A Critical Review of Technology Adoption Theories and Models for E-Learning Systems, Kenya

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ABSTRACT

E-learning has reshaped traditional education into more flexible and efficient learning in developed nations. However, e-learning remains underutilized and in the rudimentary stages of development in developing countries. Therefore, understanding the critical factors behind the adoption and acceptance of technology is a prime concern in developing countries like Kenya. Several models have been proposed in the literature to understand e-learning acceptance in which social environmental factors are not primarily addressed. This paper aims to improve understanding of what social forces influence employee's attitude and intention of e-learning adoption within an organizational context. This paper contributes to the existing literature by comprehensively reviewing the concepts, applications and development of technology adoption models and theories based on the literature review with the focus on potential application in E-Learning. These included, but were not restricted to, the Theory of Diffusion of Innovations (DIT) (Rogers, 1995), the Theory of Reasonable Action (TRA) (Fishbein and Ajzen, 1975), Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991), Decomposed Theory of Planned Behavior, (Taylor and Todd, 1995), Theory of Human Behavior (Triandis, 1977) and Social Cognitive Theory (Bandura, 1977). These reviews provide a holistic picture for future researchers in selecting appropriate single/multiple theoretical models/constructs based on their strengths and weaknesses and in terms of predictive power and path significance will shed some light and potential applications for technology applications for e-learning. It is concluded that a well-established theory should consider the personal, social, cultural, technological, organizational and environmental factors.

Keywords—*e-learning; TAM; THB; TRA; TBP; DIT; TTF; technology adoption; SCT*

I. INTRODUCTION

In the era of the knowledge economy, knowledge workers need to enhance knowledge and skills continuously to advance their career development. "E-learning" has been expected to play an important role in providing continuing education for knowledge workers. E-learning Management System (EMS) have become one of the most important innovations for delivering education in many parts of the world, this has been facilitated by a rapid expansion of information technologies globally. However, successful implementation and management of these systems is primarily based on its adoption [1]. E-learning has continuously played a vital contribution to the progress of academic staff and students, and the improvement in the quality of teaching method and learning management system which have resulted in increased popularity of education in different educational institutions and organizations [2]. Further it has also enabled learners to access the system at any time and at any place as long as there is an Internet connection. Today, information technology (IT) is universally regarded as an essential tool in enhancing the competitiveness of the economy of a country.

Constant technological change simultaneously creates threats to established business models, while also offering opportunities for novel service offerings ([3], [4], [5], [6]). Leading firms often seek to shape the evolution of technological applications to their own advantage ([7], [4]). A significant number of Universities in Kenya are using E-learning management system as a platform to provide students

with online learning. This enables students to obtain their education in parallel with pursing their personal goals and maintaining their own careers, without a need to attend classes and be subjected to a rigid schedule [8]. These initiatives are however being affected by many barriers that are threatening to bring down this technological innovation. Therefore, this paper presents the literature review of the technology acceptance models and theories leading to the development of the novel technology single platform E-Learning theoretical framework.

This paper analyzed the technology adoption models and theories relevant to e-learning implementation. These included, but were not restricted to, the Theory of Diffusion of Innovations (DIT) [9] that started in 1960, the Theory of Task-technology fit (TTF) [10], the Theory of Reasonable Action (TRA) [11], Theory of Planned Behavior (TPB) [12], Decomposed Theory of Planned Behaviour [13], the Technology Acceptance Model (TAM) [14], Final version of Technology Acceptance Model (TAM) [15], Technology Acceptance Model 2 (TAM2) [15] Unified Theory of Acceptance and Use of Technology (UTAUT), Venkatesh, Morris, Davis and Davis [16] and Technology Acceptance Model 3 (TAM3) [17]. This review could shed some light and potential applications for technology applications for future researchers to conceptualize, distinguish and comprehend the underlying technology models and theories that might affect the previous, current and future application of technology adoption of e-learning systems.

II. RESEARCH METHODOLOGY

Methodology of literature survey was followed for this paper. Research papers with relevant keywords (such as technology adoption, technology adoption theory, technology adoption model etc) were downloaded from online databases like EBSCO, Google Scholar, Proquest, INFORMS etc. The papers were scrutinized to identify and classify them on the basis of themes on which they were focused.

