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MODEL FOR MEASURING MULTIPLE FACTORS IN E-LEARNING SYSTEMS' ADOPTION IN MALAYSIA'S UNIVERSITIES: AN EXPERIENCE FROM MANAGEMENT AND SCIENCE UNIVERSITY (MSU)

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ABSTRACT

The problem of finding comprehensive model to measure e-learning systems' adoption in universities is the global agenda like Malaysia in particular. This problem has been contributed by limited factors of existing models. The main purpose of this research study is to develop the robust multi-factors model for measuring adoption of e-learning systems in Malaysia's universities with special focus in the Management and Science University (MSU). This research study is addressing this problem by adopting preliminary factors suggested by Lashayo and Gapar in their model in 2017, the model was initial tested at Open University of Tanzania (OUT) in Tanzania. The same factors will be integrated together and validated against the sample of 142 students from Management and Science University (MSU) in Malaysia. The Structural Equation Modelling (SEM) is used in analysis of the collected data. The results show that the model with eleven factors is significant measuring e-learning systems' adoption with 65.3% coefficient of determination which implies that the model with adequate number of factors capture well the needs of e-learning systems in Malaysia. These results aimed at providing a tool for measuring e-learning systems' adoption in universities and it further enhances the strategy and policy of information technology/e-learning managers in their efforts of adopting and measure these systems. The novelty of this research lies in the unique set of integrated multi-factors model developed especially addition of the following constructs: Trust, Environmental Factors and University Readiness on DeLone and McLean (2003) Information System Model

Keywords: *E-learning system, Universities, Factors, Model, Malaysia*

1. INTRODUCTION

Only 52% of 41 developing countries have managed to adopt electronic learning systems [1]. Electronic learning system (e-learning system) is regarded as the type of web-enabled system which is used in accessing and sharing of learning and teaching materials between learner and learner or instructor and learner or instructor and instructor while internet is acting as the main networking means of connecting electronic devises at which the mode of interaction may be either asynchronous or synchronous [2 - 4]. Adoption in this context means that the art of accepting and using of e-learning systems in education institutions with particular focus in universities [5]. E-learning is the key in education settings because it saves time, cost, it enhances mutual creation of knowledge among learners themselves and it creates institutions independent learners.

There are variations of investments in e-learning systems in different continents of the world. Asia continent is leading in gross investment in e-learning systems [6]. Adkins [6] reported that

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17.3% of gross income in Asian continent is invested in e-learning systems and this makes that continent to lead in terms of investment in e-learning systems, it followed up by Eastern Europe, Africa and Latin America with 16.9%, 15.2% and 14.6% respectively. In 2011, the total investment in e-learning systems worldwide was nearly $250.9 million which was expected to double to $512.7 million by 2016 [6]. Therefore, literally it is expected that Asian countries to enjoy significant returns of that investment.

Management and Science University (MSU) in Malaysia is the private owned university with main campus located in Shah Alam. It has thorough Information and Communication Technology (ICT) infrastructure connecting offices, classrooms, library and computer laboratories and other associated learning centers. This university uses e-learning system called EKLAS (Education Knowledge Learning Management System). This system has several modules including subject management, exam slip and exam results, library information system, notes and assignments, interactive learning content and virtual library.

The problem of finding a comprehensive model to measure e-learning adoption in universities is the debatable global agenda as Malaysia in particular. Hassanzadeh et al. [7], Mohammadi [8], Samarasinghe and Tretiakov [9], Tossy [10] claimed that limited factors are significantly affect incomprehensiveness of existing adoption models in e-learning systems' measurement. Andersson and Grönlund [11] argued that a model is considered to be capable of measuring e-learning systems when it explains four themes of factors (technology, course, context and individual characteristics). This study aimed at developing the robust and comprehensive model for measuring e-learning systems' adoption in Malaysia with special focus in Management and Science University (MSU) by adopting preliminary factors from Lashayo and Gapar [12], through the following specific objectives: (1) to find reliability and validity of proposed e-learning systems' adoption factors in Malaysia context, (2) to validate proposed hypotheses and present a new model.

