Towards A Framework for E-Medicine Knowledge Management in Uganda, Nigeria and Ethiopia

Stephen Robert Isabalija (PhD)
Victoria University, Kampala- Uganda
Geoffrey Mayoka Kituyi
Makerere University Business School, Kampala - Uganda

Abstract
This study therefore was intended to fill-in the e-medicine knowledge management gap in Africa by developing a theoretical framework that would help in harnessing utilizing and preserving e-medicine using telemedicine platforms in Africa. This paper proposes a knowledge management framework to ensure Knowledge sharing and management which will go a long way in solving the problems of resource-poor settings in SSA. A qualitative research design was used, although some quantitative methods were used. Structural equation modeling was used to develop and test the new framework. Findings indicate that knowledge management practices strongly influenced the sustainable e-medicine outcomes in Ethiopia, Nigeria, and Uganda. The study did not survey many of the actual users of e-medicine; we mainly worked with doctors, nurses IT specialists and administrators. This study correlates with Uwe (2002) about the "brain gain" hypothesis that seeks to reverse the conclusion of brain drain by many scholars and deduces that through a remigration of elites with good knowledge management practices, the human capital stock will increase and so does the potential growth of the developing countries. This study also reveals that the notion of information science researchers on e-medicine emphasis on ICT;s, this study recognizes that ICT is not sufficient to ensure improvement in the well-being of the underprivileged ,rather, application of ICT should be supplemented with appropriate social protection policies which would enable the poor to actually benefit from information/knowledge. knowledge management in the health sector remains a key factor in sustainability of e-medicine. The framework presented in this paper will provide a good guiding basis for managing e-medicine knowledge in developing countries.

Keywords: E-Medicine, Telemedicine, Knowledge Management, Knowledge Sharing, Knowledge Transfer, Africa

Introduction

E-medicine, also commonly referred to as telemedicine has been applied to a wide area of image-dependent medical specialties, such as radiology, pathology, cardiology and dermatology (Ekeland&Flottorp, 2010; Brauchiet al., 2004; Nordrumet al., 1998; Wootton, 2003). In addition, telemedicine has also served medical education, home care, military and prison applications, and urgent distance care. To a certain degree, the literature of telemedicine agrees that its maturity level may be higher with such image-dependent specialties as radiology and pathology (Doarn& McVeigh et al., 2010; Bashshuret al., 2005; Heinzelmannet al., 2003; Krupinskiet al., 2002; Tulu et al.,2005; Wootton, 2003) It is not surprising that these image-dependent specialties have been most successful in terms of establishing quality standards, outlined by such professional organizations as Digital Imaging and Communication in Medicine (DICOM) (Weisseret al., 2006).

A number of forms of telemedicine exist. However, at present, there is a growing body of evidence that store-and-forward (asynchronous) telemedicine, using low-cost digital imaging devices, provides a means of medical diagnosis is most applicable in many situations (Ekeland&Flottorp., 2010; Heinzelmannet al.,2005; Kifleet al., 2006b; Martinez et al., 2004; Swinfen&Swinfen, 2002; Struber, 2004; Taylor et al., 2003; Vassalloet al., 2001a, 2001b). This type of application is less expensive, as there is no live interaction between the sender and receiver, and is used for nonemergency situations where diagnosis is made after results arrive. Additionally, there has been growing interest in low-cost telemedicine initiatives in the developing world (Brauchliet al.,2004; Fraser et al.,2001; Mitka, 1998; Rigby, 2002; Wootton, 2001b).

Over the past decades, many organizations and hospitals have implemented telemedicine across Africa. Although most of these initiatives have not succeeded, little efforts have been made to conserve,share and properly utilize the knowledge provided over these platforms. Many researchers argue that this is because of the digital divide that is very prevalent in African communities.

The digital divide refers to the gap between individuals, households, businesses, and geographic areas at different socioeconomic levels with regard both to their opportunities to access information and communications technologies (ICTs) and to their use of the Internet for a wide variety of activities. It includes the imbalance both in physical access to technology and the resources and skills needed to effectively participate as a digital citizen. Africa continues to lag behind in the technologies and telephone penetration. For example, Africa has 1.6 fixed lines per 100 inhabitants compared to the rest of the world, which is at 17.1 per 100 inhabitants (ITU, 2010). However, this trend is improving as more and more Africans have started using ICTs. Therefore, their capacity and capabilities to access, share and utilize e-medicine are growing. What remains a challenge is how these technologies should be utilized to manage knowledge. This paper makes a contribution by proposing a knowledge management framework for e-medicines in Africa.

Telemedicine Practices

Telemedicine technologies have been and are still being used for: (1) clinical services; (2) diagnostic and information services; and (3) learning in the healthcare sector. *Clinical* *applications* support the access and delivery of clinical care at a distance; they capture, organize, store, and share clinical information among providers as well as between providers and patients. The information collected is typically needed for patient assessment, diagnosis, and treatment. For example, rural hospitals can obtain readings of teleradiological images from urban centers that normally would have the capability and resources to employ senior and highly qualified radiologists. *Diagnostic and information services* include four subcategories: *teleconsulting, teleconferencing, telereporting,* and*telemonitoring.* In teleconsultation, a patient consults with a health care provider by means of a telemedicine service. A teleconference has two or more health care workers communicating over a video tape link to share the responsibility for the patient, who is usually not present in this scenario. Both telereporting and telemonitoring involve the transmission of relevant health information by a clinician to a remote center for interpretation. After analysis, the information is sent back to the clinician. There is only one small difference between the last two subcategories: in telemonitoring, patient data are collected continuously or at intervals, whereas in telereporting, the transmission is usually done only once. E-learning applicationsprovide for online, Internet-based, and remote delivery of training and education services, such as continued medical education (CME) for physicians and other health care professionals via videoconferencing.

Theoretical Grounding and Research Questions

Four critical determinants of e-medicine transfer applicable to the SSA context may be found in the extant literature. The first of these is national IT policies (Mbarika&Mbarika, 2006; Meso& Duncan, 2000) that affect the transfer of IT. This concern dates back to the 1970s through the early 1990s, when dictatorial governments (especially in SSA) deliberately hindered penetration of computers and the Internet. This move was typically due to self-interested political reasons with the goal of limiting citizens' access to information that could weaken their dictatorial regimes (Meso et al., 2006; Parker, 1992; Chowdary, 1992; Pisciotta, 1994). Such regimes have generally slowed down the transfer of IT to their countries.