III. TECHNOLOGY ADOPTION MODELS AND THEORIES

The author presents various theories and models for adoption and post adoption of e-lerning systems. Technology life cycle is presented first to appreciate life cycle of information systems in general:

A. *Technology Life Cycle*

The technology life cycle (TLC) describes the costs and profits of a product from technological development phase to market maturity to eventual decline. Research and development (R&D) costs must be offset by profits once a product comes to market. Varying product lifespans mean that businesses must understand and accurately project returns on their R&D investments based on potential product longevity in the market. Thus, TLC is focused primarily on the time and cost of development as it relates to the projected profits. TLC can be described as having four distinct stages discussed after Figure 1.
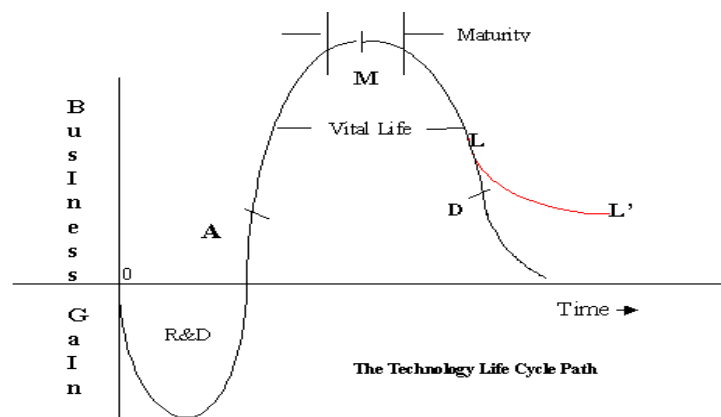

Fig. 1: Technology Life Cycle Chart

- Research and Development – During this stage, risks are taken to invest in technological innovations. By strategically directing R&D towards the most promising projects, companies and research institutions slowly work their way toward beta versions of new technologies.

- Ascent Phase – This phase covers the timeframe from product invention to the point at which out-of-pocket costs are fully recovered. At this junction the goal is to see to the rapid growth and distribution of the invention and leverage the competitive advantage of having the newest and most effective product.

- Maturity Stage – As the new innovation becomes accepted by the general population and competitors enter the market, supply begins to outstrip demand. During this stage, returns begin to slow as the concept becomes normalized.

- Decline (or Decay) Phase – The final phase is when the utility and potential value to be captured in producing and selling the product begins dipping. This decline eventually reaches the point of a zero-sum game, where margins are no longer procured.

B.   *Task-Technology Fit Theory*

Task-technology Fit (TTF) emphasizes individual impact [10]. Individual impact refers to improved efficiency, effectiveness, and/or higher quality. Goodhue et al. [10] assumed that the good fit between task and technology is to increase the likelihood of utilization and also to increase the performance impact since the technology meets the task needs and wants of users more closely. As shown in Fig. 2. this model is suitable for investigating the actual usage of the technology especially testing of new e-learning technology to get feedback. This theory is good for measuring the technology applications already release in the marketplace such as Moodle.
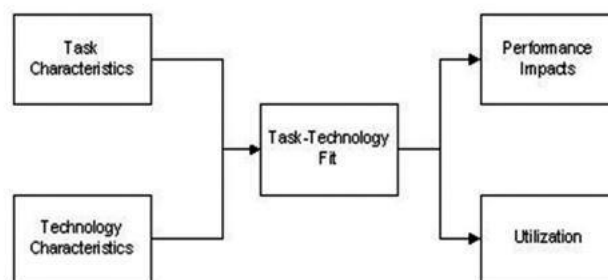

Fig. 2: Task-technology fit [10]

C. Diffusion of Innovation Theory

Rogers [9] proposed that the theory of 'diffusion of innovation' was to establish the foundation for conducting research on innovation acceptance and adoption. The diffusion of innovation theory explains that the innovation and adoption happened after going through several stages including understanding, persuasion, decision, implementation, and confirmation that led to the development of [9] S-shaped adoption curve of innovators, early adopters, early majority, late majority and laggards as shown in Fig. 3.