2. LITERATURE REVIEW

Lashayo and Gapar [12] proposed twelve factors' model which was built on DeLone and McLean (2003) model as the base model in the preliminary study which was conducted in Open University of Tanzania (OUT).The proposed model contained the following factors: (1) Course Quality, (2) Instructor Quality, (3) Technical System Quality, (4) Educational System Quality, (5) Service Quality, (6) Intention to Use, (7) Elearning Actual Use, (8) Learner Satisfaction, (9) Environme[illegible]) University Readiness, (11) Trust a[illegible]ed Benefits. This section will revisit [illegible] factors (constructs).

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Co[illegible]eans a construct which measure q[illegible]mation generated by e-learning system, which includes easy to navigate, sufficient, quality of assessment and their up-to-datedness [13].

Instructor Quality means a construct which measure how an instructor is managing a course and its contents using e-learning system which include following attributes: instructor comfortability, responsiveness and interaction with other users [14].

Technical System Quality means a construct which measure a typical quality aspect of e-learning system which include easy to use, easy to learn, security, availability and reliability [7].

Educational System Quality means a construct which measure the educational features of e-learning system which facilitate learning including: audio features, video features, text features and forum [7].

Service Quality means a construct which measure quality of the service and support which are rendered by a specialized Information Technology (IT) department or centre of a particular university which has adopted e-learning system including timely response, knowledge of the system by support team, incorporation of user's opinions [13].

Intention to Use means an attitude of using e-learning system by the learner of the universities which include learner belief and intension [13].

E-learning Actual Use means an art of actual use of e-learning system's modules by a learner of a university, this include behaviour use of e-learning materials which include notes, assessment and communication means [13, 15].

Learner Satisfaction means a perceive rate of satisfaction of the learner over an actual system in a place, relative to his/her expectation [13].

Environmental Factors means a construct which measure the external factors which influence a learner to adopt the system including peer universities' pressure, national ICT policy, educational partners [16].

University Readiness is a construct which measure how a given university is prepared internal machinery apart from technical preparation, this

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include budget, human resource and top management [16 – 17].

Trust means a construct which measure the extent of which a learner will hope that a given e-learning system will fairly provide the service without compromising standards of his/her expectation as far as education is concern [18].

Perceived Benefits means a construct which measure the impacts that e-learning system has brought in education institution which include saving time, saving cost, academic achievement, increase of learning pace and gaining of more knowledge [13].

There are several studies in Malaysia universities which tried to extend DeLone and McLeane (2003) Information System (IS) success model to exhaust factors which affect successfully e-learning systems' adoption and implementation. These studies include Alzahrani, Mahmud, Ramayah, Alfarraj and Osama [19], which tested six modified constructs and found it valid, Chang [20] with modified five constructs' model and found it valid and another study was Abdul Razak, Abu Bakar, Abdullah, Abdullah [21] with modified four constructs' model and found it valid.

Not only in Malaysia even outside Malaysia, there are several studies which extend DeLone and McLean (2003) IS model include Lee-Post [22] with three themes' model, Ozkan and Koseler [23] with six constructs' model (HELAM), Hassanzadeh et al. [7] with ten constructs' model (MELSS), Mtebe and Raisamo [15] with six constructs' model, Lwoga [14] with seven constructs' model, Mohammadi [15] with nine constructs' model and Tossy [10] with eight constructs' model, all these were valid models tested in different parts of the world in universities domain.

Despite considerable efforts made by the number of researchers to comprehend DeLone and McLean (2003) IS model, little has been done in universities in Malaysia specifically with addition of trust, environmental factors and universities readiness.

