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Evaluating Students Information System Success Using DeLone and McLean's Model: Student's Perspective

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ABSTRACT

System success is considered to be an important element in accomplishing the goals of the organization, therefore evaluation of system success need to be done to ensure that investment in IS is successful. Most of the Higher Learning Institutions (HLIs) in Tanzania have adopted the use of IS in providing service to their customers. Nevertheless, there is less evidence that system success evaluation has been done in order to identify the desired characteristics which could make IS more effective. Due to that, this study evaluates the effectiveness of Student Information System (SIS) used at the Institute of Finance Management using DeLone and McLean's Model. Convenience sampling technique was employed to select respondents from the Institute of Finance Management. A total of 391 complete and valid questionnaires were employed in data analysis. IBM SPSS software was used to analyze the hypothesized relationships between the variables. The findings show that system quality, information quality, service quality, system use and user satisfaction are the key desired characteristics in making SIS success. The study has provided implications to Researchers and practitioners on how to improve the effectiveness of the IS used in Higher Learning Institutions based on the desired characteristics.

Keywords: Information system, Effectiveness, IFM, DeLone and McLean's Model, Tanzania

INTRODUCTION

The major teaching and learning challenges facing higher education revolve around student diversity, which includes, amongst others, students' academic preparedness, language and schooling background (Sarkar 2012). As it is in many countries in the world, Tanzania has been swept by the wave of adopting modern technology in education sector to address existing challenges (Kajuna 2009). Tanzania through its National Information and Communication Technology (ICT) Policy (Tanzania 2016) is keen on promoting the use of ICT in various sectors including education in which ICT has the potential to enhance effective delivery of both formal and informal education. Sife, Lwoga and Sanga (2007) explained factors that have driven HLIs to adopt the use of ICT. These factors includes greater information access; greater communication via electronic facilities; synchronous learning; increased cooperation and collaboration, cost-effectiveness (e.g. by reaching different students and in greater numbers) and pedagogical improvement through simulations, virtual experiences, and graphic representations.

Alam (2016) shows that the usage of ICT applications provide HLIs with a competitive edge by offering enhanced services to students and faculty, driving greater efficiencies and creating enriched learning experiences.

Furthermore, Oliver (2003) added that, the growing uses of ICT as an instructional medium is changing and will likely continue to change many of the strategies employed by both teachers and students in the learning process. ICT is used as tools to enable and bring about transformation which, when used properly, can encourage the shift to an environment which is learner - centered (Sarkar 2012)

Various HLIs in Tanzania has adopted the uses of Information System (IS) in providing their services to its customers. Despite high rate of using IS in their operations, evaluating system effectiveness and success lags behind. Since the use of ICT is primarily aimed enhancing the users' ability to work better, more efficiently and to produce more, within the shortest time possible, while ensuring that cost is at its lowest, it is imperative to assess the success and effectiveness of the IS used in HLIs. This is because, there is a need to understand if the IS used in HLIs are capable of delivering the services as expected. Thorough literature review reveals that, little is known about the success and effectiveness of IS used in HLIs in Tanzania.

Therefore, this study fills the gap by examining the system effectiveness of IS used in HLIs in Tanzania. To accomplish the main objective of the study, DeLone and McLean's model was adopted to evaluate the effectiveness of Student Information System used at the Institute of Finance Management.

The significance of this study is twofold. Firstly, the study expands scholar's knowledge on the evaluating effectiveness of Information System used in HLIs. This is because studies which examine system effectiveness of the IS used in HLIs and in Tanzania in particular are very limited. Furthermore, the study provides recommendations to policy makers on desired characteristics which will make the IS used in HLIs more effective and deliver the expected services to customers.

LITERATURE REVIEW

Student Information System

Student Information Systems is system which is mostly used in academic institution to manage student information (Gürkut & Nat 2017). The student management system enables students to register for various courses, viewing assessment results, viewing performance report and other related task. Most of the academic Institutions have adopted the uses of SIS in simplifying student records keeping and management.

Effectiveness of Information Systems

Information System effectiveness refers to the capability to produce a desired results (Drucker 2004). Hamilton and Chervany (1981) defined effectiveness as the accomplishment of organizational goals, and thus could be measured in two different ways; the goal-centered view and the systems-resource view. The goal-centered view is concerned by assessing the organization with respect to its task objectives by finding the difference between performance and objectives.

