

MODEL FOR TECHNOLOGICAL ASPECT OF E-LEARNING READINESS IN
HIGHER EDUCATION INSTITUTIONS

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DEDICATION

*I dedicate this thesis to
my late father, may God have mercy on him
my beloved mother, my husband, my kids, my sister and
brothers
for their moral support and encouragement, and endless love
You give me hope, direction and light*

I am truly grateful to ALLAH for having them in my life

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ABSTRACT

E-learning has now been adopted by most universities across the world, where implementing e-learning in higher education has enabled a change in teaching and learning practices. One of the important aspects of e-learning readiness is the technological aspect, which plays an important role to ensure effective implementation of e-learning system. Although there are studies on e-learning readiness, there is still a lack of agreement about which factors shape the technological aspect of e-learning readiness. Therefore, this research investigated the technological aspect factors of e-learning readiness in higher educations, and formulated a technological aspect model based on the identified factors. This research involved three phases: First, it started with a systematic literature review to identify factors that influence technological aspect of e-learning readiness. Six technological factors emerged: hardware, software, connectivity, security, system flexibility, and technical skills and support. Second, Delphi technique was used to review the six technological factors, and to formulate the technological aspect model. The Delphi technique confirmed the 6 technological factors, and yielded 2 new factors namely cloud computing and data center. Third, a survey was conducted to evaluate the technological aspect model. A total of 374 questionnaires were collected from the academic staff of six Malaysian public universities. The data were analyzed using Structural Equation Modelling, and the results indicated that the eight technological factors, except cloud computing, have significant impact on the e-learning readiness in higher education institutions. In addition, the technological aspect model of this research highlights data center as an important technological factor for e-learning readiness, which is a new factor in e-learning readiness literature. In conclusion, this research has provided valuable insights into the relationship among the technological aspect factors. Besides, the technological aspect model is useful to assist university management teams to assess the readiness and ensure efficient implementation of their e-learning systems.

ABSTRAK

E-pembelajaran kini telah digunakan oleh kebanyakan universiti di seluruh dunia, dimana pelaksanaan e-pembelajaran dalam pendidikan tinggi telah membolehkan perubahan dalam amalan pengajaran dan pembelajaran. Salah satu aspek yang paling penting dalam kesediaan e-pembelajaran adalah aspek teknologi, yang memainkan peranan penting dalam melaksanakan sistem e-pembelajaran yang berkesan. Walaupun terdapat kajian terhadap kesediaan e-pembelajaran, masih terdapat kekurangan persetujuan tentang faktor-faktor yang membentuk aspek teknologi kesediaan e-pembelajaran. Oleh itu, kajian ini mengkaji faktor aspek teknologi kesediaan e-pembelajaran dalam pendidikan tinggi, dan membentuk model aspek teknologi berdasarkan faktor-faktor yang dikenal pasti. Kajian ini melibatkan tiga fasa: Pertama, ia bermula dengan semakan kajian lepas yang sistematik untuk mengenal pasti faktor-faktor yang mempengaruhi aspek teknologi kesediaan e-pembelajaran. Enam faktor teknologi telah dikenal pasti: perkakasan, perisian, kesambungan, keselamatan, fleksibiliti sistem, dan kemahiran teknikal dan sokongan. Kedua, teknik Delphi digunakan untuk menilai enam faktor teknologi, dan merumuskan model aspek teknologi. Teknik Delphi mengesahkan enam faktor teknologi, dan menghasilkan dua faktor baru iaitu pengkomputeran awan dan pusat data. Ketiga, tinjauan telah dijalankan untuk menilai model aspek teknologi. Sebanyak 374 soal selidik telah dikumpulkan dalam kalangan kakitangan akademik dari enam universiti awam Malaysia. Data dianalisis dengan menggunakan Model Persamaan Struktur, dan dapatan kajian menunjukkan bahawa lapan faktor teknologi, kecuali pengkomputeran awan, mempunyai kesan yang signifikan terhadap kesediaan e-pembelajaran di institusi pengajian tinggi. Di samping itu, model aspek teknologi kajian ini mendapati pusat data sebagai faktor teknologi penting untuk kesediaan e-pembelajaran, yang merupakan faktor baru dalam kesediaan e-pembelajaran. Kesimpulannya, penyelidikan ini telah memberi pandangan berharga berkaitan hubungan antara faktor-faktor aspek teknologi. Selain itu, model aspek teknologi adalah berguna untuk membantu pasukan pengurusan universiti untuk menilai kesediaan dan memastikan pelaksanaan sistem e-pembelajaran yang cekap.

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CHAPTER 1

INTRODUCTION

1.1 Overview

Information and communication technology has a great global impact on both developed and developing nations, in individual ways. Consequently, the progress and prosperity of countries has been linked to the extent of the progress and achievements in this area. Due to this impact, most countries have begun to develop various institutions to keep pace with scientific and technological revolutions. Higher education institutions are some of the most important institutions, having a great impact on society, and consequently having greater responsibility towards entire education systems (Naresh and Reddy, 2015). Higher education institutions in both developed and developing nations have begun to respond to the technological revolution with required changes, creating new opportunities for improving the existing education systems and learning styles. This helps to develop and innovate new and effective teaching and learning methods. It also assists the emergence of many modern concepts within the field of education, including e-learning.

E-learning refers to the use of electronic media, educational technology and information and communication technology (ICT) such as internet, e-mail, and computers, within the educational process (Contreras and Hilles, 2015). E-learning has become an increasingly-significant element of the pedagogy approach adopted by higher education institutions (HEIs) (Kituyi and Tsubira, 2013). According to Tarus, Gichoya, and Muumbo (2015), e-learning is an increasingly-popular approach to teaching and learning in most worldwide institutions of higher learning. The main purpose of e-learning's adoption by higher education institutions is to increase the educational process's accessibility without involving time or place restrictions, while also improving the education's quality and content (Doculan, 2016; Olson et al., 2011).

1.2 Background of the Research Problem

The e-learning trend, which has had a stunning impact in developed countries, has now also made its mark in developing countries (Naresh and Reddy, 2015). A look at developed countries indicates that their living standards have significantly improved, reflecting economic, social and technological progress (Rhema and Miliszewska, 2010). These comparatively more-developed countries provide easy technological access to their citizens, so that they can adopt the latest technology innovations and capitalize on their benefits. Similarly, in this part of the world, e-learning seems to have become an increasingly-significant element of secondary and tertiary education (Kituyi and Tusubira, 2013). Greater numbers of students and teachers are adopting this technological advancement, in order to complete educational processes. In developed countries access to technology is not only easy, but also very cheap. It therefore provides a significant opportunity for both conducting and attending educational classes virtually, without the need to be physically present. Developed countries make use of this technology in all aspects of social functioning, including in enhancing learning, communication and entertainment in their daily lives (Chan and Lee, 2007).

On the contrary, the case for adopting e-learning in developing countries has still been placed at an initial stage (Albarrak, 2010). In developing countries, the adoption of e-learning still faces challenges and failures (Hussein et al., 2007; Qureshi et al., 2012; Tarus et al., 2015). Developing countries face challenges in e-learning, including a lack of infrastructure, trained instructors, a lack of financial support, existing government policies, and reduced student readiness (Naresh and Reddy, 2015). Developing countries have more challenges than developed ones, in regards to adopting e-learning in higher education institutions (Naresh and Reddy, 2015).