Second, e-medicine implementation factors also play an important role. These factors include the same considerations as IT implementation in general: the involvement of technology champions or institutions (Kifle et al., 2005; King et al., 1994) to promote implementation of such technologies.

Third, e-medicine transfer to developing countries is hindered by poor IT infrastructures. For example, SSA countries are characterized by extremely low levels of basic telephone penetration (Mbarika, 2004).

A fourth factor is the inherent cultural differences between makers of the technologies, based in developed countries, and users of the technologies in developing countries (Loch et al., 2000; Straub et al., 2002).

Inherent Cultural Distance between Locals and Expatriates

There has been a considerable amount of research examining the cultural dimensions of IT diffusion, and a few studies have examined the cultural effects on technology in sub-Saharan Africa (Hasan and Ditsa, 1999; Korpela, 1996) comparing Australian, West African, and Middle

Eastern information systems development environments, found that cultural predisposition played a part in differential results. However, studying the root causes of organizational obstacles to IT diffusion among the Yoruba ethnic group in Nigeria, Korpela(1996) concluded that culture per se had little influence on the effectiveness of ICT in that society. Rather, he argued that a historical political economy that hindered true democracy played a far more important role. Similarly, Okoli (2003) found that stakeholders believed that culture had relatively little effect on the adoption of e-business in small and medium enterprises in SSA.

With the conflicting results in the literature, we are hesitant to make a definite proposition as to the effect or non-effect of culture, especially considering that cultural effects would not be unique to a theory of ICT transfer in developing countries. However, one feature that stands out in most ICT projects in developing countries is the presence of foreign consultants who come from a culture quite different from that of the locals who will use the ICTs. We believe that regardless of the cultural biases of the locals, or even of the expatriates who introduce the technology, potential conflicts due to cultural differences could jeopardize the success of projects. House and others (2004) presented extensive empirical evidence of significant cultural differences among global societies, and they warn of the hazards of cross-cultural organizational interactions where cultural differences are not adequately considered (p. 5).

Managers who work in the international arena are steeped in their own culture. They have lived many years of their lives in their own countries, have been educated there, and have spent years working there. As an experienced executive search expert pointed out, “Global business makes sense, but it is much more difficult to do it than talk about it. The American manager prides himself or herself on directness, frankness, being in-your-face, being accountable. But that’s almost unique in the world (Ehrlich, 2002, p. 235).In fact, directness, frankness, and “being in-your-face” are offensive behaviors in many parts of the world, including Asia, Latin America, and the Nordic European countries.

With most ICT transfers in SSA involving participants from around the world, cultural differences can be acute, leading to severe problems in governance. Managers appointed in ICT transfers are mostly Western and implement Western work practices that do not follow regional templates. The problem is compounded when the composition of the workplace is multiethnic, consisting of people from the same region with distinct clan and tribal loyalties. If differences are not reconciled, successful ICT transfers are jeopardized. Thus, rather than making direct cultural propositions here, as numerous studies have already done, we focus on the dangers of not reconciling cultural differences. This is a serious concern considering the present situation of telemedicine in SSA, where African locals would almost always need to invite foreigners to assist them in establishing projects.

Knowledge Management and sustainability of E-medicine

Researchers differ in their understanding of how knowledge should be managed whether, it as an object or as a process. If knowledge is seen as an object in knowledge management, the focus should be on the construction and management of the knowledge stock. If perceived as a process, the focus should be on the processes of distribution, sharing and creation of knowledge. We concur that knowledge should be viewed as a process and organizational knowledge should be viewed as knowledge shared by individuals and which is better explained and understood through the necessary conversion of tacit into explicit knowledge and consideration of its individual and social dimensions (Isabalija et al., 2010; Brito et al., 2010; Nonaka& Takeuchi, 1995; Sveiby, 1997).

Knowledge management is a product of a process developed over time and through which individual effort and organizational collective practices allow for socialization and integration of diverse types of knowledge. Individual knowledge is necessary for the development of organizational knowledge, but this is not the simple sum of individual knowledge (Boateng&Isabalija, 2009; Bhatt, 2000).

Knowledge management at the organizational level can also be formed through distinctive formations of interaction among technology, tactics and people, which cannot easily be imitated by other organizations, inasmuch as these interactions are formed by the unique history and culture of the organization and have implications for knowledge management (Isabalija et al.,2010; Boateng& Isabalija,2009; Moloto& Buckley, 2010; Huber,1989) argues that an organization learns when any of its components has acquired information and has this information available for use, either by other components or by itself, on behalf of the organization. Thus in both scenarios whether individually or collectively as an organization, what is stressed is the accessibility of what is known to others for usage. As such, several perspectives can exist concerning a given problem based on the information individuals and/or subunits may have, emphasizing that the possibilities of effective learning lie in bringing all this information to bear and to contribute to the definition of solutions. It is through this accessibility and action that the power of knowledge is harnessed to solve problems, preserve valuable heritage, and initiate new situations for the present and future (Liao, 2003).

Consequently, it becomes critical that the day-to-day work environment within an organization should favor learning processes that support the accessibility and utilization of knowledge in order to maximize returns and sustainability (Kessels, 2001). Knowledge management plays an important role in the organization, maintenance, retrieval, navigation, and presentation of knowledge assets in efficient and effective ways (Moloto& Buckley, 2010). An estimated 20,000 professional knowledge workers (such as doctors, nurses, teachers, engineers, scientists) are leaving African countries every year and more than half of foreign-born students who get doctorates in the United States stay in the United States. It is estimated that 30,000 Africans holding a Ph.D. are working outside Africa. These numbers are likely to remain high and even increase, as industrialized countries need to attract knowledge workers to compensate for low birth- rates and to fill unwanted jobs. There is a wealth of knowledge among Africans in the Diaspora that could be better exploited (Hamel, 2005). With telemedicine or e-medicine, the trend can be reversed to brain gain if the knowledge of the health professionals in the Diaspora from many African countries can be tapped without necessarily calling them back to Africa but giving the same knowledge to African counterparts in urban and rural areas for replication-hence, sustainability of the initiatives in tele-medicine.

