Testing Delone and Mclean's Model in Financial Institutions

Article · May 2013

CITATIONS
3

READS
491

1 author:

Ismail M. Romi
Palestine Polytechnic University
20 PUBLICATIONS **13** CITATIONS

SEE PROFILE

Testing Delone and Mclean's Model in Financial Institutions

Ismail M. Romi[a]
[a] Faculty of Administrative Sciences and Informatics,
Palestine Polytechnic University, Palestine
ismailr@ppu.edu

Abstract. Information Systems (IS) success is critical in organizations, because of its direct and indirect impact on information flow inside and outside organizations, and therefore, it affects decision making process, that influence organizational success. The main objective of this study is to provide a further insight in to IS success, develop measurement tools for IS success, and then, test Delone and Mclean's model to ensure its validity and explanations to IS success factors. In order to test the research hypotheses, data were collected from IS end users in Palestinian financial institutions using a questionnaire. 189 usable surveys were used in data analysis. After that**,** construct validity and the internal consistency reliability of the measures were tested, using Coronbach's Alpha test. The results show high reliability of all used measures, where Coronbach's Alpha exceeds 0.7. Hypothesis embedded in the research model were tested using correlation, regression, and stepwise multiple regression analysis. The main findings supports Delone and Mclean's model, and shows that the model offers good explanation of IS success in Palestinian financial institutions, where most of the hypothesis were accepted.

Keywords: Information systems success, Delone and Mclean Model, Information Systems Measures.

1 INTRODUCTION

Information Systems (IS) has a critical role in both internal and external environment to organizations. Where IS facilitates coordination between organizational levels, information flow to stakeholders, and decision making. In addition; IS enables capturing environmental data which is related to competition, markets, and customers. Therefore; evaluating IS success considered to be critical to organizations overall success (Myers, 2003; Delone and Mclean, 2003, 2008).

The main objective of this study is to provide a further insight in to IS success dimensions, and refine the measures for this success. Therefore this study addresses the following questions:

1. What are Information Systems success dimensions?
2. How to measure Information Systems dimensions?
3. To what extent does the D&M model suites the financial institutions?

To pursue these questions, this study will provide further insight into IS success dimensions, refine the required measures for those dimensions, besides testing those measures and D&M model, depending on the data that will be collected from the Palestinian Financial Institutions.

2 THEORETICAL FRAMEWORK

2.1 Information Systems Success

Information system is an integrated computer-based system that utilizes computer hardware, software, users, procedures, models, and database which interacts to produce the suitable information at the appropriate time, to support organizational activities (McLeod and Schell, 2004; Laudon and Laudon, 2004).

Information systems success factors are set of dimensions and aspects that produce the net benefits of information system, which includes system quality, information quality, service quality, system use, user satisfaction, and net benefits (Delone and Mclean, 1992, 2003, 2008; Seddon, 1994, 1997).

System Quality:

System Quality is defined as a set of constructs related to information system that determines the quality of the systems. Those constructs are refined from the literature, and includes; system reliability, easy to learn, ease of use, user preemptive, flexibility, Integration with another systems.

Information quality:

Information quality is the degree to which information presents the required benefits. Those constructs are refined from the literature, and includes; availability, timeliness, relevant, accuracy, appropriateness, completeness, concise representation, interpretability.

Service quality:

Service quality is a set of characteristics related to services submitted by IS to customers which includes services reliability, assurance, empathy, and security.

System use:

The extent to which end-users uses the results presented by the information systems. The measures of use are refined from the literature, and includes; the degree of system use, responsiveness, adaptability, effectiveness.

User satisfaction:

User satisfaction refers to the recipient response to the use of IS output. User satisfaction is associated with attitudes towards IS which depends on system availability, robustness, task achievement, productivity, efficiency.

Net benefits:

A measure for the positive and negative impacts of the IS on all persons and groups affected with the IS (customers, suppliers, employees, organizations, markets, industries…etc). Net benefits can be identified with set of constructs that includes cost savings, expanded markets, incremental additional sales, reduced search costs, and time savings.