3. METHODS

This research study opted to use the case study survey method of data collection, in which data were collected in Malaysia, on November, 2017 at the Management and Science University (MSU), main campus using the convenient sampling of undergraduate students who were around at that time. The questionnaire was dropping off to a respondent and after sometime a questionnaire was collected back, specifically this research employs Drop-off/Pick-up (DOPU) survey method in data collection in order to increase response rate [24- 25]. A total of 143 questionnaires were collected of which 142 were usable and one questionnaire was half-filled and deemed not usable [26]. According to Hair et al [26] if a respondent flop to reply correctly to more than half of the questionnaires' questions, then that questionnaire shall be removed.

3.1 Research Model

This research study adopts the model suggested by Lashayo and Gapar [12] as shown in figure 1 which was initially tested in Tanzania at Open University of Tanzania (OUT) against the sample of 97 students collected between February and March, 2017. Lashayo and Gapar [12] proposed twelve factors for measuring e-learning systems' adoption in developing countries.

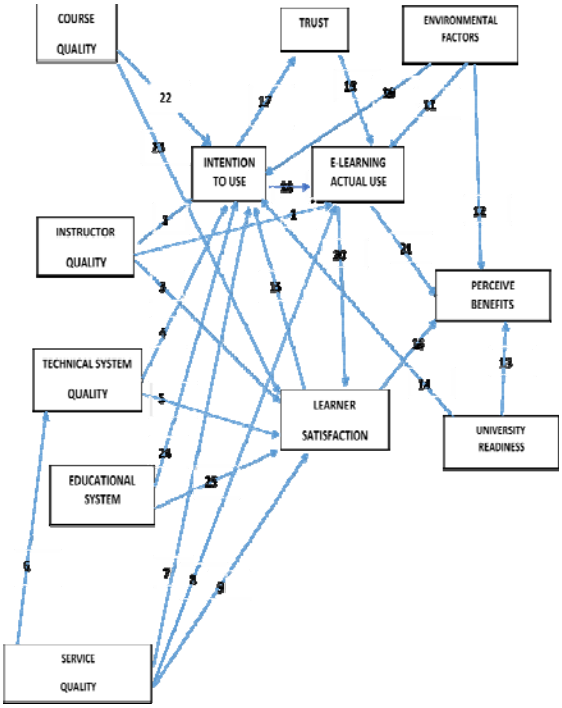

Figure 1: Research model

3.1.1 Proposed research hypotheses

The research model in figure 1 including 25 hypotheses numbered 1 to 25 as follows:

H1: *Instructor Quality has positive and significant effect* on *E-learning Actual Use.*

H2: *Instructor Quality has positive and significant effect on Intention to Use*

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H3: *Instructor Quality has positive and significant effect on Learner Satisfaction.*
H4: *Technical System Quality has positive and significant effect on Intention to Use.*
H5: *System Quality has positive and significant effect on Learner Satisfaction.*
H6: *Service Quality has positive and significant effect on Technical System Quality.*
H7: *Service Quality has positive and significant effect on Intention to Use.*
H8*: Service Quality has positive and significant effect on E-learning Actual Use.*
H9: *Service Quality has positive and significant effect on Learner Satisfaction.*
H10: *Environmental Factors has positive and significant effect on Intention to Use.*
H11: *Environmental Factors has positive and significant effect on Elearning Actual Use.*
H12: *Environmental Factors has positive and significant effect on Perceived Benefits.*
H13: *University Readiness has positive and significant effect on Perceived Benefits.*
H14: *University Readiness has positive and significant effect on Intention to Use.*
H15: *Learner Satisfaction has positive and significant effect on Intention to Use.*
H16: *Learner Satisfaction has positive and significant effect on Perceived Benefits.*
H17: *Intention to Use has positive and significant effect on Trust.*
H18: *Intention to Use has positive and significant effect on E-learning Actual Use.*
H19: *Trust has positive and significant effect on E-learning Actual Use.*
H20: *E-learning Actual Use has positive and significant effect on Learner Satisfaction.*
H21: *E-learning Actual Use has positive and significant effect on Perceived Benefits.*
H22*: Course Quality has positive and significant effect on Intention to Use.*
H23*: Course Quality has positive and significant effect on Learner Satisfaction*
H24*: Education System Quality has positive and significant effect on Intention to Use.*
H25*: Education System Quality has positive and significant effect on Learner Satisfaction*

4. ANALYSIS

Structural Equation Modelling (SEM) was used to analyse 25 hypotheses using data collected from 142 students of the Management and Science University (MSU). The analysis was divided mainly into two ordered parts, measurement modelling using Confirmatory Factor Analysis (CFA) and structure/path analysis [26].