Accordingly, the essence of collective knowledge is synergy; two plus two can equal five or even six. If two people exchange knowledge with each other, both gain information and relativelyexperience linear growth (Davenport &Probst, 2001). But if both share their knowledge withothers and feedback the new information gained, the benefits become exponential (Hope &

Hope, 1997). As Spender, 1996 argues, collective knowledge is thus more secure and has more strategic significance than individual knowledge and by comparison, it is less volatile and less easily affected by staff turnover (Chua, 2002).

Knowledge Management for Sustainability in Institutional and Social Environments

Social network analysis (Wasserman & Faust, 1994; Scott, 2000; Henry, 2008) provides the conceptual tools necessary to describe an agent's opportunities for knowledge management and learning through the social environment, and suggests some predictions concerning the relationship between network structure, knowledge, and behavior. From an analytic standpoint, learning via social influence is essentially the same as diffusion (Adam, 2008).

Throughout a social network, there has been a great deal of work in the networks literature focusing on how structure promotes or hinders diffusion processes See Newman (2003) for a review. The applied settings of these models are diverse, ranging from the spread of disease to the spread of panic in a social network. Work in this vein that bears a closer relationship to learning processes investigates how network structure influences the emergence of cooperative behavior amongst a population of agents engaged in a prisoner's dilemma type of situation (Ohtsuki et al., 2006).

The core insight of this literature is that network structure strongly influences the outcomes of social interaction, including social learning. Thus, models of learning must explicitly address how the position of agents within a network influences the learning process. The detail with which these dynamics are specified depends on the needs of the model. At a minimum, however, models must specify the importance of social influence processes, and (if social influence is considered to be an important component of learning), models should include a variable that captures an agent's proximate social environment.

Research design

A sample of 416 was selected from hospitals in Uganda (135), Nigeria (150) and Ethiopia (131) using a snow-balling sampling.Snow-balling sampling is a form of non-probability sampling to select the participants for the qualitative data (Polit&Hunglar, 1999). This method was used because of the difficulties in identifying the medical organizations. We already knew medical organizations exposed to e-medicine in one form or another because they are seen as instances that are likely to produce the most valuable data (Rea & Parker, 1997). The participants were knowledgeable in health management and education, they should be able to write and read the English language because the consent form was written in that language. In effect, they were selected with a specific purpose in mind, and that purpose reflects the particular qualities of the participants chosen and their relevance to the topic under investigation. Such methods of inclusion may produce bias (Frey, Botan& Kreps, 2000). However, this potential limitation was considered worth incurring to maximize the chances for obtaining a conceptually rich data set in light of the targeted population.

Furthermore, Dane (1990) points out the advantage of snowballing as that of the researcherhoming in on the population, which has good grounds for what they believe, which was critical for this research. Instead of going for the typical instances, a cross-section or a balanced choice, the researcher was able to concentrate on instances which display wide variety – possibly even focus on extreme cases to illuminate the research questions at hand. In this sense it was not only economical but also informative in a way that conventional probability sampling could not be used (Descombe, 1998). The aim of the study was to explore the quality of the data, not the quantity (Nachmias, 1996). One justification for using the non-probability snowballing is that it stems from the idea that the research process is one of "discovery" rather than testing of hypotheses. It is a strategy which Lincoln &Guba (1985) describe as emergent and sequential. Almost like a detective, the researcher follows a trail of clues, which lead the researcher in a particular direction until the questions have been answered and things can be explained Robson(1993). The researcher must have the insight, the ability to give meaning to data, the capacity to understand, and capability to separate the pertinent from that which is not (Strauss and Corbin, 1990). The theorists believe that theoretical sensitivity comes from a number of sources, including professional literature, professional experiences, and personal experiences. The credibility of a qualitative research outcome relies heavily on the confidence readers have in the researcher's ability to be sensitive to the data and to make appropriate decisions.

Qualitative analysis was conducted to answer the research questions and garner a descriptive interpretation of the study constructs and relationships. The interpretation was also used to assess the credibility of the model as a sensitizing framework within the population under study. Trustworthiness was maintained as illustrated in Table 1:

Table 1: Met Trustworthiness Criteria

Traditional Criteria	Trustworthiness Criteria	Measurement of Criteria
Internal Validity	Credibility	— Two months spent in the field — Working with research assistants — Interviews, observations, surveys — Discussions with e-medicine stakeholders regarding experiences.
External Validity	Transferability	— Purposive and theoretical sampling. — One hour interviews and negative case analysis — Extensive thematic development and interview excerpts.
Objectivity	Conformability	— Records of analytic process. — Records of conceptual redevelopment, theoretical insights, facial expressions, and body language
Reliability	Dependability	— Snow balling. — Accurate records maintained. — Participant’s confidentiality protected.

In summary, reliability refers to the degree to which a survey instrument is consistent and stable in measuring what it is intended to measure. The instrument is reliable if it is consistent within itself and across time. Validity refers to the degree to which the instrument actually measures what it claims to measure.

Validity determines the extent to which inferences, conclusions, and decisions made on the basis of a psychometric instrument are appropriate and meaningful. Therefore, validity is a prerequisite to testing for reliability. If a test is not valid, then reliability is also doubtful.

Choice of Statictical Technique

An R package Lavaan for structural equation modeling (Rosseel, 2011) was used to estimate all parameters for the framework. The Lavaan package provides support for both confirmatory factor analysis and structural equation modeling. Confirmatory factory analysis is theory driven. Therefore, the planning of the analysis was driven by the theoretical relationships among the observed and unobserved variables in the study. For each country, two CFA models were estimated. The first model constituted the lower parts of the framework where the latent variables are the degree of donor involvement, technology transfer project and the knowledge management system. The second model constituted the upper parts of framework, where the latent variables are social, institutional, and technology environments. In both models, these latent variables are measured with different observed Likert-based scales. The objective of confirmatory data analysis is testing hypothesis one and two. The models were used to examine the extent of interrelationships and covariation (or lack thereof) among the latent constructs. The models were used to estimate factor loadings and residual variances to determine best indicators of latent variables prior to testing a structural model (Rosseel, 2010)

The structural equation model combines exploratory factor analysis and multiple regressions (Ullman, 2001). Actually, SEM is a combination of both CFA and multiple regressions. However, SEM, in comparison with CFA, extends the possibility of relationships among the latent variables and encompasses two components: (a) CFA a measurement model and (b) a structural model representing the relation of CFA and e-medicine outcomes. The measurement model of SEM is the two CFA models and depicts the pattern of observed variables for those latent constructs in the hypothesized model. The structural or regression models show the interrelations among latent constructs and observable variables in the proposed model as a succession of structural equations.

