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# An extension of Delone and McLean IS success model with self-efficacy

Delone and  
McLean IS  
success model

## Online learning usage in Yemen

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### Abstract

**Purpose** – While many researchers have investigated the adoption and usage of online learning in different settings, one area that has yet to be examined thoroughly, particularly in the context of online learning in Yemen, is the self-efficacy role. The purpose of this paper is to extend the Delone and McLean information system success model by incorporating a self-efficacy construct as an antecedent to user satisfaction and actual usage to predict student performance.

**Design/methodology/approach** – Questionnaire survey method was used to collect primary data from 448 students in nine public universities in Yemen. The six constructs in the proposed model were measured using existing scales. The data analysed using confirmatory factor analysis and structural equation modelling via AMOS.

**Findings** – Three main results were revealed, namely that overall quality (system, information and service quality) and self-efficacy have a positive impact on user satisfaction and actual usage; that actual usage significantly predicts user satisfaction; and that both user satisfaction and actual usage have a positive impact on student performance.

**Research limitations/implications** – First as the study population were students from nine public universities, it excluded academics and administrative staff. Second, the study depends on self-reported measures to test the proposed research model. This is because getting objective data about the performance was not probable due to the issue of privacy.

**Practical implications** – The findings of this study can be a guideline for Yemeni higher education institutions to develop efficient and effective plans to improve the performance of education institutions, and train and develop student ability to use online learning. Additionally, it highlights the areas that university management needs to concentrate on, namely information systems (IS) tools that will contribute to higher student enrolment, address the lack of infrastructure and improve the quality of education outcomes, things which represent Yemen's main challenges in the higher education sector.

**Originality/value** – This paper adds to the existing literature of IS by combining overall quality, self-efficacy, actual usage and user satisfaction to predict performance impact of online learning among students in nine public universities in Yemen. Furthermore, the predictive power of the proposed model has a higher ability to explain and predict performance impact compared to those obtained from some of the previous studies.

**Keywords** Self-efficacy, Online learning, Yemen, DeLone and McLean, IS success model

**Paper type** Research paper

### 1. Introduction

Online learning has been interchangeably used with a number of similar terms, including “elearning”, “distance learning” and “blended learning”. According to Clark and Mayer (2016), it is defined as delivering instructions via the internet using digital devices like



smartphones, laptops, tablets and desktop computers. Governments worldwide are already utilising it as a part of their initiatives to promote technology in the educational process (Tenório *et al.*, 2016). Yemen is faced with difficult challenges in the education sector, and according to The Global Competitiveness Report (2017), Yemen ranked as 116 out of 138 countries in terms of tertiary education enrolment rate. There is also a gender gap according to the Educational Indicators of Yemen (2015), where the number of female students enrolled in Yemeni public universities lags behind the male by 50 per cent ( $M = 148,834$ ,  $F = 78,329$ ). According to UNESCO (2013), online learning can play a major role in facing such challenges, because among its main features is expanding the reach and equity of education, which directly addresses the challenges faced by Yemen. The country is also currently in the middle of a civil and regional war which is having a major effect on the country's universities and communications. Because infrastructure such as mobile technology is quick and easy to restore, online learning offers an optimal solution for learners who are in post-crisis areas. The notion that online learning in conflict areas can minimise disruption of the educational process is also supported by UNESCO (2013).

Many theories and models have been developed and proposed in the information systems (IS) context in order to predict and explain user behaviour with technology. Besides the DeLone and McLean Model of Information Systems Success (DMISM) (DeLone and McLean, 1992; DeLone and McLean, 2003), other well-known theories and models exist including: technology acceptance model (Davis, 1989), diffusion of innovation theory (Rogers, 1995), Theory of Reasoned Action (Ajzen and Fishbein, 1980), theory of planned behaviour (Ajzen, 1985), model of PC utilisation Chang and Cheung (2001), and unified theory of acceptance and use of technology (Venkatesh *et al.*, 2003). There are also empirical studies which have comprehensively examined the adoption and use of new technologies (Al-Busaidi, 2013; Islam, 2015; Sumak *et al.*, 2011). However, these have neglected an evaluation of IT usage (Islam, 2013), while DMISM evaluates IT usage by examining the effect of overall quality (system, information and service quality) on user satisfaction and actual usage, both of which in turn influence performance impact DMISM has, therefore, become widely used to measure the success of IS (Aldholay, Abdullah Ramayah, Isaac and Mutahar, 2018; Aldholay, Isaac, Abdullah and Ramayah, 2018; Aldholay, Isaac, Abdullah, Alrajawy and Nusari, 2018; Montesdioca and Maçada, 2015).

When engaging in online learning, learners have the choice of what, when and how long to study. These self-directed aspects of learning play an important role in the effectiveness of user learning effort (Tullis and Benjamin, 2011), which in turn can generate greater interest. Self-efficacy has risen in importance in the IS field as more studies examine its effect on technology usage (Mutahar *et al.*, 2017; Mahdavian *et al.*, 2016). For instance, Hong *et al.* (2016) found that self-efficacy significantly affects satisfaction, while Yu (2012) reported its significant role in predicting the system usage.

It is important to mention that the majority of studies utilising the DeLone and McLean IS model were conducted in western countries and none have been tried in the context of online learning in Yemen which has a very different culture. Therefore, this study proposes an extended DeLone and McLean information system success model that incorporates an important antecedent (self-efficacy) to user satisfaction and actual usage. Its findings could help provide important insights for universities and policy makers to counter the challenges faced by the Yemeni higher education sector (Aldholay, Abdullah, Ramayah, Isaac and Mutahar, 2018; Aldholay, Isaac, Abdullah and Ramayah, 2018; Aldholay, Isaac, Abdullah, Alrajawy and Nusari, 2018).

## 2. Literature review

### 2.1 Overall quality

Due to growing challenges and sophistication in the IS field, both scholars and practitioners are keen to improve the quality and functionality of new systems to tap into its growth

potential (Wang and Lai, 2014). Overall quality has been studied as a second-order construct that includes system quality, information quality and service quality (Ho *et al.*, 2010; Isaac, Abdullah, Ramayah and Mutahar, 2017a, b, c; Isaac, Abdullah, Ramayah, Mutahar and Alrajawy, 2017). The results unanimously find that a positive relationship exists between quality and each of satisfaction and actual usage (Flack, 2016). According to Sun *et al.* (2008), overall quality influences user satisfaction, while Wang and Liao (2008) stated that quality in the context of technology affects actual usage. Moreover, Petter and McLean (2009) define system quality as the degree to which system users believe that a system is easy to use, user-friendly, easy to learn, easy to connect and enjoyable to use, while Cheng *et al.* (2013) consider it a key antecedent for technology usage and user satisfaction alike. Hossain (2016) says that system quality significantly affects user satisfaction and Abrego-Almazán *et al.* (2017) report that it affects actual usage. Information quality is defined as the degree to which system users think that online learning information is up-to-date, accurate, relevant, comprehensive and organised (Halonen *et al.*, 2009). It is one of the critical factors that determines satisfaction and actual usage (Aparicio *et al.*, 2017), and researchers have described its significant impact on user satisfaction (Jung *et al.*, 2015) and actual usage (Ramirez-Correa *et al.*, 2017). Service quality is referred to through these attributes: tangibles, reliability, responsiveness, assurance, functionality, interactivity and empathy (DeLone and Mclean, 2003; Lin *et al.*, 2011; Pituch and Lee, 2006) and it significantly influences satisfaction (Oktal *et al.*, 2016) and actual usage (Chiu *et al.*, 2016). Consequently, the following two hypotheses are proposed:

H1. Overall quality has a positive effect on user satisfaction.

H2. Overall quality has a positive effect on actual usage.

### 2.2 Self-efficacy

Because individual characteristics vary significantly, this is a vital variable in terms of technology usage (Mahdavian *et al.*, 2016). Self-efficacy as an individual characteristic plays a major role in the use of technology and IS according to Prior *et al.* (2016) and is defined as the extent to which a student believes in the ability to learn from an online course of study successfully (Shen *et al.*, 2013). Various scholars have concluded that there are significant positive relationships between Self-efficacy and each of satisfaction (Hong *et al.*, 2016) and system use (Yu, 2012). Consequently the following two hypotheses are proposed:

H3. Self-efficacy has a positive effect on user satisfaction.

H4. Self-efficacy has a positive effect on actual usage.

