

# A revised UTAUT model to investigate E-health acceptance of health professionals in Africa

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## ABSTRACT

The past two decades has seen research in the adoption of information and communication technology (ICT). E-health application is an emerging information technology in the health industry which has the potential to improve access to health care and providing quality and effective service delivery in Africa. However, the adoption and diffusion of E-health in Africa and other developing countries is slow and a complex issues. For a successful implementation of information technology applications, the attitude and a commitment of stakeholders should be considered. The behavioral intention of health care professionals is critical for successful E-health implementation. The paper highlights that though several studies about technology adoption exist, little attention has been given to E-health acceptance decision in Africa. The purpose of this paper is to revise the generic unified theory of acceptance and use of technology (UTAUT) model to include other constructs and moderators that can be tested for adoption of E-health in health care settings in Africa. The contribution of this paper is in terms of building theory in the combined areas of health care and ICT.

**Keywords:** *E-health, Technology Acceptance, Health Informatics, Developing Countries, Africa.*

## 1. INTRODUCTION

The rapid growth of information and communication technology (ICT) and its ability to transcend borders has had tremendous impact in the way we live, communicate, work, transact business and socialize. In this information age, communication networks such as local area networks (LANs), intranets, wide area networks (WAN) and the Internet enable people to access large amounts of information. ICT application enables providers to deliver health care faster and more efficiently [1].

The Internet, which is the fastest growing aspect of ICT in history [2], is a useful technological tool connecting millions of computers and users around the world, providing access to information faster and more efficiently to the end user [3] and services at low expense [4, 5]. Hence the world has now become a global village via the Internet. The Internet serves as a tool with a huge potential for health care organizations to deliver quality, cost effective, care to geographically dispersed populations [1, 6]. The popularity of the Internet resonates around all the continents of the world. With the world population around 7 billion, the Internet penetration rate, the population that uses the Internet is 23% [7].

In Africa there are on-going initiatives to increase access to ICT to leverage opportunities to the underserved populations, and to increase productivity and innovation in the public and private sectors [8]. Some stakeholder initiatives include the International Telecommunication Union (ITU), the New Partnership for Africa's Development (NEPAD), the UN Economic Commission for Africa (UNECA), and the Global Knowledge Partnership [8].

In health care practice, E-health is a relatively new term which encompasses a range of health care services supported by ICT. The World Health Organization [9] (2005) defines E-health as "the cost-effective and secure use of ICT in support of health and health care related fields, including health-care services, health surveillance, health literature, and

health education, knowledge and research". Health care organizations around the world see E-health as a strategic tool for providing quality health care, and overcoming the challenges faced in the health sector [6, 10, 11]. Health care organizations in the developed nations are making substantial investment in E-health in order to achieve competitive advantage [12]. Kwankam [13] highlights the following benefits of E-health for developing countries:

- a. E-health can enable the practitioners to offer services beyond their physical reach. ICT tools such as decision support systems (DSS) and networks can enable less experienced practitioners to remotely access expertise help to make better and informed decisions.
- b. E-health makes health information available to health care consumers, and therefore makes health care consumers active participants in the health care delivery process.
- c. E-health changes the focus from individual record based systems to knowledge about the health of populations.

Mair et al. [14] highlight that the success of E-health implementation requires the collaboration of stakeholders such as health care consumers, health professionals, policymakers, public officials, researchers, and academia. The role of health care professionals is important in leveraging health information technology in the health care industry to enhance quality care [15]. The WHO (2004) report on E-health indicates that E-health projects have failed in many countries due to failures to identify and deal with constraints including:

- lack of proper needs assessment;
- lack of vision, strategy and national plans;
- lack of information and awareness about E-health for health-care delivery applications;
- computer illiteracy;
- insufficient resources to meet costs;

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- limited expertise in medical informatics;
- weak information and telecommunications infrastructures;
- absence of legislative, ethical and constitutional frameworks.

In the technology diffusion process of 25 hospitals in the United States of America researched by Meyer and Goes [16], it was found that organization structural variables attributed to a variance of 10%, while organizational cultural variables such as attitudes and perceptions attributed to 40% of the variance in adoption success.

