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To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v10-i2/6915 DOI:10.6007/IJARBSS/v10-i2/6915

Received: *30 December 2019,* ***Revised:*** *15* January *2020,* ***Accepted:*** *30* January *2020*

Published Online: 14 February 2020

In-Text Citation: (Almetere et al., 2020)

To Cite this Article: Almetere, E. S., Kelana, B. W. Y., & Mansor, N. N. A. (2020). Using UTAUT Model to Determine Factors Affecting Internet of Things Acceptance in Public Universities. *International Journal of Academic Research in Business and Social Sciences*, *10*(2), 142–150.

Vol. 10, No. 2, 2020, Pg. 142 – 150

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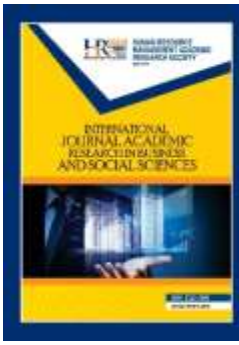
INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES
HRMARS MANAGEMENT ACADEMIC RESEARCH SOCIETY EXPLORING INTELLECTUAL CAPITAL
www.hrmars.com
ISSN: 2222-6990

Using UTAUT Model to Determine Factors Affecting Internet of Things Acceptance in Public Universities

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Abstract
This article aims to review the influencing factors and their relationships to the adoption of IoT technologies in the education domain among undergraduate students in Saudi public universities. The purpose of this study is to propose a framework using UTAUT to increase IoT acceptance. Previous studies found that performance expectancy, effort expectancy, social influence, and facilitating conditions have significant predictors of IoT acceptance. However, other studies found that not all UTAUT variables are significant predictors of IoT acceptance such as effort expectancy. There are three research gaps identified through previous studies, field issues, and theory and model. First, there is a lack of studies in consumers' adoption of IoT technologies. Second, there is a lack of user acceptance of IoT technologies. Third, there is a lack of confident and uncertainty caused by new technologies. A quantitative method approach will be used. The online questionnaire survey well be sent to 300 undergraduate students of the selected public university. The Partial Least Square-Structural Equation Modelling (PLS-SEM) will be used to analyse the collected data.
Keywords: Internet of Things – IoT acceptance – UTAUT – Psychological Capital – Technology Adoption

Introduction

According to Park et al., (2017), internet of things can be described as a network of objects which can be connected through the Internet without human interaction. The traditional Internet provides connections to transfer information between users. The Internet of Things (IoT) means any objects that can communicate and connect to each other through the internet (Biedermann Christopher, 2016; Davies, 2015). . Lohan & Singh, (2019) explained the benefit of IoT in smart home environment and described the IoT as a technology that provides autonomous communication functions between different objects using sensors. The IoT technology is used in different areas and industries such as, healthcare, smart homes, telecommunication, and transportation (Bandyopadhyay & Sen, 2011; Gregory, 2015; Khan et al., 2012; Macaulay et al., 2015; Roblek et al., 2016; Weyrich & Ebert, 2016). Education sector is the most important sector

that get instantaneous benefits from the technology developments (Agrawal & Mittal, 2019). Universities that respond to the technology change will have big opportunity to keep growing (Tarhini et al., 2018). Smart technologies are essential learning tools in European countries such as UK, Germany and Italy (Lyapina et al., 2019).

Depends on the latest report from Media Ministry of Saudi Arabia, the market of the internet of things and Machine to Machine communication increases by 2019 and it is expected to reach more than $16 billion. Saudi Arabia is investing billions of dollars in the domain of smart technologies and internet of things to achieve the 2030 vision especially in IoT technologies (Al-Ruithe et al., 2018). According to Abed et al., (2020) universities are supported by the internet and the adoption of IoT enable students to exchange data from different resources such as wearable devices, sensors, and actuators. In education, communication is important for students with the right person in the right time and place (Agrawal & Mittal, 2019). Students in most universities around the world have already used their wearable devices and smart objects inside their classrooms. Establishing the IoT technologies in campuses gives the students opportunities to improve their learning experiences. These technologies are providing smart education to the millennials who became co-creators of knowledge.

Concepts and Definitions

This study generally discusses the issues relating to the five factors in the framework (performance expectancy, effort expectancy, social influence, facilitating conditions and PsyCap).

Theoretical Background

The Concept of Iot

A collection of smart objects and devices that are connected and provided with unique identifiers to communicate and transfer data without human or computer interaction (Rosencrance et al., 2014). According to Aldossari and Sidorova (2018), IoT is a network of interconnected and uniquely identifiable objects which will lead to dramatic changes in our lives.