### 2.3 Actual usage

According to DeLone and McLean (2016), actual usage is the degree to which an individual uses the capabilities of an information system in terms of frequency, nature and duration of use. In online learning, actual usage also reflects the frequency and duration of use (Kim *et al.*, 2007). DeLone and McLean (2016) also indicated that among the most important directions in technology usage is to the need to assess the impact of system usage on IS success factors like performance. Several studies have examined the influence of actual usage on performance and satisfaction (Hou, 2012; Son *et al.*, 2012). Despite a mixed bag of results, it was determined that there is a significant relationship between actual usage and each of satisfaction and performance (D'Ambra *et al.*, 2013; Isaac, Abdullah, Ramayah and Mutahar, 2017b; Makokha and Ochieng, 2014; Ramirez-Correa *et al.*, 2017). However, there are other studies which reported the insignificance of this relationship (Cho *et al.*, 2015; Wu and Wang, 2006). While other studies examined the effect of satisfaction on actual usage

(Jafari *et al.*, 2011), this study examines the effect of actual usage on satisfaction as recommended by Isaac, Abdullah, Ramayah and Mutahar (2017a, b) Consequently, the following hypotheses are proposed:

*H5.* Actual usage has a positive effect on user satisfaction.

*H6.* Actual usage has a positive effect on performance impact.

#### 2.4 User satisfaction

As user satisfaction is considered one of the main indicators when assessing the success of new system adoption, it has been widely used as a measure in the field of IS (DeLone and McLean, 2016; Montesdioca and Maçada, 2015). According to Xinli (2015), user satisfaction refers to the extent to which a user perceives a system to be useful and wants to use it again. While Lin and Wang (2012) defined it as system user's satisfaction with regard to system speed, number of functions, quality and format. It has also been defined as the degree to which students using online learning are satisfied with their decision to use it and how well it meets their expectations (Roca *et al.*, 2006; Wang, 2008; Wang and Liao, 2008). A number of studies have shown that user satisfaction impacts performance in numerous contexts and technology applications. For instance, Isaac, Abdullah, Ramayah and Mutahar, (2017a, b, c), Isaac, Abdullah, Ramayah, Mutahar and Alrajawy (2017) reported that user satisfaction significantly influenced performance impact, and Stefanovic *et al.* (2016) found the same significant relationship between user satisfaction and net benefits. However, Daud *et al.* (2011) reported that there was no significant relationship between user satisfaction and performance impact. Consequently, the following hypothesis is proposed:

*H7.* User satisfaction has a positive effect on performance impact.

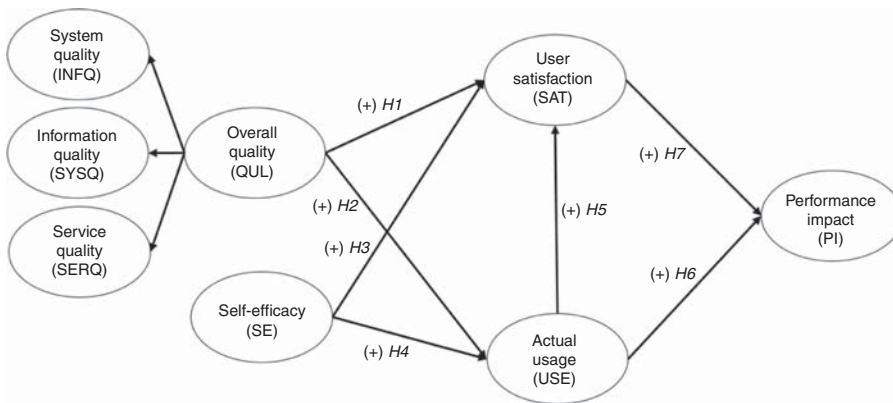
#### 2.5 Performance impact

IS scholars have used the intention to use or actual usage as the dependent variable when examining factors affecting the adoption of certain technology system (Cheng *et al.*, 2015; Cheung and Vogel, 2013; Iqbal and Qureshi, 2012). However, with rapidly changing technology and the introduction of many new systems, the focus is currently directed towards the outcome of system usage in terms of performance enhancement to evaluate and measure system success (Isaac, Abdullah, Ramayah and Mutahar, 2017a, b, c; Isaac, Abdullah, Ramayah, Mutahar and Alrajawy, 2017; Chen, 2013; Montesdioca and Maçada, 2015). Performance impact is defined as the extent to which system usage increases the quality of work by helping to complete the task quickly, allow control over work, improve job performance, eliminate errors and boost effectiveness on the job (Isaac Abdullah, Ramayah, Mutahar and Alrajawy, 2016; Isaac Masoud Samad, and Abdullah, 2016; Norzaidi *et al.*, 2007; Aldholay, Abdullah, Ramayah, Isaac and Mutahar, 2018; Aldholay, Isaac, Abdullah and Ramayah, 2018; Aldholay, Isaac, Abdullah, Alrajawy and Nusari, 2018). In this study, performance impact is defined as the degree that online learning impacts student performance in terms of resource savings, productivity, competence, and knowledge acquisition (Isaac, Abdullah, Ramayah and Mutahar, 2017a, b, c; Isaac, Abdullah, Ramayah, Mutahar and Alrajawy, 2017).

### 3. Research method

#### 3.1 Overview of the proposed research model

For this study, the hypothesised variables and their relationships in the model have been derived from the available literature of the models and theories that have been prescribed in the literature mentioned above. The proposed extended model can be seen in Figure 1. While examining the proposed model, it can be seen that overall quality (containing system



**Figure 1.**  
Proposed  
research model

quality, information quality and service quality) affects user satisfaction and actual usage constructs, which both predict performance impact. These relationships are derived from Delone and McLean (2003), whereas self-efficacy is taken from Hong *et al.*, (2016) and Yu (2012). The proposed extended model examines the relationship between overall quality and self-efficacy as antecedent variables to user satisfaction and actual usage, which in turn explains performance impact as an output variable among students who used or are still using online learning in nine public universities in Yemen. The proposed model has seven hypotheses to test.

### 3.2 Development of instrument

A 29-item questionnaire was developed for this study, and in line with the existing literature in the IS field, a multi-item Likert scale was applied (Lee *et al.*, 2009). The variables were measured using the seven-point Likert scale, with 7 being “strongly agree” and 1 being “strongly disagree”, except for actual usage which was measured using a five-rank scale. Because respondents were Arabic speakers, it was vital that the questionnaire be precisely translated from English to Arabic. Therefore a back translation was performed, a procedure extensively applied to test the precision of the translation in a cross-cultural survey (Brislin, 1970). Validated instruments were adapted from related previous studies to measure the variables of this study as shown in Table AI. With regard to item count for every construct, this study followed the directions of Hayduk and Littvay (2012) who suggested using the few best items, and that many items are rarely warranted because additional redundant items provide less research benefit.

### 3.3 Data collection

Data collection was conducted using a self-administered paper questionnaire which was delivered “in-person” from October 2016 to April 2017 to students who had used or were using online learning in the main libraries of nine public universities in Yemen. The students were approached while in library facilities because these contain computer labs and students were from different fields, backgrounds and faculties. After verifying whether the students used or are using online learning, they were given the questionnaire to be filled and left at the same place to be collected in the same day. A total of 800 questionnaires were distributed, with 464 sets returned of which 448 responses were useful for the analysis. The final sample size was considered as adequate (Krejcie and Morgan, 1970; Tabachnick and Fidell, 2012). The 58 per cent response rate is considered very good and above average (Baruch and Holtom, 2008) by comparison with other studies found in the relevant literature.

A total of 16 questionnaires were deleted of which 13 cases were removed due to missing data for more than 15 per cent of the questions and three cases involving straight lining. The demographic profile of the respondents is shown in Table I.