### 1.1 Challenges in Current Health Care and the Role of E-health

The health care organizations in developing countries are confronted by multiple medical problems. Several diseases such malaria, dysentery, cholera, typhoid, yellow fever and diarrhoea, plague the continent, leading to the loss of millions of lives every year. Shortage of medical

personnel is another major problem faced by African countries. Africa has an acute shortage of doctors, particularly specialists [17]. Insufficient health infrastructure is also another problem facing African countries.

ICT has the ability to reduce the effects of geographical isolation, enable remote access to data and provide the platform for the sharing of medical information and support [18]. Tan [19], asserts that E-health is a new paradigm for healthcare systems, encompassing both processing and telecommunication technologies. The adoption of E-health can reduce costs of health care systems, provide quality health care delivery and also improve efficiency [20]. E-health also provides the potential benefits of linking developed and developing countries to enhance sharing of knowledge, resources and tools to improve health, education and research [21]. Massaih (2008) further explains that E-health can increase access to health services, improve quality, and raise productivity (table 1).

**Table 1:** Some benefits of E-health services based on access, quality and productivity

Access	Quality	Productivity
Reduce waiting time for diagnostic and laboratory results	Better interpretation of diagnostic and laboratory results	Increase access to integrated patient data
Improved availability of community based health services	Decrease adverse drug event	Reduce duplication of test and prescriptions
Reduce patient travel time and access to services	Decrease prescription errors	Reduce physician prescription call-backs
Increase patient participation in home care	Increase speed and accuracy detecting infections and disease outbreaks	Reduce patient and provider travel cost

Chismar and Wiley-Patton [11], believes that E-health is a strategic tool for health care organizations to overcome some of the challenges they face. With the continuous advancement in ICT and the growth of the Internet, researchers have predicted increasing demand for ICT by health care organizations (An, 2005; Kerwin, 2002). Core services in the health industry would in the future be determined by ICT, and developing countries are ready to invest in ICT to maximize the opportunities [22].

## 2. MODELS OF TECHNOLOGY ACCEPTANCE

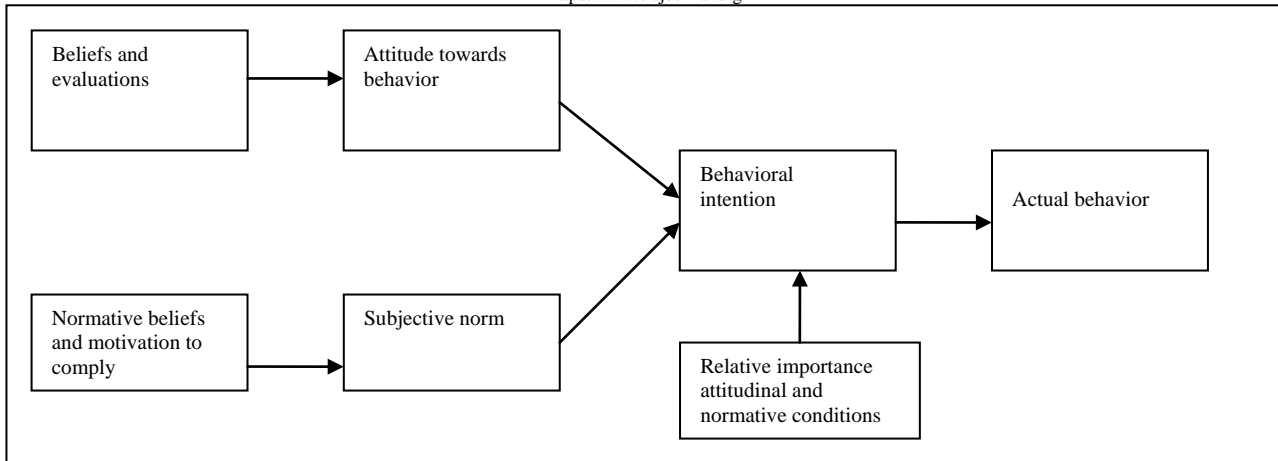
The issue of technology acceptance has been studied quite extensively in information systems (IS) and ICT research investigating the theories and models that can be used to predict and explain behavior across many domains [23]. Some of the notable models considered in this study include: Theory of Reasoned Action (TRA), The Theory of Planned Behavior (TPB), Diffusion of

Innovation (DOI), The Technology Acceptance Model (TAM), The Unified Theory of Acceptance and Use of Technology (UTAUT).

