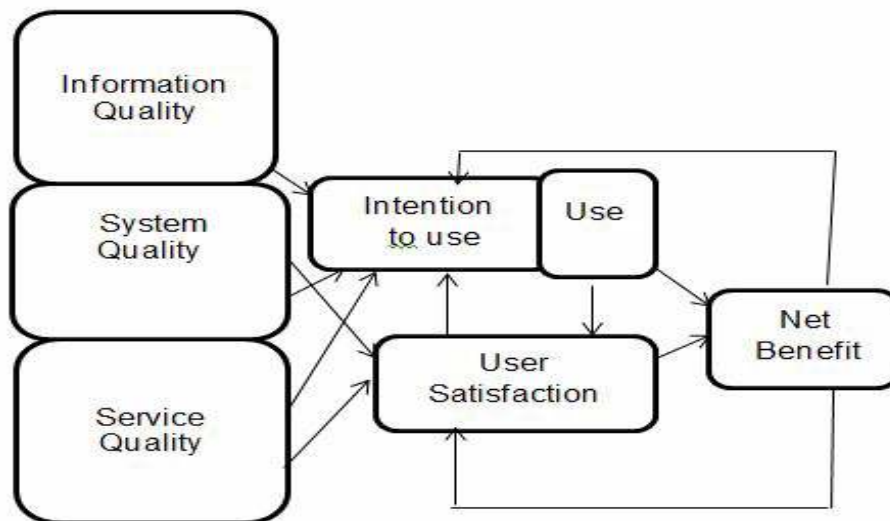


Figure 1: DeLone and McLean, (2003:24)

System quality in an e-government system is about the performance of the system in terms of its ease of use and learning integration. System quality is a key determining factor of e-government system use (Teo *et al.*, 2008): how flexible and reliable the e-government system is to the users; and how friendly and usable the system is in terms of accessing government information (Wang & Liao, 2008). In an e-government setup, system quality symbolises the perceptions of citizens on the technical performance of the information system, in terms of information retrieval and delivery.

Information quality is defined as the quality of e-government output, and it is associated with the routine requirements of the user (Petter, DeLone, & Mclean, 2013). Increased information quality has an impact on the level of openness and transparency citizens have with the government (Grimsley, Meehan & Tan, 2007). The desirable factors that are associated with quality in an e-government system are: continuous access to government information and services, provision of accurate, relevant and updated information, and the provision of efficient and effective services to the citizens (Ondego & Moturi, 2016).

Service quality can be described as the overall support the users of an e-government system receive from the service provider (DeLone & McLean, 2003). This construct measures the general perspective of e-government systems, from the perspective of how ready the staff is to provide the required service, and examines the accessibility

of the system, as well as the safety of transactions undertaken. The availability of the system to users, provision of individualised attention by the IT personnel and the specific needs of users are evaluated under this construct (Stefanovic *et al.*, 2016). The focus of this construct is to measure how well the e-government services are delivered, and whether or not they match the expectations of the users.

The intention to use/use is the degree to which customers and staff use the capabilities of an e-government system. Petter, Delone, & Mclean, (2008) assert that the use and intention to use construct can be used alternatively, depending on whether the context of usage is voluntary or mandatory. For the e-government system, use is more relevant since citizens' utilisation of the system is voluntary. The "use" construct evaluates the attitude to, and the general satisfaction of, users with the e-government system.

User satisfaction is the means of measuring customer's opinion of the information system; it should capture the entire customer experience, in terms of the reports produced and the support services provided to the users (DeLone & McLean, 2003).

Net benefit can be described as the extent to which e-government information systems contribute to the success of clients and organisations using the system such as greater efficiency, improved decision-making, and improved productivity (DeLone & McLean, 2003).