#### 4. Data analysis and results

##### 4.1 Measurement model assessment and confirmatory factor analysis (CFA)

As shown in Table II, all the goodness-of-fit indices exceed their respective common acceptance levels as suggested by previous research, thus demonstrating that the

Demographic Item	Categories	Frequency	Percentage
Gender	(1) Male	240	53.5
	(2) Female	208	46.4
Marital status	(1) Single	379	84.6
	(2) Married	53	11.8
	(3) Divorced	5	1.1
	(4) Widowed	1	0.2
	(5) Others	10	2.2
Age	(1) Less than 20 years	85	19.0
	(2) 20–29 years	343	76.6
	(3) 30–39 years	16	3.6
	(4) 40–49 years	3	0.7
	(5) 50–59 years	1	0.2
Education Background	(1) High school	218	48.7
	(2) Diploma	51	11.4
Faculty	(3) Bachelor degree	156	34.8
	(4) Master's degree	11	2.5
	(5) PhD/DBA degree	3	0.7
	(6) Others	9	2.0
	(1) Applied science	356	79.4
(2) Social, humanities and arts	92	20.5	

**Table I.**  
Summary of demographic profile of respondents

Fit Index	Cited	Admissibility	Result	Fit (Yes/No)
$\chi^2$			692.095	
DF			364	
<i>p</i> -value		> 0.05	0.000	No
$\chi^2/DF$	Kline (2010)	1.00–5.00	<i>1.901</i>	Yes
RMSEA	Steiger (1990)	< 0.08	<i>0.045</i>	Yes
SRMR	Hu and Bentler (1999)	< 0.08	0.039	Yes
GFI	Jöreskog and Sörbom (1998)	> 0.90	0.904	Yes
AGFI	Jöreskog and Sörbom (1998)	> 0.80	0.885	Yes
NFI	Bentler and Bonnet (1980)	> 0.80	0.935	Yes
PNFI	Bentler and Bonnet (1980)	> 0.05	0.839	Yes
IFI	Bollen (1990)	> 0.90	0.968	Yes
TLI	Tucker and Lewis (1973)	> 0.90	0.964	Yes
CFI	Byrne (2016)	> 0.90	<i>0.968</i>	Yes
PGFI	James <i>et al.</i> (1982)	> 0.50	0.756	Yes

**Notes:** DF, degree of freedom; GFI, goodness-of-fit; NFI, normed fit index; IFI, the increment fit index; TLI, Tucker–Lewis coefficient Index; CFI, comparative-fit-index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; PNFI, parsimony normed fit index; AGFI, adjusted goodness of fit index. The indexes present in italics are recommended since they are frequently reported in literature (Awang, 2014)

**Table II.**  
Goodness-of-fit indices for the measurement model

measurement model exhibits a fairly good fit with the data collected, and allowing the writer to proceed to evaluate the psychometric properties of the measurement model in terms of construct reliability, indicator reliability, convergent validity and discriminant validity.

For construct reliability, this study tested the individual Cronbach's  $\alpha$  coefficients to measure the reliability of each of the variables in the measurement model. The results indicate that all the individual Cronbach's  $\alpha$  coefficients of the eight constructs ranging from 0.818 to 0.959 were greater than the recommended level of 0.7 (Kannana and Tan, 2005; Nunnally and Bernstein, 1994). Additionally, for testing construct reliability, all the composite reliability (CR) values ranging from 0.818 to 0.959 were higher than 0.7 (Kline, 2010; Gefen *et al.*, 2000), which adequately indicates that construct reliability is fulfilled as shown in Table III. Therefore, the achieved Cronbach's  $\alpha$  and CR for all constructs were considered to be sufficiently error-free.

First-order constructs	Second-order construct	Item	Loading (> 0.5)	<i>M</i>	<i>SD</i>	$\alpha$ (> 0.7)	CR (> 0.7)	AVE (> 0.5)
System quality (SYSQ)		SYSQ1	0.878	4.773	1.601	0.848	0.851	0.656
		SYSQ2	0.871					
		SYSQ3	0.867					
Information quality (INFQ)		INFQ1	0.914	5.088	1.447	0.888	0.898	0.637
		INFQ2	0.925					
		INFQ3	0.914					
		INFQ4	0.925					
		INFQ5	0.914					
Service quality (SERQ)		SERQ1	0.858	4.824	1.504	0.874	0.878	0.707
		SERQ2	0.876					
		SERQ3	0.790					
		Overall quality (QUL)	SYSQ					
INFQ	0.880							
SERQ	0.825							
Self-efficacy (SE)	SE1	0.842	4.140	1.466	0.857	0.858	0.668	
	SE2	0.880						
	SE3	0.825						
User satisfaction (SAT)		SAT1	0.933	4.679	1.560	0.913	0.914	0.780
		SAT2	0.941					
		SAT2	0.941					
Actual usage (USE)		USE1	0.915	4.286	1.223	0.818	0.818	0.692
		USE2	0.879					
Performance impact (PI)		PI1	0.816	4.747	1.382	0.959	0.959	0.702
		PI2	0.885					
		PI3	0.848					
		PI4	0.563					
		PI5	0.816					
		PI6	0.885					
		PI7	0.848					
		PI8	0.563					
		PI9	0.848					
		PI10	0.563					

**Notes:** INFQ, information quality; SYSQ, system quality; SERQ, service quality; QUL, overall quality; SE, self-efficacy; SAT, user satisfaction; USE, actual usage; PI, performance impact; CR, composite reliability; AVE, average variance extracted. The measurement used is a seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree), only actual usage used five-point ranking scale. All the factor loadings of the individual items are statistically significant ( $p < 0.01$ ) except for the item SE4 which was eliminated from the scale due to low loadings

**Table III.**  
Mean, standard deviation, loading, Cronbach's  $\alpha$ , CR and AVE



Factor loading was used to test indicator reliability. High loadings on a construct indicate that the associated indicators seem to have much in common, and this is captured by the construct (Hair *et al.*, 2013). Factor loadings greater than 0.50 are considered to be very significant (Hair *et al.*, 2010). The loadings for all items exceeded the recommended value of 0.5 as shown in Table III, and therefore the loading for all items in the model have fulfilled all the requirements without being eliminated from the scale.

This study used the average variance extracted (AVE) to test convergent validity, and it indicated that all AVE values were higher than the recommended value of 0.50 (Hair *et al.*, 2010) ranging from 0.637 to 0.780. The convergent validity for all constructs has therefore been successfully fulfilled and adequate convergent validity exhibited as Table III shows.

The discriminant validity of the measurement model was checked using the Fornell–Larcker criterion. As shown in Table IV, the correlations between the factors, ranging from 0.474 to 0.783, are smaller than the square root of the average variance extracted estimates which are in the range of 0.817–0.883. This indicates that the constructs are strongly related to their respective indicators compared to other constructs of the model (Fornell and Larcker, 1981), thus suggesting a good discriminant validity (Hair *et al.*, 2013). In addition, the correlation between exogenous constructs is less than 0.85 (Awang, 2014). Hence, the discriminant validity of the constructs is fulfilled.

#### 4.2 Structural model assessment

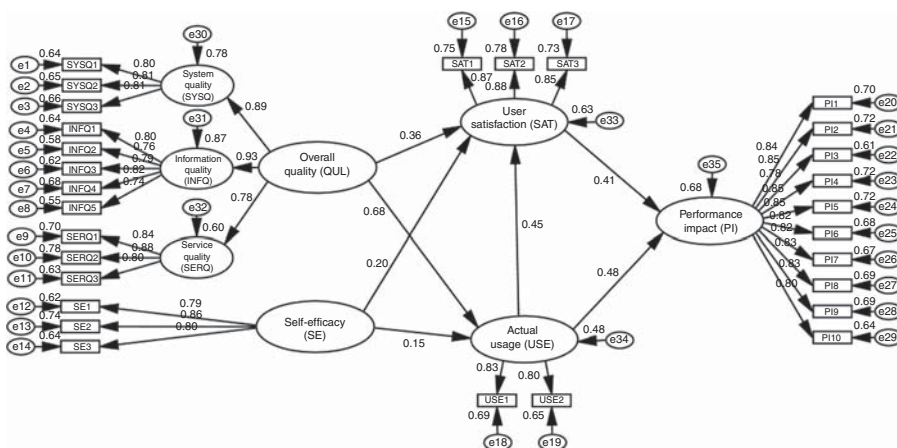
The goodness-of-fit of the structural model was comparable to the previous CFA measurement model. In this model, the values are recorded as  $\chi^2/df = 2.301$ , CFI = 0.954 and RMSEA = 0.054. These fit indices provide evidence of adequate fit between the hypothesised model and the observed data (Byrne, 2016). Thus, the path coefficients of the structural model could be examined.