### 2.1 Theory of Reasoned Action (TRA)

Ajzen and Fishbein [24] developed the Theory of Reasoned Action which finds its origins in the field of social psychology. TRA has been successful in predicting and explaining behavior across a wide variety of domains. The TRA focuses on the role of attitudinal, social influence, and intention variables to predict behavior. It is hypothesized by the TRA that an individual's behavior is a function of his or her intentions that attitudes and subjective norms are mediated through behavioral intention and that behavioral and normative beliefs are mediated through their attitude and subjective norm. Demographic factors, personality characteristics, beliefs concerning objects, attitudes towards objects, task characteristics, and situational variables are the external variables (Figure 1).

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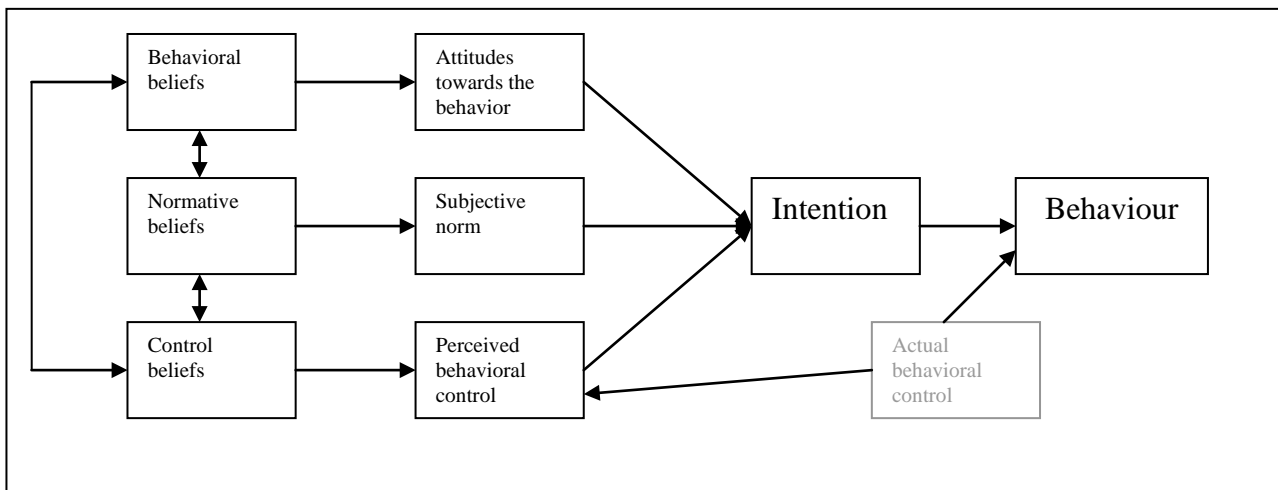


**Fig 1:** Theory of Reasoned Action (Ajzen & Fishbein, 1980)

**2.2 The Theory of Planned Behavior (TPB)**

Ajzen (1991) proposed the Theory of Planned Behavior (TPB), which is based on TRA and extends it with the aim of better explaining an individual’s behavior in specific situations. TPB postulates that an individual’s

behavior is determined by a joint function of intention and perceived behavioral control. Behavioral intention in turn is determined by a function of the attitude toward the behavior, subjective norms and perceived behavioral control (Figure 2).