4.1 Part One: Confirmatory Factor Analysis (CFA)

In this part, analysis of measurement items variable is performed. The contribution of individual items' variable to its corresponding latent construct are measured, the most concern is the significant contribution of individual items and their consistency [26]. The overall purpose of this part one of analysis (CFA) is to find valid and reliable factors.

Table 1: Cronbach Alpha, Composite Reliability and Average Variance Extracted

S/n	Construct name	Item name	Factor Loading > 0.6	Cronbach alpha (α) > 0.7	Composite reliability (CR) > 0.7	Average Variance Extracted (AVE)> 0.5
1	Course Quality (CQ)	CQ3	0.811	0.821	0.822	0.698
		CQ4	0.859			
2	Instructor Quality (IQ)	IQ3	0.816	0.877	0.879	0.709
		IQ4	0.849			
		IQ5	0.860			
3	Technical System Quality (TSQ)	TSQ1	0.891	0.897	0.897	0.814
		TSQ2	0.913			
4	*Educational System Quality (ESQ)	ESQ2	*0.487	*0.553	*0.607	*0.452
		ESQ3	0.816			
5	Service Quality (SQ)	SQ2	0.742	0.876	0.876	0.587
		SQ3	0.788			
		SQ4	0.744			
		SQ5	0.786			
		SQ	0.768			

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		6				
6	Intention to Use (ITU)	ITU 2	0.752	0.855	0.859	0.671
		ITU 3	0.844			
		ITU 4	0.858			
7	Elearning Actual Use (EAU)	EA U 2	0.888	0.837	0.840	0.724
		EA U4	0.812			
8	Learner Satisfaction (LS)	LS1	0.730	0.789	0.795	0.564
		LS2	0.786			
		LS4	0.736			
9	Environmental Factors (EF)	EF1	0.838	0.782	0.784	0.645
		EF2	0.767			
10	University Readiness (UR)	UR 3	0.767	0.791	0.797	0.664
		UR 4	0.857			
11	Trust (T)	T1	0.882	0.889	0.891	0.672
		T2	0.866			
		T3	0.777			
		T4	0.746			
12	Perceived Benefits (PB)	PB 3	0.818	0.845	0.845	0.646
		PB 4	0.770			
		PB 5	0.822			

Notes. *means failing the required test

In CFA, three types of approaches were used unidimensionality, validity and reliability [27]

4.1.1 Unidimensionality

Unidimensionality is achieved when each of the items which measure latent construct is reached an acceptable value which is above 0.6 [27]. From the results of items in table 1 they are all achieved except an item (ESQ2) from Education System Quality (ESQ) construct.

4.1.2 Validity

Validity is the measurement of how strong a latent construct is in measuring what is supposed to measure [27].

Three sub-processes (convergent validity, construct validity and discriminant validity) have been taken in measuring construct validity [27].

Convergent validity is attained when all measuring items of the model are statistically significant and it is proved by checking the value of AVE if is greater than 0.5 [27]. Table 1 indicates that all latent constructs have the value greater than 0.5 except Education System Quality (ESQ) construct.

Construct validity is attained when all required indexes have attained the minimum threshold [27]. Table 2 shows that minimum fit indexes for measurement modelling are achieved.

