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Theoretical Modelling to Explain Lecturers' Use of Educational Support Systems for Teaching in University-based Library Schools in Nigeria: Extending the Technology Acceptance Model (TAM).

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THEORETICAL MODELLING TO EXPLAIN LECTURERS' USE OF EDUCATIONAL SUPPORT SYSTEMS FOR TEACHING IN UNIVERSITY-BASED LIBRARY SCHOOLS IN NIGERIA: EXTENDING THE TECHNOLOGY ACCEPTANCE MODEL (TAM)

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Abstract

This work is an attempt at theoretical modelling. The result of a search for a theoretical framework and a conceptual model to explain lecturers' use of Educational Support Systems (ESS) for teaching in university-based library schools in Nigeria. The applicability, similarity and relevance of Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB) and the Technology Acceptance Model (TAM) were discussed. TAM was found to be the most appropriate framework for the research based on its variables and/or constructs; hence, a research model, an adaptation of TAM was drawn and used to guide the research. Based on the findings of the research, a new model tagged Library Educators' ESS Use Model (LEEUM) was proposed to further the frontier of knowledge, generally and in Library and Information Science, particularly.

Keywords: Theoretical Modelling, Use of Educational Support Systems, Theory of Reasoned Action, Theory of Planned Behaviour, Technology Acceptance Model, Library Educators' ESS Use Model, Library Schools, Library Educators, Universities, Nigeria.

Lecturers' use of educational support systems for teaching: a global perspective

Educational support systems (ESS) are information, communication and telecommunication technologies, hardware and equipment that are deployed for instructional purposes. They work with the aid of software installed either at the factory, point of sale or use. They are used in institutions of higher learning all over the world as tools to support the educational objectives of teaching, learning and research. They provide and help in developing skills for educational activities such as searching and assessing information, cooperation, communication, problem solving and lifelong learning which are important for the preparation of students for the knowledge society (Drent and Meelissen, 2008; Afshari, Abu Bakar, Su Luan, Abu Samah and Say Fooi (2009). The use of ESS for teaching is one of the new learning trends that challenge the banking concept of education (that is, the assumption that the teacher owns the knowledge and deposits it into the students who attend the class).

The change from teacher-centered education system to learner-centered education the world over in the past few years also contribute to the use of technology in tertiary education. This use enables equal access, quality education and equips new generations of learners with enhanced skills to operate in the 21st century where technology is construed as a resource to help students in developing higher order thinking, creativity and research skills (Ringstaff and Kelley, 2002; Inwent, 2004; Tella, Tella, Toyobo, Adika and Adeyinka (2007). Technology integration

in tertiary education, according to Dias and Atkinson (2001), has covered the continuum from instruction on programming skills, self-directed drill and practice, interactive learning software, online training, testing, instructional delivery augmentation, and Internet-based accessibility to information, communication and publication. This integration is driven primarily by hardware and software evolution, accessibility to computers in educational settings and popular instructional technology trends. Nowadays, there are educational support software and administrative packages which can generate and store student records; schedule classes through e-mails and word processing, and design teacher tools like computerized grade books, test worksheets and examination and curriculum templates (Onyebinama, 2007).

ESS promote conducive teaching and learning environments in tertiary education and have been shown to have positive impact on the learning environment and students generally. Educators in tertiary institutions can use multimedia to teach interactively and work on class projects. They can communicate and do research with the use of the Internet. ESS allow educators to have more control over their teaching, to analyze problem critically and to collaborate. This involves the instructional use of information processing and productivity software like word processors, databases creator and manager, spreadsheets, presentation programs, multimedia authoring tools, e-mail, video production equipment, digital reference materials, electronic indexes and network search engines.

ESS have great potential to increase access to knowledge. This is because access to computers and the Internet has increased the ability of educators to carry out more research which has led to improved quality of teaching and instruction. ESS has also provided opportunities to establish contact, cooperate, and maintain beneficial relationships with other educators of similar interests across the world. It has broadened the course of analysis and research and improved the quality of work with the opportunity for diverse views (from experts and other colleagues) acquired over increasingly short periods of time.

Kumar, Che Rose and D'Silva (2008) opined that the use of ESS in the classroom will, no doubt, inspire the teachers to approach their tasks with a greater sense of purpose and, more importantly, a sense of play, to make the learning process fun for students. According to them, the Internet provides far more up-to-date information than textbooks. They averred that, searching for books only to discover at the end of the day that they do not have the required information can be time consuming and frustrating. The Net, they argued, is readily available

and precise once you use the right keyword or search term. Textbook, according to them, can present obsolete information that could misguide students into believing that there is no further development after a particular discovery while information on the Net are constantly updated and current.

The computer is perceived as an instructional tool that motivates and caters for different teaching and learning abilities (and/or disabilities). As information technology tends to accord more closely with the way students think, it has changed the way different subjects are taught (Kumar et al., 2008). Tella et al. (2007) revealed that vast amounts of up-to-date information in the teaching and learning of different subjects are found on the World Wide Web and that almost all subjects ranging from mathematics (the most structured) to music (the least structured) can be learnt with the help of computers.