In system-resource view, effectiveness is concerned with resource viability. For the assessment of system effectiveness, these considerations should converge. Furthermore, Hamilton and Chervany (1981) stated that, IS provides a means for an organization to reach its goals, which could be evaluated from two perspectives; efficiency of IS resources utilization, and effectiveness of the IS to users in achieving organizational objectives. Additionally, Hamilton and Chervany (1981) claimed that to assess the IS goals, performance measures developed for both of the perspectives could be used. IS can be called effective if it supports organization to reach its objectives as a whole (Malik 2001). Early studies used efficiency as an IS evaluation measure, however it is replaced by effectiveness since IS systems are goal-oriented systems, thus need to measure its influence on the

environment (Gul 2009). Therefore, this study focuses on measuring the effectiveness of the SIS in attaining its main objectives.

RESEARCH FRAMEWORK AND HYPOTHESES

This study adopted the DeLone and McLean's (D&M) Information Systems Success Model for assessing the IS effectiveness of the Student Information System. The model adopted all dimensions of the IS success model, namely; System quality, Information quality, Service quality, Use, User satisfaction and Net benefits. This IS success model has been adopted because it has been found to be a useful framework for organizing IS success measurements and the most comprehensive model used as a theoretical framework to measure IS success or effectiveness in IS field and has been widely used by IS researchers for understanding and measuring the dimensions of IS success (Andoh-Baidoo et al. 2010; Petter, DeLone & McLean 2008; Seddon & Kiew 1996). DeLone and McLean (2003) argued that Use and Intention to Use are alternative based on mandatory or voluntary usage. Since the usage of SIS is mandatory in HLIs, this study adopts *Use* instead of *Intention to Use* as SIS effectiveness measure.

Furthermore, DeLone and McLean (2003) and Seddon (1997) have come to a compromise on the use of net benefit as IS success measure. Diverse stakeholders have different observations on what represent a benefit to them. Since the aim of this study is to measure SIS effectiveness from students' perspective, net benefit will be referred as student-perceived benefit of using SIS in accessing academic information.

System quality constitutes the desirable characteristics of an IS and, thus, subsumes measures of the IS itself. These measures typically focus on usability aspects and performance characteristics of the information system under examination. A very common measure is perceived ease of use caused by the large amount of research related to the Technology Acceptance Model (TAM) (Urbach & Müller 2011). Several studies have analyzed the influence of system quality in evaluating the use of information system, and their findings shows that system quality have significantly positive effect on use and user satisfaction (Ojo 2017; Rammutloa 2017; Romi 2013; Šmýkala 2018). Based on previous findings, this study hypothesizes that:

H1: System quality has positive and significant effect on use of SIS.

H2: System quality has positive and significant effect on user satisfaction of SIS.