DeLone and McLean (2003) model as more widely used information systems success model

The revised DeLone and McLean IS success model has been used for various aspects of information systems success, and it is considered widely used in the evaluation of IS success (Khayun, Ractham, & Firpo, 2012; Stefanovic *et al.*, 2016). E-government is considered to be an aspect of an information system and the D&M Model can be applied to assess its effectiveness. The key primary purpose with which the two scholars, DeLone and McLean, came up with the model was to synthesise the previous information systems research into more coherent knowledge, which can be used as a guide for future researchers. Although the model has not been empirically

tested, it has guided many researchers in assessing the success of information systems (Khayun *et al.*, 2012) Lowry, Karuga, & Richardson's (2007) fifteen-year scientometric analysis of articles from three premier IS journals between 1990 – 2004 indicate that DeLone and Mclean are among the most highly cited authors in the field of information systems. They used the citation analysis to demonstrate the impact of articles on individual authors in the field of information systems.

Hussein, Karim, Mohamed, & Ahlan, (2007:2) opine that DeLone and McLean's model was a major breakthrough in the IS field, as the model has become universal and instrumental in evaluating information systems performance. A number of studies have used the model to evaluate different aspects of the e-government system: Wang & Liao (2008) successfully used the model to study on citizens' perspectives of e-government system. In another study, Teo *et al.* (2008) examined the role of trust in e-government success using 214 Singaporeans e-government website users. In a related study, Connolly, Bannister, & Kearney (2010) evaluated the quality of Irish revenue online e-government system.

According to Schaupp (2010:47), the D&M model is the most predominant in information systems literature, and it is a widely cited framework that providing a comprehensively review the success of IS. It has been cited in over 300 referenced journals as the basis of measuring different valuables in information systems research. The author explains that users make use of an information system and then evaluates it on the basis of either being satisfied, or not, with the outcome. Floropoulos, Spathis, Halvatzis, & Tsipouridou, (2010) used the model to measure the success of Greek e-government taxation information system, from the employees perspectives.

In a similar study, Hsu & Chen (2007) assessed the e-government model in Taiwan, on user behaviour. Chiu *et al.*, (2016:240) explain that evaluating information system' success is difficult, but based on DeLone and McLean's strong foundation and extensive literature review, the model has a concrete definition of success, and the capability to explain the success factors that influence both individual and organisational users of information systems.

Some recent publications on the satisfaction of e-government services (Rana, Dwivedi, Williams, & Lal, 2015; Floropoulos et al., 2010; Formunyuy & De Wet, 2018; Rana, Dwivedi, Williams, & Weerakkody, 2015; Veeramootoo, Nunkoo, & Dwivedi, 2018) have used different approaches of the D&M model to evaluate the success of information systems. Rana, Williams, Dwivedi, & Williams, (2012:42) assert that DeLone and McLean's (1992, 2003) IS success model has been instrumental in establishing the primary factors that influence the use and acceptance of e-government services by citizens.

Critiques of D&M model

The main critic of the Delone & Mclean, (1992) model was Seddon, who claimed that "the inclusion of both variance and process interpretation in the model leads to so many potentially confusing meanings" (Seddon, 1997:240). Another critic observed that the measures of IS effectiveness focus more on the product than the service of IS. The argument was that IS researchers will not determine IS effectiveness if service quality is not included in the assessment package (Pitt, Watson, & Kavan, 1995:173).

DeLone and McLean addressed the criticism by proposing an updated model (DeLone & Mclean, 2003), which grouped all the "impact" measures into "net benefit" and also added another measure "service quality" as a new dimension. Seddon, (1997) further claimed that the use construct in D&M model is not a success measure, but that of behavior. The argument was that non-users of a system may not indicate that it is not useful, but that potential users are engaged with other tasks.

Other researchers have mentioned the difficulties of applying the D&M model in the area of defining and implementing the IS model in some specific research contexts. Jiang & Klein (1999) claim that users have different preferences of measures, depending on the type of system being evaluated. Despite the criticisms, the D&M model makes important contributions to understanding IS success. It provides a scheme for categorising various IS success measurements that are used in literature, and suggests a model of casual dependencies between the categories (Seddon, 1997).