**Fig 2:** Theory of Planned Behavior diagram (Ajzen, 1991)

**2.3 Innovation Diffusion Theory (IDT)**

Innovation Diffusion Theory (IDT) by Rogers [25] was derived from sociology and explains the events of the innovation decision process: (1) the innovation, (2) communication channels, (3) time, and (4) the social system (figure 3). The theory suggests that individuals can be classified according to their rate of adoption of

innovations: innovators, early adopters, early majority, late majority and laggards. An individual’s attitude towards the innovation and ultimately its adoption is influenced by the following variables: relative advantage, compatibility, complexity, trial ability, and observability (Figure 3).

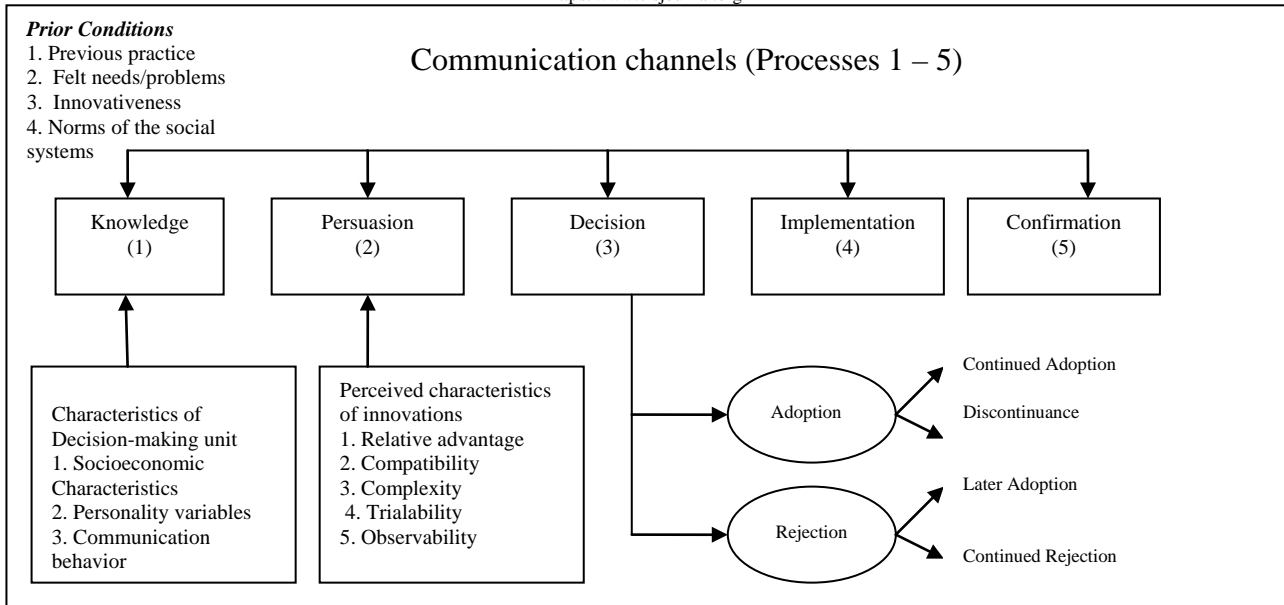


Fig 3: A model of stages in the Innovation-Decision Process (Rogers 1995)

**2.4 Technology Acceptance Model (TAM)**

The technology acceptance model (TAM) [26] was developed to explain user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified. TAM, which was also developed from TRA, focuses on the attitudinal explanation of intention to use a specific technology or service. Devaraj, Fan and Kohli [27] assert that the development of TAM was the starting point for researchers wanting to predict end-user acceptance of ICT.

TAM posits that an individual’s attitude toward the use of a technology is determined by two factors: perception of usefulness and ease of use of that technology. This attitude influences their intention to use the technology (Figure 4). Davis [26] explained perceived usefulness as the degree to which an individual believes that using a particular system will enhance his or her job performance while perceived ease of use is the degree to which an individual believes that using a particular system is free of physical and mental effort.