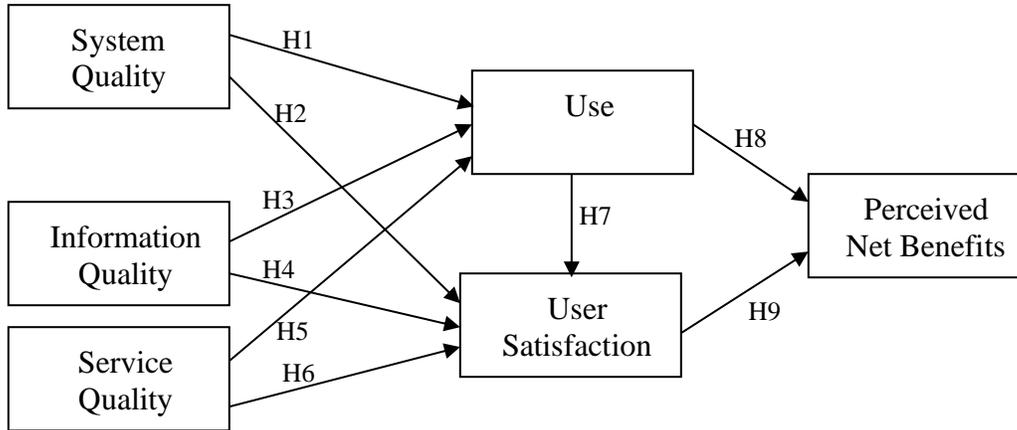


Figure 1. Research Conceptual Framework

The success dimension information quality constitutes the desirable characteristics of an IS's output. An example would be the information an employee can generate using a company's IS, such as up-to-date sales statistics or current prices for quotes. Thus, it subsumes measures focusing on the quality of the information that the system produces and its usefulness for the user. Information quality is often seen as a key antecedent of user satisfaction (Urbach & Müller 2011). The information quality dimension has received greater attention among scholars in IS success studies and has been regarded as an important measure for the successful implementation of the information systems in organizations. Several studies have attested that information quality has direct positive and significant influence on use and user satisfaction (Gürkut & Nat 2017; Jaafreh 2017; Ojo 2017; Romi 2013; Šmýkala 2018). Based on previous findings, this study hypothesizes that:

H3: Information quality has positive and significant effect on use of SIS.

H4: Information quality has positive and significant effect on user satisfaction of SIS.

Service quality represents the quality of the support that the users receive from the IS department and IT support personnel, such as, for example, training, hotline, or helpdesk. This construct is an enhancement of the updated D&M IS Success Model that was not part of the original model. The inclusion of this success dimension is not indisputable, since information system quality is not seen as an important quality measure of a single system by some authors (Urbach & Müller 2011).

Moreover, several studies have found a positive relationship between service quality and use and user satisfaction of IS (Jaafreh 2017; Ojo 2017; Romi 2013; Šmýkala 2018).

Similarly, DeLone and McLean (DeLone & McLean 2016) suggested a positive relationship between service quality and IS. Therefore, delivering prompt and reliable service according to user-specific needs might lead to a better product or service delivery to IS users. However, the absence of key service quality attributes may undermine the delivery of efficient service content of the system which may lead to complex processes for the user (Shagari & Abdullah 2017). Thus, higher service quality provisions could enable information system to achieve its effectiveness. Hence, the following relationships are hypothesized;

H5: Service quality has positive and significant effect on use of SIS.

H6: Service quality has positive and significant effect on user satisfaction of SIS.

The use dimension represents the degree and manner in which an information system is utilized by its users. Measuring the usage of an information system is a broad concept that can be considered from several perspectives. In case of voluntary use, the actual use of an IS may be an appropriate success measure. Previous studies measured use objectively by capturing the connect time, the functions utilized, or the frequency of use. As the amount of time a system is used is apparently not a sufficient success measure, other studies applied subjective measures by questioning users about their perceived use of a system. Due to difficulties in interpreting the dimension use, DeLone and McLean suggest intention to use as an alternative measure to use for some contexts (Urbach & Müller 2011).

The adoption of Use as a means to measure success or effectiveness requires consideration and a response to the following questions; to what extent is the system used; what is the nature and quality of the system being used; and lastly, is the system appropriate to use? (Rammutoa, 2017). Certain constructs of the IS success model were evaluated by another author and highlighted that usefulness is not used as stated on the DeLone and McLean's model (Seddon & Kiew 1996). However, DeLone and McLean maintain that the construct of use should still be maintained as an appropriate measure and not usefulness with other researchers also (Jaafreh 2017; Ojo 2017; Romi 2013; Šmýkala 2018) showing it has significant effect on the success of IS. Based on these findings, this study hypothesis that:

H7: Use has positive and significant effect on user satisfaction of SIS.

H8: Use has positive and significant effect on perceived net benefit of SIS.

User satisfaction refers to user's attitude towards an information system. Satisfaction in any given condition is how an individual feel or the kind of attitude displayed towards varied factors affecting that particular condition or situation. The attitudes displayed by users as they interact with the intranet are pivotal in measuring its success or failure to satisfy the expected results. Measuring user attitudes would eliminate any element of preference when measuring the effectiveness of a system (Rammutloa 2017).