The hypotheses of this study were tested using structural equation modelling via AMOS, as presented in Figure 2. The structural model assessment as shown in Table V provides the indication of the hypotheses tests. All seven hypotheses are supported. Overall quality significantly predicts user satisfaction and actual usage, hence, *H1* and *H2* are accepted ( $\beta = 0.36$ ,  $t = 5.705$ ,  $p < 0.001$ ) and ( $\beta = 0.68$ ,  $t = 11.516$ ,  $p < 0.001$ ), respectively. Self-efficacy also significantly predicts user satisfaction and actual usage, so, *H3* and *H4* are supported ( $\beta = 0.20$ ,  $t = 4.984$ ,  $p < 0.001$ ) and ( $\beta = 0.15$ ,  $t = 3.155$ ,  $p < 0.01$ ) respectively. *H5* is similarly supported as actual usage significantly predicts user satisfaction ( $\beta = 0.45$ ,  $t = 6.749$ ,  $p < 0.001$ ). This result is similar to actual usage and user satisfaction which were found to significantly influence performance impact, so, *H6* and *H7* are supported ( $\beta = 0.48$ ,  $t = 7.309$ ,  $p < 0.001$ ) and ( $\beta = 0.41$ ,  $t = 6.793$ ,  $p < 0.001$ ), respectively. Note that the standardised path coefficient indicates the strength of the relationships between the

S. No.	Factors	1 PI	2 SE	3 QUL	4 SAT	5 USE
1	PI	0.838				
2	SE	0.497	0.817			
3	QUL	0.713	0.611	0.867		
4	SAT	0.777	0.576	0.745	0.883	
5	USE	0.783	0.474	0.702	0.756	0.832

**Table IV.**  
Results of  
discriminant validity  
by Fornell–Larcker  
criterion for the model

**Notes:** QUL, overall quality; SE, self-efficacy; SAT, user satisfaction; USE, actual usage; PI, performance impact. Diagonals represent the square root of the average variance extracted while the other entries represent the correlations

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**Notes:**  $\chi^2=844.631$ ;  $df=367$ ;  $p=0.000$ ; relative  $\chi^2=2.301$ ; CFI=0.954; RMSEA=0.054; GFI=0.889; AGFI=0.868; NFI=0.921; PNFI=0.833; IFI=0.954; TLI=0.949; PGFI=0.750

**Figure 2.**  
Research structural  
model results

Hypothesis	Relationship	Standard $\beta$	SE	$t$ -value	Decision	$R^2$
H1	QUL $\rightarrow$ SAT	0.36	0.069	5.705***	Supported	0.63
H2	QUL $\rightarrow$ USE	0.68	0.047	11.516***	Supported	0.48
H3	SE $\rightarrow$ SAT	0.20	0.045	4.984***	Supported	
H4	SE $\rightarrow$ USE	0.15	0.038	3.155**	Supported	
H5	USE $\rightarrow$ SAT	0.45	0.091	6.749***	Supported	
H6	USE $\rightarrow$ PI	0.48	0.081	7.309***	Supported	0.68
H7	SAT $\rightarrow$ PI	0.41	0.055	6.793***	Supported	

**Notes:** INFQ, information quality; SYSQ, system quality; SERQ, service quality; QUL, overall quality; SE, self-efficacy; SAT, user satisfaction; USE, actual usage; PI, performance impact. \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

**Table V.**  
Structural path  
analysis result

independent and dependent variables, so the direct effects of overall quality on user satisfaction and actual usage is much stronger than self-efficacy as evident from the values of path coefficient.

## 5. Discussion

This study proposes an extension to the DMISM by incorporating self-efficacy as a determinant of user satisfaction and actual usage in the context of online learning in Yemen. The study investigated overall quality through three dimensions and 11 indicators, and the findings revealed that overall quality significantly affects both user satisfaction and actual usage, which is consistent with previous studies (Abrego-Almazán *et al.*, 2017; Chiu *et al.*, 2016; Tam and Oliveira, 2016). This indicates that the higher the quality of online learning system is in terms of easiness, flexibility and understandability, the higher are both student actual usage and satisfaction. The fact that if the information offered by online learning is regarded by Yemeni students to be up-to-date, accurate, relevant and comprehensive, this should encourage top management to invest in and promote its use. For service quality, respondents in general praised what online learning can offer (responsiveness, interaction and reliability) and this is reflected in their satisfaction and the extent of their use of the system.

The results also shows that self-efficacy does have a significant influence on user satisfaction and actual usage and this supports previous findings (Hong *et al.*, 2016; Prior *et al.*, 2016), indicating that the more confident students are in searching the web, using e-mail and downloading files, the more they are utilising online learning and the greater their satisfaction with it.

With regard to actual usage, the results reveal that actual usage significantly impacts user satisfaction, which is also consistent with previous studies (Stefanovic *et al.*, 2016; Norzaidi, 2008), and is explained by the fact that when actual usage of online learning among students of public universities in Yemen increases, their performance improves. Further, it was found that actual usage, along with user satisfaction, significantly predicts performance impact, which is in line with previous studies (Hou, 2012; Kim *et al.*, 2015). It is also explained by the fact that when students in public universities in Yemen increase the frequency and duration of their online learning usage and have prior satisfaction with the system, an improvement in their performance results in three dimensions: efficiency (accomplish tasks quickly, accomplish tasks easily and save money), knowledge acquisition (acquire new knowledge and skills, develop innovative ideas, are assisted to learn) and productivity (learning performance and academic productivity), while enhancing moderately the fourth dimension of competence (eliminate errors and realise future targets).

Based on the extended DMISM, this study improves the understanding of the roles played by TL and compatibility in the process of online learning adoption and usage among students from nine public universities in Yemen, and hence highlights relevant implications and suggestions for university management and policy makers to realise the positive outcome of online learning. This is discussed in more detail below.

The study found that overall quality does have a significant positive effect on user satisfaction indicating that the higher the quality of an online learning system in terms of easiness, flexibility, up-to-date, accuracy, relevance, comprehensiveness, responsiveness, functionality and interactivity, the more students perceive it as meeting their expectations and thus feel satisfied. These results are consistent with previous studies (Abrego-Almazán *et al.*, 2017; Chiu *et al.*, 2016; Tam and Oliveira, 2016).

The results also reveal that overall quality has a significant positive effect on actual usage, indicating that the higher the quality of online learning is in terms of easiness, flexibility, up-to-date, accuracy, relevance, comprehensiveness, responsiveness, functionality and interactivity, the higher the frequency and duration of student online learning use will be. This is in line with prior studies (Althunibat, 2015; Dokhan and Akkoyunlu, 2016; Wang and Lai, 2014).

In addition, the results reveal that self-efficacy significantly affects user satisfaction and actual usage implying that the more confident students are with their ability to search the web, use e-mail and download files, the more they will be utilising online learning and perceive it as meeting their expectations. This result is in line with prior studies about the role of self-efficacy (Hong *et al.*, 2016; Prior *et al.*, 2016).

With regard to the effect of actual usage on user satisfaction, the results show that actual usage does have a significant effect on user satisfaction, and this is consistent with previous studies (Stefanovic *et al.*, 2016; Isaac, Abdullah, Ramayah and Mutahar, 2017a, b, c; Isaac, Abdullah, Ramayah, Mutahar and Alrajawy, 2017; Norzaidi, 2008), and explained by the notion that when actual usage of online learning among students of public universities in Yemen increases, their satisfaction improves.

With regard to the effect on performance impact by actual usage and user satisfaction, it was confirmed that actual usage, along with user satisfaction, both significantly predict performance impact, which is in line with prior studies (Hou, 2012; Islam, 2015; Kim *et al.*, 2015). It is also understood by the fact that when students in public universities in Yemen increase the frequency and duration of their online learning use and have prior satisfaction

with the system, this will lead to an enhancement in their performance in three perspectives: efficiency (accomplish tasks quickly, accomplish tasks easily and save money), knowledge acquisition (acquire new knowledge and skills, develop innovative ideas, are assisted to learn) and productivity (learning performance and academic productivity), while enhancing moderately the fourth dimension of competence (eliminate errors and realise future targets). By contrast, Wu and Wang (2006) reported that actual usage has no significant impact on perceived benefit, Khayun and Ractham (2011) also indicated that there is no relationship between actual usage and performance impact, and Cho *et al.* (2015) concluded that actual usage does not predict performance impact. These contradictory results may be explained by differing study settings and variables that were used to measure actual usage.

## 6. Implications

### 6.1 *Implications for research*

Online learning has been extensively studied in terms of adoption and in this study we offer an insight into a post-usage model. In addition to successfully extending the Delone and McLean information success model, it has been applied to a new setting and context, namely online learning in Yemen. Further, this study has validated a second-order model of overall quality for the purpose of increasing the power of explaining user satisfaction and actual usage, which contains three first-order constructs (system quality, information quality, and service quality). The Delone and McLean information success model has been extended by adding self-efficacy construct in order to create a rigid model to be used in new contexts. Also in this study, 68 per cent of the performance impact variance was explained. The predictive power of this model, which includes transformational leadership and compatibility, has a greater capability to explain and predict performance impact compared to models from some previous studies, where performance impact variance explained was 46 per cent (Khayun and Ractham, 2011), 42 per cent (Xinli, 2015), 40 per cent (Wang and Liao, 2008) and 37 per cent (Hou, 2012). Finally, this study provides evidence that the proposed model can be more effective in explaining performance impact, especially within the online learning context than other models in the previous literature.

### 6.2 *Implication for practice*

The findings of this study can be used as a guideline for the Yemeni Centre for Information Technology in Higher Education which was established to be an authority to enable the availability of information technology in Yemen universities for students, as well as academic and management staff, by highlighting the important factors and the ability of new technology to solve the many problems facing the country's higher education sector, and thus encourage and support the execution of the higher education master plan at both organisational and national level (Al-Madhagy, 2013).