Diffusion of innovation is affected by readiness. Technology readiness (TR) refers to people's propensity to embrace and use of new technologies for accomplishing goals in home life and at work [19]. Based on individual's technology readiness score and the technology readiness, [9] further classified technology consumers into five technology readiness segments of explorers, pioneers, skeptics, paranoids, and laggards.
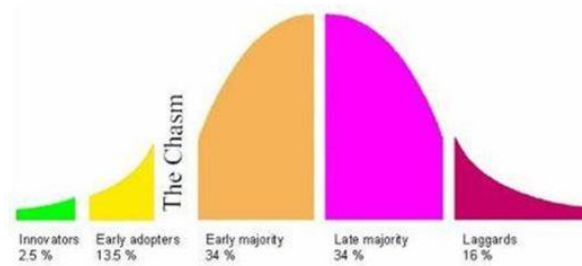
Fig. 3: Innovation Adoption Curve [9]

Rogers [9] S-shaped adoption curve consists of innovators, early adopters, early majority, late majority and laggards. This is actually what happens to various instituions adopting e-learning systems. The Diffusion of innovation or Technology readiness is vital for organization implementation success because it is market focus.

D. Theory of Reasonable Action

Fishbein and Ajzen [11] proposed the Theory of Reasonable Action. This is one of the most popular theories used and is about one factor that determines behavioral intention of the person's attitudes toward that behaviour as shown in Fig. 4. [11] defined "attitude" as the individual's evaluation of an object and defined "belief" as a link between an object and some attribute, and defined "behaviour" as a result or intention. Attitude has a great impact on the extent to which users will embrace e-learning solutions for their operations.
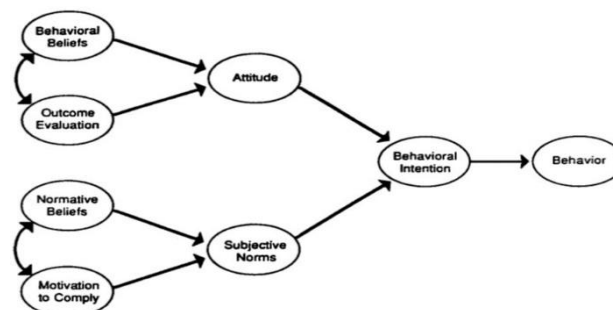

Fig. 4: The Theory of Reasonable Action [11]

E. Theory of Planned Behavior

This theory by Ajzen [1] is about perceived behavioral control as a factor that determines behavioural intention of the person's attitudes toward that behaviour as shown in Fig. 5. This factor is an addition to the first two factors as defined in Theory of Reasonable Action [11]. Perceived control behaviour is the control which users perceive that may limit their behaviour (e.g: Can I take online studies through Moodle learning management system and what are the requirements?). Fig.5. shows TPB.
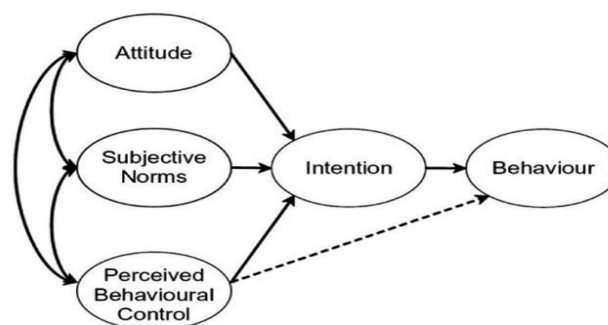

Fig. 5: The Theory of Planned Behavior [12]

However, there is an enhancement of the TPB. This is the Decomposed Theory of Planned Behaviour (Decomposed TPB) which was introduced by [13]. The Decomposed TPB consists of three main factors influencing behavior intention and actual behavior adoption which are attitude, subjective norms and perceived behavior control