A review of literature shows that most failures and challenges related to e-learning adoption come from the perspective towards technology in developing countries (Kwofie and Henten, 2011; Al-Masaud and Gawad, 2014; Islam et al., 2015; Mulugeta and Buckley, 2015; Naresh and Reddy, 2015). Andersson and Grönlund (2009) conducted a study to review research focused on challenges to e-learning in

higher education, with a particular focus on developing countries. They also conducted a comprehensive literature review of e-learning challenges, implemented for the purpose of understanding how to implement e-learning in developing countries. The overall conclusion reached is that more papers focus on technology aspect, meaning that the technology aspect presents more of a challenge to e-learning in developing countries. According to Hills and Overton (2010), the technological aspect is one reason for e-learning failure, an example being the use of bespoke or experimental software, rather than tried or tested tools, which can result in failure. This result is a motivation to learn more about the technological aspects of e-learning.

The technological aspect is one important factor behind the success of an e-learning system (Albarrak, 2010; Alhomod and Shafi, 2013; Mehregan et al., 2011). The technological aspect of e-learning refers to the use of different types of technologies to facilitate, enhance and support teaching and learning. These technology types include computers, the internet, mobile phones, audio/video tools, CDs, DVDs, video conferences, emails, and discussion forums (Nyandara, 2012).

The primary reason for the failure to adopt e-learning in many organizations is the lack of an assessment of organizational readiness for e-learning (Alshaher, 2013). Hanafizadeh and Ravasan (2011) state that, without proper readiness assessment, e-learning projects will probably face challenges during implementation. E-learning readiness is “the mental or physical preparedness of an individual for some e-learning experience or action” (Borotis and Poulymenakou, 2004). E-learning readiness has also been defined as “factors that must be accomplished before e-learning implementation can be regarded as being successful” (Odunaike et al., 2013). The commonly-used approach to determining e-learning ‘readiness’ is to assess certain organizational and individual factors that should be considered if organizations are likely to be successful in introducing an e-learning strategy (Chapnick, 2000; Redmon and Salopek, 2000; Hall, 2001; Rosenberg, 2001). According to Schreurs and Al-Huneidi (2012), to successfully undertake e-learning implementation, to realize its benefits and to overcome related barriers, organizations must be ready for e-learning by measuring its readiness and improving its weak points. Adopting e-learning technology without measuring e-learning’s readiness leads to failure in implementing

e-learning (Rohayani, 2015). Therefore, most higher education institutions in developing countries still face challenges in terms of implementing e-learning, especially in relation to technological aspects, due to a lack of assessment of technological aspect readiness. Here lack of assessment creates challenges and jeopardizes e-learning's successful implementation (Alshaher, 2013).

The technological aspect of e-learning readiness refers to institutions providing necessary ICT infrastructure for e-learning in terms of technical help, e-learning content delivery and broadband facilities, and also a Learning Management System (LMS) and the availability of computers and Internet (Krishnan and Hussin, 2017). The successful implementation of e-learning relies on a high level of ICT infrastructure readiness (Ouma et al., 2013). Albarrak (2010) has pointed out that researchers have made several attempts to investigate the influence of readiness factors on the outcomes of e-learning. In light of these studies, it has been found that technological readiness is one key factor that shapes and affects the outcomes of e-learning within an educational setting. For example, one of the relevant technological aspects is internet access, with low internet speeds and other problems faced while using e-learning systems potentially resulting in dissatisfaction, and causing students to drop out from e-learning courses (Keramati et al., 2011). Therefore it is necessary to assess the issue of technological readiness for e-learning before implementing an e-learning system, so that its benefits can be realized, and so that challenges related to e-learning implementation can be reduced (Alshaher, 2013). Bhuasiri et al. (2012) highlighted technological aspects as being an important factor in a successful e-learning system. Therefore, the readiness of technological aspects need to be thoroughly explored in order to analyse overall e-learning readiness.

As a developing country, Malaysia has a vision to become a fully developed nation in the near future (Grapragasem et al., 2014). The government, along with policy-makers, have developed a similar vision for the higher education sector. This aspiration for higher education has been expressed in the National Higher Education Strategic Plan (NHESP). Accordingly, the higher education policy has been consistent and in line with Vision 2020 (Ministry of Higher Education, 2011). Embi (2011) indicates that NHESP is a document which interprets the direction of national higher

education for developing human capital for the future. To ensure NHESP's implementation in accordance with set phases, the Ministry of Higher Education (MOHE) has developed 21 Critical Agenda Projects (CAPs). E-learning is one of the CAPs, and a National Key Result Area (NKRA) of MOHE (Khodabandelou, 2014). In 2017 the Malaysian government conceived Transformation National 2050 (TN50), within the lineage of the New Economic Policy. TN50 is a continuation of Vision 2020 within Malaysia's development journey (Kaur, 2017). TN50 is a national development initiative spanning the years from 2020 to 2050. This initiative will be driven by clear 30-year goals and targets, which are being developed through an inclusive and consultative process (Ministry of Foreign Affairs of Malaysia, 2017). The general goal for TN50 is for Malaysia to become a top-20 country by the year 2050.

Since e-Learning is one of the Critical Agenda Projects (CAPs) and a National Key Result Area (NKRA) of the Malaysian Ministry of Higher Education (MOHE), Malaysia's private universities have begun to include objectives designed to promote e-learning methodologies and multimedia skills. The introduction of e-learning in private universities is important, because this sector depends on e-learning much more than the public counterpart, and because these universities are compelled by their charters to provide distance education and multimedia teaching options (Puteh and Hussin, 2007). Therefore, Malaysia's higher education institutions need to assess the technological aspect of e-learning readiness, whereby the readiness of the technological aspect is a critical factor for the success of e-learning initiatives. The assessment of the technological aspect will help the administrative leaders of higher education institutions to determine the level of readiness and work required to improve the weaknesses of technological aspect points, so that they can be used to better apply e-learning and to keep up with the government-led initiatives in achieving e-learning across all Malaysian higher education.

Despite there being several studies assessing e-learning readiness, such as those of Darab and Montazer (2011), Akaslan and Law (2011), Keramati et al. (2011), Omoda-Onyait and Lubega (2011), Alshaher (2013), and Engholm and McLean (2001), there is a lack of studies used to identify factors which influence the technological aspect of e-learning readiness, especially in the context of Malaysian

higher education. Therefore, this research seeks to formulate a technological aspect model, which includes technological factors used to assess e-learning readiness.

1.3 Problem Statement

Most e-learning failures and challenges come from the approaches' technological aspect, the reason for this being the lack of assessment technological aspect readiness in e-learning. The lack of readiness regarding the technological aspect creates challenges and jeopardizes the successful implementation of e-learning. In order to have successful e-learning, and to overcome technological aspect challenges, higher education institutions should be ready by assess the technological aspect of e-learning readiness. Therefore, this research seeks to formulate a model which highlights the factors of the technological aspect which should be considered when assessing e-learning readiness. This model will help higher education institutions by providing important technological factors that should be considered by the institutions seeking to adopt e-learning projects. Furthermore, this model can be used by designers and developers as a guideline for identifying necessary technological aspect requirements for e-learning adoption.

1.4 Research Aims

In accordance with the study conducted by Alhomod and Shafi (2013) prior to implementing an e-learning system, it is important to identify factors that can influence the technological aspects of effective e-learning. Therefore, this research seeks to investigate and identify the technological aspect factors of e-learning readiness in higher education institutions, and to formulate a technological aspect model based on the identified technological factors.

1.5 Research Questions

The main questions this research seeks to answer include:

1. What factors influence the technological aspect of e-learning readiness?
2. How can a model be formulated for the technological aspect of e-learning readiness?
3. How can the formulated model for technological aspect of e-learning readiness be evaluated?

1.6 Research Objectives

For this research, the following objectives have been identified:

1. To investigate factors influencing the technological aspect of e-learning readiness.
2. To formulate a model for the technological aspect of e-learning readiness.
3. To evaluate the technological aspect model of e-learning readiness.