Movements in the model are influenced by two effects: direct and indirect effects. A direct effect represents the effect of an independent variable (exogenous) on a dependent variable (endogenous). For example, knowledge management system and technical environment have a direct effect on e-medicine sustainability outcome. An indirect effect represents the effect of an independent variable on a dependent variable through a mediating variable. For example, the social environment has an indirect effect on e-medicine sustainability, coming through institutional and technical environment. The total effect of all latent variables is the summation of the direct and indirect effects of these variables on e-medicine outcome. The objective of the structural equation model was to test the theoretical propositions regarding how technical environment and knowledge management systems are theoretically linked and the directionality of significant relationships.

Interpretation and Discussionof Results

Tests for Construct Reliability and Validity

Results of the reliability and validity tests are presented in Table 2 Results on the estimated Cronbach's coefficient indicated that items included to measure all seven domains in each country strongly measure the expected latent construct (α>0.8). This implies that the questions asked were clear enough and there were enough questions asked to create the intended measure or scale. Results also indicate that all items in the domains were all measuring similar latent constructs (α>0) and were on the same scale.

Reliability assesses the degree to which items are consistent in measurement. This study applied the R ITM Package option to estimate the Cronbach alpha which is mostly used for internal consistency (Cronbach&Meehl, 1955; Nunnally, 1994). Cronbach's alpha reliability coefficient normally ranges between 0 and 1. The closer Cronbach's alpha coefficient is to 1.0, the greater the internal consistency of the items in the scale. Based upon the formula = rk / [1 + (k 1) r], in which k is the number of items considered and r is the mean of the inter-item correlations, the size of alpha is determined by both the number of items in the scale and the mean inter-item correlations. George and Mallery (2003) provide the following rules of thumb: "_ > .9 – Excellent, _ > .8 – Good, _ > .7 – Acceptable, _ > .6 – Questionable, _ > .5 – Poor, and < .5 – Unacceptable"

(p. 231). While increasing the value of alpha is partially dependent upon the number of items in the scale, the study noted that an alpha of .8 is probably a reasonable goal. Literature also notes that while a high value for Cronbach's alpha indicates good internal consistency of the items in the scale, it does not mean that the scale is one-dimensional. In this study, for all country sites the Cronbach's alpha was greater than (> 0.8), which was considered good internal consistency.

Table 2: Estimated Cronbach's Coefficient Alpha

Variable	Ethiopia	Uganda	Nigeria
All Items	**0.899**	**0.909**	**0.927**
Excluding IE1	**0.895**	**0.909**	**0.924**
Excluding IE2	**0.896**	**0.908**	**0.924**
Excluding IE3	**0.895**	**0.911**	**0.927**
Excluding IE4	**0.896**	**0.911**	**0.924**
Excluding IE5	**0.897**	**0.909**	**0.927**
Excluding TE1	**0.901**	**0.909**	**0.927**
Excluding TE2	**0.899**	**0.910**	**0.927**
Excluding TE3	**0.897**	**0.910**	**0.926**
Excluding SE1	**0.898**	**0.909**	**0.923**
Excluding SE2	**0.898**	**0.908**	**0.927**
Excluding SE3	**0.898**	**0.909**	**0.927**
Excluding SE4	**0.899**	**0.908**	**0.927**
Excluding DI1	**0.898**	**0.906**	**0.926**
Excluding DI2	**0.899**	**0.909**	**0.926**
Excluding DI3	**0.899**	**0.909**	**0.926**
Excluding DI4	**0.898**	**0.908**	**0.926**
Excluding TTE1	**0.899**	**0.905**	**0.927**
Excluding TTE2	**0.901**	**0.904**	**0.927**

Excluding TTE3	**0.899**	**0.904**	**0.927**
Excluding KM1	**0.896**	**0.904**	**0.924**
Excluding KM2	**0.896**	**0.904**	**0.924**
Excluding KM3	**0.894**	**0.905**	**0.923**
Excluding KM4	**0.894**	**0.904**	**0.925**
Excluding KM5	**0.896**	**0.904**	**0.924**
Excluding KM6	**0.894**	**0.905**	**0.927**
Excluding KM7	**0.892**	**0.906**	**0.925**
Excluding KM8	**0.899**	**0.904**	**0.922**
Excluding KM9	**0.895**	**0.906**	**0.923**
Excluding KM10	**0.899**	**0.908**	**0.923**
Excluding ST1	**0.896**	**0.904**	**0.923**
Excluding ST2	**0.895**	**0.902**	**0.923**
Excluding ST3	**0.896**	**0.907**	**0.923**
Excluding ST4	**0.896**	**0.906**	**0.923**
Excluding ST5	**0.895**	**0.905**	**0.924**
Excluding ST6	**0.895**	**0.907**	**0.923**
Excluding ST7	**0.893**	**0.910**	**0.923**
Excluding ST8	**0.898**	**0.910**	**0.923**
Excluding ST9	**0.897**	**0.908**	**0.923**
Excluding ST10	**0.897**	**0.906**	**0.926**

Table 3 shows the estimated coefficients for Ethiopia's Confirmatory Factor Analysis as related to Donor Involvement, Technology Transfer Project Environment and Knowledge Management Practices Relationship. In the table estimates are estimated parameters, Std.err are standard error Std.lv and Std., respectively represent estimates of the model when items are standardized and the latent variables are not standardized and when both variables are standardized. The latter is often called the completely standardized solution.