2.2 Research model and Hypothesis

Delone and Mclean's model (D&M) presented in 2003 (Figure 1) can be classified as one of the most interesting models in the area of measuring information systems success (Seddon 1994, Gable et al, 2003). This model enables the applied theories in the area of IS measurement to take place (Seen et al, 2006). The model also specifies the dimensions of IS success in six groups and associated the relationship between those groups (Roldan and Leal, 2003). In addition the model takes in to consideration the perspectives of all information systems recipients.

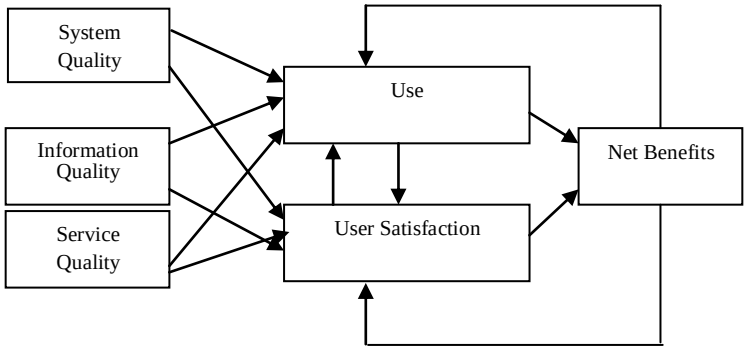

Figure 1: D&M model
Source: (Delone and Mclean, 2003, p. 24)

D&M IS Success Model includes arrows to demonstrate proposed associations among success dimensions in a process sense, but does not show positive or negative signs for those associations in a causal sense. The nature of these causal associations should be hypothesized within the context of a particular study (Delone and Mclean, 2003). Therefore, the following hypotheses take place:

H1: System quality positively influences use.
H2: System quality positively influences user satisfaction.
H3: Information quality positively influences use.
H4: Information quality positively influences user satisfaction.
H5: Service quality positively influences use.
H6: Service quality positively influences user satisfaction.
H7: Use positively influences user satisfaction and vice versa.
H8: Use positively influences net benefits and vice versa.
H9: User satisfaction positively influences net benefits and vice versa.

3 METHODOLOGY

3.1 Data collection

In order to test information systems success factors measurements, and the research hypotheses, data were collected from IS end users (respondents) in Palestinian Financial Institutions (39 institution) using a questionnaire. 234 surveys were sent to the respondents in all management levels, where 203 surveys were returned (87% response rate). 14 surveys were excluded, because of non validity of these surveys. Therefore 189 usable surveys were used (81%) in data analysis.

3.2 Characteristics of Respondents

The respondents represented a cross-section of different managerial levels in the Palestinian Financial Institutions, where majority of respondents are:

- Less than 40 years old.
- Males (76%).
- Have Bachelor of Science degree
- Exceeds one year of experience.
- Their work classified as information intensive.

3.3 Reliability and Validity

Data was collected from respondents using a questionnaire, which is designed to measure the dimensions of information systems success (Table 1). To ensure the reliability of the constructs used, a reliability analysis was conducted on the data. The criteria given by

Table1: Reliability and Component Matrix Analysis of Constructs items

Construct	Construct Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Loading	Component
System Quality Items: 6 Alpha: 0.868	system reliability	.6970	.8400	0.8080	1
	easy to learn	.6980	.8430	0.8130	
	ease of use	.6410	.8500	0.7720	
	user preemptive	.6100	.8580	0.7210	
	flexibility	.6930	.8410	0.7890	
	Integration	.6880	.8410	0.7830	
Information Quality Items: 8 Alpha:0.905	Availability	.7290	.8900	0.8020	1
	Timeliness	0.713	.8910	0.7910	
	Relevancy	0.725	.8900	0.7980	
	Accurate	.6890	.8930	0.7700	
	Appropriateness	.7000	.8930	0.7760	
	Interpretability	.6770	.8950	0.7570	
	Completeness	.6560	.8960	0.7380	
	concise representation	.7290	.8900	0.7670	
IS Service	services reliability	.6570	.7790	0.8190	1