The success dimension user satisfaction constitutes the user's level of satisfaction when utilizing an IS. It is considered as one of the most important measures of IS success. Measuring user satisfaction becomes especially useful, when the use of an IS is mandatory and the amount of use is not an appropriate indicator of system's success (Urbach & Müller 2011). Several authors have investigated the construct of user satisfaction and found that it can be utilized to assess the effectiveness or success of information systems (Azadeh, Songhori & Sangari 2009; Jaafreh 2017; Romi 2013; Šmýkala 2018). Based on these findings, this study postulates that:

H9: User satisfaction has positive and significant effect on perceived net benefits of SIS.

RESEARCH METHODOLOGY

Population of Study

The population of the study comprised of students only who are studying at the Institute of Finance Management. Currently, the Institute enrolls about 8,400 students in both undergraduate and graduate programs (IFM Website 2018). The Institute of Finance Management was selected because it is one of HLIs which has used IS for more than 10 years is providing services to its customers. The study uses students only in sample frame because they are the one who are most affected by the uses of SIS than staff because, large percent of the Institute's services are accessible through SIS.

Sample size

Sample size used in this study was computed using Yamane's formula (Yamane 1967). The formula is applicable when the population of study is well known. Since

the population of study was known, then applying Yamane's formula was found to be viable.

$$n = \frac{N}{1 + N(e^2)} \dots \dots \dots \text{Equation 1}$$

Where n; Sample size, N: population of study; e: level of precision

Based on the above formula, substituting 8400 as a total population and 5% as level of precision, a sample of 382 was found. Therefore, this study has used a minimum sample of 382 respondents.

Data Collection Instruments

A questionnaire consisting of closed-ended questions was used to collect data from respondents in this study. The questionnaire comprised of three main sections namely: introduction, demographic section and measurement items. The measurement items used to develop questionnaire were borrowed from Lee-Post (2009), Lwoga (2013), Mtebe and Raisamo (2014), Yakubu and Dasuki (2018). The items were further modified to suite the current study context. Measurement items used five-point Likert scales ranging from strongly disagree (1) to strongly agree (5).

Sampling Technique

Due to difficultness of accessing respondents, respondents were selected using convenient sampling technique (Etikan, Musa & Alkassim, 2016). In order to have good representation of the respondents, researchers visited classes before lecture session and requested students to fill in the questionnaire. Respondents who were willingly to fill the questionnaire were given the questionnaire to fill. All questionnaire distributed were collected for data analysis.

RESULTS AND FINDINGS

Demographic Information

Table 1 show that 391 respondents were used in this study of which 51.4% are males which is the large percentage of the sample collected as compared to female. Respondents pursuing undergraduate degrees represent 86.4% of the respondents while postgraduate 13.6% of the respondents. Furthermore, respondents on year of study were approximately 38.6% in first year, 33.0% second year and 28.4% third year.

Demographic Variable	Group	Frequency	Percent (%)
Gender	Male	201	51.4
	Female	190	48.6
Level of Study	Undergraduate	338	86.4
	Postgraduate	53	13.6
Year of Study	First	151	38.6
	Second	129	33.0
	Third	111	28.4

Table 1. Demographic Information

Missing Data and Normality Test

The data collected were evaluated for missing values; five (5) questionnaires were dropped due to large percent (15 percent or more) of missing values (Hair, 2015). Furthermore, 20 questionnaires were having small number of missing values; evaluation to check its effects was conducted by using MCAR test (Newman 2014). The findings show that they have no significant effect on the data ($\chi^2(286) = 311, \rho = 0.105$). Therefore, all data were replaced by using Expectation Maximization (EM) algorithm.

Data normality test was conducted by using skewness and kurtosis. Awang (2015) and George and Mallery (2016) suggested that an absolute value of 2 and 3 for skewness and kurtosis respectively show that the data are normally distributed. The normality test findings show that the skewness and kurtosis in this

study have an absolute value of 1.2 and 2.8 respectively which shows that the data used in this study are normally distributed.

Reliability and Validity

The model was examined for the reliability, construct reliability, and convergent validity of individual items. The individual item reliability was deemed adequate with a standard loading greater than 0.5 as suggested by Hair Jr et al, (Hair Jr et al. 2014). The results shown in Table 2 indicated that all items possessed standard loadings greater than 0.5. Construct reliability was assessed using composite reliability (CR) as a measure of internal consistency, while the convergent validity was assessed by determining the Average Variance Extracted (AVE) (Awang 2015).