Angers and Machtmes (2005) insisted that the recent advancement in information technology innovations and computer usage is rapidly transforming work culture and educators cannot escape the fact that today's classrooms must provide technology-supported learning. Therefore, they advised that being prepared to adopt and use technology and knowing how that technology can support student learning must become integral skills in every educator's professional repertoire.

ESS also provide avenue to improve educational standards and outreach across institutions of higher learning and continents by: (1) supporting and expanding existing curricula; (2) increasing the accuracy, presentation, user-friendliness, and attractiveness of courses; (3) serving as a medium for lecture delivery and extension services to correspondence or distance learners and students who are home-bound or who prefer learning at or from home and (4) enabling telework (that is, educators preferring to work remotely from home and/or abroad). Strategic linkages between educators in Africa and those in other continent and the wider global community could also be forged with ESS (Onyebinama, 2007; Adedoja, Adelore, Egbokhare and Oluleye, 2013).

Studies on the use of technology in education consistently found that students in technology rich environments experienced positive effects on performance in all subject areas. It was found that technology provides fast and accurate feedback to students, and speed up computations and graphing, thus freeing students to focus on strategies and interpretation (Look, 2005; Bee Theng and Chia Hua, 2008). Use of interactive multimedia software may motivate

students and lead to improved performance. Educational support systems also enable many people (sometimes at once) to generate and disseminate information, thus playing an active role in the process of gainful interaction and brain-picking between academia, professionals, learners, peers and policy makers.

According to Volman and Van Eck (2001), the use of technology creates a powerful learning environment and transforms the teaching and learning environment to where students deal with knowledge in an active, self-directed and constructive way. Educational support systems offer the potential to meet the learning needs of individual students, promote equal opportunity, offer learning materials, and also promote interdependence of learning (cooperative or collaborative learning) among learners (Leach, Ahmed, Makalima and Power, 2005). Where educational support systems are used for teaching, students are encouraged to think and be creative, find alternate solutions to problems and engage in higher order learning objectives. Thus, technology is not just regarded as a tool, which can be added to or used as a replacement of existing teaching methods but is seen as an important instrument to support new ways of teaching and learning.

ESS provide access to a vast wealth of information sources and learning experiences; new channels of communication and interaction between educators and their peers and opportunity for learning for those who may normally not have access to information or opportunity for tertiary education. However, despite the afore-listed benefits of these educational support systems when deployed for teaching and learning, their integration into universities in Nigeria, particularly in university-based library schools has been observed to be slow and their use low.

Application of educational support systems in universities in Nigeria

The application of educational support systems in Nigerian universities, according to Onyebinama (2007), has evolved in basically four directions. First, it has evolved via individual university initiatives through the establishment of academic computer science departments and/or computer/computing/ICT centres, the latter as academic support units. Secondly, it has evolved by the introduction of administrative computing through computerised Management Information System (MIS) units. Thirdly, this development has taken place via three initiatives: (1) the NuNet, a project for the networking of the university system in Nigeria and its connection

to the Internet; (2) The Information Navigator Library Management Software (TINLIB) supplied with some computer hardware to all federal university libraries in Nigeria in 1994 and (3) the National Virtual Library Project established in 2001, which seek to collect and connect all the e-resources in Nigerian libraries. The mission of the project according to Okebukola (2002:1) is "to provide…enhanced access to national and international library and information resources and for sharing locally-available resources with libraries all over the world using digital technology". These three initiatives were spearheaded by the National Universities Commission (NUC), a national body, set up by the Federal Government of Nigeria to co-ordinate and monitor Nigerian universities. Fourthly, technology use in Nigerian universities has evolved through the library and information services set up by individual university library initiatives. These four directions, according to Onyebinama (2007), have not been convergent and therefore resulted in unnecessary competition for limited resources as well as duplication of efforts and facilities.

The use of ESS have also evolved in universities in Nigeria through cheap and easy personal access to the Internet and e-resources provided to students and educators by telecommunication companies (for example, MTN, GLO, Airtel, Etisalat, and others) and/or Independent Service Providers via personal modems and customised mobile technologies loaded with pre/postpaid airtime. Access to communicate with peers, browse a whole library and download the latest idea needed for research, are granted with the loading of a little token. With this easy personal access, there is increased visibility of African local content posted or uploaded to the Internet.

Two classical examples of online scholarly works that have been beneficial for academic or instructional purposes in universities in Nigeria according to Nwogu, Akinde and Onyebinama (2008) are: (1) African Journal Online (AJoL) an initiative of the International Network for the Availability of Scientific Publication (INASP) based in United Kingdom which offers free online access to the Table of Content (ToC) and Abstracts of scholarly journals published in Africa and (2) the Database of African Theses and Dissertation (DATAD) Project, an initiative of the Association of African Universities (AAU) which collect and manage digitised copy of students' research work from universities of member countries.

The emerging university (off/online) repositories or database for the collection, storage and management of a university's intellectual output (for example, in the University of Jos, Nigeria and a few other universities), which can be consulted for research and instructional

purposes, is another example of educational support system. Furthermore, universities in Nigeria are now creating or entering into different forms of consortia for the purpose of collaboration and resource sharing in face of limited ESS infrastructure, human capacity and resources. In some universities in Nigeria, through ESS like the Internet, online journals are acquired, free web journals and full-text databank (on open access) are identified and patronised or downloaded, and access is provided to online version of current print subscriptions, via their libraries.