4. Approach /method

To conduct this review, Webster & Watson's (2002) approach was used. The approach recommends the following guidelines to be considered when conducting research on systematic literature review, especially in information systems related research; (1) to select and use the right keyword for searching the databases (2) to select the most relevant publications with matching criteria (3) in-depth reading to identify irrelevant publications. The literature search for this study concentrated on the period 1992-2018, the choice of 1992 as the baseline is because that was when the first DeLone and McLean (D&M) model appeared. To retrieve relevant updated literature for this review, EBSCO Discovery Service and SCOPUS databases were used. A number of search strings were used to conduct the searches and these include: D&M IS success model, e-government success evaluation and information systems success.

A ten-year analysis of D&M Model application was conducted by carrying out a search on two online databases. The focus of this analysis is to explore the application of the model in e-government research. The literature selection process is presented in Figure 2:

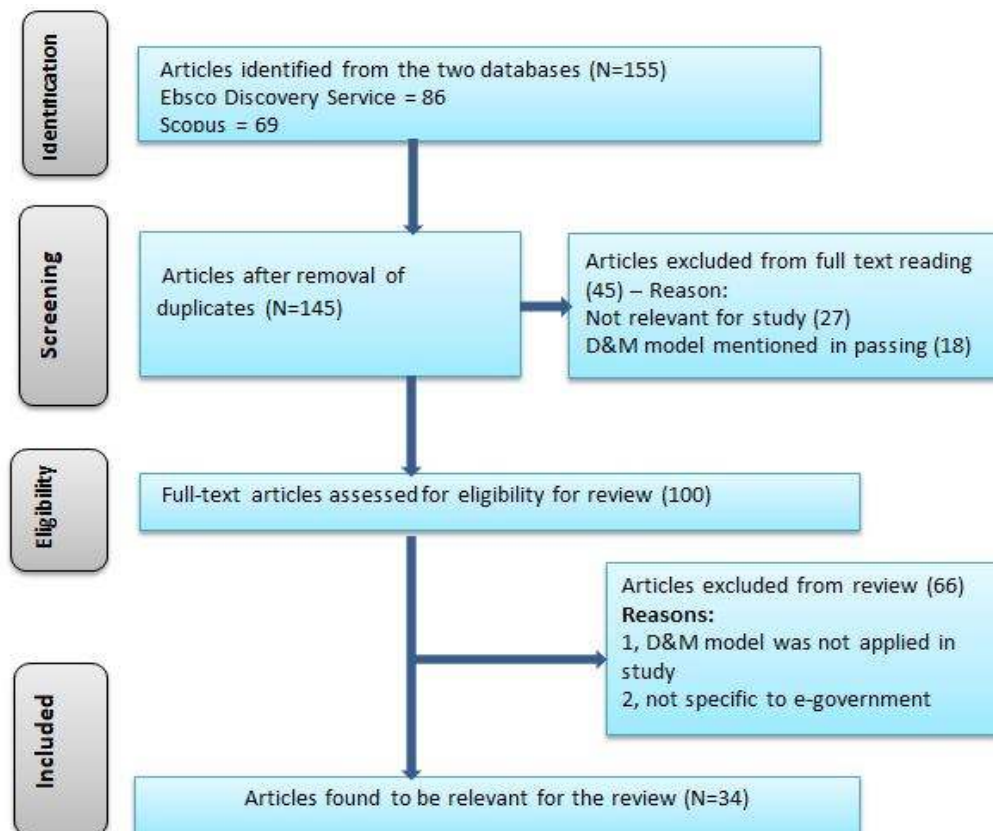


Figure 2: Flow chart of the literature selection process
(Sampson *et al.* 2009:948)

Step one: The search was carried out using these two reliable and reputable online journal databases. The databases are updated daily, have diverse field coverage and contain peer reviewed articles. The two databases allows the use of delimiters to refine the search .The databases of choice for the literature analysis are

1. Ebsco Host Discovery (<https://ebSCO.com>)
2. Scopus (<http://www.scopus.com>)

Step two: The study was restricted to articles published from 2009 to 2019

Step three: To extract the articles, the study search included only open access articles published in English language, that are peer reviewed and full text between 2009 and 2019. The advanced search strategy was performed on the databases using the Boolean operators, ‘AND’ and ‘OR’ to filter the search. To be included for review, both DeLeon & McLean model or IS success AND e-government must feature in the title, keywords by author or in the abstract. Some of the articles were irrelevant

and were further filtered. A summary of the inclusion and exclusion criteria is presented below in Table 1.