According to The Global Competitiveness Report (2017), Yemen comes last in the quality of education system indicator (138 out of 138 countries) and also has one of the lowest GDP per capita in the world (\$1,302.9). This indicates that Yemen urgently needs a solution that can enhance education quality and maximise cost efficiency. According to Internet World Stats (2017), the number of Yemeni online users is increasing rapidly, and mobile gadgets subscriptions are on the rise (World Bank Group, 2017). Thus, online learning can be an effective solution due to its potential to improve the quality of education with the least infrastructure and minimum of resources (Chang, 2015; Shukor *et al.*, 2015).

This study also shows that self-efficacy does predict user satisfaction and actual usage of online learning, which in turn explains 68 per cent of performance variance. Thus, it is important for university management to focus on this antecedent to take advantage of the benefits of online learning. Indeed, the implications of this study are not just limited to

higher education institutions because learning is an essential part of any entity. For example, with knowledge management systems (KMS), online learning is essential for the support of KMS phases. The successful use of online learning can also improve organisational competencies. This research is also imperative for global companies which use online learning as part of their activities, because user compatibility factors do affect learning performance, so even within the same organisation, online learning strategies have to be crafted to users depending on their specific characteristics.

The findings of this study can be a guideline for Yemeni higher education institutions to develop efficient and effective plans to improve the performance of education institutions, and train and develop student ability to use online learning. Additionally, it highlights areas that university management needs to concentrate on, namely IS tools that will contribute to higher student enrolment, address the lack of infrastructure and improve the quality of education outcomes, things which represent Yemen's main challenges in the higher education sector. The implications of the key findings indicate many benefits, not only to higher education students, but also to the performance of higher education institutions and the economy as a whole (Mutahar *et al.*, 2018), because students in this study generally agreed that online learning helped improve knowledge acquisition, and resource savings, while enhancing productivity and competence. These findings should also be very useful for the Yemeni Government by highlighting the importance of the effect of new technology in solving the many problems facing the higher education sector, and encourage and support the execution of the Yemeni higher education master plan at both the organisational and national levels.

### **7. Limitations and suggestions for future work**

Even though the study offers positive new insights for both practice and theory, the findings should be taken with caution because they face limitations in three aspects. First as the study population comprised students from nine public universities, it excluded academic and administrative staff. Second, the research was cross-sectional, and while gaining experience in using online learning will change student beliefs, this cannot be tracked with a cross-sectional study. Third, the study depended on self-reported measures to test the proposed research model because getting objective data about performance was not possible due to privacy issues which could diminish the relevance of the findings to alternative contexts.

Researchers could also vary the outcome through organisational performance rather than individual performance, and because there is a possibility of a moderating role of culture existing in terms of collectivism/individualism, this is viable area for researchers to explore. Finally, because of rapid advances in technology, it could be beneficial to validate the findings in longitudinal settings in order to explore how technological innovations influence online learning use.

### **8. Conclusion**

Technology continues to offer solutions to the many challenges that we face in our daily activities. Its effect on education is profound as it is shaping the way future learning will be conducted. In trying to solve the problems faced by the Yemeni higher education sector which include a growing student population, weak infrastructure, low-quality standard of education and limited resources (Alrajawy *et al.*, 2016; Isaac, Masoud, Samad, and Abdullah, 2016), this research examined the role of transformational leadership and compatibility as antecedents in the Delone and McLean information system success model, examining data from among students from nine public universities in Yemen. The results revealed that the proposed framework was successful in demonstrating the constructs of the impact of student academic performance through using online learning. The study also found that

self-efficacy plays a significant role in predicting user satisfaction and actual usage of online learning. Hence, practitioners should focus on such factor to maximise the opportunity to encourage better performance. As such, these findings represent significant support to Yemeni Government initiatives in the higher education sector for encouraging students and creating an environment that is compatible with student values and lifestyle in which they are more likely to use online learning, and enhance their academic professionalism and ultimately the quality of their working life. The implications of this study from the perspective of research and practitioners have been deliberated, limitations have been noted and some directions for future research have been suggested.

## References

- Abrego-Almazán, D., Sánchez-Tovar, Y. and Medina-Quintero, J.M. (2017), "Influence of information systems on organizational results", *Contaduría y Administración*, Vol. 62 No. 2, pp. 321-338, available at: <https://doi.org/10.1016/j.cya.2017.03.001>
- Ajzen, I. (1985), "From intentions to actions: a theory of planned behavior", in Kuhl (Ed.), *Action Control: From Cognition to Behavior*, Springer-Verlag, Berlin; Heidelberg; and New York, NY, pp. 11-39.
- Ajzen, I. and Fishbein, M.A. (1980), *Understanding Attitudes and Predicting Social Behaviour*, 1st ed., Pearson, New York, NY.
- Al-Busaidi, K.A. (2013), "An empirical investigation linking learners' adoption of blended learning to their intention of full e-learning", *Behaviour & Information Technology*, Vol. 32 No. 11, pp. 1168-1176.
- Aldholay, A.H., Abdullah, Z., Ramayah, T., Isaac, O. and Mutahar, A.M. (2018), "Online learning usage and performance among students within public universities in Yemen", *International Journal of Services and Standards*, Vol. 12 No. 2, pp. 163-179.
- Aldholay, A.H., Isaac, O., Abdullah, Z. and Ramayah, T. (2018), "The role of transformational leadership as a mediating variable in DeLone and McLean information system success model: the context of online learning usage in Yemen", *Telematics and Informatics*, Vol. 35 No. 5, pp. 1421-1437, available at: <https://doi.org/10.1016/j.tele.2018.03.012>
- Aldholay, A.H., Isaac, O., Abdullah, Z., Alrajawy, I. and Nusari, M. (2018), "The role of compatibility as a moderating variable in the information system success model: the context of online learning usage", *International Journal of Management and Human Science (IJMHS)*, Vol. 2 No. 1, pp. 9-15.
- Al-Madhagy, T. (2013), "ICT policy in Yemen", Faculty of Information and Communication Technology, University Utara Malaysia, Sintok.
- Alrajawy, I., Daud, N.M., Isaac, O. and Mutahar, A.M. (2016), "Mobile learning in Yemen public universities: factors influence student's intention to use", *7th International Conference Postgraduate Education (ICPE7)*, Shah Alam, pp. 1050-1064.
- Althunibat, A. (2015), "Determining the factors influencing students' intention to use m-learning in Jordan higher education", *Computers in Human Behavior*, Vol. 52 No. 1, pp. 65-71, available at: <https://doi.org/10.1016/j.chb.2015.05.046>
- Aparicio, M., Bacao, F. and Oliveira, T. (2017), "Grit in the path to e-learning success", *Computers in Human Behavior*, Vol. 66 No. 1, pp. 388-399, available at: <https://doi.org/10.1016/j.chb.2016.10.009>
- Awang, Z. (2014), *Structural Equation Modeling Using AMOS*, Penerbit Universiti Teknologi MARA, Shah Alam.
- Baruch, Y. and Holtom, B.C. (2008), "Survey response rate levels and trends in organizational research", *Human Relations*, Vol. 61 No. 8, pp. 1139-1160, available at: <https://doi.org/10.1177/0018726708094863>
- Bentler, P.M. and Bonnet, D.G. (1980), "Significance tests and goodness of fit in the analysis of covariance structures", *Psychological Bulletin*, Vol. 88 No. 3, pp. 588-606.