Table 2: Fit Indexes for both Measurement and Structural Modelling

S/n	Name of Index	Level of acceptance	Measurement model	Structural model
1	RMSEA *(Test of absolute fit)*	RMSEA < 0.08	0.05	0.063
2	Chi-square		513.987	639.428
3	Degree of freedom (df)		379	410
4	Chi-square/df *(Test of Parsimonious fit)*	Chisq/df < 3.0	1.356	1.562
5	CFI *(Test of Incremental fit)*	CFI > 0.90	0.951	0.917
6	TLI *(Test of Incremental fit)*	TLI > 0.90	0.940	0.905
7	IFI *(Test of*	IFI > 0.90	0.952	0.918

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	Incremental fit)			

Discriminant validity in measurement modelling is attained when all items and their corresponding construct (factors) are free from being redundant [27]. The correlation between the latent constructs should not exceed 0.85 and this is normally proved by constructing discriminant validity index table [27].

Table 3: The Discriminant Validity Index Summary for the Construct

CQ	IQ	TSQ	SQ	ITU	EAU	T	LS	EF	PB
0.835									
0.633	**0.842**								
0.710	0.550	**0.902**							
0.519	0.710	0.440	**0.766**						
0.571	0.594	0.428	0.505	**0.819**					
0.333	0.504	0.281	0.508	0.365	**0.851**				
0.628	0.718	0.589	0.712	0.548	0.497	**0.820**			
0.659	0.704	0.584	0.621	0.726	0.574	0.719	**0.751**		
0.629	0.556	0.618	0.651	0.592	0.475	0.700	0.668		
0.528	0.638	0.451	0.506	0.580	0.364	0.613	0.593	0.693	**0.804**

Table 3 shows that values in diagonal which are bolded is the square root of AVE of the construct while other values are the correlation between a given constructs, therefore the discriminant was achieved since the values in diagonal is greater than the values in its corresponding row and column.

4.1.3 Reliability

Reliability is the measurement of consistence of each of the construct (factors) in the given model and this is achieved through composite reliability and average variance extracted [26].

According to Awang [27] a value greater than of 0.6 is required for composite reliability and a value greater than 0.5 for Average Variance Extracted (AVE). Table 1 indicates that both composite reliability and AVE have been attained, hence reliability for eleven constructs were attained.

4.2 Part Two: Path/Structure analysis (hypotheses testing)

According to Hair et al. [26] this part is about nature of the relationship among a given latent constructs and magnitude of that relationship. The distinguished eleven latent constructs found on table 1 were collected together and instantaneously measured for their structure relationship [27]. The overall purpose of this part two is to determine if the proposed hypotheses from Lashayo and Gapar [12] are significant and extent of their impacts.

According to Lwoga and Komba [4] three levels of statistic significant are well-thought-out in testing hypotheses (*p < 0.05, **p < 0.01 and ***p < 0.001).