Much is still left to be desired in this regard because of university libraries' limited subscription to and promotion of these resources and the limited institutional infrastructure and capacity for the acquisition or capturing, storage or accommodation and maintenance or management of these educational support systems. Recently, Carnegie, MacArthur and Cartah Foundations have come to the rescue but some educators and universities have not been able to benefit from the exchange programmes and grant opportunities offered because of their not meeting up with the stringent conditions attached. In most of the developing countries in Africa and in Nigeria especially, finance, inadequacy of expertise and technical support seems to explain educators' limited use of a wider range of systems, software, courseware and resources that have been found to be useful for teaching, learning and research in institutions of higher learning all over the world.

Theoretical framework for lecturers' use of educational support systems

The framework for the study was hinged on the Technology Acceptance Model (TAM) which was proposed as a research model for studying technology user behaviour (Davis, 1986; Davis, Bagozzi and Warshaw, 1989). TAM is an offshoot of the Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB). The study attempted a brief description of the two theories, thier relationships, applicability and relevance to the research model.

The Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) proposed by Fishbein (1967) and further developed by Fishbein and Ajzen (1975) and Ajzen and Fishbein (1980) estimates the discrepancy between attitude and behaviour with intention mediating. It predicts that behavioural intent is created or caused by two factors: our attitudes and our subjective norms. Attitudes, according to the theory have two components; Fishbein and Ajzen call these the evaluation and

strength of a belief. Subjective norms, in the theory, also have two components: normative beliefs (an individual's perception of people's expectations with regards to a behaviour) and motivation to comply (the importance the individual attached to people's expectations of the behaviour). TRA claims that all other factors which influence an individual's behaviour only do so in an indirect way by influencing the attitude, subjective norms or intention.

TRA assumes that the behaviour being studied is under total volitional control of the performer, that is, the person can decide at will to perform or not perform the behaviour (voluntary behaviour). It was later realised that behaviour may not be totally voluntary and under control, this resulted in the addition of perceived behavioural control and the emergence of the Theory of Planned Behaviour (TPB) which predicts deliberate and planned behaviour. The TRA's limitation is in dealing with behaviours over which people have incomplete volitional control. However, the TPB was developed as a deliberate attempt to broaden the applicability of the TRA to include non-volitional behaviours by incorporating explicit considerations of perceptions of control over performance of the behaviour as an additional predictor of behaviour.

Theory of Planned Behaviour (TPB)

The basic concepts of the Theory of Planned Behaviour (TPB) developed by Ajzen (1985; 1988) are intention to perform a behaviour, attitude toward the behaviour, subjective norm (what the participants believe others think of the behaviour), perceived behavioural control (that is, how much power the participant believes they have over the choice to do the behaviour), and different kinds of beliefs that constitute the informational foundation for the behaviour (Madden, Ellen and Ajzen, 1992). According to the TPB, intentions formation depends on attitudes toward the target behaviour which, in turn, reflect beliefs and perceptions. The hypothesised relations among these variables are shown in Figure 1.

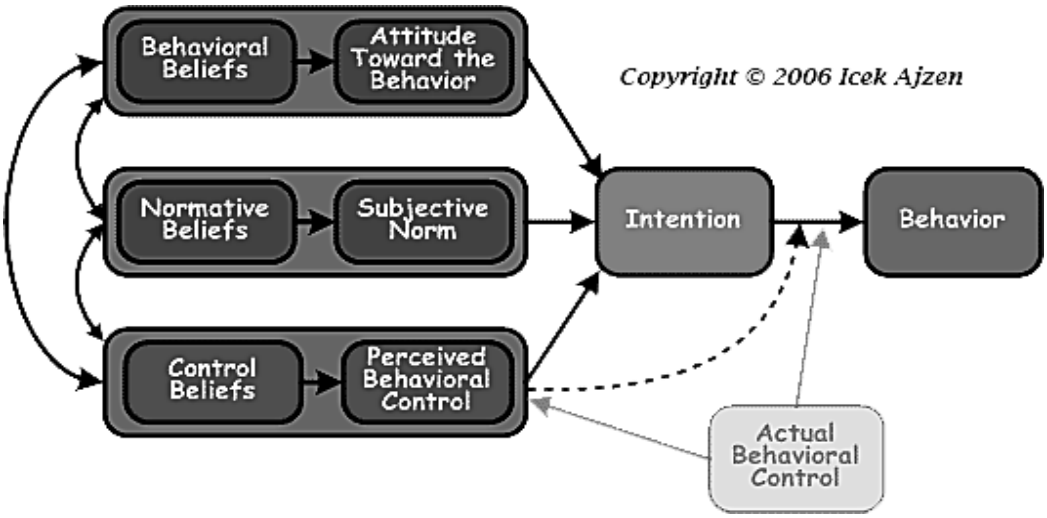

Figure 1: Theory of Planned Behaviour (TPB) (Ajzen, 2006)