F. Technology Acceptance Model

Technology Acceptance Model (TAM) was introduced by Davis in 1986 as shown in Fig. 6. An adaptation of Theory of Reasonable Action, TAM [19] is specifically tailored for modeling users' acceptance of information systems or technologies. TAM attempts to help researchers and practitioners to distinguish why a particular technology or system may be acceptable or unacceptable and take up suitable measures by explanation besides providing prediction
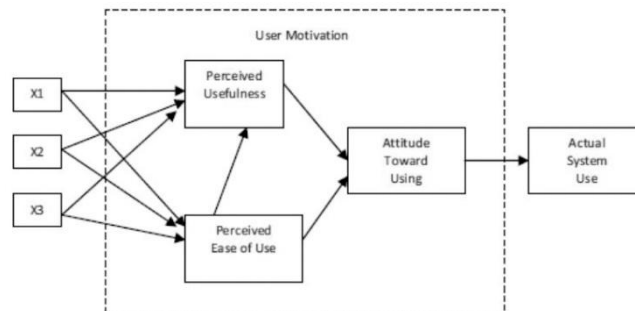

Fig. 6: Original Technology Acceptance Model [19]

In 1989 Davis used TAM to explain computer usage behaviour as shown in Fig. 7. The purpose for the modification of original TAM was to explain the general determinants of computer acceptance that lead to explaining users' behaviour across a broad range of end-user computing technologies and user populations. The basic TAM model included and tested two specific beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Perceived Usefulness is defined as the potential user's subjective likelihood that the use of a certain system (e.g: single platform E-Learning System) will improve his/her action and Perceived Ease of Use refers to the degree to which the potential user expects the target system to be effortless [20]. The belief of the person towards a system may be influenced by other factors referred to as external variables in TAM.
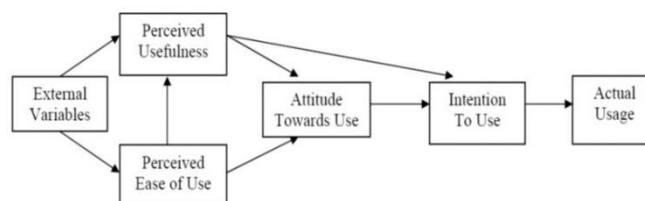

Fig. 7: First modified version of Technology Acceptance Model (TAM) [14]

The final version of Technology Acceptance Model was formed by [21] as shown in Fig. 8 after the main finding of both perceived usefulness and perceived ease of use were found to have a direct influence on behaviour intention, thus eliminating the need for the attitude construct.
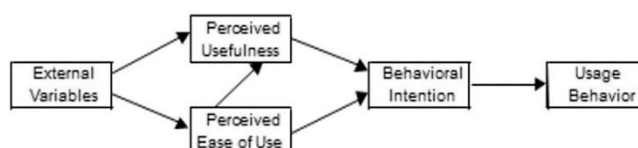

Fig. 8: Final version of Technology Acceptance Model (TAM) [21]

G. Theory of Human Behavior

This theory is drawn from social studies. The Model of PC Utilization [22]. The model is based on the Theory of Human Behaviour by [23] which differs in some ways from the Theory of Reasoned Action because it makes a distinction between cognitive and affective components of attitudes. Beliefs belong to the cognitive component of attitudes.

According to this theory "Behaviour is determined by what people would like to do (attitudes), what they think they should do (social norms), what they have usually done (habits), and by the expected consequences of their behavior". This theory primarily deals with extent of utilization of a computing device by a worker where the use is not mandated by the organization but is contingent on the option of the user. In such a setting, the theory posits that the use of computers is likely to be influenced by several factors such as his feelings (affect) toward using the devices, prevalent social norms regarding use of computing devices at the work place, general habits related to use of the computer, consequences expected through use of computing devices and extent of conditions that are present at the work place for facilitating use of technologies.

H. Social Cognitive Theory

Social Cognitive Theory (SCT) explains how people acquire and maintain certain behavioral patterns based on the learning from others [24]. SCT theorizes that portions of an individual's knowledge acquisition can be directly related to observing others within the context of social interactions, experiences, and outside media influences. The theory suggests that behavior is affected by both outcome expectations and self-efficacy, while outcome expectations and self-efficacy are in turn influenced by prior behavior. In the postadoption research self-efficacy also influences continued intention to use a technology ([25], [26]).

IV. E-LEARNING POST ADOPTION THEORIES

Since adoption research mainly focuses on the binary condition of people's initial adoption or non-adoption, these research studies have not captured the dynamics of the postadoption behavior of technology use. In this study, post-adoption behavior can be approached as a cognitive process where people consciously examine their technologies during the usage stage [31]. These theories also reflect on people's cognitive reasoning, in regards to their post-adoption decision making processes.