Quality Items: 4 Alpha: 0.827	assurance	.7190	.7500	0.8600	
	empathy	.6510	.7820	0.8090	
	security	.5840	.8120	0.7570	
Use Items:4 Alpha: 0.822	degree of system use	.6710	.7640	0.8290	1
	Responsiveness	.7180	.7410	0.8590	
	Adaptability	.6000	.7960	0.7720	
	Effectiveness	.5940	.7990	0.7680	
User Satisfaction Items: 5 Alpha: 0.879	system availability	.6600	.8660	0.7830	1
	robustness	.6840	.8600	0.8040	
	task achievement	.7340	.8480	0.8400	
	productivity	.7470	.8450	0.8410	
	efficiency	.7410	.8440	0.8390	
Net Benefits Items: 5 Alpha: 0.895	cost savings	.7250	.8760	0.8260	1
	expanded markets	.7930	.8610	0.8790	
	incremental additional sales	.8180	.8540	0.8960	
	reduced search costs	.7620	.8680	0.8580	
	time savings	.6230	.9000	0.7430	

Nunally (1978) that an alpha reliability 0.7 or more is considered an adequate reliability coefficient was applied to determine the adequacy and the reliability coefficient obtained for each construct.

To ensure the validity of the constructs used, a factor analysis was conducted on the data. The recommended guidelines by (Hair et al, 1998) were used to determine the relative importance and significance of the factor loading of each item in the construct. Thus loading factor greater than 0.3 is considered significant, loading 0.4 is more important and loading of 0.5 or greater is considered as very significant.

Table (1) shows the results of the internal consistency reliability, and the factor analysis used to test the constructs validity. The results indicate that all constructs items are significantly correlated with the total items and that the alpha reliability will not improve if any of the items is deleted. Where the values of alpha for the constructs were as follow: system quality 0.868, information quality 0.905, service quality 0.827, use 0.822, user satisfaction 0.879, and net benefits 0895. In addition, the results show that all constructs items fall under one dimension for each construct items, with loading exceeding 0.7. Thus the measure was able to demonstrate level of construct validity.

4 HYPOTHESIS TESTING

Hypothesis embedded in the research model were tested using correlation, regression, and stepwise multiple regression analysis. Any hypothesis that was rejected based on the absence of significant correlation between variables was not further tested using stepwise regression analysis. As the research hypothesis implies causal relationships rather than mere associations, a hypothesis accepted by the correlation analysis but rejected based on the regression analysis will be rejected in the overall evaluation of the model.

4.1 Correlation Analysis

The results of Pearson correlation (Table 2) show that there is a positive relationship between system quality and use ($r=0.696$), and this result is significant ($p<.05$). This implies that the results support H1; therefore, system quality positively influences use. The same results indicates that; there is a positive relationship between system quality and user satisfaction ($r=0.701$), and this result is significant ($p<.05$). This implies that the results support H2; therefore, system quality positively influences user satisfaction.

Furthermore; the results of Pearson correlation (Table 2) show that there is a positive relationship between information quality and use ($r=0.775$), and this result is significant ($p<.05$). This implies that the results support H3; therefore, information quality positively influences use. The same results indicates that; there is a positive relationship between

information quality and user satisfaction (r=0.724), and this result is significant (p<.05). This implies that the results support H4; therefore, information quality positively influences user satisfaction.

Hypothesis H5 indicates that service quality positively influences use. Referring to the correlation matrix; Pearson factor (r = 0.827), where this result is significant (p<.05). This implies that the results support H5. Where (r=0.791) for the relationship between service quality and user satisfaction, and the result is significant (p<0.05). This implies that the results support H6: Service quality positively influences user satisfaction.