Table 1 Inclusion and exclusion criteria	
<ul style="list-style-type: none"> • Inclusion criteria: • Open access articles about DeLone & McLean model • Articles about information systems model • Articles written in English • E-government articles that applied D&M IS success model in the study • Articles that can answer the research question • Articles published from 2009 - 2019 	<ul style="list-style-type: none"> • Exclusion criteria: • Duplicate articles • Articles that are not written in English • Articles that are not full text • Articles that are not dealing with e-government • Articles that did not apply D&M IS success model in the study • Unpublished articles

Step four: The remaining full text articles were then analysed to determine whether they met the stipulated criteria. Articles that met these criteria were the ones included for review in the study. Data extraction

Table 2 below presents the result of data extracted from the two databases.

Table 2 Number of studies in the two selected sources		
Source	Direct search results	Selected for the study
Ebsco Host Discovery	86	23
Scopus	69	11

For the eligibility, all extracted data was screened as presented in Table 3.

Table 3 Screening of extracted data		
	Screening label	Number of studies
A	Directly eligible articles	34
B	Model discussed but not applied in the study	66
C	Mentioned in passing	18
D	Not relevant	27
E	Duplicate	10
	TOTAL	155

5. Findings and discussions

The analysis findings are presented according to the three research questions the study sought to answer.

5.1 What is the extent of use of DeLone and Mclean IS success model in e-government evaluation- research?

The study findings as indicated in Figure 2 show that of 100 articles eligible for the study, 66 were excluded because they were not related to e-government evaluation. This analysis shows that the model has not been applied in e-government like in other areas dealing with IS. The analysis also shows the highest number of the articles (16) that discuss various aspects of D&M model application in e-government originated from Asia; followed by Europe, then North America. The least are from Africa.

This is not surprising, because according to the 2018 e-government survey (United Nations, 2018) Asia has a noticeable improvement in e-government development, 37 out of 47 countries in Asia scored above the world average e-Government Development Index (EGDI). In the same report, countries in the African regional's average EGDI scores were significantly lower than the world average. Africa is making progress, but can learn from the countries with high EGDI. The highest number of the papers reviewed, dealt with the subject of e-government preformation and user satisfaction, which are key indicators of an e-government system success as presented in Table 6.

Table 6 Geographical & subject distribution of articles of study					
Subject	Africa	Asia	Europe	North America	Totals
E- Filing		1			1
E-government systems Adoption				2	2
E-government performance / satisfaction	2	6	4	1	13
Transparency in government		2	1		3
Online public grievance redressal system		2			2
Internet in public administration		2	2		4
Website evaluation	1	1	2	1	5
Information storage & retrieval system		2	2		4
Totals for each region	3	16	11	4	34

5.2 Are the six dimensions of DeLone and McLean IS model being used in e-government research?

The results of the analysis reveal that the six dimensions of the model were not applied in the studies reviewed as presented by DeLone and McLean. Studies which used all the dimensions of the model had to make some modification to suit the IS being evaluated. Information quality, service quality and user satisfaction constructs were highly used in the reviewed articles.

The results of this review show that most e-government evaluation studies in Africa use some of the dimensions of D&M model and add others that complement the IS being assessed. Both the Ebsco Discovery Service and Scopus review results showed that no study had adopted the D&M model for e-government performance evaluation in Kenya.