According to the TPB, as explained by Ajzen (2006:1),

> human behaviour is guided by three kinds of considerations: beliefs about the likely outcomes of the behaviour and the evaluations of these outcomes (behavioural beliefs), beliefs about the normative expectations of others and motivation to comply with these expectations (normative beliefs), and beliefs about the presence of factors that may facilitate or impede performance of the behaviour and the perceived power of these factors (control beliefs). In their respective aggregates, behavioural beliefs produce a favourable or unfavourable *attitude toward the behaviour*; normative beliefs result in perceived social pressure or *subjective norm*; and control beliefs give rise to *perceived behavioural control*. In combination, attitude toward the behaviour, subjective norm, and perception of behavioural control lead to the formation of a behavioural *intention*. As a general rule, the more favourable the attitude and subjective norm, and the greater the perceived control, the stronger should be the person's intention to perform the behaviour in question. Finally, given a sufficient degree of *actual* control over the behaviour, people are expected to carry out their intentions when the opportunity arises. Intention is thus assumed to be the immediate antecedent of behaviour.

In other words, "perceived behavioural control" is presumed to not only affect actual behaviour directly, but also affect it indirectly through behavioural intention. To the extent that it is an accurate reflection of actual behavioural control, perceived behavioural control can,

together with intention, be used to predict behaviour. Perceived behavioural control plays an important part in the TPB (Madden et al., 1992) because it explains the relationship between behavioural intention and actual behaviour. It is further described as perceived likelihood of various events occurring that will act to facilitate or thwart intention, and the perceived impact that such events will have in making the performance of the behaviour difficult or easy (Ajzen, 1991). As a matter of fact, the TPB differs from the TRA in that it considers perceived as well as actual control over the behaviour of interest. The TPB emphasises that human behaviours are governed not only by personal attitudes and social pressures but also a sense of control.

Furthermore, the TPB assumes that performance of behaviour depends to some degree on such factors as availability of requisite opportunities, resources and cooperation of others. In other words, the perceived consequences of a behaviour, the expectations of important referents and availability of resources needed to perform the behaviour, may affect the actual behaviour. The resources, environment and opportunities available to a person must to some extent dictate the likelihood of behavioural achievement. These, according to Ajzen (1991) are called the facilitating factors or external variables.

Ajzen (2006) postulated further in TPB that interventions designed to change behaviour can be directed at one or more of its determinants: attitudes, subjective norms, or perceptions of behavioural control. Changes in these factors, according to him, should produce changes in behavioural intentions and, given adequate control over the behaviour, the new intentions should be carried out under appropriate circumstances. Interventions will still be ineffective, however, unless individuals are in fact capable of carrying out their newly formed intentions. He therefore advised that intervention programmes should not stop at influencing intentions only but the ultimate goal should be to influence people's behaviour. However, when it has to do with understanding users' technology adoption behaviour, the Technology Acceptance Model (TAM) (which was derived from these two theories) has been found to have similar or better explanatory power than the TRA and TPB (Davis et al., 1989).

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), an influential extension of TRA and TPB, a well-known model related to technology adoption and use, is originally proposed by F. D. Davis in 1986 (Davis, 1986) and later revised in 1989 (Davis, 1989). It has been validated as a

powerful and parsimonious framework to explain users' adoption of different technologies. TAM model adapted the belief-attitude-intention-behaviour relationship of TRA and TPB to explain user's acceptance of technology. It has been proven as a theoretical model in helping to explain and predict technology user behaviour (Legris, Ingham and Collerette, 2003). TAM provides a basis with which one traces how external variables influence perception, attitude, intention to use a particular technology and the actual technology use (Figure 2).

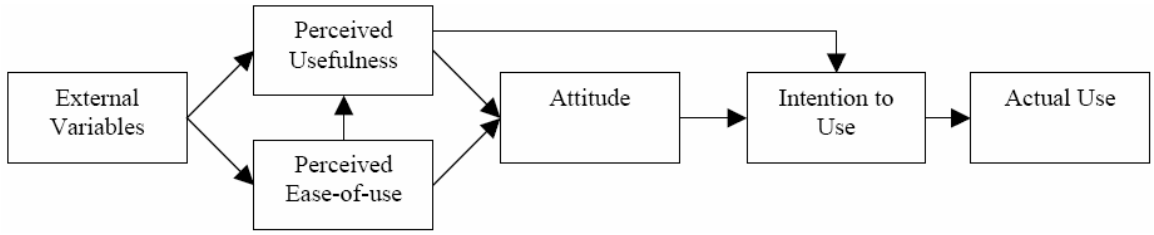

Figure 2: The original Technology Acceptance Model (TAM 1) (Davis, 1986; 1989).

Two cognitive beliefs are posited by TAM: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). According to TAM, one's actual use of a technology is influenced directly or indirectly by the user's behavioural intentions, attitude, perceived usefulness of the system and perceived ease of use of the system. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use (Davis, 1989 and Davis et. al., 1989).

TAM had represented important theoretical contribution towards understanding technology usage and technology acceptance behaviours (Malhotra and Galletta, 1999). It has been used as the theoretical basis for many empirical studies of user technology acceptance and use (Davis, 1989; Davis et. al., 1989; Mathieson, 1991; Tella et al. 2007; Kumar et al., 2008; Adedoja et al., 2013). Because of its robust and parsimony in explaining user's acceptance of technology, TAM has won extensive empirical supports since its inception (Liu and Ma, 2006) and is broadly accepted as framework in explaining users' technology acceptance decisions (Hong, Thong, Wong and Tam, 2002).