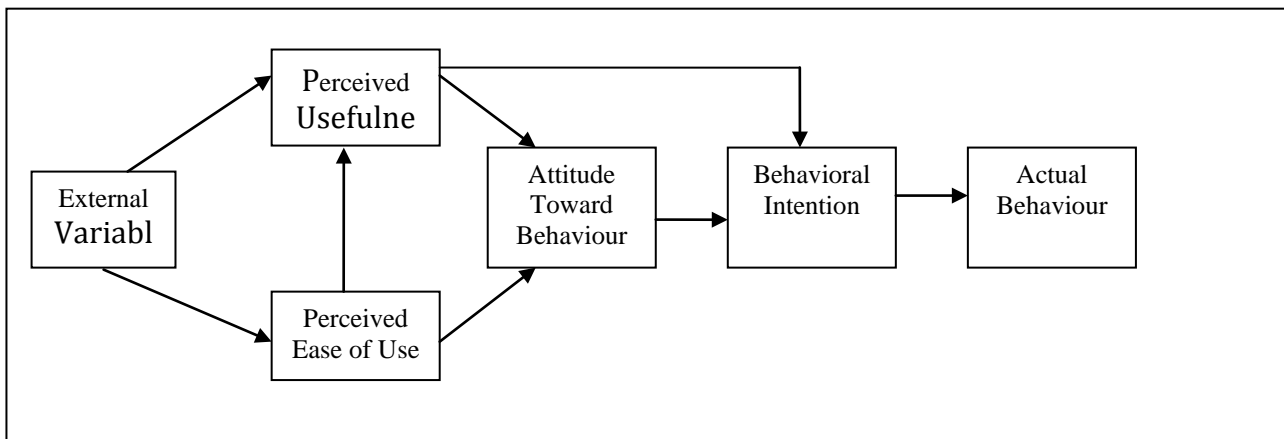
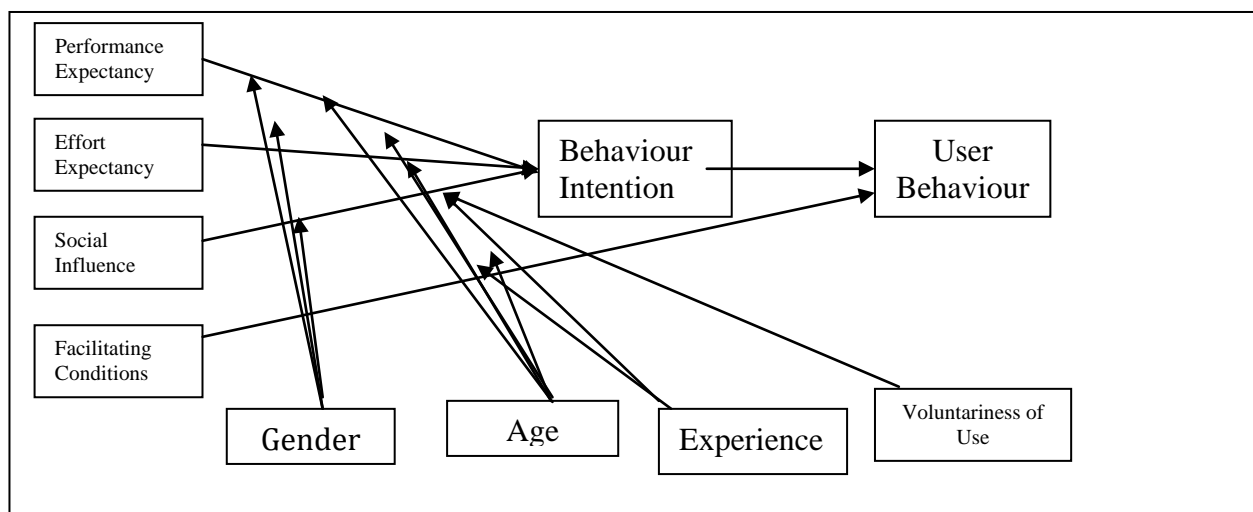


Fig 4: Technology Acceptance Model (TAM) (Davis, Bagozzi & Warshaw, 1989)

**2.5 Unified Theory of Acceptance and Use of Technology (UTAUT)**

The Unified Theory of Acceptance and Use of Technology was developed by [28] to present an integrated view of user acceptance and usage of new technology. The models reviewed and integrated into UTAUT include TRA, TPB, TAM, TAM2, IDT, Motivational Model [29], Model of PC Utilization

(MPCU) [30] and Social Cognitive Theory (SCT) [31]. UTAUT integrates four core determinants of intention and usage with up to four moderators of key relationships (Figure 5). The four key constructs, performance expectancy, effort expectancy, social influence, and facilitating conditions, affect intention to use. The key moderators in the model are gender, age, voluntariness and experience.