Adoption Models

In the information systems field, there are different developed adoption and acceptance models which came after several efforts during past years. These theories and models have been developed to understand consumer's intention behavior, adoption, and actual usage (Chipeva et al., 2018). The Theory of Reasoned Action is the earliest model in the consumer acceptance research. This model was developed by Ajzen and Fishbein in 1980. The founders of TRA want not only to predict but also to explain and influence the behavior of users through this theory. According to the TRA, the primary determinant of behavior is not the person's attitude towards the behavior, but his or her intention to perform the behavior (Alshehri, 2012). However, TRA has limitation which prevent it from explain other attitude such as irrational decisions or habitual actions. Due to this limitation, Ajzen produced a new extension which is TPB. The Theory of Planned Behavior came to include measures of perceived behavioral control to fix the previous limitation in the TRA. According to Martins & Oliveira (2014), UTAUT is the most essential and complete model to predict usage intention in technology acceptance and can explain 70% of the distinction in behavior or intention. According to Chipeva et al. (2018), the unified theory of acceptance and use of technology (UTAUT) was introduced by Venkatesh et al., (2003) to explain

user intentions to use an information systems and usage behavior. previous acceptance models were merge in an integrated model which is UTAUT. It was built on eight previously developed theories which are TRA, TAM, MM that introduced by Davis et al., (1992) and TPB, MPCU by Thompson et al., (1991), DOI by
(Rogers, 1983), social cognitive theory by Bandura, (1989) and TAM-TPB by Taylor & Todd, (1995). According to Slade et al., (2015), UTAUT is one of the most important models of technology adoption and has four key constructs which are performance expectancy, effort expectancy, social influence, and facilitating conditions. These factors influence the behavioral;

The predictors	Definitions
performance expectancy	"The degree to which the user expects that using the system will help him or her to attain gains in job performance"
effort expectancy	"The degree of ease associated with the use of the system"
social influence	"The degree to which an individual perceives that important others believe he or she should use the new system"
facilitating conditions	"The degree to which an individual perceives that organizational and technical infrastructure exist to support use of the system"
Psychological Capital	"The positive and developmental state of an individual as characterized by high self-efficacy, optimism, hope and resiliency (Luthans & Youssef, 2004)".

PYSCAP

The technology can create an attitude of a lack of confident and uncertainty when the technology is still new in the market such as IoT. In consciences, consumers with less confidence will resist to adopt and work with the new technology (Lee & Shin, 2019). Some studies examined one of the dimensions (self-efficacy) from PsyCap, but no previous studies talk about the main construct which is PysCap in the technology adoption context. There are several studies investigated the relationship between self-efficacy and the intention to use and they found that there is a positive impact of self-efficacy on the intention to use (Kim et al., 2018). However, no studies examine the relationship between PysCap and the intention to use especially in the IoT adoption context. There are many studies found a positive relationship between PsyCap and different attitude and behaviors such as (start-up intention, entrepreneurs' growth intentions, job involvement) and a negative relationship between PsyCap and turnover intention (Jin, 2017).