1.7 Research Scope

This research's scope has been limited to the following areas:

A systematic literature review (SLR) was performed for identifying the factors that shape the technological aspect of e-learning readiness. The reason behind using

the SLR technique was its thorough and fair process, as it is comprised of predefined search strategies (Kitchenham, 2004; Kitchenham, et al., 2009). In this research the SLR approach was concentrated on searching scientific databases for journals articles, workshop papers, conference papers, books chapters and published theses that addressed e-learning readiness.

The Delphi technique was used to review the list of technological factors identified from SLR, for the purposes of their naming, their description, the relationships between factors, and formulating a technological aspect model. The reason behind using the Delphi technique is that it is an effective study method used to formulate group judgments from a group of experts, by means of a series of questionnaires interspersed with controlled opinion feedback (Hsu and Sanford, 2007). The size of the Delphi Panel in this research was 11 experts, with the selected experts specializing in the field of e-learning, having knowledge of the technology aspect. Three rounds of the Delphi technique (R1-R3) were used to collect data through questionnaires, whereby questionnaires were sent to eleven experts via email.

For conducting surveys, quantitative questionnaires as an instrument were distributed to faculty members in six Malaysian public universities, including Universiti Malaya (UM), Universiti Islam Antarabangsa Malaysia (UIAM), Universiti Kebangsaan Malaysia (UKM), Universiti Teknologi MARA (UiTM), Universiti Putra Malaysia (UPM), Universiti Pertahanan Nasional Malaysia (UPNM), and Universiti Pendidikan Sultan Idris (UPSI). In the context of this research, Malaysian public universities were chosen as Malaysia aims to become a developed country in the year 2050 (Grapragasem et al., 2014). E-learning is one of the higher education policies aimed to be achieved in the goal of TN50. In relation to the ambitious TN50 project, Malaysia's private universities have begun to include objectives designed to promote e-learning methodologies and multimedia skills (Puteh and Hussin, 2007). This research on e-learning readiness is therefore timely and will shed light on e-learning readiness in Malaysia. For that reason, the focus on Malaysia and its vision to reach the implantation of e-learning in the year 2050 is timely. The six public universities were selected because they implemented e-learning. Therefore, it was possible for this research to benefit from their experience in applying e-learning, in order to evaluate

the formulated technological aspect model of e-learning readiness. This research also considered using the academic staff population as its respondents, since it is crucial to elicit opinions from people who are highly efficient and have experience in the relevant domain (Al-Hilawi, 2006). The reason behind selecting the questionnaire as a survey conduction instrument was that there was a need to have a large amount of responses in reduced time, and at a relatively low cost (Kasunic, 2005). The data was analyzed through two software programs, including the Statistical Package for the Social Sciences (SPSS v23) and Structural Equation Modelling (SEM) using Amos. The sample size used for this research was 374 faculty members, whose e-learning experience included teaching, establishing, maintaining, and designing e-learning system applications.

1.8 Research Contribution and Significance

This research has sought to add to the body of knowledge related to the field of e-learning, by identifying the technological aspect factors of e-learning readiness. Advances to the existing body of knowledge have been made possible by performing SLR with the greater availability of published literature, and through detailed search processes. By identifying the technological factors of e-learning readiness, the researchers have managed to overcome the gap of the lack of existing studies reporting on factors that influence the technological aspect of e-learning readiness.

This research has formulated the technological aspect model of e-learning readiness. The model highlights the technological aspect factors that should be consider for assessing e-learning readiness, helping university management and stakeholders to assess and analyze their preparedness through the factors included in the model, before initiating e-learning projects. The assessment of technological aspects will provide guidance for administrative leadership in higher education institutions, in terms of developing policies and plans. It will also help them identify some weak points which can be improved through taking some improvement actions, and thereby avoiding potential risks in implementing e-learning stages (Alshaher, 2013). The model can also guide higher education institutions in identifying the

requirements of technological aspects for adopting e-learning. In addition, the model can be used as a reference guideline for designers and developers in identifying necessary technological requirements for implementing e-learning.

This research provides an empirical model regarding the technological aspect of e-learning readiness. There is a scarcity of studies focused on the formulating and empirical testing of models concerning the technological aspect of e-learning readiness. Therefore, a model of the technological aspect has been formulated and tested through this research. The model has added new knowledge for understanding significant factors of the technological aspect of e-learning readiness. The most important factor for the technological aspect has been considered by taking into account the university faculty members' viewpoint, namely that related to software, hardware, connectivity, security, system flexibility, technical skills and support, and data centers. The relationships between the technological aspect factors were described through the research model. Therefore, this research contributes to the body of knowledge related to the e-learning field, and to the limited existing literature related to the Malaysian context.

A mixed-method approach has been employed to achieve the defined research objectives. Most previous studies have used either a qualitative or quantitative approach. The advantages of applying a mixed-method approach is that it allows researchers to be more confident in their results' reliability and validity (Jick, 1979). Through this research the qualitative approach has been applied by means of the Systematic Literature Review (SLR) and the Delphi technique. The conducted SLR provides broad and deep information about factors which affect the technological aspect of e-learning readiness. The Delphi technique has been implemented to formulate a model for the technological aspect of e-learning readiness. Meanwhile the quantitative approach has applied using questionnaire surveys, to evaluate the research model. The results of the carried-out survey have detailed the technological aspect model of e-learning readiness, describing the independent technological factors that affect e-learning readiness. The mixed methods strategy adds richness to the research, along with the empirical findings specifically relevant to Malaysian higher education.

1.9 Definition of Terms

E-learning: Liaw et al. (2007) defined e-learning as being the convergence of technology and learning, and as the use of network technologies to facilitate learning anytime, anywhere. For this research's purpose, e-learning has been defined as being the use of computer network technology through the internet, to deliver information and instruction to learners.

E-learning Readiness: Readiness, in regards to this research, can be defined as "how ready the organization is on several aspects to implement e-learning" (Schreurs et al., 2008). E-learning readiness has been defined as being related to the completeness of an e-learning programme or education system, while also being defined as a prerequisite of any e-learning programme (Vilkonis, Bakanovienė and Turskienė, 2013). For the purpose of this research, readiness is defined as being the mental or physical preparedness of higher education institutions for the e-learning experience.

Technological Aspect of E-learning: This refers to the use of different types of technologies to facilitate, enhance and support teaching and learning. These technologies include computers, the internet, mobile phones, audio/video tools, CDs, DVDs, video conferences, emails, and discussion forums (Nyandara, 2012).

Higher Education: In the World Declaration on Higher Education, as adopted by the World Conference on Higher Education in 1998, higher education has been defined as being: "all types of studies, training or training for research at the post-secondary level, provided by universities or other educational establishments which are approved as institutions of higher education by competent state authorities" (World Conference on Higher Education, 1998).

1.10 Outline of the Thesis

In order to successfully achieve this research's main aims and objectives, a predetermined outline and layout for the research has been recognized as necessary. In the case of this research, the outline includes seven chapters which can be summarized as follows:

Chapter 1 introduces the research topic discusses the related issues and details the relevant background, while also providing the key objectives that the researcher intends to achieve through the research's successful completion. Additionally, this chapter of the research identifies the problem statement that the researcher intends to answer by completing this research. In addition, the chapter also details the motivation, scope, significance and rationale of conducting this research. Lastly this chapter briefly outlines the format the researcher followed in the pursuing the achievement of this research's objectives.

Chapter 2 presents a review of relevant literature. In this chapter, the previous literature available on the topic has been analyzed and assessed, to further develop an understanding of the research topic. This chapter discusses each topic element in detail, through both generalized and specific points of view. Additionally, in this chapter identifies gaps in studies conducted by previous researchers, information which is useful for conducting this research.

Chapter 3 explains the research design and methodology used in this research. In this chapter, the methodologies adopted by the researcher for achieving the research objectives are identified, including Systematic Literature Review (SLR), the Delphi technique, and the survey method. In addition, the techniques adopted by the researcher to generate data and analyze the collected data have also been presented.