The goal in developing TAM was to provide and theoretically justify explanation of determinants of technology acceptance that was capable of explaining behaviour across a wide

range of applications and user populations (Davis, 1989). TAM is the most popular and widely used theoretical framework for technology user studies and it is found to be appropriate in explaining instructional use of educational support systems and examining the external factors that influence the usage of these systems. In other words, the framework adopted in this study uses the constructs of the Technology Acceptance Model (TAM) to explain library educators' ESS teaching use behaviour.

Technology acceptance was defined as "an individual's psychological state with regard to his or her voluntary or intended use of a particular technology" (Maslin, 2007). In TAM, the main dependent construct(s)/factor(s) is the behavioural intention to use and actual system usage while the main independent constructs/factors are attitude, perceived usefulness and perceived ease of use. The theoretical framework of Davis's TAM explains the self-intention of a particular user or the internal behaviour of the person towards the usage of new technology (Figure 2). This intention is based on the person's self-perceived usefulness (PU) and the perceived ease of use (PEOU) of the new technology.

The concept of perceived usefulness explains the extent the use of new technology can give benefit or can enhance or improve job performance or productivity while the perceived ease of use explain the extent the usage of new technology can make work easier, give more work-relief or freedom from effort. Both of these TAM attributes, PU and PEOU, are explaining the individual's self-approach towards the use of the new technology (Davis, 1989). It is also noted that if the task is totally related to IT, then PEOU influence the PU for new technology acceptance (David and Detmar, 2000). However, the two constructs are conceptually independent.

It has been noted that the easier and more effortless a technology is, the more likely users will use the technology. "Ease of use" is particularly of influence in the early stages of user experience with a technology or system (Davis, 1989; 1993). Following this, Venkatesh (2000:343) stated that ". . . with increasing direct experience with the target system, individuals adjust their system-specific ease of use to reflect their interaction with the system". Implying that if educators get more experienced with the use of educational support systems for teaching, they will adjust their perception regarding the "ease of use" of these systems, as instructional media, in a positive direction. Perceived ease of use was theorised as a fundamental determinant of TAM.

TAM emphasises the importance of usefulness as another determinant of user acceptance of new technologies. Users' intention to use a system is driven, to a large extent, by their perceived usefulness of the system (Davis et. al., 1989). There is also extensive empirical evidence in the literature on this (Venkatesh and Davis, 1996, 2000; Venkatesh, 2000; Venkatesh and Morris, 2000). The ultimate reason that users exploit some systems and applications is that they find them useful to their needs and/or tasks. TAM postulated that perceived usefulness determined, with relative weight, the person's attitude and intention towards using the system. Perceived usefulness had been theorised to be another fundamental determinant of system use (Davis et. al., 1989).

TAM has been widely studied and accepted as a valid model in predicting individual acceptance behaviour across various technologies and users (Davis et al., 1989; Mathieson, 1991; Koufaris 2002; Thong, Hong and Tam, 2002; Adedoja et al., 2013; Claar, Dias and Shields, 2014). Despite the large body of existing research on TAM, continuing research efforts in extending TAM can be observed in literature (Davis et al., 1989; Venkatesh and Davis, 1996; Venkatesh, 2000; Venkatesh and Morris, 2000; Davis and Venkatesh, 2004). Presently, there are two revisions or upgrades of TAM (that is, TAM 2 and 3). The original TAM or TAM 1 was found to be the most relevant in explaining library educators' use of educational support systems.

TAM 1, as shown in Figure 2, believed that perceived ease of use directly determines users' attitude toward using system (Davis, 1986; 1989) and indirectly impacts on attitude towards use via perceived usefulness (Davis et al., 1989). In other words, a system can be avoided, even by talented computer scientists, if it is clumsy and difficult to handle. In order to prevent the "underused" useful system problem, educational technologies need to be both easy to learn and easy to use. Davis (1989) contested that perceived ease of use may actually be a causal antecedent to perceived usefulness, as opposed to a parallel, direct determinant of system usage.

In TAM 1, "usefulness" refers to consumers' perceptions regarding the outcome of the experience while "ease of use" refers to their perceptions regarding the process leading to the final outcome. These have been found to determine users' attitude (Davis, 1989; 1992; 1993). It is argued that attitude has a strong, direct, and positive effect on users' intentions to use and consequently on the actual use of the new technology or system (Davis, 1993; Bobbitt and Dabholkar, 2001; Adedoja et al., 2013). When IT professionals foster users' beliefs in ease of use and usefulness of a focal IT, adoption and usage are likely to occur. Attitude, according to

TAM, is affected directly by perception and indirectly through external variables. If a user of a system perceived it to be easy to use and useful in achieving a particular end, his attitude towards the use of the system will be positive and he will intend to use the system and actually use it whenever the opportunity present itself.