Research Model

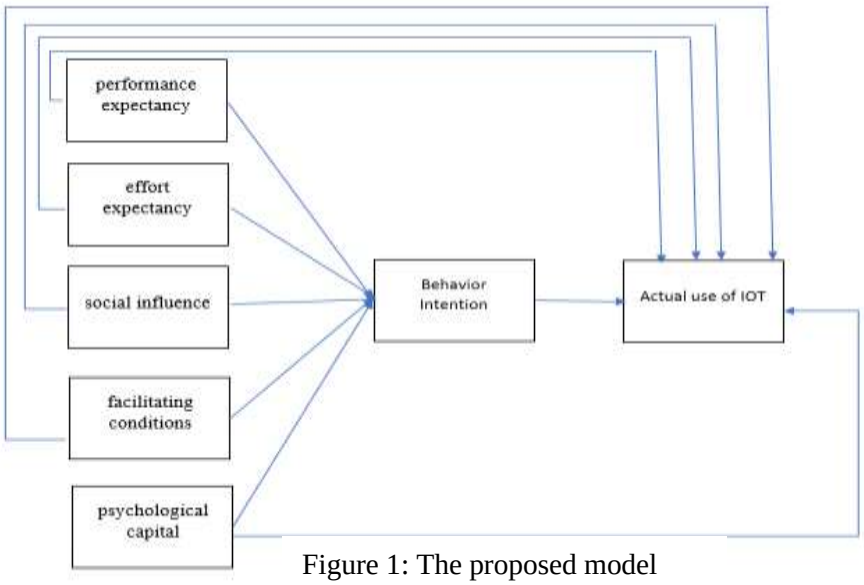

Figure 1: The proposed model

Performance Expectancy

One of the reliable predictors of behavioral intention in the technology adoption and usage context is performance expectancy (W. Lee & Shin, 2019). PE is similar to the perceived usefulness of TAM and the relative advantage of IDT (Martins & Oliveira, 2014). According to Lee & Shin, (2019), Performance expectancy is described as the degree of user expectation if using a technology will lead to get benefits. In the context of IoT, performance expectancy refers to the degree to which students perceive that using the IoT technologies will improve their productivity and performance. In other words, consumers will use the technology when they feel that their performance will be improved. For example, students who have Dyslexia will use smart and interactive objects if they feel their auditory and visual skills will be improved.

Effort Expectancy

Effort expectancy is the degree of ease associated with the use of technology and previous researches have confirmed that EE is a significant predictor of intention to use technologies (Dinev & Hu, 2007).According to Marr & Prendergast, (1991)there is a greater chance that technologies will be adopted by users, if these technologies are understandable and clear to use. This statement was supported by Chipeva et al., (2018) in his study in Bulgaria and Portugal. Hence, in the context of IoT, students will be able to adopt record class attendance technology if they feel they will spend less effort and can understand the system. Lee & Shin, (2019), confirmed that the more effort consumers spend to use IoT technology, the less likely they will use and adopt this technology.

Social Influence

The degree to which an individual perceives that important others believe he or she should use the new system (Venkatesh, 2003). For the purpose of this study, SI means the degree to which the student perceives that important people believe he or she should use the new technology. According to Venkatesh & Brown (2001), the opinions of student's friends and family members can influence the students to use and adopt new technologies. In the industry of Internet-based banking, social influence has an important and essential role to adopt (Rahi & Abd. Ghani, 2018; Riquelme & Rios, 2010; Wang et al., 2015).

Facilitating Conditions

Venkatesh (2003) has defined facilitating conditions as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system. The findings of Venkatesh (2003) and (Handayani & Sudiana, 2017) confirmed that the facilitating condition has a significant impact on the usage behavior of technology context. According to Y. Wang et al., (2019) some technical support such as computers, internet speed, integration with other systems play important role on the acceptance and use of the technology.

H. Lee , (2009)supported the same statement in the internet banking context and mentioned that user's knowledge, ability, and resources have influence on the use of technology. Technology acceptance is related to have digital skills and if there is a lack of these skills, that would make the students face difficulties to use IoT (Bartau-Rojas et al., 2018). However, there are some studies found that facilitating conditions has no impact on usage behavior

Behavioral Intention

According to Hoque & Sorwar, (2017) behavior intention means the person willingness to perform a behavior. In other words, behavior intention comes before the usage behavior. The previous information technology acceptance studies discuss the positive relationship between BI and AU of information technology. Behavioral intention is a mediating variable in this study between the actual usage of IoT and the independent variables which are performance expectancy, effort expectancy, social influence, facilitating conditions, and psychological capital.

Conclusion

In conclusion, the aim of this study is achieved when the researcher proposed a framework model using UTAUT to increase IoT acceptance in higher education of Saudi Arabia. The framework model developed was based on systematic literature review in order to close and identify the theoretical and practical gaps that would be enhanced and influenced by the developed framework model using UTAUT to increase IoT acceptance in higher education of Saudi Arabia. Since this paper is conceptual paper, it gives a significant and overall view about the influencing factors and their relationship to the adoption of IoT technology in education domain among undergraduate student in Saudi Public University.

Contribution and Recommendation

Apparently, the framework model developed based on the past and current studies from prominent scholars does not only limited and practical in higher education in Saudi public

university but somehow the framework model can be practiced by academicians, practitioners, non-government organization, and ministry of education to implement in their education blueprint to enhance and utilize the technology to the classroom management as well as to the education system.

Limitation

This study is focusing on one group which is undergraduate students in Saudi public universities. It is recommended in future research to focus on other groups and generations. Future studies should include other nations and expand the boundaries.

Acknowledgment

First, I would like to thank my supervisors Prof. Nur Naha Abu Mansor and Dr. Beni Widarman Yus Kelana for their guidance, continuous support, and outstanding assistance to do my first conceptual paper. I appreciate the support from Taif University to offer me the opportunity to study in University Technology Malaysia. Finally, warmest appreciation goes to my husband Ahmed for his sustainable support.

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