5.3 What are the challenges of using D&M Model in evaluating e-government information system?

The evaluation of e-government initiatives like all other information systems has proven to be important and complex, both in theory and practice. The complexity arises because of the many perspectives involved; the difficulties in identifying and quantifying benefits; not being familiar with evaluation techniques; and the difficulties

in the interpretation of results from the data collected (Grimsley & Meehan, 2007; Alshawi & Alalwany, 2009 ; Shan *et al.* 2011)

In the e-government context, determining stakeholders is complex because of the diversity (government officials, elected representatives, public and private organisations). This requires the researcher to be clear on who the stakeholders for the study are. The context of measuring net benefit needs to be clear for each study. Confusion arises as to what constitutes net benefit, whether it should be looked at from the individual perspective, the government or that of business community or citizens. Different stakeholders may have varying opinions on what constitutes net benefit to them.

Table 4 presents the key findings for each article extracted from Ebsco Host Discovery.

Compendium of D & M Model application in e-government as reflected by Ebsco discovery service (2009-2019)

Table 4: Key findings from the reviewed Ebsco Discovery articles				
S/ N	Author	Year	Title of publication	Focus of publication
1.	Akram, Malik, Shareef, & Goraya, Shakir	2019	Exploring the interrelationships between technology predictors and behavioral mediators in online tax filling: the role of perceived risk	The study investigates the relationship between technology and behaviour mediators in explaining users' continuance intention for using online tax filing. D&M model construct information, systems & service quality were used in evaluating the e-tax system.
2	Chen, Hu, Tseng, Juang, & Chang,	2019	Cross-boundary e-government system: determinants of performance	Focus is on the cross-boundary e-government system studies in order to develop a framework for key performance measures (efficiency, effectiveness and accountability) using some of D&M model constructs
3	Veeramootoo <i>et al.</i>	2018	What determines success of an e-government Service? Validation of an integrative model of e-filing continuance usage	Study validated continuous usage of the integrated e-filing model, which has its basis in D&M Information system Success Model
4	Zaidi, Muneerah, & Aminah	2018	Relationship between service quality and e-government acceptance: the role of gender as a moderator	The paper investigates the factors that contribute to continued use of e-government in Malaysia. Findings show that quality of service a construct of D&M model is important in the uptake of e-government services
5	Hasan <i>et al.</i>	2018	A proposed conceptual success model of citizen-	Aim of the study was to find e-government system success, using theoretical approach. Information and service quality D&M success model

			centric digital government in Malaysia	constructs were used to measure the overall quality of the government system
6	Suh, Chung, & Choi	2017	An empirical analysis of a maturity model to assess information system success: a firm-level perspective	Particular focus of the study is on factors that influence citizens' trust in e-government adoption. It's a review of six databases, from the findings, a conceptual framework is proposed by developing D&M model further, and adds trust as an additional construct
7	Alzahrani, Al-karaghoul, & Weerakkody	2017	Analysing the critical factors influencing trust in e-government adoption from citizens' perspective: a systematic review and a conceptual framework	Provides a critical and systematic review on factors that influence citizens' trust in the adoption of e-government. Based on the review, a conceptual framework was proposed, using the D&M model constructs
8	Weerakkody <i>et al.</i>	2016	Are U.K citizens satisfied with e-government services? Identifying and testing antecedents of satisfaction	Focus of the study is on UK citizens' satisfaction with the e-government services by examining the impact of information quality, systems quality & trust using D&M model to establish user satisfaction with the services.
9	Sharma & Jayasimha	2016	Assessment of e-government services quality: an emerging market perspective	A review of existing models of e-government, including D&M model on service quality and service delivery were used. From the findings, a new conceptual model for measuring service quality of e-government is proposed.
10	Stefanovic <i>et al.</i>	2016	Assessing the success of e-government systems: an employee perspective	Examines IS success of e-government system from employees' perspectives. The results confirm the validity of D&M model in the context of e-government employees