External variables (representing the many influences which are beyond the control of a system user, include but not limited to: policies on using technology; resources on ground; opinions of colleagues; support from managers and technical staff; working condition; knowledge sharing and pressure from peers) may affect how a system user perceive the ease of use and usefulness of the system. Consequently, such a positive or negative perception will affect the user's attitude, intention and actual use of the system. In other words, systems actual use is indirectly influenced by the external variables which are known as work-environment in this study.

TAM has been applied to a wide range of Information Systems (Jackson, Chow and Leitch, 1997) and user profiles (Venkatesh, 1999). Using TAM as framework, Lederer, Maupin, Sena and Zhuang (2000) and Moon and Kim (2001) studied the use of World Wide Web; Porter and Donthu (2006) investigated Internet usage; Macharia and Nyakwende (2010) studied the use of e-mail in teaching and learning while Ke, Sun and Yang (2012) studied the use of web-based classroom response system. TAM had also been used in the banking sector, for instance, Rose and Forgathy (2006) investigated the use of self-service banking technologies while Jahangir and Begum (2008) studied users of electronic banking technology. Specifically, TAM 1 is tailored to understanding issues in the adoption and use of computer-based technologies not minding area of deployment; be it in education, health, banking, security, to mention a few. Considering both the effectiveness and simplicity of TAM 1 (Figure 2); its wide applicability to different kinds of technologies and its variables and/or constructs, TAM 1 was adopted as the most appropriate framework to explain factors affecting lecturers' use of ESS for teaching in university-based library schools in Nigeria.

Conceptual model

From the review, the researcher found that TAM 1 was helpful in evaluating and forecasting library educators' use of educational support systems for instructional purposes. This is because TAM 1 specifies the causal effects of perceived ease of use, perceived usefulness and

attitude towards use on actual usage behaviour, the four variables of interest. "Usefulness" in TAM 1 is the degree to which a person believes or the individual's perception that using the *new technology* will enhance or improve *her/his performance* (Davis, 1989, 1993). Applying this definition to this research context, if ESS is classified as the *new technology* and the outcome of their instructional use as the *individual's performance,* then, "usefulness" refers to educators' perception that using a particular ESS as a medium enhances the outcome of their instructional experience. Hence, this perception may affect the actual use of that ESS for instructional purposes. "Usefulness" is also linked with "ease of use" to determine use. According to TAM 1, "usefulness" is influenced by "ease of use", because the easier a technology is to use, the more useful it can be (Davis et al., 1989; Venkatesh, 2000; Adedoja et al., 2013).

"Ease of use" is the degree to which a person believes or the individual's perception that using the new technology will be free of effort (Davis, 1989; 1993). Applying this to the research context, "ease of use" is the educators' perception that the use of ESS for teaching will involve a minimum effort. Whereas "usefulness" referred to educators' perception regarding the outcome of the instructional experience, "ease of use" refers to their perception regarding the process leading to the final instructional outcome. Simply put, "usefulness" is how effective an ESS is, in helping educators to accomplish their instructional task, while "ease of use" is how easy an ESS, as an instructional medium, is to use.

Attitude, according to TAM 1, is affected directly by perception. In other words, the moment a library educator perceive ESS to be easy to use and useful in achieving an instructional end, his attitude towards the use of ESS will be positive and he will intend to use ESS and actually use ESS whenever the opportunity present itself. Moreover, in TAM 1, external variables (like availability and accessibility of necessary infrastructural facilities; ready fund; leadership, encouragement and support from administrators; knowledge sharing, team coaching and collaboration of peers and reliable and systematic technical support and backup) may affect how a library educator perceive the ease of use and usefulness of ESS. Consequently, such a positive or negative perception will affect the educator's attitude, intention and actual use of ESS in that order.

In other words, actual use of ESS (and extent of use) is indirectly affected by external variables which are also known as facilitating conditions. Facilitating conditions or factors are the external agents found in educators' working environment on which he may have no control.

In considering actual use of ESS, the facilitating conditions are important external variables that play a vital role of situational anchors. The facilitating conditions can differ according to the circumstance found in each university. The facilitating conditions are taken as external variables in TAM 1 and work-environment in this work. This study focused on modelling a framework to explain how the attitude of educator to the use of ESS directly affect their use for teaching; how easy and useful they perceive the use of these technologies for teaching and the effects of that perceptions on use and extent of use of ESS and how some work-environment indices directly affect the use and extent of use of these technologies for teaching. These factors attitude, perception and work-environment come within Davis' TAM 1 of 1986 and 1989 (Figure 2).

The Research Model

In adapting TAM 1 to explain library educators' use of educational support systems, the model proposed five work-environment indices (that is, infrastructural, financial, administrative, peer and technical supports) as external variables which may affect the use and extent of use of ESS for teaching. These external variables (work-environment) are proposed to foster a direct effect on use of ESS instead of an indirect effect hypothesised by TAM 1 (Figures 2 and 3).