Results of Model 2 for Ethiopia (Table 3), indicate that all item loading were statistically significant at p-value<0.01. Therefore, we reject the null hypothesis and accept the alternative that all items included in the model influence the respective latent variables. Likewise, the residual variances are statistically significant at p-value<0.01, rejecting the null hypothesis that the items are measured without errors. It can also be seen that there is a statistically significant positive co-variation (p-value<0.05) between donor involvement and knowledge management practices. This means that the two latent variables influence each other. However, there is no co-variation between donor involvement and technology transfer project environment, knowledge management practices and Technology project transfer environment

Based on these results the standardized loadings (last column) indicate the importance of each item at loading on the respective latent variables. For example, DI2 with a loading factor of 0.888 was important than DI1 witha loading factor of 0.954. The item DI4 was the least important, with a loading factor of 0.576.

Table 3: Confirmatory Factor Analysis Results for Ethiopia on Donor Involvement, Technology Transfer Project Environment, and Knowledge Management Practices Relationship

Observed and Latent Variables	Estimate	Std.err	Z-value	P(>|z|)	Std.lv	Std.all
Donor Involvement						
DI1	**1.000**				**1.015**	**0.854**
DI2	**1.093**	**0.096**	**11.342**	**0.000**	**1.110**	**0.888**
DI3	**0.937**	**0.102**	**9.157**	**0.000**	**0.951**	**0.724**
DI4	**0.724**	**0.106**	**6.843**	**0.000**	**0.735**	**0.576**
Technology Transfer Project Environment						
TTE1	**1.000**				**1.104**	**0.777**
TTE2	**1.143**	**0.114**	**10.061**	**0.000**	**1.262**	**0.929**
TTE3	**0.891**	**0.094**	**9.496**	**0.000**	**0.984**	**0.791**
Knowledge Management Practices						
KM1	**1.000**				**0.798**	**0.584**
KM2	**1.258**	**0.212**	**5.942**	**0.000**	**1.004**	**0.654**
KM3	**1.337**	**0.221**	**6.038**	**0.000**	**1.067**	**0.669**
KM4	**1.459**	**0.227**	**6.418**	**0.000**	**1.165**	**0.733**
KM5	**1.266**	**0.210**	**6.035**	**0.000**	**1.010**	**0.669**
KM6	**1.694**	**0.249**	**6.793**	**0.000**	**1.352**	**0.804**
KM7	**1.625**	**0.243**	**6.696**	**0.000**	**1.297**	**0.785**
KM8	**0.990**	**0.200**	**4.940**	**0.000**	**0.790**	**0.511**
KM9	**1.162**	**0.200**	**5.813**	**0.000**	**0.927**	**0.634**
KM10	**0.764**	**0.195**	**3.912**	**0.000**	**0.610**	**0.387**
Covariance Among Latent Variables						
Donor involvement with						
Technology transfer project environment	**0.146**	**0.111**	**1.322**	**0.186**	**0.131**	**0.131**
Knowledge management practices	**0.202**	**0.086**	**2.351**	**0.019**	**0.249**	**0.249**
Technology transfer project environment						
Knowledge management practices	**-0.056**	**0.086**	**-0.648**	**0.517**	**-0.063**	**-0.063**
Variances						
DI1	**0.383**	**0.078**	**4.891**	**0.000**	**0.383**	**0.271**
DI2	**0.331**	**0.084**	**3.930**	**0.000**	**0.331**	**0.212**
DI3	**0.819**	**0.118**	**6.924**	**0.000**	**0.819**	**0.475**
DI4	**1.087**	**0.143**	**7.585**	**0.000**	**1.087**	**0.668**
TTE1	**0.801**	**0.128**	**6.253**	**0.000**	**0.801**	**0.397**
TTE2	**0.253**	**0.110**	**2.292**	**0.022**	**0.253**	**0.137**

TTE3	**0.577**	**0.096**	**6.001**	**0.000**	**0.577**	**0.374**
KM1	**1.233**	**0.162**	**7.613**	**0.000**	**1.233**	**0.659**
KM2	**1.349**	**0.182**	**7.397**	**0.000**	**1.349**	**0.572**
KM3	**1.405**	**0.191**	**7.337**	**0.000**	**1.405**	**0.552**
KM4	**1.166**	**0.166**	**7.005**	**0.000**	**1.166**	**0.462**
KM5	**1.261**	**0.172**	**7.339**	**0.000**	**1.261**	**0.553**
KM6	**0.998**	**0.157**	**6.375**	**0.000**	**0.998**	**0.353**
KM7	**1.048**	**0.159**	**6.589**	**0.000**	**1.048**	**0.384**
KM8	**1.766**	**0.227**	**7.765**	**0.000**	**1.766**	**0.739**
KM9	**1.280**	**0.171**	**7.468**	**0.000**	**1.280**	**0.598**
KM10	**2.117**	**0.267**	**7.930**	**0.000**	**2.117**	**0.851**
DE	**1.031**	**0.179**	**5.748**	**0.000**	**1.000**	**1.000**
TTE	**1.219**	**0.243**	**5.012**	**0.000**	**1.000**	**1.000**
KM	**0.637**	**0.182**	**3.496**	**0.000**	**1.000**	**1.000**

Results of Model 1 in Uganda (Table 4) also indicate that all item loadings were statistically significant p-value<0.01. Therefore we reject the null hypothesis and accept the alternative that all items included in the model influence the respective latent variables. The study also reports that most of the residual variances were statistically significant at p-value<0.01(apart from TTE 2 (P-Value<0.01= 0.187). We therefore reject the null hypothesis that the items are measured without errors. It can also be seen that there was a statistically significant positive co-variation (p-value<0.05) between donor involvement and knowledge management practices. This means that the two latent variables influence each other. There was co-variation between technology transfer project environment and knowledge management practices.

Based on these results, the standardized loadings (last column) indicate the importance of each item at loading on the respective latent variables. For example, In Uganda KM2 with a loading factor of 0.955 was more important than KMI1 with a loading factor of 0.904. The item KM 10 was the least important with a loading factor of 0.514.