11	Rehman, Kamal, & Esichaikul	2016	Adoption of e-government services in Pakistan: a comparative study between online and offline users	Study investigates the critical factors that influence citizens' intention to use e-government services at the information and transaction level. D&M model construct was utilized in the study.
12	Agrifoglio, Metallo, & Lepore	2016	Success factors for using case management system in Italian courts	Focuses on understanding the effectiveness of e-court application system. Study applied the D&M model constructs of information & service quality to establish the systems effectiveness to court users
13	Mellouli, Bentahar, & Bidan	2016	Trust and e-government acceptance: the case of Tunisian online tax filing	The paper identifies trust as a determinant of intention to use the online tax filing system by combining construct of both TAM and D&M model
14	Rana, Dwivedi, Williams, & Lal	2015	Examining the success of the online public grievance redressal system: an extension of the IS success model	The study examines the success of the online public grievance redressal system, from the citizens' perspectives, using information, system quality and user satisfaction D&M model constructs in order to improve on transparency and minimise corruption
15	Fan & Yang	2015	Study on e-government services quality: the integration of online and offline services	Focus is on establishing the key factors affecting the perceptions of users on the quality of e-government services, using three D&M model construct information, system and service quality.
16	Ritchi, Wahyudi, & Susanto	2015	Research program on key success factors of e-government and their impact on accounting information quality	Multi-years research on 27 municipalities to measure the implication of e-government on the accounting information quality using the theoretical foundations of D&M IS success model and TAM
17	Rana, Dwivedi,	2015	Investigating success of an e-government initiative:	The paper focuses on measuring the intention of use and user satisfaction of

	Williams, & Weerakkody		validation of an integrated IS success model	system, from Indian citizens' perspectives, using D&M IS success model to ascertain the success.
18	Dwivedi, Wastell, Laumer, & Henriksen	2015	Research on information systems failure and successes; status update and failure	The focus of the study was to bring out the need for new perspective and to provide insights on the factors that enable IS success, as well as the factors to consider, in order to avoid IS failure.
19	Venkatesh, Hoehle, & Aljafari	2014	A usability evaluation of Obamacare website	Investigates the usability and satisfaction of US citizens with the Obamacare website. The approach used has its theoretical basis on D&M model, especially on the quality of information received by citizens
20	Jukic, Vintar, & Bencina	2013	Ex-ante evaluation: towards an assessment model of its impact on the success of e-government projects	The research tries to fill the gap between the theoretical and empirical approach on issues of ex-ante e-government evaluation using some of D&M success constructs; service quality, use & user satisfaction. Results prove that the ex-ante evaluation of e-government projects has impact on project success.
21	Alawneh, Al-refai, & Batiha	2013	Measuring user satisfaction from e-government services: lessons from Jordan	A review to identify key factors which determine the satisfaction of citizens with Jordan's e-government service portals. Information and service quality D&M model constructs were considered for the review.
22	Rana et al.	2012	Theories and theoretical models for examining the adoption of e-government services	The study systematically explores existing body of literature in e-government. The use of D&M model analysis indicated that system quality was not used to measure intention of use

23	Kaisara & Pather	2011	The e-government evaluation challenge: a South African Batho Pele-aligned service quality approach	The paper focuses on evaluating e-government service quality in South Africa e-government websites. Information quality, a D&M dimension, has been used to evaluate the quality of information being accessed by the citizens.
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Compendium of reviewed D & M Model application in e-government as reflected by Scopus (2009-2019)

Table 5: Key findings from the reviewed Scopus articles				
S/ N	Author	Year	Title of Publication	Focus of Publication
1	Tegethoff, Santa, Granobles, & Hoyos	2019	Does trust have impact on system and operational effectiveness? The implementation of e-government in Colombia	The focus is on investigating trust in e-government system after implementation. Three D&M model construct: information, system and service quality were used in the evaluation. From the findings, system and service quality had no impact on operational effectiveness
2	Santa, Macdonald, & Ferrer	2019	The role of trust in e-government effectiveness, operational effectiveness and user satisfaction: lesson from Saudi Arabia in e-government to business.	Explores the effect of trust on online e-government system satisfaction by the users. Information, systems and service quality of the D&M IS success model measures were considered as key drivers of user satisfaction
3	Idoughi & Abdelhakim	2018	Developing countries e-government services evaluation identifying and testing antecedents of satisfaction case of Algeria	The impact of systems, information and service quality D&M model constructs were considered key factors in establishing users' satisfaction with the e-government system in Algeria.