- Bollen, K.A. (1990), "Overall fit in covariance structure models: two types of sample size effects", *Psychological Bulletin*, Vol. 107 No. 2, pp. 256-259, available at: <https://doi.org/10.1037/0033-2909.107.2.256>
- Brislin, R.W. (1970), "Back-translation for cross-cultural research", *Journal of Cross-Cultural Psychology*, Vol. 1 No. 3, pp. 185-216, available at: <https://doi.org/10.1177/135910457000100301>
- Byrne, B.M. (2016), *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming*, 3rd., Routledge, New York, NY.
- Chang, M. and Cheung, W. (2001), "Determinants of the intention to use internet/www at work: a confirmatory study", *Information and Management*, Vol. 39 No. 1, pp. 1-14.
- Chang, V. (2015), "Review and discussion: e-learning for academia and industry", *International Journal of Information Management*, Vol. 36 No. 3, pp. 476-485, available at: <https://doi.org/10.1016/j.ijinfomgt.2015.12.007>
- Chen, Y.S. (2013), "The study of behavioral intention for mobile commerce: via integrated model of TAM and TTF", *Quality and Quantity*, Vol. 47 No. 580, pp. 1009-1020.
- Cheng, D., Liu, G., Qian, C. and Song, Y.-F. (2013), "Customer acceptance of internet banking: integrating trust and quality with UTAUT model", *IEEE International Conference on Service Operations and Logistics, and Informatics*, pp. 383-388.
- Cheng, S.I., Chen, S.C. and Yen, D.C. (2015), "Continuance intention of e-portfolio system: a confirmatory and multigroup invariance analysis of technology acceptance model", *Computer Standards and Interfaces*, Vol. 42 No. 1, pp. 17-23, available at: <https://doi.org/10.1016/j.csi.2015.03.002>
- Cheung, R. and Vogel, D. (2013), "Predicting user acceptance of collaborative technologies: an extension of the technology acceptance model for e-learning", *Computers and Education*, Vol. 63 No. 1, pp. 160-175, available at: <https://doi.org/10.1016/j.compedu.2012.12.003>
- Chiu, P.-S., Chao, I.-C., Kao, C.-C., Pu, Y.-H. and Huang, Y.-M. (2016), "Implementation and evaluation of mobile e-books in a cloud bookcase using the information system success model", *Library Hi Tech*, Vol. 34 No. 2, pp. 207-223, available at: <https://doi.org/10.1108/LHT-12-2015-0113>
- Cho, K.W., Bae, S.-K., Ryu, J.-H., Kim, K.N., An, C.-H. and Chae, Y.M. (2015), "Performance evaluation of public hospital information systems by the information system success model", *Healthcare Informatics Research*, Vol. 21 No. 1, pp. 43-48, available at: <https://doi.org/10.4258/hir.2015.21.1.43>
- Clark, R.C. and Mayer, R.E. (2016), *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*, 4th ed., Wiley, London.
- D'Ambra, J., Wilson, C.S. and Akter, S. (2013), "Application of the task-technology fit model to structure and evaluate the adoption of e-books by academics", *Journal of the American Society for Information Science and Technology*, Vol. 64 No. 1, pp. 48-64, available at: <https://doi.org/10.1002/asi>
- Datta, P. (2011), "A preliminary study of ecommerce adoption in developing countries", *Information Systems Journal*, Vol. 21 No. 1, pp. 3-32, available at: <https://doi.org/10.1111/j.1365-2575.2009.00344.x>
- Daud, N., Kassim, N., Said, W. and Noor, M. (2011), "Determining critical success factors of mobile banking adoption in Malaysia", *Australian Journal of Basic and Applied Sciences*, Vol. 5 No. 9, pp. 252-265.
- Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, Vol. 13 No. 3, pp. 319-340.
- 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, available at: <https://doi.org/10.1073/pnas.0914199107>
- DeLone, W.H. and McLean, E.R. (2016), *Information Systems Success Measurement. Series in Information Technology Management*, Now Publishers Inc., PO.

- Dokhan, G. and Akkoyunlu, B. (2016), "Modeling the continuance usage intention of online learning environments", *Computers in Human Behavior*, Vol. 60 No. 1, pp. 198-211, available at: <https://doi.org/10.1016/j.chb.2016.02.066>
- Educational indicators of Yemen (2015), *Supreme Council for Education Planning*, Ministry of Higher Education, Sana'a.
- Flack, C.K. (2016), *IS Success Model for Evaluating Cloud Computing for Small Business Benefit: A Quantitative Study*, Kennesaw State.
- Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.
- Gbenga, F., Victor, A., Godspower, E., Solomon, A. and Janet, K. (2013), "Adoption of mobile learning among 3G-enabled handheld users using extended technology acceptance model", *World Journal on Educational Technology*, Vol. 5 No. 3, pp. 420-430.
- Gefen, D., Straub, D. and Boudreau, M.-C. (2000), "Structural equation modeling and regression: guidelines for research practice", *Communications of the Association for Information Systems*, Vol. 4 No. 1, pp. 1-79.
- Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2010), *Multivariate Data Analysis*, 7th ed., Pearson, New York, NY.
- Hair, J.F., Hult, G.T.M., Ringle, C.M. and Sarstedt, M. (2013), *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, SAGE Publications, New York, NY.
- Halonen, R., Acton, T., Golden, W. and Conboy, K. (2009), "DeLone & McLean success model as a descriptive tool in evaluating a virtual learning environment", *International Conference on Organizational Learning, Knowledge and Capabilities (OLKC), Amsterdam*, p. 16, available at: <https://doi.org/10.4018/jissc.2010040103>
- Hayduk, A.L. and Littvay, L. (2012), "Should researchers use single indicators, best indicators, or multiple indicators in structural equation models?", *BMC Medical Research Methodology*, Vol. 12 No. 1, pp. 159-176.
- Ho, L.-A., Kuo, T.-H. and Lin, B. (2010), "Influence of online learning skills in cyberspace", *Internet Research*, Vol. 20 No. 1, pp. 55-71, available at: <https://doi.org/10.1108/10662241011020833>
- Hong, J.C., Hwang, M.Y., Szeto, E., Tsai, C.R., Kuo, Y.C. and Hsu, W.Y. (2016), "Internet cognitive failure relevant to self-efficacy, learning interest, and satisfaction with social media learning", *Computers in Human Behavior*, Vol. 55 No. 1, pp. 214-222, available at: <https://doi.org/10.1016/j.chb.2015.09.010>
- Hossain, M.A. (2016), "Assessing m-health success in Bangladesh: an empirical investigation using IS success models", *Journal of Enterprise Information Management*, Vol. 29 No. 5, pp. 774-796, available at: <https://doi.org/10.1108/JEIM-02-2014-0013>
- Hou, C.-K. (2012), "Examining the effect of user satisfaction on system usage and individual performance with business intelligence systems: an empirical study of Taiwan's electronics industry", *International Journal of Information Management*, Vol. 32 No. 6, pp. 560-573, available at: <https://doi.org/10.1016/j.ijinfomgt.2012.03.001>
- Hsu, M.-H. and Chiu, C.-M. (2004), "Internet self-efficacy and electronic service acceptance", *Decision Support Systems*, Vol. 38 No. 3, pp. 369-381, available at: <https://doi.org/10.1016/j.dss.2003.08.001>
- Hu, L. and Bentler, P.M. (1999), "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 6 No. 1, pp. 1-55.
- Huang, E. (2008), "Use and gratification in e-consumers", *Internet Research*, Vol. 18 No. 4, pp. 405-426, available at: <https://doi.org/10.1108/10662240810897817>
- Internet World Stats (2017), "Internet usage as a percentage of population: Yemen vs. Arab countries", Internet World Stats.



- Iqbal, S. and Qureshi, I.A. (2012), "M-learning adoption: a perspective from a developing country", *International Review of Research in Open and Distance Learning*, Vol. 13 No. 3, pp. 147-164.
- Isaac, O., Abdullah, Z., Ramayah, T. and Mutahar, A.M. (2017a), "Examining the relationship between overall quality, user satisfaction and Internet usage: an integrated individual, technological, organizational and social perspective", *Asian Journal of Information Technology*, Vol. 16 No. 1, pp. 100-124.
- Isaac, O., Abdullah, Z., Ramayah, T. and Mutahar, A.M. (2017b), "Internet usage, user satisfaction, task-technology fit, and performance impact among public sector employees in Yemen", *The International Journal of Information and Learning Technology*, Vol. 34 No. 3, pp. 210-241, available at: <https://doi.org/10.1108/IJILT-11-2016-0051>
- Isaac, O., Abdullah, Z., Ramayah, T. and Mutahar, A.M. (2017c), "Internet usage within government institutions in Yemen: an extended technology acceptance model (TAM) with internet self-efficacy and performance impact", *Science International*, Vol. 29 No. 4, pp. 737-747.
- Isaac, O., Abdullah, Z., Ramayah, T., Mutahar, A.M. and Alrajawy, I. (2016), "Perceived usefulness, perceived ease of use, perceived compatibility, and net benefits: an empirical study of internet usage among employees in Yemen", *7th International Conference on Postgraduate Education, Shah Alam*, pp. 899-919.
- Isaac, O., Abdullah, Z., Ramayah, T., Mutahar, A.M. and Alrajawy, I. (2017), "Towards a better understanding of Internet technology usage by Yemeni employees in the public sector: an extension of the task-technology fit (TTF) model", *Research Journal of Applied Sciences*, Vol. 12 No. 2, pp. 205-223, <https://doi.org/10.3923/rjasci.2017.205.223>
- Isaac, O., Masoud, Y., Samad, S. and Abdullah, Z. (2016), "The mediating effect of strategic implementation between strategy formulation and organizational performance within government institutions in Yemen", *Research Journal of Applied Sciences*, Vol. 11 No. 10, pp. 1002-1013, available at: <https://doi.org/10.3923/rjasci.2016.1002.1013>
- Islam, A.K.M.N. (2013), "Investigating e-learning system usage outcomes in the university context", *Computers and Education*, Vol. 69 No. 1, pp. 387-399, available at: <https://doi.org/10.1016/j.compedu.2013.07.037>
- Islam, A.K.M.N. (2015), "E-learning system use and its outcomes: moderating role of perceived compatibility", *Telematics and Informatics*, Vol. 33 No. 1, pp. 48-55, available at: <https://doi.org/10.1016/j.tele.2015.06.010>
- Jafari, S.M., Ali, N.A., Sambasivan, M. and Said, M.F. (2011), "A respecification and extension of DeLone and McLean model of IS success in the citizen-centric e-governance", *Proceedings of the IEEE International Conference on Information Reuse and Integration, IRI*, pp. 342-346, available at: <https://doi.org/10.1109/IRI.2011.6009571>.
- James, L.R., Muliak, S.A. and Brett, J.M. (1982), *Causal Analysis: Models, Assumptions and Data*, Sage Publications, Beverly Hills, CA.
- Jöreskog, K. and Sörbom, D. (1998), *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*, Scientific Software International Inc., Chicago, IL.
- Jung, T., Chung, N. and Leue, M.C. (2015), "The determinants of recommendations to use augmented reality technologies: the case of a Korean theme park", *Tourism Management*, Vol. 49 No. 1, pp. 75-86, available at: <https://doi.org/10.1016/j.tourman.2015.02.013>
- Kannana, V.R. and Tan, K.C. (2005), "Just in time, total quality management, and supply chain management: understanding their linkages and impact on business performance", *Omega: The International Journal of Management Science*, Vol. 33 No. 2, pp. 153-162.
- Khayun, V. and Ractham, P. (2011), "Measuring e-excise tax success factors: applying the DeLone & McLean information systems success model", *Proceedings of the Annual Hawaii International Conference on System Sciences, Honolulu, HI*, pp. 1-10.
- Kim, B.G., Park, S.C. and Lee, K.J. (2007), "A structural equation modeling of the internet acceptance in Korea", *Electronic Commerce Research and Applications*, Vol. 6 No. 4, pp. 425-432, available at: <https://doi.org/10.1016/j.elerap.2006.08.005>