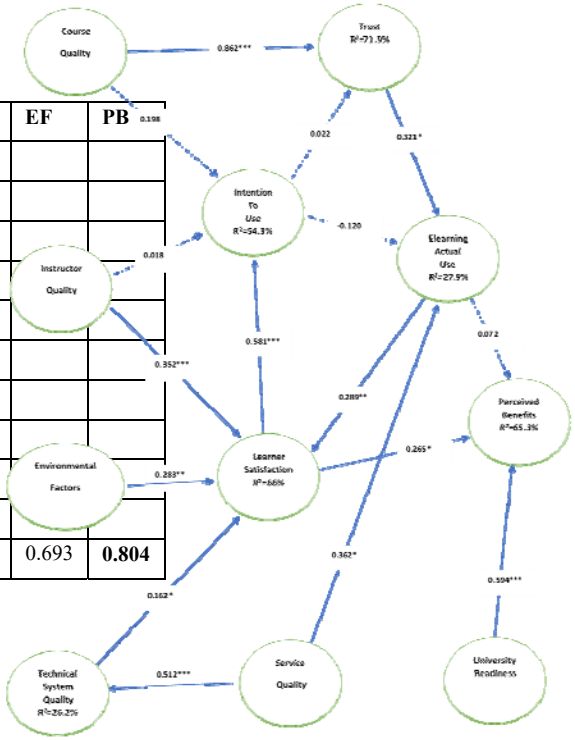

Figure 2: Structural Model Result from SEM Analysis

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5. DISCUSSIONS

The hypotheses were tested in three levels of statistical significance ($p < 0.05$, $p < 0.01$ and $p < 0.001$) and strengths (β) of the relationship among constructs were classified into three points which were: $\beta <= 0.2$ which is declared weak; $0.2 < \beta < 0.5$ which is declared medium and last is $\beta >= 0.5$ which is declared strong [28]. Figure 2 evidences that this is the only research study which developed eleven distinguished constructs model in Malaysia's universities with coefficient of determination/variance explained (R^2) of 65.3%.

H: Course quality has positive and significant effect on Trust.

This hypothesis is supported with $p < 0.001$ and strength of relationship (β=0.862) refer to figure 2. The size of the strength is strong between Course Quality and Trust of learners on e-learning system. This implies that contents provided in e-learning system (EKLAS) are good, sufficient, update and well organised. This study results corresponds with that of Ndume, Tillya and Twakiondo [18] although that study was descriptive.

H: Course quality has positive and significant effect on Intention to Use

This hypothesis is not supported. This finding is the same as the previous study by Hassanzadeh et al. [7]. This requires more research.

H: Instructor Quality has positive and significant effect on Intention to Use.

This hypothesis is not supported. This result is supported by Lwoga [14].

H: Instructor Quality has positive and significant effect on Learner Satisfaction.

This hypothesis is supported with $p < 0.001$ and impact on Learner Satisfaction exerted by Instructor Quality is moderate with value of β=0.352. This implies that the comfortability of instructor over e-learning system, his/her response and interaction toward students has moderate impact on learner satisfaction. This result is consistent with Lwoga [14] who find the same moderate impact.

H: Environmental factors has positive and significant effect on Learner Satisfaction.

This is supported with $p < 0.01$ and strength of impact which is moderate, β=0.283, this implies that influence of other universities, education partners (Dell, Lenovo, HP), government policy and prospective students have significant moderate influence on learner satisfaction over the system. This is consistent with result of Munguatosha et al. [16].

H: Technical System Quality has positive and significant effect on Learner Satisfaction.

This hypothesis is supported with $p < 0.05$ and strength of contribution of this construct on learner satisfaction is weak but significant with β=0.162. This implies that system characteristics (easy to learn, easy to use, secured, reliability and availability) have significant weak influence on learner satisfaction over the system. This is consistent with the current study in Malaysia by Alzahrani et al. [19].

H: Service Quality has positive and significant effect on Technical System Quality.

This is supported with $p < 0.001$ and strong impact of β=0.512. This implies that service quality features which include timely support, training to users, supporting staff's knowledge over application system are critical to technical system quality of system. This is the new finding.

H: Service Quality has positive and significant effect on E-learning Actual Use.

This hypothesis is supported with $p < 0.05$ and moderate impact of β=0.362. This implies that the characteristics of the supporting team, (time response, training and their knowledge as far as system is concerned), is played a vital role in students' decision to have the behaviour of using e-learning systems in universities. This is consistence with the previous research in Malaysia by Alzahrani et al. [19].

H: University Readiness has positive and significant effect on Perceived Benefits.

This hypothesis is supported with $p < 0.001$ and strong strength of impact of β=0.594. This implies that the budget the universities reserve for e-learning system use, a reliable internet service, support of human resource who are not technical staff and support of the top management are extremely important for sustainability of e-learning systems in universities. This is consistency with the previous study in Malaysia by Ramayah, Ahmad and Hong [17] which dealt with employee training using e-learning systems in an organization.

H: Learner Satisfaction has positive and significant effect on Intention to Use e-learning systems.

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This hypothesis is supported with $p < 0.001$ and strong impact of $\beta=0.581$. This implies that learner satisfaction determines critically an attitude of students to use e-learning system. This result is supported by Mohammadi [8].