Chapter 4 presents the SLR's results and a discussion of them, focusing on the technological factors of e-learning readiness. Selected papers were analysed in accordance with the designed selection processes, and the findings of SLR research questions were presented.

Chapter 5 provides the results of the Delphi technique, in order to review the identified technological factors extracted from SLR. The chapter also discusses finds from the three rounds of the Delphi technique, and then formulates the technological aspect model of e-learning readiness.

Chapter 6 describes the survey conducted to evaluate the formulated model of the technological aspect of e-learning readiness. This chapter describes the survey's structure, in terms of its objective, target audience, population and sampling, and its questionnaire design, testing and distribution. The survey's analysis and results were also described in this chapter.

Chapter 7 concludes the research. The researcher firstly shows that each research objectives has been achieved, and that the results have been thoroughly discussed. After this the major contributions have been stated, and finally the conclusions, recommendations and suggestions for future works are presented.

1.11 Summary

This chapter introduces the research context and provides a brief outline of the research's background. The specific problem statement is also described, with the research aims being defined. Three research questions were defined for this research, and three objectives have been determined as a means for answering the research questions. The scope of this research has been explained, followed by an explanation of its significance. Key definitions of terms related to the research have also been presented. Finally, the thesis's structure has been explained through this chapter.

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Appendix A The List of Panel of Delphi

1. Dr. Fatiha Bousbahi
Assistant Professor in Information Technology Department, College of Computer and Information Sciences, Riyadh, Kingdom of Saudi Arabia.
Email: fbousbahi@ksu.edu.sa
2. Prof. Dr. Mowaffaq AbdulAziz Al-Hisnawi
Professor in South Technical University - Technical Institute in Nasiriyah, Iraq.
Email: pdmh2005@yahoo.com
3. Dr. Ahmad M. Al-Khasawneh
Associate professor of Information Systems at Hashemite University, School of Computer Information Systems, Jordan.
Email: akhasawneh@yahoo.com
4. A.Professor Dr. Kadhim B. Swadi Aljanabi
Professor in Department of Computer Science, Faculty of Computer Science and Mathematics, University of Kufa, Iraq
Email: kadhim.aljanabi@uokufa.edu.iq
5. Dr. Issa Shehabat
Assistant Professor in Management Information Systems Department, College of Information Technology & Computer Sciences, Yarmouk University, Irbid – Jordan
Email: ishehabat@yu.edu.jo
6. Dr. Asmaa Alsumait
Assistant Professor in Computer Engineering Department, Kuwait University, Kuwait
Email: asmaa.alsumait@ku.edu.kw
7. Dr. Hasniza Nordin
Deputy Director (Training), University Teaching and Learning Centre, Universiti Utara Malaysia (UUM), Malaysia
Email: nizadin@uum.edu.my
8. Dr. Shaffe Mohd Daud
Senior Lecturer in faculty of educational studies, Universiti Putra Malaysia (UPM), Malaysia
Email: shaffee@upm.edu.my
9. Dr. Rouhollah Khodabandelou
Assistant Professor of Educational Technology at HELP University, Malaysia
Email: khodaband@gmail.com
10. Assoc. Prof. Dr. Noraidah Sahari
Assoc. Prof in Faculty of Information Science And Technology, Universiti Kebangsaan Malaysia (UKM), Malaysia.
Email: nsa@ukm.edu.my
11. Dr. Hasnain Zafar Baloch
Assistant Manager in e-learning department, International Medical University, Kuala Lumpur, Malaysia
Email: hasnainzafar@gmail.com

Appendix B Delphi Expert Information

Please mark '√' where applicable at No.1 & No.5 & No.6.

1. Level of Education and Field of Study:

Bachelor	Master	PhD	Others (Please State)
Field of Study:			

2. Current employer:

3. Current job position:

4. Working experience (in years):

5. Correspondence way you prefer (select one way only):

Email	Courier	Mail	Address

6. I plan to put a list of expert's panel in the APPENDIX of my thesis, please indicate whether you agree or disagree to mention your name in this list.

Agree	Disagree

Thank you very much for your cooperation

Appendix C Letter of Invitation to Panel of Experts Delphi Technique



Advanced Informatics
School (AIS)

Advanced Informatics School
Level 5, Menara Razak
Universiti Teknologi Malaysia
Jalan Semarak
54100 Kuala Lumpur, Malaysia

Tel: +(6)03-21805192 Fax: +(6)03-21805370 <http://www.ais.utm.my> Email: enquiry_ais@ic.utm.my

UTM.K.38/13.11/1/4 Jld. 17 (15)

7 April 2016

OUR REF.:

LETTER OF INVITATION TO PANEL OF EXPERTS DELPHI STUDY

Dear Sir/ Madam,

My name is Asma Ali Mosu Eltharif. I am a PhD student at the Advanced Informatics School (AIS), Universiti Teknologi Malaysia (UTM). The title of my research is "A model for Assessing Technological Aspects of E-learning Readiness for Higher Education Institutions in Developing Countries". I am currently completing my first objective of the research which is investigate factors that shape technological aspects of e-learning readiness for higher education Institutions. A systematic literature review (SLR) used to identify the important technological factors to assess e-learning readiness, we extracted six technological factors namely: software, hardware, connectivity, security, flexibility of the system, and technical staff and support. I am writing to you to invite your participation in reviewing these six technological factors of e-learning readiness.

You are invited to participate in this study based on your expertise and experience in this field after I reviewed your profile on website. If you are willing to participate in the study, I would be very grateful if you fill up the Delphi expert information attached with this email and return it by email within **Two (2) days** from the date of this email.

This research will be carried out using the Delphi consisting of 3 to 4 rounds of questionnaires aiming to achieve consensus. With your permission the questionnaires will be send to you by email/courier/mail (this depending on what correspondence way you prefer). After receiving consent to participate and receipt of Delphi expert information form, you will receive the first questionnaire (Round one). I would be grateful, if you can complete the questionnaire and return it to me within **Three (3) WEEKS** from the date of you receive the questionnaire.

It is anticipated that the Delphi questionnaires will take few minutes to complete, however, this will vary between participants and will be dependent on the amount of information you are happy to provide. It is important to remember that this study is seeking at your expert opinion and there is no right or wrong answer. The results will be available to you when the analyzing completed. Your name will not be recorded on any of the rounds; instead, you will be allocated a unique code that can only be identifiable to the researcher. You will remain anonymous to the other participants (or expert) throughout this study and only the researcher will be able to identify your answer.

Thank you for your cooperation and please do not hesitate to contact me or my supervisor if you require further information through the below details.

Regards,

Asma Ali Mosu Eltharif,
PhD Student,
Advanced Informatics School (AIS),
Universiti Teknologi Malaysia (UTM)
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Dr Mohd Naz'ri Mahrin,
Supervisor,
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Universiti Teknologi Malaysia (UTM)
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INTELLECTUAL
PROPERTY AWARD 2010
Organisation Category
rank: 1st place



MERDEKA AWARD 2009
Outstanding Scientific Achievement and
Health, Science & Technology



Reader's Digest
TRUSTED BRAND 2010
University Category

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Appendix D Delphi Questionnaire (Round One)

A systematic literature review (SLR) have been conducted to identify the factors that shape technological aspect of e-learning readiness, the six technological factors are shown in **Table 1**.

Table 1: Technological Factors of E-learning Readiness

No	Technological Factors	Definition of Factors
1	Hardware	The physical equipment such as computers, servers and communication networks that must be available to apply e-learning.
2	Software	The programs and other operating information that enables computer systems to work.
3	Connectivity	The ability to link to and communicate with other computer systems, electronic devices, software or the Internet.
4	Security	The extent to which a computer system is protected from data corruption, destruction, interception, loss or unauthorized access (see also “secure system”).
5	Flexibility of the system	The ability of a system to engage with future changes in its requirements such as adaptability, changeability, agility and elasticity.
6	Technical Skills and Support	The knowledge, understanding and abilities that are used to accomplish tasks related to maintenance and upgrading of the infrastructure of computers, networks, communications, as well as providing support to users when they face technical problems.