Table 4: Confirmatory Factor Analysis Results for Uganda on Donor Involvement, Technology Transfer Project Environment and Knowledge Management Practices Relationship

Observed and Latent Variables	**Estimate**	**Std.err**	**Z-value**	**P(>|z|)**	**Std.lv**	**Std.all**
Donor Involvement						
DI1	**1.000**				**0.568**	**0.480**
DI2	**1.008**	**0.270**	**3.738**	**0.000**	**0.572**	**0.405**
DI3	**2.077**	**0.374**	**5.558**	**0.000**	**1.179**	**0.865**
DI4	**2.091**	**0.377**	**5.539**	**0.000**	**1.187**	**0.900**
Technology Transfer Project Environment						
TTE1	**1.000**				**1.041**	**0.881**
TTE2	**1.096**	**0.057**	**19.104**	**0.000**	**1.141**	**0.986**
TTE3	**0.989**	**0.061**	**16.221**	**0.000**	**1.030**	**0.910**

Knowledge Management Practices						
KM1	**1.000**				**1.315**	**0.904**
KM2	**0.942**	**0.048**	**19.516**	**0.000**	**1.239**	**0.955**
KM3	**0.811**	**0.053**	**15.407**	**0.000**	**1.067**	**0.874**
KM4	**0.711**	**0.055**	**13.005**	**0.000**	**0.934**	**0.809**
KM5	**0.441**	**0.065**	**6.734**	**0.000**	**0.580**	**0.527**
KM6	**0.610**	**0.068**	**8.941**	**0.000**	**0.802**	**0.649**
KM7	**0.437**	**0.058**	**7.575**	**0.000**	**0.574**	**0.576**
KM8	**0.649**	**0.066**	**9.879**	**0.000**	**0.853**	**0.692**
KM9	**0.730**	**0.078**	**9.384**	**0.000**	**0.960**	**0.670**
KM10	**0.509**	**0.078**	**6.530**	**0.000**	**0.669**	**0.514**
Covariance Among Latent Variables						
Donor involvement with						
Technology transfer project environment	**0.234**	**0.071**	**3.291**	**0.001**	**0.396**	**0.396**
Knowledge management practices	**0.126**	**0.074**	**1.707**	**0.088**	**0.169**	**0.169**
Technology transfer project environment						
Knowledge management practices	**0.788**	**0.148**	**5.331**	**0.000**	**0.575**	**0.575**
Variances						
DI1	**1.077**	**0.137**	**7.867**	**0.000**	**1.077**	**0.770**
DI2	**1.675**	**0.210**	**7.979**	**0.000**	**1.675**	**0.836**
DI3	**0.466**	**0.128**	**3.634**	**0.000**	**0.466**	**0.251**
DI4	**0.332**	**0.123**	**2.701**	**0.007**	**0.332**	**0.191**
TTE1	**0.311**	**0.045**	**6.983**	**0.000**	**0.311**	**0.223**
TTE2	**0.036**	**0.027**	**1.319**	**0.187**	**0.036**	**0.027**
TTE3	**0.221**	**0.035**	**6.297**	**0.000**	**0.221**	**0.173**
KM1	**0.387**	**0.059**	**6.574**	**0.000**	**0.387**	**0.183**
KM2	**0.147**	**0.032**	**4.551**	**0.000**	**0.147**	**0.088**
KM3	**0.351**	**0.050**	**7.040**	**0.000**	**0.351**	**0.236**
KM4	**0.461**	**0.061**	**7.529**	**0.000**	**0.461**	**0.346**
KM5	**0.876**	**0.109**	**8.055**	**0.000**	**0.876**	**0.723**
KM6	**0.887**	**0.112**	**7.938**	**0.000**	**0.887**	**0.579**
KM7	**0.663**	**0.083**	**8.016**	**0.000**	**0.663**	**0.668**
KM8	**0.791**	**0.101**	**7.870**	**0.000**	**0.791**	**0.521**
KM9	**1.133**	**0.143**	**7.907**	**0.000**	**1.133**	**0.551**
KM10	**1.248**	**0.155**	**8.063**	**0.000**	**1.248**	**0.736**
DE	**0.322**	**0.115**	**2.790**	**0.005**	**1.000**	**1.000**
TTE	**1.083**	**0.168**	**6.460**	**0.000**	**1.000**	**1.000**
KM	**1.729**	**0.257**	**6.740**	**0.000**	**1.000**	**1.000**

Results of Model 2 in Nigeria (Table 5) Further indicate that all item loadings were statistically significant at p-value<0.01. The study therefore rejected the null hypothesis and accepted the alternative that all items included in the model influence the respective latent variables. The study also reports that all of the residual variances were statistically significant at p-value<0.01, we therefore reject the null hypothesis that the items were measured without errors. It can also be seen that there was a statistically significant positive co-variation (p-value<0.05) between Donor Involvement, Technology Transfer Project Environment, and Knowledge Management Practices. This means that the two latent variables influence each other. There was co-variation between

Technology Transfer Project Environment and Knowledge Management Practices, though not statistically significant.

Based on these results, the standardized loadings(last column) indicate the importance of each item at loading on the respective latent variables. For example, Nigeria TTE2 with a loading factor of 0.879 was more important than TTE3 with loading factor of 0.810. The item TTE1 was the least important, with a loading factor of 0.674.

Table 5: Confirmatory Factor Analysis Results for Nigeria on Donor Involvement, Technology Transfer Project Environment and Knowledge Management Practices Relationship