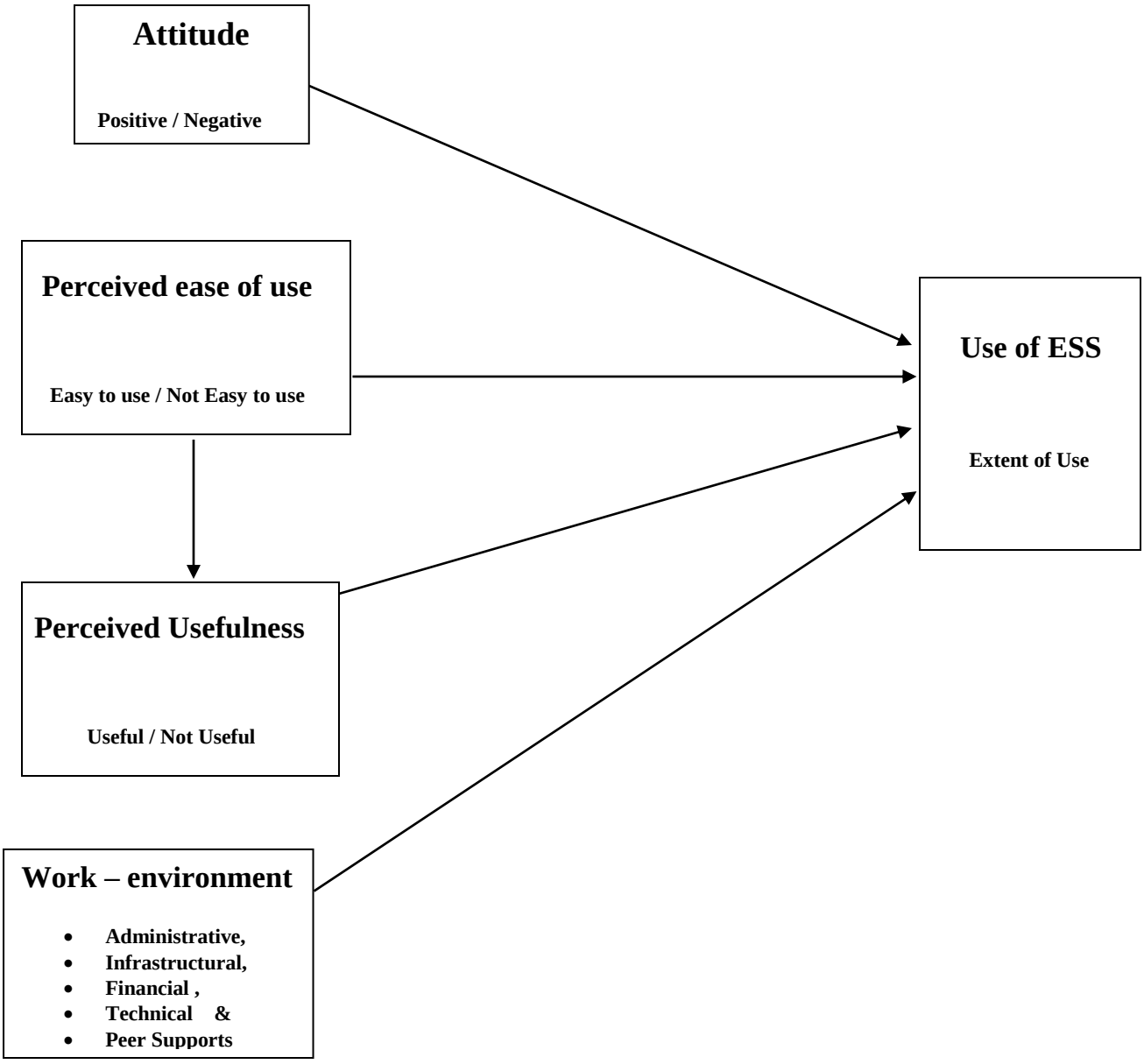

Figure 3: ***The research model (as adapted from TAM 1 by Davis 1986; 1989)***

Perception, which may manifest in perceived ease of use and perceived usefulness, is proposed in this model to have a direct effect on use of ESS and consequently on the extent of use while TAM 1 hypothesised an indirect effect of perception on actual use with attitude and intention mediating (Figure 2). Attitude of educators is proposed in the model to have a direct

effect on use of ESS while TAM 1 hypothesised an indirect effect with intention intervening (Figure 2). This is because this model, in contrast to TAM 1, assumed that 'Intention to Use' is subsumed in 'Use' (Figure 2; Figure 3); hence, it is not considered. The model assumed that an individual will most likely intend to use a technology before s\he actually uses it (with the exception of forced or accidental use). In other words, the model was used to explain library educators' voluntary use of ESS for teaching.

The model suggested as shown in Figure 3 that educators' attitude towards the use of ESS for teaching and their perception of how easy to use and useful they are for teaching, may have direct effect on the use of ESS (and extent of use) given a work-environment which may also impact use and extent of use directly. Furthermore, the model proposed just like in TAM 1, that educators' perception of the ease of use of ESS may affect how they perceive their usefulness for teaching. This is because an ESS that is difficult to use may be easily dismissed and not given the chance to prove its usefulness. The model sought to extend TAM by suggesting "Extent of Use" as a construct under the "Use" variable (Figure 3). Finally, it was proposed that library educators' use (and extent of use) of ESS for teaching in university-based library schools in Nigeria may be directly affected by their attitude to use; perception and work-environment.