Part A: The technological factors as in **Table 1**. Please use the following Likert scale to rate your level of agreement with the technological factors (Mark ‘√’ where applicable using the scale provided)

1= **Strongly Disagree (SD)**, 2= **Disagree (D)**, 3= **Neutral (N)**, 4= **Agree (A)**, 5= **Strongly Agree (SA)**

No	List of Technological Factors	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
1	Hardware					
2	Software					
3	Connectivity					
4	Security					
5	Flexibility of the system					
6	Technical Skills and Support					

Part B: Answer the following questions:

Q1. Do you want to add a new factor(s) to the list of factors? Please provide the new factor(s) and your justification (**If you add new factors, then you have to write the description of factor(s) as in Table 1 in following space**)

Q2. Do you want to rename any factors from the list of factors in **Table 1**? Which one? (**Please provide your justification for renaming the factors**)

Q3. Do you think the factors descriptions need modifications? Which one? Please provide your description (**Please refer to the description of each factor at Table 1**)

Part C: Please use the following table to identify any relationship between any two/ (more) of factors? (If you added a new factor(s) at Part B (Q1), then you have to add it/them in the space given in following Table)

Technological Factors	Hardware	Software	Connectivity	Security	Flexibility of the system	Technical Skills and Support						Mention the Relationship and your justification
Hardware												
Software												
Connectivity												
Security												
Flexibility of the system												
Technical Skills and Support												

Part D: A list of statements related to assessing technological aspects of e-learning readiness were identified. Please use the following Likert scale to rate your level of agreement with the statements (Mark ‘√’ where applicable using the scale provided).

1= Strongly Disagree (SD), 2= Disagree (D), 3= Neutral (N), 4= Agree (A), 5= Strongly Agree (SA)

Hardware						
No	Statements	SD	D	N	A	SA
1	The Institution is willing to provide students and faculty access to appropriate hardware to apply e-learning (e.g., Computer; laptops; Printer; Printer/Scanner; Microphone/Speakers/Headset)					
2	Students and faculty in the institution have access to a computer with the necessary software installed					
3	The Institution systems are sufficiently flexible to incorporate electronic links to external parties					
4	The institution has a high quality of hardware equipment to apply e-learning (e.g., Computer; laptops; Printer; Printer / Scanner; Microphone/Speakers/Headset)					

Software						
No	Statements	SD	D	N	A	SA
1	The institution provides a necessary software needed for the e-learning implementation					
2	The institution has online platform used for course delivery (e.g., learning management System, social media and peer-to-peer platforms, online meeting/conferencing)					
3	The online platform used for course delivery has the necessary system capacity to support the learning activities of the course					
4	The online platform provides appropriate tools for communication and collaboration					
5	Software applications can be easily transported and used across multiple platforms					
Connectivity						
No	Statements	SD	D	N	A	SA
1	The institution provides a wide range of connectivity services to apply e-learning (e.g., network services, broadband services, Intranet capabilities)					
2	The institution has stable Internet connection to apply e-learning					
3	Connection speeds are sufficient for communication and accessing all course materials					
4	The institution has extensive bandwidth capability					
5	The institution has a high degree of systems inter-connectivity					
Security						
No	Statements	SD	D	N	A	SA
1	The institution is provided a virus protection to apply e-learning (e.g., Norton Antivirus, McAfee, AVG, etc.)					
2	The institution is provided an identity recognition mechanism such as login name, password					
3	A control mechanism for access levels are available in the institution					
4	In the institution, there is a different level of access (lecturer, students, guest) to e-learning system					
5	There is high level of security for protection of systems (hardware, software) from misdirection or penetration.					
6	In the institution, different methods have been used to protect the transfer of data, including encryption and from-the-ground-up engineering					
7	The institution provides the required security to the system (e.g. security policies, disaster planning, firewalls)					
Flexibility of the system						
No	Statements	SD	D	N	A	SA
1	The system should has the ability to adapt with the a new peripherals					
2	The software can be adapt with some deviations in the environment					
3	The software has the ability for the solution to adapt to possible or future changes in its requirements					

Flexibility of the system						
No	Statements	SD	D	N	A	SA
4	The systems are sufficiently flexible to incorporate electronic links to external parties					
Technical Skills and Support						
No	Statements	SD	D	N	A	SA
1	The institution provides updates/maintenance of connectivity					
2	The institution periodically updates software with newer versions to meet changing information requirements					
3	The institution periodically upgrades hardware with a newer or better version, and provides maintenance of hardware					
4	Adequate and timely support is available in the institution to the lecturer and students when technical issues arise					
5	The institution has experienced human resources, or a department that organizes training sessions related to online learning, as well as accomplishing tasks related to the use of technology					
E-learning Readiness						
No	Statements	SD	D	N	A	SA
1	I like the idea of using e-learning to design and deliver instruction					
2	I like to try new technologies in teaching related to e-learning					
3	Developing an e-learning course would take significantly more time than developing a traditional course					
4	I feel confident in my ability to use e-learning in teaching					
5	I hesitate to use e-learning for fear of making mistakes.					
6	I can teach myself most of the things I need to know about using e-learning					
7	I would feel better about using e-learning if I knew more about it					
8	Developing e-learning materials require extensive training and support					
9	I am beginning to understand the process of incorporating e-learning in my courses					
10	I think about e-learning as a tool to assist me teaching my courses					
11	Greater incentives are needed to get faculty members to design an e-learning course					

Part F: Answer the following questions

Q1. Would you add any new statements to any of technological factors? Which one?

Please provide the statements and your justification

Q2. Do you want to modify any of statements from list of statements? Please provide the modification and your justification

Q3. If you added a new factor(s) at **Part B (Q1)**, then mention its/their statements in the following space

Part G: Other Comments

Is there anything else you'd like to add that hasn't been covered by the questions?

End of questionnaire.

Please email your answer to asma4_ali@yahoo.com

Thank you very much for your cooperation

Appendix E Delphi Questionnaire (Round Two)

This is the summary of responses of the expert panel (including yourself) in Round One regarding the verification of technological factors of e-learning readiness. This questionnaire contains six parts, from A to F. Parts A is to re-rating of the technological factors of e-learning readiness, re-rating the statements which related to assessing technological aspect of e-learning readiness. Part B is to rate the new technological factors of e-learning readiness which experts added to existing factors in Round one. Part C is open-ended questions about the new statements that experts added in Round one. Part D is to rate the new statements which experts added in Round One. Part E is to rate the relationships between the technological factors that experts identified in Round One, while part F is pertaining to the additional input which you may wish to add.

I would be very grateful if you could verify using the options given and return the questionnaire within **Three (3) Weeks** from the date of you receive the questionnaire.

Regards,

Asma Ali Mosa Eltharif,
PhD Student,
Advanced Informatics School (AIS),
Universiti Teknologi Malaysia (UTM)
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Part A: This part pertains to the summary and results of Round One undertaken previously. Please confirm your responses in Delphi Round One. If you do not wish to change your previous rating, you may leave the column for this round blank. The researcher will use your previous round rating in the calculation of Delphi Round Two. If your rating is not within the majority responses range (mean), you need to give your reasons in the column provided.

Please use the following Likert scale to rate your level of agreement with the technological factors of e-learning readiness at Table 1, and with the statements at Table 2 (Mark ‘√’ where applicable using the scale provided).