A. Expectation Confirmation Theory

This theory was originally developed by Oliver [28] and it theorizes that consumer's post-purchase satisfaction is jointly determined by prepurchase expectation, perceived performance (of technology), and expectancy confirmation. ECT is a cognitive theory which seeks to explain post-purchase or post-adoption satisfaction as a function of expectations, perceived performance, and disconfirmation of beliefs. The theory explains the cause of satisfaction by focusing on both the antecedents of satisfaction and the satisfaction formation process [29].
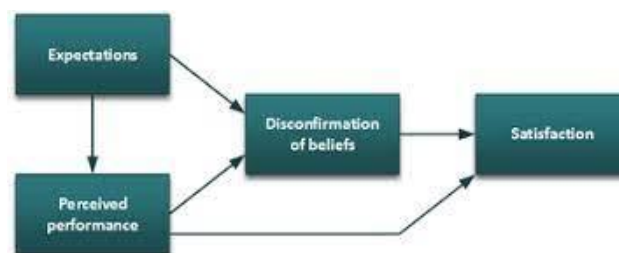

Fig. 11: Expectation Confirmation Theory [28]

There are several studies that used the ECT as a major theoretical framework in studying the post-adoption behavior of ICTs such as e-learning systems. Many of these studies found that confirmation has statistically significant relationships with various adoption and use constructs including perceived

usefulness ([30], [31], [32]), perceived ease of use ([30], [33]), perceived enjoyment [33], perceived behavioral control [34], and finally satisfaction [35], [36].

B. IS Continuance Model

Bhattacherjee [35] proposed a theoretical model of IS continuance that takes into account the distinctions between acceptance and continuance behaviors as illustrated in Fig. 12.
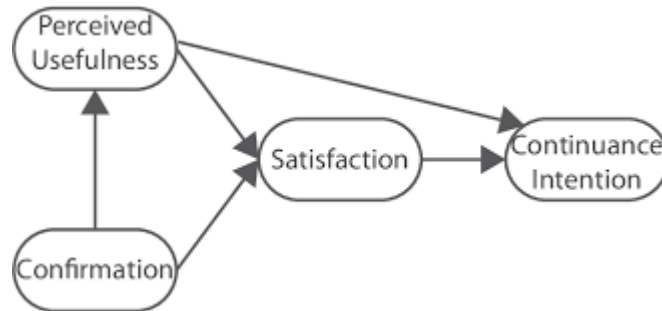

Fig. 12: IS Continuance Model [35]

This model is grounded on the resemblance between individuals' continuous IS usage decisions and consumers' repeated purchase decisions by using the ECT. In both ECT and IS Continuance model satisfaction is a key concept in post-adoption behavior. [37] also argued that satisfaction represents a construct that is partly cognitive and partly emotional. Various IS scholars found out that satisfaction is an important component of IS use and an indicator of system success [38, 39]. This has seen som scholars who have tried to integrate user satisfaction and technology acceptance [40]. It can be deduced that that users' continuance intention is determined by their satisfaction with IS use and perceived usefulness of continued IS use. User satisfaction, in turn, is influenced by their confirmation of expectation from prior IS use and perceived usefulness. Post- acceptance perceived usefulness is influenced user's confirmation level. This is a very important aspect when analyzing post-adoption trends of e-learning systems.

V. CONCLUSIONS

The main objective of this paper is to review theories and models that can be used in e-learning adoption research. Through this review, share the difference of technology adoption models and theories with different theoretical insights, research problems, variables, and measurements, we proposed some possible solutions for studying the post-adoption behavior of e-learning technology. The paper presents a theoretical framework by considering cognitive, affective, and habitual factors to study scientists continued use of e-learning technologies. These reviews will shed some light and potential applications for technology applications for future researchers to conceptualize, distinguish and comprehend the underlying technology models and theories that may affect the previous, current and future application of technology adoption in the area of learning. This research paper could be the first step in understanding the main adoption and continued-use factors for scientists on e-learning technologies in Kenya and beyond

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