Observed and Latent Variables	Estimate	Std.err	Z-value	P(>|z|)	Std.lv	Std.all
Donor Involvement						
DI1	**1.000**				**1.193**	**0.929**
DI2	**1.014**	**0.063**	**16.119**	**0.000**	**1.210**	**0.948**
DI3	**0.622**	**0.090**	**6.891**	**0.000**	**0.742**	**0.516**
DI4	**0.538**	**0.093**	**5.787**	**0.000**	**0.642**	**0.447**
Technology Transfer Project Environment						
TTE1	**1.000**				**0.825**	**0.674**
TTE2	**1.132**	**0.135**	**8.407**	**0.000**	**0.934**	**0.879**
TTE3	**1.002**	**0.121**	**8.300**	**0.000**	**0.827**	**0.810**
Knowledge Management Practices						
KM1	**1.000**				**1.078**	**0.715**
KM2	**1.074**	**0.122**	**8.841**	**0.000**	**1.158**	**0.762**
KM3	**1.122**	**0.121**	**9.268**	**0.000**	**1.210**	**0.800**
KM4	**0.690**	**0.111**	**6.212**	**0.000**	**0.744**	**0.534**
KM5	**0.991**	**0.117**	**8.482**	**0.000**	**1.068**	**0.730**
KM6	**0.389**	**0.109**	**3.586**	**0.000**	**0.420**	**0.308**
KM7	**0.951**	**0.149**	**6.394**	**0.000**	**1.025**	**0.549**
KM8	**1.202**	**0.132**	**9.085**	**0.000**	**1.296**	**0.783**
KM9	**0.912**	**0.118**	**7.746**	**0.000**	**0.983**	**0.666**
KM10	**0.839**	**0.110**	**7.641**	**0.000**	**0.905**	**0.657**
Covariance Among Latent Variables						
Donor Involvement With						
Technology Transfer Project Environment	**0.474**	**0.108**	**4.370**	**0.000**	**0.482**	**0.482**
Knowledge Management Practices	**0.174**	**0.116**	**1.502**	**0.133**	**0.135**	**0.135**
Technology Transfer Project Environment						
Knowledge Management Practices	**0.025**	**0.082**	**0.308**	**0.758**	**0.029**	**0.029**
Variances						
DI1	**0.225**	**0.071**	**3.166**	**0.002**	**0.225**	**0.137**
DI2	**0.166**	**0.071**	**2.346**	**0.019**	**0.166**	**0.102**
DI3	**1.516**	**0.179**	**8.460**	**0.000**	**1.516**	**0.734**
DI4	**1.645**	**0.193**	**8.523**	**0.000**	**1.645**	**0.800**
TTE1	**0.815**	**0.110**	**7.429**	**0.000**	**0.815**	**0.545**
TTE2	**0.256**	**0.072**	**3.532**	**0.000**	**0.256**	**0.227**
TTE3	**0.358**	**0.067**	**5.356**	**0.000**	**0.358**	**0.344**
KM1	**1.113**	**0.145**	**7.694**	**0.000**	**1.113**	**0.489**
KM2	**0.971**	**0.132**	**7.378**	**0.000**	**0.971**	**0.420**
KM3	**0.825**	**0.118**	**7.012**	**0.000**	**0.825**	**0.361**
KM4	**1.389**	**0.167**	**8.294**	**0.000**	**1.389**	**0.715**

KM5	**0.998**	**0.131**	**7.602**	**0.000**	**0.998**	**0.467**
KM6	**1.683**	**0.196**	**8.564**	**0.000**	**1.683**	**0.905**
KM7	**2.429**	**0.294**	**8.262**	**0.000**	**2.429**	**0.698**
KM8	**1.058**	**0.147**	**7.185**	**0.000**	**1.058**	**0.386**
KM9	**1.211**	**0.153**	**7.923**	**0.000**	**1.211**	**0.556**
KM10	**1.076**	**0.135**	**7.959**	**0.000**	**1.076**	**0.568**
DE	**1.422**	**0.200**	**7.122**	**0.000**	**1.000**	**1.000**
TTE	**0.680**	**0.155**	**4.379**	**0.000**	**1.000**	**1.000**
KM	**1.163**	**0.239**	**4.872**	**0.000**	**1.000**	**1.000**

Discussion Conclusion and Recommendations

Researchers differ in their understanding of how knowledge should be managed whether, as an object or as a process. If knowledge is seen as an object in knowledge management, the focus should be on the construction and management of the knowledge stock. If perceived as a process, the focus should be on the processes of distribution, sharing and creation of knowledge. The study concurs that knowledge management should be viewed as a process and organizational knowledge as shared by individuals which is better explained and understood through the necessary conversion of tacit into explicit knowledge and consideration of its individual and social dimensions (Isabalija et. al., 2010; Brito, et al., 2010; Nonaka& Takeuchi, 1995; Sveiby 1997).

The results of our studyrevealed that knowledge management practices strongly influenced the sustainable e-medicine outcomes in Ethiopia, Nigeria, and Uganda. The results support the general trend in SSA where knowledge of the health professionals in the diaspora from many African countries is being tapped without necessarily calling them back to Africa but giving the same knowledge to African counterparts in urban and rural areas for replication; hence, sustainability of the initiatives in telemedicine.

For instance, knowledge management on satellite-enhanced e-health and telemedicine for sub-Saharan Africa has been initiated by European organizations; African stakeholders and the World Health Organization pool their efforts towards a program for building a sustainable, satellite-enhanced e-health and telemedicine network for the whole of sub-Saharan Africa, embracing as a key element African ownership. This initiative does not only offer continuing professional knowledge education via satellite to health workers in selected underserved areas, but also provides clinical services that support rural healthcare facilities in the management of patients by linking them to African medical centers of excellence.

The essence of collective knowledge management is relative to sustainable e-medicine outcomes. This is because the sharing of knowledge withother professionals has greater benefits than when it is not shared (Hope & Hope, 1997). As Spender (1996) argues that collective knowledge, is thus more secure and has more strategic significance than individual knowledge, and by comparison it is less volatile and less easily affected by staff turnover (Chua, 2002).

Limitations

The study also did not survey many of the actual users of e-medicine; we mainly worked with doctors, nurses IT specialists and administrators. The study recognizes that the actual users of e-medicine could have a different perspective to e- medicine sustainability though it could have been difficult to identify the actual users of e-medicine with statistically meaningful samples without the data bases that this study recommends. The next study will use databases but for purposes of this study, the sample was adequate.

Research implications and contribution

This study correlates with Uwe (2002) about the "brain gain" hypothesis that seeks to reverse the conclusion of brain drain by many scholars and deduces that through a remigration of elites with good knowledge management practices, the human capital stock will increase and so does the potential growth of the developing countries. This study seeks to establish knowledge management platforms to ensure Knowledge sharing and management which will go a long way in solving the problems of resource-poor settings in SSA

This study also reveals that the notion of information science researchers on e-medicine emphasis on ICT;s, this study recognizes that ICT is not sufficient to ensure improvement in the well-being of the underprivileged ,rather, application of ICT should be supplemented with appropriate social protection policies which would enable the poor to actually benefit from information/knowledge. Practicing information is not just a function of availability of options but depends on the supplementary policies that enable practicing in real life situations for long term sustainability. For Social orientation of the private sector not only the government, but the private sector should also be socially responsible.