The results shown in Table 2 verify that the model is reliable and has acceptable convergent validity, as the CR and AVE are at least 0.7 and 0.5, respectively (Fornell & Larcker 1981; Hair Jr et al. 2014; Nunnally & Bernstein 1994).

Variable	Measurement Items	Factor Loadings	CR	AVE
System Quality	SQ1	0.726	0.842	0.501
	SQ2	0.715		
	SQ3	0.701		
	SQ4	0.686		
Information Quality	IQ1	0.801	0.861	0.606
	IQ2	0.778		
	IQ3	0.777		
	IQ4	0.757		
Service Quality	SEQ1	0.858	0.831	0.624
	SEQ2	0.833		
	SEQ3	0.664		
System Use	SU1	0.854	0.887	0.662
	SU2	0.809		
	SU3	0.809		
	SU4	0.781		
User Satisfaction	US1	0.895	0.897	0.686

	US2	0.856		
	US3	0.834		
	US4	0.717		
Net Benefit	NB1	0.819	0.834	0.559
	NB2	0.775		
	NB3	0.722		
	NB4	0.667		

Table 2. Reliability and Validity Results

Hypotheses Testing

Hypotheses presented in the research model were tested using IBM SPSS Version 22. Regression analysis was used to test the effect and impact of the independent variable on the dependent variable. The findings of the regression analysis are presented in Table 3, Table 4 and Table 5.

$R^2 = .526$, adjusted $R^2 = .519$, $F = 70.009$, $p < .05$

Model	Unstandardized Coefficients		Standardized Coefficients		
	β	Std. Error	β	t	Sig.
(Constant)	0.171	0.135		1.273	0.205
SYSQUAL	0.293	0.062	0.274	4.692	0.000
INFOQUAL	0.055	0.063	0.049	0.879	0.384
SERVQUAL	0.199	0.054	0.189	3.693	0.000

**Table 3. Regression Analysis for System Use Dependent Variable
Dependent Variable: System Use (SYSUSE)**

The results in Table 3 show that System Quality and Service Quality explained 52.6% of the variance of System Use. The results show that System quality and service quality have positive and significant effects on System Use. Therefore, H1 and H5 were supported while H3 was rejected. The findings shows that System quality has strong effect on System Use ($\beta = 0.274$) than service quality ($\beta = 0.189$). These findings are consistent with previous studies which have also found that system quality and service quality have positive and significant effects on

System Use (Cho et al. 2015; Halawi, McCarthy & Aronson 2008; Iivari 2005; McGill & Klobas 2005; Seddon & Kiew 1996; Sio Kuan Lai & Pires 2010; Urbach & Müller 2011; Wu & Wang 2006).

$R^2 = .587$, adjusted $R^2 = .580$, $F = 89.376$, $p < .05$

Model	Unstandardized Coefficients		Standardized Coefficients		Sig.
	β	Std. Error	β	t	
(Constant)	0.116	0.119		0.972	0.332
SYSQUAL	0.066	0.061	0.051	1.081	0.281
INFOQUAL	0.233	0.054	0.216	4.312	0.000
SERVQUAL	0.195	0.047	0.196	4.122	0.000
SYSUSE	0.225	0.048	0.239	4.692	0.000

**Table 4. Regression Analysis for User Satisfaction Dependent Variable
Dependent Variable: User Satisfaction (USERSAT)**

The results in Table 4 show that Information Quality and Service Quality have positive and significant effect on User satisfaction. Furthermore, the findings reveal that, when students increase usage of SIS then their satisfaction on SIS will increase as well. The three significant variables have explained 58.7% of the variance of User Satisfaction. Therefore, H4, H6 and H7 were supported while H2 was rejected. Furthermore, the results show that information system use has a strong effect ($\beta = 0.239$) compared to other variables. These findings are in line with previous studies which have also found that system quality, information quality and System Use have positive and significant effects on User satisfaction (Cho et al. 2015; Halawi, McCarthy & Aronson 2008; Iivari 2005; McGill & Klobas 2005; Seddon & Kiew 1996; Sio Kuan Lai & Pires 2010; Urbach & Müller 2011; Wu & Wang 2006).