**Fig 5:** Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)

### 3. RESEARCH IN E-HEALTH TECHNOLOGY ACCEPTANCE

Several research works have used technology acceptance models, including TAM and UTAUT, to examine technology acceptance within health care organizations. Many previous studies have adopted and expanded TAM and UTAUT with additional constructs. Nuq [32] applied UTAUT to investigate E-health marketing services in developing countries. The attitude of physicians, nurses and health system executives toward acceptance of an electronic health record (EHR) application was explored by Seligman [33] using TAM. Chiu [34] applied UTAUT in E-health services among Chinese Canadians caring for a family member with dementia. Kowitlawakul [35] used TAM to examine the applicability of the model in explaining nurses'

acceptance of telemedicine technology in a health care setting. Aldosari [36] also used TAM to examine physician attitudes toward EHR adoption. The willingness of customers to adopt technologies in health care services was examined in Finland by Sintonen [37] using TAM.

Baroud [38] explored stakeholder readiness to adopt e-health in the Palestinian healthcare system in the Gaza Strip. Koivunen [39] applied TAM to describe the acceptance and use of information technology (IT) among health care professionals working in psychiatric hospitals. Table 1 demonstrates the diversity of studies completed in recent years using TAM and UTAUT in health care settings.

**Table 2:** Technology acceptance studies in health organizations

Author	System/Application
An [40]	E-Health
Carlsson, Carlsson, Hyvonen, Puhakainen and Walden [41]	Adoption of mobile devices
Hu, Chau, Liu Sheng, and Tam [42]	Telemedicine
Han, Harkke, Collan and Tetard [43]	Mobile E-health
Schaper [44]	ICT and occupational therapists, E-health
Lubrin, Lawrence, Zmijewska and Navarro [45]	Health care wireless sensor
Chau and Hu [46]	Telemedicine
Lubrin, Lawrence, Zmijewska, Navarro and Culjak [47]	Using notes to monitor health
Jung [48]	E-health
Han, Mustonen, Seppanen and Kallilo [49]	E-health
Duyck et al., [50]	Monitoring the PACS of Health care system
Liang, Xue, & Byrd [51]	PDA usage
Wang et al., [52]	E-health, e-prescription
Or, Karsh, Severtson and Brennan [53]	E-health

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#### 4. REVISED UTAUT FOR E-HEALTH ACCEPTANCE BY HEALTH PROFESSIONALS

Literature relating to theories of technology adoption shows that the UTAUT has the highest power in explaining behavior intention and usage than any of the other theories [28]. UTAUT also gives better understanding about the factors that determine behavior intentions [28]. However to apply UTAUT in certain

special IT application such as E-health in Africa, it is important to modify the model as recommended by Venkatesh et al. (2003). Figure 6 shows the revised UTAUT model which includes:

- a. satisfaction of E-health by users
- b. geographical location of users [54]
- c. the culture of Africans