1= Strongly Disagree (SD), 2= Disagree (D), 3= Neutral (N), 4= Agree (A), 5= Strongly Agree (SA)

Table 1: The Technological Factors

No	List of Technological Factors	Mean in Round One	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Your Comments
1	Hardware	4.90						
2	Software	4.80						
3	Connectivity	4.90						
4	Security	4.50						
5	Flexibility of the system	4.70						
6	Technical Skills and Support	4.30						

Table 2: The Statements Which Related to Assess Technological Aspect of E-learning Readiness

Hardware								
No	Statements	Mean Round one	1	2	3	4	5	Your Comments
1	The Institution is willing to provide students and faculty access to appropriate hardware in order to undertake e-learning (e.g., Computers; laptops; Printer; Printer/Scanner; Microphone/Speakers/Headset)	4.30						

Hardware									
No	Statements	Mean Round one	1	2	3	4	5	Your Comments	
2	Students and faculty in the Institution have access to a computer with the necessary software installed	4.60							
3	The Institution's systems are sufficiently flexible to incorporate electronic links to external parties	4.70							
4	The Institution has a high quality of hardware equipment with which to apply e-learning (e.g., Computer; laptops; Printer; Printer / Scanner; Microphone/Speakers/Headset)	4.70							
Software									
No	Statements	Mean Round one	1	2	3	4	5	Your Comments for This	
1	The Institution provides the necessary software needed for e-learning implementation	4.70							
2	The Institution has an online platform used for course delivery (e.g., learning management system, social media and peer-to-peer platforms, online meeting/conferencing)	4.80							
3	The online platform used for course delivery has the necessary system capacity to support the learning activities of the course	4.80							
4	The online platform provides appropriate tools for communication and collaboration	4.80							
5	Software applications can be easily transported and used across multiple platforms	4.50							
Connectivity									
No	Statements	Mean Round one	1	2	3	4	5	Your Comments for This	
1	The Institution provides a wide range of connectivity services by which to apply e-learning (e.g., network services, broadband services, Intranet capabilities)	4.50							
2	The Institution has sufficiently stable Internet connection to apply e-learning	4.80							
3	Connection speeds are sufficient for communication and accessing all course materials	4.50							

Connectivity									
No	Statements	Mean Round one	1	2	3	4	5	Your Comments for This	
4	The Institution has extensive bandwidth capability	4.50							
5	The Institution has a high degree of systems inter-connectivity	4.20							
Security									
No	Statements	Mean Round one	1	2	3	4	5	Your Comments for This	
1	The Institution is provided with a virus protection to apply e-learning (e.g., Norton Antivirus, McAfee, AVG, etc.)	4.70							
2	The Institution is provided with an identity recognition mechanism such as login name, password	4.90							
3	A control mechanism for access levels is available in the Institution	4.90							
4	In the Institution, there are different levels of access to the e-learning system (lecturer, students, guests)	4.80							
5	There is a high level of security for protection of systems (hardware, software) from data loss or corruption to hardware failure, human error, hacking or malware	4.60							
6	The Institution uses an efficient method for protecting information security and privacy (e.g. Biometrics, Encryption, intrusion detection system (IDS), Firewall, Virtual Private Network)	4.20							
Flexibility of the system									
No	Statements	Mean Round one	1	2	3	4	5	Your Comments for This	
1	The system has the ability to adapt to new peripherals	4.20							
2	The system can be adapted with some deviations that can occurs in the software environment	4.10							
3	The systems (hardware, software, connectivity) has the ability to adapt with possible or future changes according to its requirements	4.10							
4	The systems are sufficiently flexible to incorporate electronic links to external parties	4.30							

Technical Skills and Support								
No	Statements	Mean Round one	1	2	3	4	5	Your Comments for This
1	The institution provides updates/maintenance of connectivity	4.40						
2	The institution periodically updates software with newer versions to meet changing information requirements	4.60						
3	The institution periodically upgrades hardware with a newer or better version, and provides maintenance of hardware	4.20						
4	Adequate and timely support is available in the institution to the lecturer and students when technical issues arise	4.30						
5	The institution has experienced human resources, or a department that organizes training sessions related to online learning, as well as accomplishing tasks related to the use of technology	4.40						
E-learning Readiness								
No	Statements	Mean Round one	1	2	3	4	5	Your Comments for This
1	I like the idea of using e-learning to design and deliver instruction	4.40						
2	I like to try new technologies in teaching related to e-learning	4.50						
3	Developing an e-learning course would take significantly more time than developing a traditional course	2.50						
4	I feel confident in my ability to use e-learning in teaching	4.00						
5	I hesitate to use e-learning for fear of making mistakes	2.30						
6	I can teach myself most of the things I need to know about using e-learning	4.20						
7	I would feel better about using e-learning if I knew more about it	4.10						
8	Developing e-learning materials requires extensive training and support	2.40						
9	I am beginning to understand the process of incorporating e-learning in my courses	4.60						
10	I think about e-learning as a tool to assist me in teaching my courses.	4.30						
11	Greater incentives are needed to encourage faculty members to design an e-learning course	4.30						

Part B: New Factors of Technological Aspects of E-learning Readiness

The new technological factors that expert added in Round one with their description as follows:

No	The New Technological Factors	Definition
1	Data Center	A large group of networked computer servers typically used by organizations for the remote storage, processing, or distribution of large amounts of data.
2	Cloud Computing	The use of services and applications available on demand via the Internet and accessed by Internet protocols and networking standards.

Please use the following Likert scale to rate your level of agreement with the new technological factors of e-learning readiness (Mark ‘√’ where applicable using the scale provided).

1= Strongly Disagree (SD), 2= Disagree (D), 3= Neutral (N), 4= Agree (A), 5= Strongly Agree (SA)

No	The New Technological Factors	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
1	Data Center					
2	Cloud Computing					

Part C: Answer the following questions:

Q1. Do you want to rename any of technology factors? If **Yes**, please suggest the new name and your justification

Q2. Do you want to modify the description of any technology factors? If **Yes**, please suggest your description and justification

--

Part D: Please use the following Likert scale to rate your level of agreement with the new statements that experts added in Round One (Mark ‘√’ where applicable using the scale provided).

1= Strongly Disagree (SD), 2= Disagree (D), 3= Neutral (N), 4= Agree (A), 5= Strongly Agree (SA)

Security						
No	Statements	1 SD	2 D	3 N	4 A	5 SA
1	Backup of the data is constantly being made					
2	The institution has a planning program that can protect the data in the event of an emergency or disaster that could potentially destroy data					
3	The Institution has physical security systems for the data center (e.g. biometrics and video surveillance systems)					
Cloud Computing						
No	Statements	1 SD	2 D	3 N	4 A	5 SA
1	The Institution is taking advantage of the services offered by the cloud computing paradigm to apply e-learning					
2	The Institution offers software applications through the internet as a service (e.g. Google Docs, Salesforce.com CRM, Zoho Office... etc.)					
3	The Institution uses a virtual platform over the Internet to develop and deploy their applications in the cloud scenario with the tools, languages, functions, libraries and services enabled by the service provider					
4	The Institution uses cloud computing to obtain the needed resources like servers, storage, and connections					

Data Center						
No	Statements	1 SD	2 D	3 N	4 A	5 SA
1	The Institution has a physical location of data center					
2	The institution has an alternative location for the data center					
3	The Institution has actual equipment for IT operations and storage of the organization's data; this includes servers, storage hardware, cables, and racks					
4	The Institution has Uninterruptible Power Sources (UPS) for data center (e.g. battery banks, generators, and redundant power sources)					
5	The Institution has environmental control for data center (e.g. computer room air conditioners (CRAC), heating, ventilation, and air conditioning (HVAC) systems, and exhaust systems)					

Part E: Please use the following Likert scale to rate your level of agreement with the relationship between technological factors that experts identified in Round One (Mark ‘√’ where applicable using the scale provided).