The results in Table 5 show that System Use and User Satisfaction explained 48.3% of the variance of Net Benefits. The findings show that both System Use and User Satisfaction have positive and significant effects on net benefits and therefore all H8 and H9 were supported. Furthermore, the results show that user satisfaction has a strong effect ($\beta = 0.396$) on net benefit as compared to System Use ($\beta = 0.371$). These findings are in line with previous findings which have shown that System Use and User satisfaction have positive and significant effects on system effectiveness (Devaraj & Kohli 2003; Dewi 2010; Guimaraes, Yoon & O'Neal

1997; Halawi, McCarthy & Aronson 2008; Klein 2007; Leclercq 2007; McGill & Klobas 2005; Rai, Lang & Welker 2002; Seddon & Kiew 1996; Zhu & Kraemer 2005).

R ² = .483, adjusted R ² = .480, F = 148.771, p < .05					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	β	Std. Error	β		
(Constant)	0.52	0.105		4.963	0.000
SYSUSE	0.334	0.047	0.371	7.065	0.000
USERSAT	0.378	0.051	0.396	7.553	0.031

**Table 5. Regression Analysis for Net Benefits Dependent Variable
Dependent Variable: Net Benefits (NETBEN)**

DISCUSSION OF THE FINDINGS

Various HLIs have invested a lot of effort in SIS in order to provide good services to their students. Despite these investments less effort has been deployed to evaluate the effectiveness of SIS used in HLIs. Therefore, the main purpose of this study was to determine the effectiveness of Student Information System using D&M IS Success Model. The study adopted all variables specified in D&M IS model in examining the effectiveness of SIS. Generally, the findings show that 7 out of 9 hypotheses were supported. This study has contributed to the body of IS knowledge by testing D&M IS success model on evaluating effectiveness of SIS used in HLIs in Tanzania.

The findings show that System quality has positive and significant effect on system Use and system use have positive and significant effects on system's effectiveness. This means top management in HLIs should invest more time in providing quality SIS in order to be assured that students will use SIS on the intended purposes. This could be achieved by making sure that SIS is available 24/7 in order for the students to access their information. Furthermore, the system should be reliable for the students to use it. The system's response time should be minimal in order to save the student time in using SIS. Also technical team should consider usability of the system by providing more functionality on the SIS. Usability could be achieved by making the SIS easy-to-use, useful and flexible. Providing help menu, system documentation manual on how to use the

system could increase the usability of the system hence increases the usage of the SIS.

The findings show that service quality has influence on both System Use and User satisfaction. This means top management in HLIs and technical team should invest much time in making sure that the services provided through SIS are of high quality in order to improve its effectiveness in delivering the intended services. Service quality may be attained by improving assurance of the SIS services and responsiveness of the SIS. High responsiveness of technical and supporting staff in addressing problems encountered by students could lead to effectiveness on the usage of SIS. Furthermore, technical staff should train students on how to use the system; this will improve students' technical knowhow and reduce questions on how to use the SIS.

Furthermore, the findings show that information quality has effects on user satisfaction and therefore influence effectiveness of the SIS. This means the system should provide quality information to the students for students to use SIS. This may be attained by making sure, information provided through SIS is complete, easy to understand, personalized, relevant and up to date. This could lead to higher level of SIS usage satisfaction among the students. The information should be clearly presented and personalized to allow students to interpret and understand the information.

LIMITATIONS AND FUTURE STUDIES

Firstly, this study is cross-section study rather than longitudinal study in nature, and therefore effect of the variables which denotes the effectiveness of SIS may change over a long period of time. Therefore, longitudinal study could be better in determining the effect among the variables used in examining the effectiveness of SIS. Secondly, the study has employed first generation data analysis technique which does not combine all variables in single evaluation. Therefore, future studies may employ second generation data analytic techniques which could combine all variables in one analysis and provide a more reliable output. Thirdly, the study has used non-probability method in selection of respondents which could lead to unreliable results. Therefore, future studies should consider employing probability methods in selecting respondents when evaluating the effectiveness of SIS. Fourth, findings show that the coefficient of determination of net benefit is 48.3% which is considered as small variance. Therefore, future studies should consider adding more variables which could improve the variables of net benefit.

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