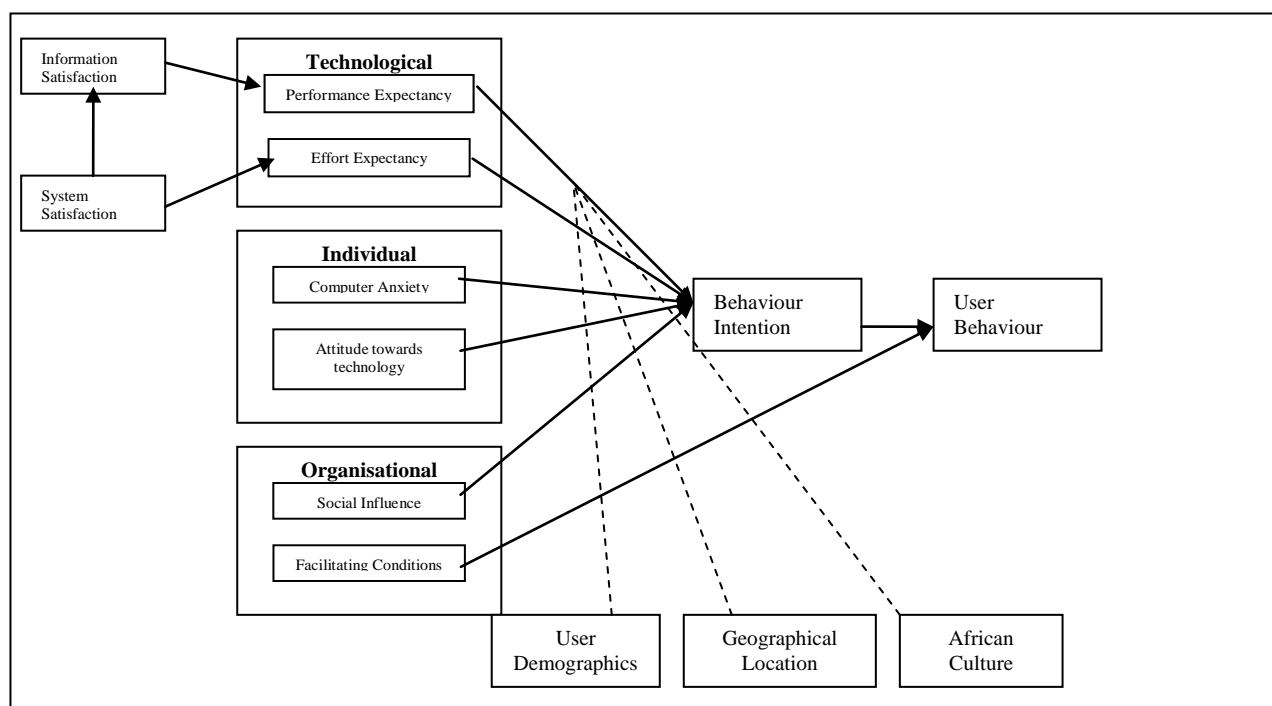


Fig 6: Revised UTAUT model

#### 5. RESEARCH METHODOLOGY THAT CAN BE USED TO TEST THE REVISED UTAUT MODEL

The research question should be the most significant influence to guide the direction of the research methodology [55, 56]. The choice of methodology to test the revised UTAUT model should be designed to capture a cross-sectional or longitudinal picture of a case study, focus groups etc. of E-health applications acceptance by healthcare professionals. Cook & Reichardt [57] suggested that, 'a researcher should not adhere blindly to one of the polar-extreme paradigms that have been labelled quantitative and qualitative but can freely choose a mix of attributes from both paradigms so as to best fit the demands of the research problem at hand' p.19.

Qualitative research methods are often used to explore a phenomenon in its natural setting [58, 59] and provide a context to develop understanding or meaning through the opinions of people [60], narrative and observation [61, 62]. Creswell, [63], views quantitative approach as an inquiry into an identified problem, based on testing a theory composed of variables, measured with numbers, and analyzed using mathematical or statistical

techniques, with the goal of determining whether the predictive generalizations of the theory hold true. It is recommended that a mixed method be adopted as suggested by Cook & Reichardt [57].

#### 6. CONCLUSION

Health care, which spans across all ages, genders, races, culture and geographical boundaries, is an area of concern in both developed and developing countries. To apply UTAUT to the acceptance of E-health by health professionals in Africa, this paper proposes a revision of the model to include satisfaction of E-health by users; geographical location of users and the culture of Africans. The paper also recommends that, the methodology to test the revised UTAUT model should be designed to capture a cross-sectional or longitudinal picture of a case study, focus groups etc. of E-health applications acceptance by health care professionals.

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