Extending the Technology Acceptance Model: A Contribution to Knowledge

The research model above was used as a framework for a research study by Akinde (2016) and based on its findings, the researcher sought to contribute to theoretical modelling knowledge by proposing a redrawn or an extended TAM to explain library educators' use of ESS for teaching in universities in Nigeria. The proposed model (Library Educators' ESS Use Model (LEEUM)) is as shown in Figure 4.

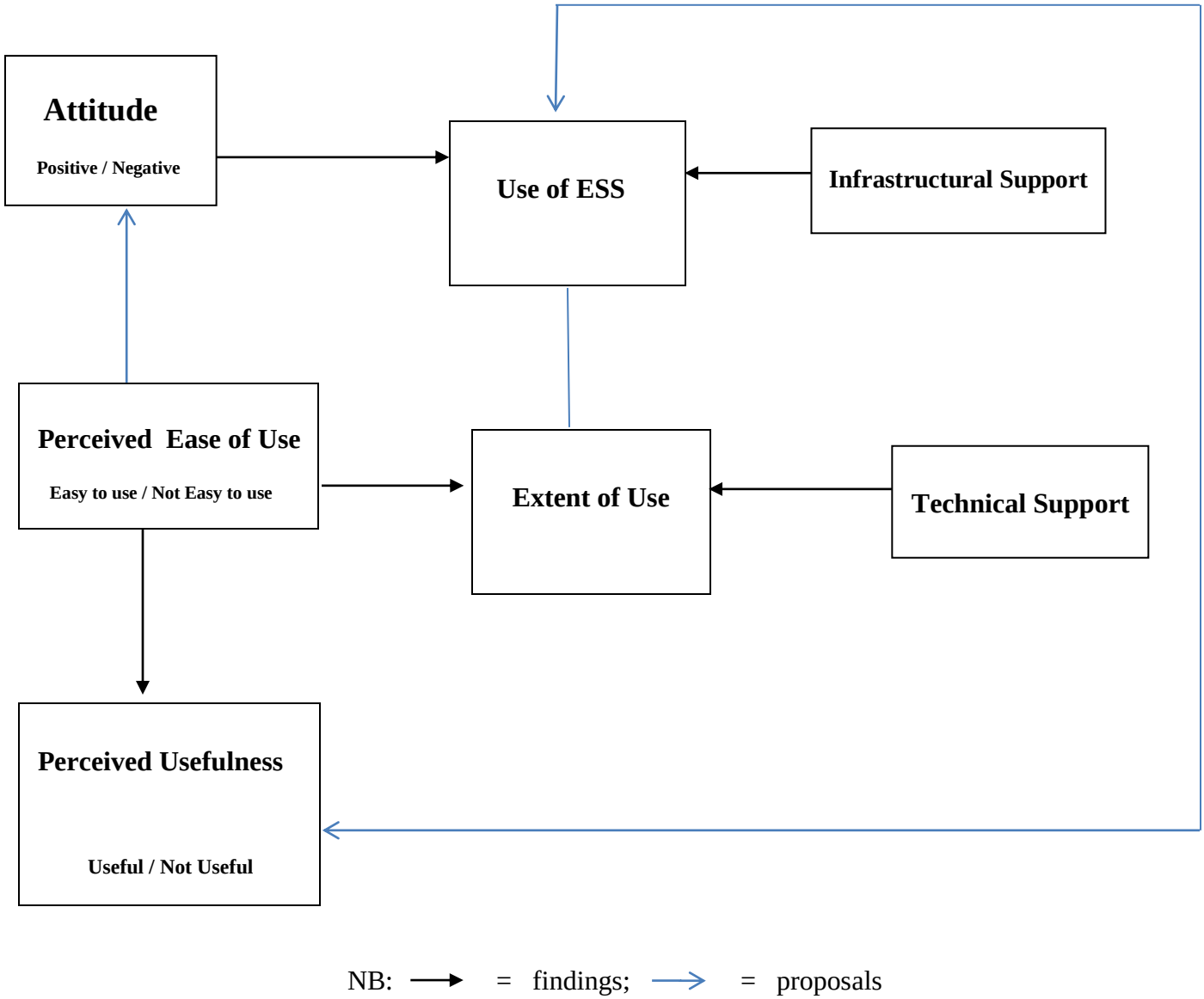

Figure 4: The proposed Library Educators' ESS Use Model (LEEUM)

The LEEM shows attitude of educators and infrastructural support affecting the use of ESS for teaching as found in the unpublished research study by Akinde (2016). In the use of ESS for teaching, the model proposes that the extent of use should be considered. In view of this, the study found, as shown in Figure 4, that perceived ease of use and technical support may affect the extent of use of ESS for teaching. Furthermore, it was found (as shown) that, perceived

usefulness may be affected by perceived ease of use just as it is in TAM 1. It was hypothesised in TAM 1 and retained in LEEUM that, attitude may be affected by perceived ease of use (though, this hypothesis was not tested in the study). Finally, LEEUM suggests that perceived usefulness once established for a particular ESS may engender more use and usefulness. This explains the double-headed arrow in Figure 4. The LEEUM as shown in Figure 4 may be validated or refuted by future researchers to further the frontier of knowledge generally and in library and information science particularly.

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