- Kim, C., Lee, I.-S., Wang, T. and Mirusmonov, M. (2015), "Evaluating effects of mobile CRM on employees' performance", *Industrial Management & Data Systems*, Vol. 115 No. 4, pp. 740-764, available at: <https://doi.org/10.1108/IMDS-08-2014-0245>
- Kim, H.W., Chan, H.C. and Gupta, S. (2007), "Value-based adoption of mobile Internet: an empirical investigation", *Decision Support Systems*, Vol. 43 No. 1, pp. 111-126, available at: <https://doi.org/10.1016/j.dss.2005.05.009>
- Kline, R.B. (2010), *Principles and Practice of Structural Equation Modeling*, 3rd ed., The Guilford Press, New York, NY.
- Krejcie, R.V. and Morgan, D.W. (1970), "Determining sample size for research activities", *Educational and Psychological Measurement*, Vol. 38 No. 1, pp. 607-610, available at: <https://doi.org/10.1177/001316447003000308>
- Lee, B.C., Yoon, J.O. and Lee, I. (2009), "Learners' acceptance of e-learning in South Korea: theories and results", *Computers and Education*, Vol. 53 No. 4, pp. 1320-1329, available at: <https://doi.org/10.1016/j.compedu.2009.06.014>
- Lin, F., Fofanah, S.S. and Liang, D. (2011), "Assessing citizen adoption of e-government initiatives in Gambia: a validation of the technology acceptance model in information systems success", *Government Information Quarterly*, Vol. 28 No. 2, pp. 271-279, available at: <https://doi.org/10.1016/j.giq.2010.09.004>
- Lin, W.-S. and Wang, C.-H. (2012), "Antecedences to continued intentions of adopting e-learning system in blended learning instruction: a contingency framework based on models of information system success and task-technology fit", *Computers & Education*, Vol. 58 No. 1, pp. 88-99, available at: <https://doi.org/10.1016/j.compedu.2011.07.008>
- Liu, Y., Li, H. and Carlsson, C. (2010), "Factors driving the adoption of m-learning: an empirical study", *Computers and Education*, Vol. 55 No. 3, pp. 1211-1219, available at: <https://doi.org/10.1016/j.compedu.2010.05.018>
- Mahdavian, M., Wingreen, S.C. and Ghlichlee, B. (2016), "The influence of key users' skills on erp success", *Journal of Information Technology Management*, Vol. XXVII No. 2, pp. 48-64.
- Makokha, M.W. and Ochieng, D.O. (2014), "Assessing the success of ICT's from a user perspective: a case of coffee research foundation", *Journal of Chemical Information and Modeling*, Vol. 53 No. 9, pp. 1689-1699, available at: <https://doi.org/10.1017/CBO9781107415324.004>
- Mohammadi, H. (2015), "Investigating users' perspectives on e-learning: an integration of TAM and IS success model", *Computers in Human Behavior*, Vol. 45 No. 1, pp. 359-374, available at: <https://doi.org/10.1016/j.chb.2014.07.044>
- Montesdioca, G.P.Z. and Maçada, A.C.G. (2015), "Measuring user satisfaction with information security practices", *Computers & Security*, Vol. 48 No. 1, pp. 267-280, available at: <https://doi.org/10.1016/j.cose.2014.10.015>
- Mutahar, A.M., Daud, N.M., Ramayah, T., Isaac, O. and Aldholay, A.H. (2018), "The effect of awareness and perceived risk on the technology acceptance model (TAM): mobile banking in Yemen", *International Journal of Services and Standards*, Vol. 12 No. 2, pp. 180-204.
- Mutahar, A.M., Daud, N.M., Ramayah, T., Isaac, O. and Alrajawy, I. (2017), "Examining the Intention to use mobile banking services in Yemen: an integrated perspective of technology acceptance model (TAM) with perceived risk and self- efficacy", *Asian Journal of Information Technology*, Vol. 16 No. 2, pp. 298-311.
- Ngai, E.W.T., Poon, J.K.L. and Chan, Y.H.C. (2007), "Empirical examination of the adoption of WebCT using TAM", *Computers & Education*, Vol. 48 No. 1, pp. 250-267.
- Norzaidi, M.D. (2008), "Factors determining intranet usage: an empirical study of middle managers in Malaysian port industry", Multimedia University, available at: <http://core.ac.uk/download/pdf/11362252.pdf>
- Norzaidi, M., Chong, S.C., Murali, R. and Salwani, M.I. (2007), "Intranet usage and managers' performance in the port industry", *Industrial Management & Data Systems*, Vol. 107 No. 8, pp. 1227-1250, available at: <https://doi.org/10.1108/02635570710822831>