References

Aynu, B. Okoli..C & Mbarika .V. (2003). IT Training in sub-Saharan Africa: A moderator of IT Transfer for Sustainable Development. *Proceedings of 4th Annual conference* 10,

Boateng, R., Isabalija, R.S. & Indome, R. (2010) Women Entrepreneurship in ICT Sector: A Case Study of Ghana, *Journal of International Management studies (JIMS),* Vol.10-4

Boateng, R., Isabalija, R.S.& Hinson, R. (2009) Learning and Transferring Knowledge in and between Organizational Projects, *Proceedings of International Academy of African Business 10th Conference.*

Brito, E., Cardoso, L., & Peralta, C. (2010). Conditionant Organizational Factors in Knowledge Management Processes. *Proceedings of the European Conference on Knowledge Management*, 155-165.

Checchi, R. M., G. R. Sevcik, K. D. Loch & D. Straub (2002). An instrumentation process for measuring ICT Policies and culture. *Proceedings of International Conference on Information Technology, Communications, and Development*. Kathmandu, Nepal, December 1-3, 2002.

Chowdary, T. H. (1992).Telecommunications restructuring in Developing countries. *Telecommunications Policy*, 16, pp. 591-602.

Dane, F. C(1990) – Research Methods , Brooks/Cole Publishing Company

Descombe, M.(1998) – The good research guide: For small-scale social research projects, Great Britain, Guildford & Kings.

Doarn, C. R.,McVeigh, F., & Poropatich, R. (2010). Innovative new technologies to identify and treat traumatic brain injuries: Crossover technologies and approaches between military and civilian applications. *Telemedicine and e-Health*, 16(3), 373-381.

Ekeland, A. G., Bowes, A., & Flottorp, S. (2010). Effectiveness of telemedicine: A systematic review of reviews. *International Journal of Medical Informatics*, 79(11), 736-771.

Fraser, H. and D. McGrath (2000). Economical solutions are available to support health care in remote areas. *British Medical Journal* (321), pp. 465-466.

Lincoln, Y. and Guba, E.G (1985) *Naturalist inquiry*, Sage Publications, Newbury Park, CA.

Isabalija, R.S., Banyanga, R., Boateng, R.& Mbarika, V. (2010) Knowledge management in the construction industry in Uganda, *International Journal of Business Research (IJBR)*,Vol.10-5

Isabalija, R.S., Banyanga, R., Boateng, R. & Mbarika, V. (2010) Knowledge management in the construction Industry in Uganda, *International Academy of Business and Economics 2010 Annual Conference*, Las Vegas, USA, October 17- 20, 2010.

ITU (2000). Telemedicine and developing countries. document 2/116, International Telecommunications Union, Geneva.

Kifle, M., V. Mbarika, P. Datta (2006). Interplay of Cost and Adoption of Tele-medicine in Sub-Saharan Africa: The Case of Tele-Cardiology in Ethiopia. *IS Frontiers*, (8:3), pp. 211-223.

Kifle, M., V. Mbarika & F. Shiferaw (2006) 'Ethiopia's Medical Challenges: Telemedicine as a Possible Solution', *Proceedings of the 6th Nordic International Conference on eHealth and Telemedicine*, Helsinki, Finland.

Kifle, M., V. Mbarika, F. Payton (2005). Testing integrative technology (Telemedicine) Acceptance Models among Ethiopian Physicians. *Proceedings of the 2005 Southeast Decision Sciences Institute (DSI) Conference*, Raleigh, NC.

King, J. ., V. Gurbaxani, K. L. Kraemer, F. W. McFarlan, K. S. Raman and C. S. Yap (1994). Institutional factors in information technology innovation. *Information Systems Research* (5:2), pp. 139-169.

Korpela, M. (1996).Traditional culture or political economy? On the root causes of organizational obstacles of IT in developing countries. *Information Technology for Development* (7:1), pp. 29-42.

Loch, K., D. W. Straub & S. Kamel (2000). Use of the Internet: A Study of Individuals and Organizations in the Arab World. *Proceedings of Global Information Technology Management Conference*, 2000.Global Information Technology Management Association.

Mbarika, V. & I. Mbarika (2006). Africa calling: burgeoning wireless networks connect africans to the world and each other. *IEEE Spectrum,* (43:5), May 2006, pp. 56 - 60.

Mbarika, V. (2004). Telemedicine in Africa- A Possible Panacea for Sub-Saharan Africa's Medical Nightmare. *Communications of the ACM,* (47:7), pp. 21 – 24.

Mbarika, V. & C. Okoli (2003). Telemedicine: A possible panacea for sub-Saharan Africa’s medical nightmare. *Proceedings of 36th Hawaii International Conference on System Sciences*. Waikoloa Village, Hawaii, January 6-9, 2003.

Meso, P., P. Datta, V. Mbarika (2006). Moderating information infrastructure’s effects on national development with good governance: a study of developing countries. *Journal of the American Society for Information Sciences and Technology*. (57:2), pp. 186-197.

Meso, P. and N. Duncan (2000). Can national information infrastructures enhance social development in the least developed countries? an empirical investigation. *Journal of Global Information Management Journal* (8:4), pp. 30-42.

Moloto, S., & Buckley, S. (2010) The acceptance of technology-based knowledge management systems by knowledge workers. *Proceedings of the International Conference on Information Management & Evaluation*, 244-253

Parker, E. B. (1992). Developing third world telecommunications markets. *The Information Society (*8) pp. 147-167.

Rosseel, Y. (2010). Lavaan: Latent variable analysis. R package version 0.4-3.

Straub, D. W., K. D. Loch, R. Evaristo, E. Karahanna & M. Srite (2002). Toward a theory based definition of culture. *Journal of Global Information Management* (10:1), pp. 13-23.