H: Learner Satisfaction has positive and significant effect on Perceived Benefits.

This hypothesis is supported with $p < 0.05$ and medium impact of $\beta=0.265$. This implies that overall satisfaction of students on system is essential to determine the benefits they perceive when using e-learning system. This is consistent with Lwoga [14] and one study in Malaysia by Ramayah et al. [17].

H: Intention to Use has positive and significant effect on Trust.

This hypothesis is not supported. This needs more research.

H: Intention to Use has positive and significant effect on Elearning Actual Use.

This hypothesis is not supported. This may be due to static nature of the contents and un-attractive nature of the system. This needs more research.

H: Trust has positive and significant effect on Elearning Actual Use.

This hypothesis is supported with $p < 0.05$ and moderate strength of impact of $\beta=0.321$. This implies that overall trust of e-learning system is substantial to turn students into the frequently user of system. This result is consistent with Masa'deh et al. [29] and Lin [30].

H: Elearning Actual Use has positive and significant effect on Perceived Benefits.

This hypothesis is not supported. This result is consistent with the previous study by Lwoga [14].

H: E-learning Actual Use has positive and significant effect on Learner Satisfaction.

This hypothesis is supported with $p < 0.01$ and with medium strength of $\beta=0.289$. This implies that the more students use e-learning system's materials the more they will become satisfied with the system. This is supported by DeLone and McLean [13].

Table 4: Comparison of Number of Factors Explored in this Study with Latest Research Studies in Malaysia extending DeLone and McLean (2003) IS Model

S/n	Author (s)	Year of publication	Number of factors (constructs)
1	Chang	2014	05
2	Abdul Razak et al.	2016	06
3	Alzahrani et al.	2017	06
4*	Lashayo, Alkawaz and Johar	2018	11

Notes. *means this study

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Serial number 4 of table 4 shows that there is the significant number of explored factors for measuring e-learning systems in universities in Malaysia which have been integrated together in this study, which makes DeLone and McLean (2003) IS model more robust and comprehensive. The additional factors help to comprehend significantly what were missing in the past developed models for measuring e-leaning systems in Malaysia.

6. CONCLUSION AND FUTURE STUDIES

The main purpose of this research paper was to develop a comprehensive model to measure e-learning systems in Malaysia's universities using Management and Science University (MSU) as the case study, with that note, this research study presents an empirically-developed model as shown in figure 2 with eleven distinctive, reliable and valid factors which have been well tested using Structural Equation Modelling (SEM) and confirmed. This study found that Service Quality has the strong positive impact on Technical System Quality and also Course Quality has the strong positive impact on Trust, these two hypotheses are the new findings in e-learning systems adoption in Malaysia.

The integration of Trust, Environmental Factors, University Readiness and Instructor Quality with other information system success constructs (Course Quality, Technical System Quality, Service Quality, Learner Satisfaction, Intention to Use, Elearning Actual Use) and were proved valid and reliable, this makes the developed model more comprehensive and robust compared with the rest of the previous developed models in e-learning system adoption in Malaysia's universities and Management and Science University (MSU) in particular.

According to Falk and Miller in [31], Samarasighe and Tretiakov [9], the coefficient of determination/variance explained (R^2) obtained in developed model in figure 2 which is 65.3% presents the substantial result of this research study in capturing multiple factors which determine the successful adoption of e-learning systems in Malaysia universities with special attention of Management and Science University (MSU).

The significance of this developed model, will be acting as the tool to help e-learning developers and IT personnel in knowing important factors and in doing so they will lay down strategies and policies for better use of e-learning systems. It will also bridge the gap of literature in information systems and e-learning systems in particular.

Since the developed tool in figure 2 is not a closed model then it may either be empirically tested in a single or mixed study in other developing countries. Also, it may be extended further to accommodate changes of technology and context.

Furthermore, research studies with varieties of e-learning platforms in more than one university in Malaysia will enhance the generalization of these findings.

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