Table 2: Constructs Correlation Matrix

		Use	Satisfaction	Net Benefits
System Quality	Pearson Correlation	.696(**)	.701(**)	---
	Sig. (2-tailed)	.000	.000	
Information Quality	Pearson Correlation	.775(**)	.724(**)	---
	Sig. (2-tailed)	.000	.000	
Service Quality	Pearson Correlation	.827(**)	.791(**)	---
	Sig. (2-tailed)	.000	.000	
Use	Pearson Correlation	---	.827(**)	.665(**)
	Sig. (2-tailed)		.000	.000
Satisfaction	Pearson Correlation	---	---	.734(**)
	Sig. (2-tailed)			.000

Table (2) show that there is a positive relationship between use and user satisfaction (r=0.809), and this result is significant (p<.05). This implies that the results support H7; therefore, system use positively influences user satisfaction. The same results indicates that; there is a positive relationship between system use and net benefits (r=0.665), and this result is significant (p<.05). This implies that the results support H8; therefore, system use positively influences net benefits. In addition; there is a positive relationship between user satisfaction and net benefits (r=0.734), and this result is significant (p<.05). This implies that the results support H9; therefore, user satisfaction positively influences net benefits.

4.2 Stepwise Multiple Regression Analysis

The research model incorporates three models of stepwise multiple regression, mainly; systems use, user satisfaction, and net benefits. Those models will specify the importance of the research variables, and their explanatory ability to the variance in the independent variables. The independent variable will be included in the regression equation (model) when it is significant (p<=0.05). And then, the model and its significant variables will be adjusted (adjusted r square, and beta), to suite the new situation; where significant variables are included in the model and non-significant excluded.

4.2.1 Stepwise Multiple Regression Analysis for the Systems Use

Depending on the research model, and correlation analysis, variables that have an impact on system use are: system quality, information quality, service quality, user satisfaction, and net benefits. All those variables were included in the stepwise multiple regression analysis for the system use.

The results in figure 2, show that service quality, information quality, and user satisfaction explain 0.782 of the variance occurs in system use, and this result is significant (p<=0.01). Where the explanation of those variables were (Beta = 0.339) for the service quality, (Beta = 0.395) for user satisfaction, and (Beta= 0.225) for the information quality. Where, the same results show a non significant explanation for system quality and net benefits, therefore those

variables excluded from the regression equation. This implies that the results support H3, H5, and H7, where H1 and H8 doesn't support, and thus will be rejected.

Model Summary					
R	R Square	Adjusted	Std. Error of the Estimate		
.885(c)	.782	.779	.28077		
ANOVA(b)					
	Sum of Squares	df	Mean Square	f	Sig.
Regression	52.449	3	17.483	221.779	.000(c)
Residual	14.584	185	.079		
Total	67.032	188			
Coefficients(a)					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.	Beta		
(Constant)	.250	.139		1.805	.073
Service Quality	.311	.058	.339	5.310	.000
User Satisfaction	.391	.058	.395	6.769	.000
Information	.223	.056	.225	3.975	.000
Excluded Variables					
	Beta In	T	Sig.	Partial Correlation	Collinearity Statistics
System Quality	.027(c)	.485	.628	.036	.369
Net Benefits	.052(c)	1.009	.314	.074	.449

Figure 2: Stepwise Multiple Regression Analysis for the Use Determinants

4.2.2 Stepwise Multiple Regression Analysis for the User Satisfaction

Variables that have an impact on user satisfaction are: system quality, information quality, service quality, system use, and net benefits. Where the results in figure 3, show that use, net benefits, service quality, and system quality explain 0.772 of the variance occurs in user satisfaction, and this result is significant ($p<=0.01$). Where the explanation ability of those variables were: (Beta = 0.386) for system use, (Beta = 0.267) for net benefits, (Beta= 0.206) for service quality, and (B=0.134) for system quality. Where, the same results show a non significant explanation for information quality, therefore this variable excluded from the regression equation. This implies that the results support H2, H6, H7, and H9, where H4 doesn't supported, and thus will be rejected.