1= **Strongly Disagree (SD)**, 2= **Disagree (D)**, 3= **Neutral (N)**, 4= **Agree (A)**, 5= **Strongly Agree (SA)**

No	Technological Factors	The Relationship between Technological Factors	1 SD	2 D	3 N	4 A	5 SA
1	Hardware	Hardware (+) Software					
		Hardware (+) Security					
		Hardware (+) Flexibility of the system					
		Hardware (+) Technical Skills and Support					
2	Software	Software (+) Security					
		Software (+) Technical Skills and Support					
		Software (+) Flexibility of the system					
		Software (+) Cloud Computing					
3	Connectivity	Connectivity (+) Hardware					
		Connectivity (+) Software					
		Connectivity (+) Security					
		Connectivity (+) Technical Skills and Support					
4	Security	Security (+) Technical Skills and Support					
5	Data Center	Data Center (+) Security					
		Data Center (+) Cloud Computing					

Part F: Additional Input

This part is for you to state any input i.e. if you feel that any feedback that you gave in Round One was poorly described/taken into consideration; or if you have any additional comments or feedback regarding Delphi Round Two.



End of questionnaire

Thank you very much for your cooperation

Appendix F Delphi Questionnaire (Round Three)

I would like to express my utmost gratitude for your previous feedback and responses for my PhD research, specifically to verify the technological factors of e-learning readiness. Based on all the feedback received from the experts in the previous two rounds, I have thoroughly analyzed the data and findings. Consequently, I finalized the technological factors; the relationship between technological factors; the hypothesis, the statements that related to assessing technological aspects of e-learning readiness, and would like you as a panellist in the Delphi panel to verify them.

This questionnaire contains three parts, from A to C. Parts A is about re-rating of the new technological factors of e-learning readiness. Part B is about re-rating of the relationship between technological factors of e-learning readiness. Part C is about re-rating of the new statements that related to assessing technological aspect of e-learning readiness.

I would be very grateful if you could verify using the options given and return the questionnaire within **Three (3) Weeks** from the date of you receive the questionnaire. If your response is not received after the three weeks, this may suggest that you are agree with the technological factors; the relationship between technological factors; the hypothesis, the statements that related to assessing technological aspects of e-learning readiness, and would not want to make any amendments.

As this is the final round of the Delphi study, I would like to take this opportunity to thank you for your participation, time, cooperation and patience throughout the research.

Regards,

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Instructions: This questionnaire pertains to the summary and results of rating the new technological factors of e-learning readiness in Round Two undertaken previously. If you do not wish to change your previous rating, you may leave the column for this round blank. The researcher will use your previous round rating in the calculation of Delphi Two. If your rating is not within the majority responses range (mean), you need to give your reasons in the column provided.

Part A: Please use the following Likert scale to rate your level of agreement with the new technological factors of e-learning readiness (Mark ‘√’ where applicable using the scale provided).

1= Strongly Disagree (SD), 2= Disagree (D), 3= Neutral (N), 4= Agree (A), 5= Strongly Agree (SA)

No	List of Technological Factors	Mean in Round Two	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Your Comments
1	Cloud Computing	3.60						
2	Data Center	4.30						

Part B: Please use the following Likert scale to rate your level of agreement with the relationship between technological factors of e-learning readiness (Mark ‘√’ where applicable using the scale provided).

1= Strongly Disagree (SD), 2= Disagree (D), 3= Neutral (N), 4= Agree (A), 5= Strongly Agree (SA)

No	Technological Factors	The Relationship between Technological Factors	Mean of R2	1 SD	2 D	3 N	4 A	5 SA	Your Comments
1	Hardware	Hardware (+) Software	4.80						
		Hardware (+) Security	4.80						
		Hardware (+) Flexibility of the system	3.90						
		Hardware (+) Technical skills and Support	4.20						

No	Technological Factors	The Relationship between Technological Factors	Mean of R2	1 SD	2 D	3 N	4 A	5 SA	Your Comments
2	Software	Software (+) Security	4.60						
		Software (+) Technical skills and Support	3.80						
		Software (+) Flexibility of the system	4.00						
		Software (+) Cloud Computing	3.90						
3	Connectivity	Connectivity (+) Hardware	4.70						
		Connectivity (+) Software	4.70						
		Connectivity (+) Security	4.60						
		Connectivity (+) Technical skills and Support	3.90						
4	Security	Security (+) Technical skills and Support	4.20						
5	Data Center	Data Center (+) Security	4.70						
		Data Center (+) Cloud Computing	3.90						

Part C: Please use the following Likert scale to rate your level of agreement with the new statements that related to assessing technological aspect of e-learning readiness (Mark ‘√’ where applicable using the scale provided)

1= Strongly Disagree (SD), 2= Disagree (D), 3= Neutral (N), 4= Agree (A), 5= Strongly Agree (SA)

Security									
No	Statements	Mean Round Two	1 SD	2 D	3 N	4 A	5 SA	Your Comments	
1	Backup of the data is constantly being made	4.60							
2	The institution has a planning program that can protect the data in the event of an emergency or disaster that could potentially destroy data	4.00							
3	The Institution has physical security systems for the data center (e.g. biometrics and video surveillance systems)	4.20							

Cloud Computing								
No	Statements	Mean of R2	1 SD	2 D	3 N	4 A	5 SA	Your Comments for This
1	The Institution is taking advantage of the services offered by the cloud computing paradigm to apply e-learning	3.60						
2	The Institution offers software applications through the internet as a service (e.g. Google Docs, Salesforce.com CRM, Zoho Office... etc.)	3.40						
3	The Institution uses a virtual platform over the Internet to develop and deploy their applications in the cloud scenario with the tools, languages, functions, libraries and services enabled by the service provider	3.60						
4	The Institution uses cloud computing to obtain the needed resources like servers, storage, and connections	3.50						
Data Center								
No	Statements	Mean of R2	1 SD	2 D	3 N	4 A	5 SA	Your Comments for This
1	The Institution has a physical location of data center	4.30						
2	The institution has an alternative location for the data center	4.30						
3	The Institution has actual equipment for IT operations and storage of the organization's data; this includes servers, storage hardware, cables, and racks	4.60						
4	The Institution has Uninterruptible Power Sources (UPS) for data center (e.g. battery banks, generators, and redundant power sources)	4.30						
5	The Institution has environmental control for data center (e.g. computer room air conditioners (CRAC), heating, ventilation, and air conditioning (HVAC) systems, and exhaust systems)	4.50						

End of questionnaire

Thank you very much for your cooperation

Appendix G A survey on “A model for Technological Aspects of E-learning Readiness in Higher Education Institutions”

Dear Sir/Madam,

The successful implementation of e-learning relies on the readiness of technological aspects in order to realize the benefits provided by it and reduce the barriers to e-learning implementation. In my capacity as a PhD student at the Universiti Teknologi Malaysia (UTM), I am conducting a research project that has as its central focus the development of a model for assessing technological aspects of e-learning readiness in higher education Institutions. The purpose of this survey is to validate this model.

As a member of the faculty in higher education, we would be most appreciative if you could answer 48 questions to validate a proposed model for assessing technological aspects of e-learning readiness within higher education Institutions. The questionnaire has three parts; A, B and C. Part A contains General Questions; Part B comprises statements that are related to assessing technological aspects of e-learning readiness; while Part C pertains to additional input concerning the survey. The questionnaire is expected to take approximately fifteen minutes to complete. If you agree to participate, and I very much hope that you do, please fill in the questionnaire accordingly. You are not asked to reveal your identity. Your participation would add tremendous value to this research.