	Idoughi & Abdelhakim		antecedents of satisfaction case of Algeria	in establishing users' satisfaction with the e-government system in Algeria.
4	Wirtz & Kurtz	2018	Local e-government service: quality aspects and citizens usage preferences.	Investigates the role trust plays between operational and system effectiveness. D&M constructs: information systems and service quality, were applied in the study and the quality of information was the most significance.
5	Mirchandani, Kathawala, Jr, Hayes, & Chawla	2018	A comparison of perspectives of Kuwait and Indonesian residents towards e-government.	The study focused on assessing the importance of e-government services and the website features, using residents of both countries. D&M IS success measures were used and the results showed that residents' feedback on the website was important.
6	Aminah <i>et al.</i>	2018	E-procurement system success factors and their impact on transparency perceptions: perspectives from supplier side	Study focus analyses the determinants of e-procurement systems' success and the impact on expected transparency from the suppliers. D&M model constructs system and service quality, and user satisfaction, were considered for the study
7	Widiyanto, Sandhyaduhiti, Hidayanto, & Munajat	2016	Exploring information quality dimensions of e-government agency's information services through social media: a case study of the ministry of Education and culture in Indonesia.	Aim of the study is to investigate the dimension of information quality that affect user satisfaction with government services. Information quality was found to be a determinant of IS success
8	Rana, Dwivedi, & Williams	2013	Evaluating the validity of IS success models for electronic government research: an	Focus is to compare and evaluate the validity of information systems' success models, using both D&M and Sheldon's 1997 model, on Online

			empirical test and integrated model	Public Grievance Redressal System. Four constructs of D&M model were used for the study.
9	Chen & Zhang	2012	Citizen-centric e-government performance satisfaction with e-information	Aim is to develop a citizen-centric e-government performance measurement scheme, using some of the D&M model constructs of information and service quality
10	Luna-Reyes <i>et al.</i>	2012	Towards a multidimensional model for evaluating electronic government: proposing a more comprehensive and integrative perspective	The article analyses the current state of how e-government is evaluated. Information systems success (Wang model) construct was included in the evaluation. It has its theoretical foundation from the D&M IS model.
11	Helbig, Gilgarcía, & Ferro	2009	Understanding the complexity of electronic government implication form the digital divide life.	The paper focuses on the parallels and connections between e-government and digital divide in relation to understanding e-government projects

Conclusion

It is evident that none of the articles had used all the six dimensions of D&M ISsuccess model. In some studies, the D&M constructs were replaced, or added, with other dimensions from other models that are closely related to the IS under evaluation. The findings showed Asia leading in the application of D&M Model in e-government research, while Africa showed the least utilisation of the model. The analysis review shows the highest number of papers dealt with the subject of e-government performance and user satisfaction.

DeLone & Mclean (1992) suggest that the success of information systems evaluation requires the performance of all the six D&M model dimensions. From this study, it appeared that most of the e-government evaluation research works have not adhered to this suggestion; as most of them used few of the D&M dimensions and added their

own, closely related dimensions to their studies. The review show that two of D&M model constructs highly used in the e-government evaluations were information quality (15 articles ;44%) and Service quality (13 articles; 38%).

From the review, 100 articles (64.5%) used D&M model for IS evaluation in various fields, while only 34% of the articles were in e-government, and made use of the dimensions of D&M model for IS evaluation. This corroborated the submission that D&M is a widely used model in evaluating IS success (Stefanovic *et al.*, 2016) though in e-government the utilisation is still very low. The study analysis shows that information systems, service quality and user satisfaction construct of D & M model were highly utilised in e-government research and not the complete set of the six constructs. This implies that there is partial application of the six dimensions of D&M model in e-government IS success research. According to Delone & Mclean, (1992) information systems success evaluation is multidimensional and requires the performance of all the six construct of D&M model. The results of such an evaluation would provide the policy makers with comprehensive review that would enhance e-government service delivery to the citizens.

This study limits the search to only two databases; it is suggested that future studies consider a more comprehensive review by using more databases. Also, there is a need for more empirical studies on the application of D&M IS success model in e-government research in Africa.

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