4.2.3 Stepwise Multiple Regression Analysis for the Net Benefits

Depending on the research model, and correlation analysis, variables that have an impact on system net benefits are: system use, and user satisfaction.

The results (figure 4), show that system use, and user satisfaction explain 0.549 of the variance occurs in the net benefits, and this result is significant ($p<=0.01$). Where the explanation of those variables were (Beta = 0.582) for the user satisfaction, and (Beta = 0.184) for system use. This implies that the results support H8, and H9.

Model Summary			
R	R Square	Adjusted	Std. Error of the Estimate
.879(d)	.772	.767	.29172
ANOVA(b)			

	Sum of Squares	df	Mean Square	f	Sig.
Regression	52.951	4	13.238	155.555	.000(d)
Residual	15.658	184	.085		
Total	68.610	188			
Coefficients(a)					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.	Beta		
(Constant)	.241	.146		1.652	.100
Use	.390	.069	.386	5.686	.000
Net Benefits	.236	.043	.267	5.434	.000
Service Quality	.191	.062	.206	3.093	.002
System Quality	.135	.052	.134	2.578	.011
Excluded Variables					
	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
Information	.019(d)	.283	.777	.021	.280

Figure 3: Stepwise Multiple Regression Analysis for the User Satisfaction

Model Summary					
R	R Square	Adjusted	Std. Error of the Estimate		
.741(b)	.549	.544	.46023		
ANOVA(b)					
	Sum of Squares	df	Mean Square	f	Sig.
Regression	48.002	2	24.001	113.312	.000(b)
Residual	39.398	186	.212		
Total	87.400	188			
Coefficients(a)					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.	Beta		
(Constant)	.362	.220		1.641	.102
User Satisfaction	.657	.099	.582	6.650	.000
Use	.210	.100	.184	2.096	.037
Excluded Variables					
	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics

Figure 4: Stepwise Multiple Regression Analysis for the Net Benefits Determinants:

5 RESULTS

Table (3) presents a summary of testing results for the hypothesis using correlations and stepwise multiple regressions. The results of hypothesis testing (table 3) show that; most hypotheses were accepted, and three non significant relations were rejected. In general; the research model offers good explanation of information systems success in Palestinian financial institutions.

Table 3: Summary Testing results for the Hypothesis

Research Model Hypothesis	Correlation	Stepwise	Result

	Support	Regression Support	
H1: System quality positively influences use.	Accepted	Rejected	Rejected
H2: System quality positively influences user satisfaction.	Accepted	Accepted	Accepted
H3: Information quality positively influences use.	Accepted	Accepted	Accepted
H4: Information quality positively influences user satisfaction.	Accepted	Rejected	Rejected
H5: Service quality positively influences use.	Accepted	Accepted	Accepted
H6: Service quality positively influences user satisfaction.	Accepted	Accepted	Accepted
H7: Use positively influences user satisfaction and vice versa.	Accepted	Accepted	Accepted
H8: Use positively influences net benefits.	Accepted	Rejected	Rejected
H9: User satisfaction positively influences net benefits	Accepted	Accepted	Accepted

Figure (5) depicts hypothesis testing results, where the determinants of systems use explains 78.2% of the variance in system use, the determinants of user satisfaction explains 77.2% of the variance in user satisfaction, and the determinants of net benefits explains 54.9% of the variance in the net benefits.