- Nunnally, J.C. and Bernstein, I.H. (1994), *Psychometric Theory*, McGraw-Hill, New York, NY.
- Oktal, O., Alpu, O. and Yazici, B. (2016), "Measurement of internal user satisfaction and acceptance of the e-justice s...: EBSCOhost", *Aslib Journal of Information Management*, Vol. 68 No. 6, pp. 716-735, available at: <https://doi.org/10.1108/AJIM-04-2016-0048>
- Petter, S. and McLean, E.R. (2009), "A meta-analytic assessment of the DeLone and McLean IS success model: an examination of IS success at the individual level", *Information and Management*, Vol. 46 No. 3, pp. 159-166, available at: <https://doi.org/10.1016/j.im.2008.12.006>
- Pituch, K.A. and Lee, Y. (2006), "The influence of system characteristics on e-learning use", *Computers & Education*, Vol. 47 No. 1, pp. 222-244.
- Prior, D.D., Mazanov, J., Meacham, D., Heaslip, G. and Hanson, J. (2016), "Attitude, digital literacy and self-efficacy: flow-on effects for online learning behavior", *The Internet and Higher Education*, Vol. 29 No. 1, pp. 91-97, available at: <https://doi.org/10.1016/j.iheduc.2016.01.001>
- Ramirez-Correa, P.E., Rondan-Cataluna, F.J., Arenas-Gaitan, J. and Alfaro-Perez, J.L. (2017), "Moderating effect of learning styles on a learning management system's success", *Telematics and Informatics*, Vol. 34 No. 1, pp. 272-286, available at: <https://doi.org/10.1016/j.tele.2016.04.006>
- Roca, J.C., Chiu, C.M. and Martinez, F.J. (2006), "Understanding e-learning continuance intention: an extension of the technology acceptance model", *International Journal of Human Computer Studies*, Vol. 64 No. 8, pp. 683-696, available at: <https://doi.org/10.1016/j.ijhcs.2006.01.003>
- Rogers, E.M. (1995), *J. Diffusion of Innovations*, 4th ed., The Free Press, New York, NY; and London.
- Shen, D., Cho, M.H., Tsai, C.L. and Marra, R. (2013), "Unpacking online learning experiences: online learning self-efficacy and learning satisfaction", *Internet and Higher Education*, Vol. 19 No. 1, pp. 10-17, available at: <https://doi.org/10.1016/j.iheduc.2013.04.001>
- Shukor, N.A., Tasir, Z., der Meijden and H.V. (2015), "An examination of online learning effectiveness using data mining", *Procedia—Social and Behavioral Sciences*, Vol. 172 No. 1, pp. 555-562, available at: <https://doi.org/http://dx.doi.org/10.1016/j.sbspro.2015.01.402>
- Son, H., Park, Y., Kim, C. and Chou, J.-S. (2012), "Toward an understanding of construction professionals' acceptance of mobile computing devices in South Korea: an extension of the technology acceptance model", *Automation in Construction*, Vol. 28, pp. 82-90, available at: <https://doi.org/10.1016/j.autcon.2012.07.002>
- Stefanovic, D., Marjanovic, U., Delic, M., Culibrk, D. and Lalic, B. (2016), "Assessing the success of e-government systems: an employee perspective", *Information & Management*, Vol. 53 No. 1, pp. 717-726, available at: <https://doi.org/10.1016/j.im.2016.02.007>
- Steiger, J.H. (1990), "Structural model evaluation and modification: an interval estimation approach", *Multivariate Behavioral Research*, Vol. 25 No. 2, pp. 173-180, available at: [https://doi.org/10.1207/s15327906mbr2502\\_4](https://doi.org/10.1207/s15327906mbr2502_4)
- Šumak, B., Hericko, M. and Pušnik, M. (2011), "A cross-cultural study of ICT competency, attitude and satisfaction of Turkish, Polish and Czech university students", *Turkish Online Journal of Educational Technology*, Vol. 10 No. 4, pp. 31-38, available at: <https://doi.org/10.1016/j.chb.2011.08.005>
- Sun, P.-C., Tsai, R.J., Finger, G., Chen, Y.-Y. and Yeh, D. (2008), "What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction", *Computers & Education*, Vol. 50 No. 4, pp. 1183-1202, available at: <https://doi.org/10.1016/j.compedu.2006.11.007>
- Tabachnick, B.G. and Fidell, L.S. (2012), *Using Multivariate Statistics*, 6th ed., Pearson, New York, NY.
- Tam, C. and Oliveira, T. (2016), "Understanding the impact of m-banking on individual performance: DeLone & McLean & TTF perspective", *Computers in Human Behavior*, Vol. 61 No. 1, pp. 233-244, available at: <https://doi.org/10.1016/j.chb.2016.03.016>
- Tenório, T., Bittencourt, I.L., Isotani, S. and Silva, A.P. (2016), "Does peer assessment in on-line learning environments work? A systematic review of the literature", *Computers in Human Behavior*, Vol. 64 No. 1, pp. 94-107, available at: <https://doi.org/10.1016/j.chb.2016.06.020>

- The Global Competitiveness Report (2017), "The global competitiveness Report 2016–2017", World Economic Forum, Geneva, available at: <https://doi.org/92-95044-35-5>
- Tucker, L.R. and Lewis, C. (1973), "A reliability coefficient for maximum likelihood factor analysis", *Psychometrika*, Vol. 38 No. 1, pp. 1-10.
- Tullis, J.G. and Benjamin, A.S. (2011), "On the effectiveness of self-paced learning q", *Journal of Memory and Language*, Vol. 64 No. 2, pp. 109-118, available at: <https://doi.org/10.1016/j.jml.2010.11.002>
- UNESCO (2013), "UNESCO Policy guidelines for mobile learning.", UNESCO working paper series on mobile learning, Paris, available at: <http://unesdoc.unesco.org/images/0021/002196/219641e.pdf>
- Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003), "User acceptance of information technology: toward a unified view", *MIS Quarterly*, Vol. 27 No. 3, pp. 425-478.
- Wang, W.-T. and Lai, Y.-J. (2014), "Examining the adoption of KMS in organizations from an integrated perspective of technology, individual, and organization", *Computers in Human Behavior*, Vol. 38 No. 1, pp. 55-67, available at: <https://doi.org/10.1016/j.chb.2014.05.013>
- Wang, Y.S. (2008), "Assessing e-commerce systems success: a respecification and validation of the DeLone and McLean model of IS success", *Information Systems Journal*, Vol. 18 No. 5, pp. 529-557, available at: <https://doi.org/10.1111/j.1365-2575.2007.00268.x>
- 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, available at: <https://doi.org/10.1016/j.giq.2007.06.002>
- World Bank Group (2017), "World Development Indicators", World Bank Group.
- Wu, J.H. and Wang, Y.M. (2006), "Measuring KMS success: a respecification of the DeLone and McLean's model", *Information and Management*, Vol. 43 No. 6, pp. 728-739, available at: <https://doi.org/10.1016/j.im.2006.05.002>
- Xinli, H. (2015), "Effectiveness of information technology in reducing corruption in China", *Electronic Library*, Vol. 33 No. 1, pp. 52-64, available at: <https://doi.org/10.1108/EL-11-2012-0148>
- Yu, C.-S. (2012), "Factors affecting individuals to adopt mobile banking: empirical evidence from the UTAUT model", *Journal of Electronic Commerce Research*, Vol. 13 No. 1, pp. 104-121.
- Zhou, T. (2011), "An empirical examination of initial trust in mobile banking", *Internet Research*, Vol. 21 No. 5, pp. 527-540, available at: <https://doi.org/10.1108/10662241111176353>

Variable	Measure	Source
System quality (SYSQ)	SYSQ1: I find the online learning to be easy to use SYSQ2: I find the online learning to be flexible to interact with SYSQ3: My interaction with the online learning is clear & understandable	Zhou (2011), Mohammadi (2015), Ngai <i>et al.</i> (2007)
Information quality (INFQ)	INFQ1: Online learning provides up-to-date knowledge INFQ2: Online learning provides accurate knowledge INFQ3: Online learning provides relevant knowledge INFQ4: Online learning provides comprehensive knowledge INFQ5: Online learning provides organised knowledge	Lin and Wang (2012), Lin <i>et al.</i> (2011), Mohammadi (2015)
Service Quality (SERQ)	SERQ1: I could use the online learning services at anytime, anywhere I want SERQ2: Online learning offers multimedia (audio, video, and text) types of course content SERQ3: Online learning enables interactive communication	Lin <i>et al.</i> (2011), Pituch and Lee (2006)
Self-Efficacy (SE)	SE1: I feel confident finding information by using a search engine (e.g. Google) SE2: I feel confident in the online learning sending and receiving e-mail messages SE3: I feel confident in the online learning downloading and uploading files	Hsu and Chiu (2004)
User Satisfaction (SAT)	SAT1: My decision to use the online learning was a wise one SAT2: The online learning has met my expectations SAT3: Overall, I am satisfied with the online learning	Sun <i>et al.</i> (2008), Wang (2008), Huang (2008)
Actual usage (USE)	USE1: On average, how frequently do you use the online learning? <input type="checkbox"/> Certainly not <input type="checkbox"/> Less than once a month <input type="checkbox"/> Once a month <input type="checkbox"/> A few times a month <input type="checkbox"/> A few times a week <input type="checkbox"/> About once a day <input type="checkbox"/> Several times a day USE2: On average, how much time do you spend per week using the online learning? <input type="checkbox"/> Certainly not <input type="checkbox"/> Almost never <input type="checkbox"/> less than 2 hours <input type="checkbox"/> 2–4 hours <input type="checkbox"/> 4–6 hours <input type="checkbox"/> 6–8 hours <input type="checkbox"/> More than 8 hours	Kim <i>et al.</i> (2007)
Performance impact (PI)	PI1: Online learning helps me to accomplish my tasks more quickly PI2: Online learning makes it easier to complete my tasks PI3: Online learning saves my money PI4: Online learning improves my learning performance PI5: Online learning enhances my academic effectiveness PI6: Online learning helps reviews and eliminate errors in my work tasks PI7: Online learning helps me to realise my future target PI8: Online learning helps me acquire new knowledge PI9: Online learning helps me acquire new skills PI10: Online learning helps me to come up with innovative ideas	Isaac <i>et al.</i> (2017a, b, c), Kim <i>et al.</i> (2007), Khayun and Ractham, (2011), Gbenga <i>et al.</i> (2013), Datta (2011), Wu and Wang (2006), Liu <i>et al.</i> (2010)

**Table AI.**  
Instrument for variables

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