Should you require further information pertaining to this research, please do not hesitate to contact either me or my supervisor through the details given below:

Yours sincerely,

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Survey Questionnaire

PART A

General Questions

Please mark 'X' where applicable for questions 1, 2 and 5

1. Gender:

Male	Female

2. What is the highest level of education you have completed?

Bachelor	Master	PhD	Others (Please State)

3. What is your current position?

--

4. How many years of experience do you have in establishing/ maintaining/teaching by e-learning?

--

5. What is your experience in e-learning?

Establishing	Maintaining	Teaching	Others (Please State)

PART B**Technological Factors of E-learning Readiness**

Based on your experience and point of view, please provide a response indicating the level of agreement with each of the following statements of technological factors by ticking (√).

1=Strongly Disagree (SD), 2=Disagree (D), 3=Neutral (N), 4= Agree (A),
5= Strongly Agree (SA)

Hardware: This factor refers to physical equipment such as computers, servers and communication networks that must be available in order to apply e-learning						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	The Institution is willing to provide students and faculty access to appropriate hardware in order to undertake e-learning (e.g., Computers; laptops; Printer; Printer/Scanner; Microphone/Speakers/Headset)					
2	Students and faculty in the Institution have access to a computer with the necessary software installed					
3	The Institution's systems are sufficiently flexible to incorporate electronic links to external parties					
4	The Institution has a high quality of hardware equipment with which to apply e-learning (e.g., Computer; laptops; Printer; Printer / Scanner; Microphone/Speakers/Headset)					

Software: This factor refers to the programs and other operating information that enables computer systems to work. It includes libraries and related non-executable data, such as online documentation or digital methods						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	The Institution provides the necessary software needed for e-learning implementation					
2	The Institution has an online platform used for course delivery (e.g., learning management system, social media and peer-to-peer platforms, online meeting/conferencing)					
3	The online platform used for course delivery has the necessary system capacity to support the learning activities of the course					
4	The online platform provides appropriate tools for communication and collaboration					
5	Software applications can be easily transported and used across multiple platforms					

Connectivity: This factor refers to the ability to link to and communicate with other computer systems, electronic devices, software or the Internet						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	The Institution provides a wide range of connectivity services by which to apply e-learning (e.g., network services, broadband services, Intranet capabilities)					
2	The Institution has sufficiently stable Internet connection to apply e-learning					
3	Connection speeds are sufficient for communication and accessing all course materials					
4	The Institution has extensive bandwidth capability					
5	The Institution has a high degree of systems inter-connectivity					

Security: This factor refers to the protection of the computer system from data corruption, destruction, interception, loss or unauthorized access						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	The Institution is provided with a virus protection to apply e-learning (e.g., Norton Antivirus, McAfee, AVG, etc.)					
2	The Institution is provided with an identity recognition mechanism such as login name, password					
3	A control mechanism for access levels is available in the Institution					
4	In the Institution, there are different levels of access to the e-learning system (lecturer, students, guests)					
5	There is a high level of security for protection of systems (hardware, software) from data loss or corruption to hardware failure, human error, hacking or malware					
6	Backup of the data is constantly being made					
7	The Institution uses an efficient method for protecting information security and privacy (e.g. Biometrics, Encryption, intrusion detection system (IDS), Firewall, Virtual Private Network)					
8	The institution has a planning program that can protect the data in the event of an emergency or disaster that could potentially destroy data					
9	The Institution has physical security systems for the data center (e.g. biometrics and video surveillance systems)					

Flexibility of the system: This factor refers to the ability of a system to engage with future changes in its requirements such as adaptability, changeability, agility and elasticity						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	The system has the ability to adapt to new peripherals					
2	The system can be adapted with some deviations that can occurs in the software environment					
3	The systems (hardware, software, connectivity) has the ability to adapt with possible or future changes according to its requirements					
4	The systems are sufficiently flexible to incorporate electronic links to external parties					

Cloud Computing: This factor refers to the use of services and applications available on demand via the Internet and accessed by Internet protocols and networking standards						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	The Institution is taking advantage of the services offered by the cloud computing paradigm to apply e-learning					
2	The Institution offers software applications through the internet as a service (e.g. Google Docs, Salesforce.com CRM, Zoho Office... etc.)					
3	The Institution uses a virtual platform over the Internet to develop and deploy their applications in the cloud scenario with the tools, languages, functions, libraries and services enabled by the service provider					
4	The Institution uses cloud computing to obtain the needed resources like servers, storage, and connections					

Data Center: This factor refers to a large group of networked computer servers typically used by organizations for the remote storage, processing, or distribution of large amounts of data						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	The Institution has a physical location of data center					
2	The institution has an alternative location for the data center					
3	The Institution has actual equipment for IT operations and storage of the organization's data; this includes servers, storage hardware, cables, and racks					
4	The Institution has Uninterruptible Power Sources (UPS) for data center (e.g. battery banks, generators, and redundant power sources)					
5	The Institution has environmental control for data center (e.g. computer room air conditioners (CRAC), heating, ventilation, and air conditioning (HVAC) systems, and exhaust systems)					

Technical Skills and Support: This factor refers to the knowledge, understanding and abilities that are used to accomplish tasks related to the maintenance and upgrade of the infrastructure of computers, networks, and communications. They also provide support to users when they face technical problems						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	The institution provides updates/maintenance of connectivity					
2	The institution periodically updates software with newer versions to meet changing information requirements					
3	The institution periodically upgrades hardware with a newer or better version, and provides maintenance of hardware					
4	Adequate and timely support is available in the institution to the lecturer and students when technical issues arise					
5	The institution has experienced human resources, or a department that organizes training sessions related to online learning, as well as accomplishing tasks related to the use of technology					

E-learning Readiness: The mental or physical preparedness of higher education Institutions for the e-learning experience						
No	Statements	SD 1	D 2	N 3	A 4	SA 5
1	I like the idea of using e-learning to design and deliver instruction					
2	I like to try new technologies in teaching related to e-learning					
3	I feel confident in my ability to use e-learning in teaching					
4	I can teach myself most of the things I need to know about using e-learning					
5	I would feel better about using e-learning if I knew more about it					
6	I am beginning to understand the process of incorporating e-learning in my courses					
7	I think about e-learning as a tool to assist me in teaching my courses					
8	Greater incentives are needed to encourage faculty members to design an e-learning course					

PART C

Additional Input

Please express any additional comments or thoughts here: (if you have any)

Thank you very much for your cooperation

LIST OF PUBLICATIONS

1. **Mosa, A. A.**, Naz'ri bin Mahrin, M., & Ibrahim, R. (2016). Technological aspects of e-learning readiness in higher education: A review of the literature. *Computer and Information Science*, 9(1), 113-127. <https://doi.org/10.5539/cis.v9n1p113>. **(Non-indexed Journal)**
2. **Al-araibi, A. A. M.**, Mahrin, M. N. R. B., & Yusoff, R. C. M. (2016). A systematic Literature Review of Technological Factors for E-learning Readiness in Higher Education. *Journal of Theoretical & Applied Information Technology*, 93(2), 500-521. **(Q3, Indexed by SCOPUS)**
3. **Al-araibi, A. A. M.**, Mahrin, M. N. R. B., & Yusoff, R. C. M. (2016). Technological Aspect Factors of E-learning Readiness in Higher Education Institutions: Delphi Technique. *Education and Information Technologies*, 24(1), 567–590. <https://doi.org/10.1007/s10639-018-9780-9>. **(Q2, Indexed by ISI and SCOPUS)**
4. **Al-araibi, A. A. M.**, Mahrin, M. N. R. B., & Yusoff, R. C. M. (2016). A model for Technological Aspect of E-learning Readiness in Higher Education. *Education and Information Technologies*, 24 (2), 1–37. <https://doi.org/10.1007/s10639-018-9837-9>. **(Q2, Indexed by ISI and SCOPUS)**
5. **Al-araibi, A. A. M.**, Mahrin, M. N. R. B., & Yusoff, R. C. M. (2018). Assessing Technological Aspect of Higher Institutions E-learning Readiness Using Delphi Technique. (Under Progress)