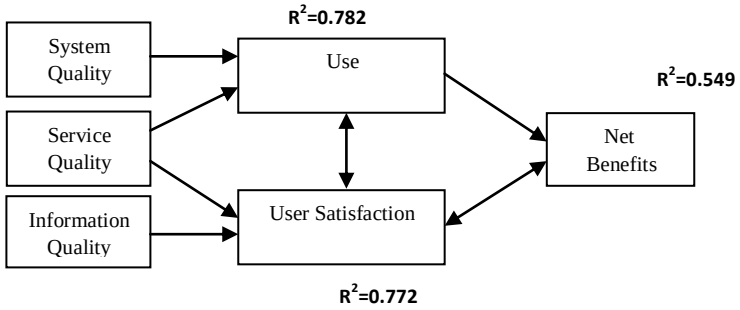

Fig.5: Model Hypothesis Testing Results

6 RECOMMENDATIONS

This paper refines the required measures for information systems success dimensions, and tests those measures. After that a test was conducted to the D&M model proposed by the Delone and Mclean (1992, 2002, 2003, 2008), depending the collected data from the Palestinian Financial Institutions. The results show that; the explanation of the model variables needs more causal variables to be embedded in the model. Therefore; this study recommends more researches in this area, in order to find more variables that have impact on system use, and user satisfaction.

References

Delone, W.H, Mclean, E.R, (2003), "The Delone and Mclean Model of Information Systems Success: a Ten- Year
Update", *Journal of Information Systems*, 19: pp. 9-30.
DeLone, W.H., McLean, E.R., (1992), "Information systems success: The quest for the dependen variable",
Information Systems Research, 3, 1, 60–95.
DeLone, W.H., McLean, E.R., (2002), "Information systems success Revisited", Proceedings of the 35th Hawaii
International Conference on System Sciences.
DeLone, W.H., McLean, E.R., Petter, S., (2008), "Measuring information systems success: models, dimensions,

measures, and interrelationships", *European Journal of Information Systems*, 17: pp. 236-263.
Gable, G.G, Sedera, D., Chan, T., (2003), "Enterprise Systems Success: Ameasurement Model", *Twenty-Fourth*
International Conference on Information System, pp. 576-591.
Laudon, K. C. and Laudon J. P. (2004), "Management Information Systems – Managing the Digital Firm", (8th ed.),
New Jersey: Pearson Education Inc.
Mcleod, R. Jr., Schell, G. P., (2004), "Management Information Systems", (9th ed.), *New Jersey: Pearson Education*
Inc.
Myers, M.D. (2003): "The IS core — VIII, defining the core properties of the IS discipline: not yet, not now",
Communications of the Association for Information Systems, 12(38): pp. 582-587.
Nunally, J. C., (1978), "Psychometric Theory", 2nd ed., *McGrow-Hill: New York, USA*.
Roldan, J.L, Leal, A., (2003), "A Validation Test of an Adaptation of the Delone and Mclean's Model in the Spanish
EIS Field", *Spain: Idea Group Publishing:* pp. 66-84.
Seddon, P.B, (1997), "A Re-specification and Extension of the Delone and Mclean's Model of IS Success",
Information Systems Research, 18(3): pp. 240-253.
Seddon, P.B., (1994), "A partial Test Development of Delone and Mclean's Model of IS Success", *The international*
Conference of Information Systems, Vanconver.
Seen, M., Rouse, A., Beaumont, N. Mingins, C, (2006), "The Information Systems Acceptance Model: A Meta
Model to Explain and Predict Information Systems Acceptance and Success", *Manosh University, ISSN 1327-5216*.

Ismail M. Romi is an assistant professor of information systems at Palestine Polytechnic University. He received his BSc. in information systems from Al-Quds open University in 1997, MBA in Business Administration from Al-Quds university in 2001, and PhD degree in information systems from Alexandria University. He has a number of training courses in ICT Law from University of Namur, Belgium, 2011, IT Development Policy from Korea International Cooperation Agency (KOICA), South Korea, 2005, and Enhancement of Quality Assurance & Institutional Planning at Universities from UNDP, Amman, 2004. He has more than 15 years experience in information systems, and is the author of over 8 peer-reviewed scientific publications and conference papers, and responsible of conducting many exhibitions, workshops and Symposiums, scientific days. His current research interest include information management, information systems modeling and assessment, managing and planning information systems and technology, statistical databases, human computer interaction, and business strategic planning & alignment with information systems.