Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2005 Proceedings

Americas Conference on Information Systems (AMCIS)

2005

Testing a Modified TAM that Accounts for Realities of Technology Acceptance in Sub Saharan Africa

Philip F. Musa
University of Alabama at Birmingham, musa@uab.edu

Peter N. Meso
Georgia State University, pmeso@ggc.edu

Victor W. Mbarika
Southern University at Baton Rouge, victor@mbarika.com

Testing a Modified TAM that Accounts for Realities of Technology Acceptance in Sub Saharan Africa

Philip F. Musa, Ph.D., P.E.
The University of Alabama at Birmingham
E-mail: *musa@uab.edu*

Peter N. Meso, Ph.D.
Georgia State University
E-mail: *pmeso@cis.gsu.edu*

Victor W. Mbarika
Southern University, Baton Rouge, Louisiana
E-mail: *victor@mbarika.com*

ABSTRACT

One of the motivations for this paper is to enhance our understanding of the interactions that come to bear between some socio-economic development needs and factors generally innate to sub-Sahara Africa that manifest to impede technological adoption in the region. Developing countries, of which all sub-Sahara Africa countries are part, lag in adopting foreign technologies for various reasons, among which are institutional, cultural, geo-political, tribal, and economic policy factors. This research is an examination of some antecedents to the perceived user resource model, which in turn was developed from the original TAM literature; it also extends ideas espoused in Information Technology literature related to socio-economic development. We validate the model by analyzing survey data gathered in two representative Sub-Saharan Africa countries. We offer some diagnostics and prescriptions for how to effect a sustainable technological adoption and development across the region.

Key Words: Accessibility, Sub-Saharan Africa, Socio-economic Development, Precursors to Accessibility, Technology infrastructure, Positive-impact Factors, Negative-impact Factors, Partial Least Squares (PLS), Path Coefficient, TAM.

INTRODUCTION

While there has been considerable research on innovation adoption and diffusion especially in the rapid growth area of Information Technology, most has focused on developed countries (Mathieson et al., 2001; Straub, 1994; Gallivan, 2001). Most of technology adoption research presumes that technology is readily available, and the onus of accepting or rejecting it resides with the end user. However, this assumption falls short of realities in developing countries such as those in Sub-Saharan Africa. Countries in this region lag behind the rest of the world in basic socio-economic factors such as income, education, health, productivity, etc., all of which are pertinent to the day-to-day use of modern technologies (Mbarika et al., 2002).

To the vast majority of potential users in developing countries, adoption is not about choice, since universal access to technology is not available. It is noteworthy here that much of the IT infrastructure in sub-Saharan Africa is concentrated largely in metropolitan areas that account for less than 30% of the region's population. Furthermore, only a select few of those living in the metropolitan areas have access to information and communications technologies (ICTs), hence exacerbating the problem for what is recognized as the least developed region of the world. Given this scenario, it is no wonder that when it comes to Sub-Saharan Africa, ICTs are considered luxury items affordable largely by the "bourgeoisie" (Ansah, 1985; Mbarika et al., 2002).

Despite the plethora of models and studies on technology adoption in mainstream IS research, there are little or no known studies that examine technology adoption and the precursors thereof within the sub-Saharan African context. Several researchers have also reported that the original technology adoption model and other revised versions omit variables that may be important predictors of usage (Mathieson et al., 2001; de Vreede et al., 1999; Malhotra and Galletta, 1999).

This paper seeks to examine some of the antecedents to the technology acceptance model that accounts for some technology adoption dynamics and precursors in the context of Sub-Saharan Africa. Our study builds on the works of other researchers that have made notable contributions to the field of information technology adoption and

socio-economic development (e.g., Davis, et al., 1989; Mathieson, et al., 2001; de Vreede et al., 1999; Malhotra and Galletta, 1999; Madon, 2000).

One of the contributions we make in this research is to examine the influence of accessibility of ICTs and individual's perceptions of their immediate socio-economic environment on their acceptance and use of ICT. A second contribution relates to policy prescriptions of how best to effect a systematic development of infrastructure that leads to sustainable socio-economic development and requisite technologies that support the needs of a developing region. Why is technology adoption important for sub-Saharan Africa and other less developed regions? It is partly because adequate adoption allows a country to realize the impact of technology. At the end of the day, it is the impact of ICTs that is of most importance. Ultimately, it is the positive impact on human development that we seek to accomplish using ICTs and other means. Some questions that motivated the development of this paper include:

RQ1: Is accessibility of technology a precursor to an individual's adoption of a new technology? Said otherwise, does exposure to modern information technology lead to adoption?

RQ2: Is there a relationship between individuals' perceptions of the socio-economic environment and their accessibility to ICTs?

It would seem reasonable that we should not simply extrapolate the existing variations of technology acceptance models or experiences from the developed nations of the world to apply to Sub-Saharan Africa without accounting for various local circumstances. For example, based on how technology has evolved over time in developed countries, and the importance of learning curve, access and exposure to basic forms of technology over a period of time allows for a much easier progression to and acceptance of modern types of technologies. Yes such access remains a problem in most of SSA. The implication to developing countries is that everyone is telling them to jump on the technology superhighway band wagon, or be doomed. But technologies are not artifacts that could be adopted immediately by all of societies regardless of historical, cultural, or socio-economic conditions.

What further complicates the matter for Sub-Saharan Africa and other developing countries is that access to even the most basic of technologies largely remains a dream. What they yearn for is infrastructure for socio-economic developments, from which access and exposure to more modern technologies would follow. While we recognize the important role that ICTs play in today's world, we call attention to the evidence that point to the failure and waste which often results from sudden massive transfer of ICTs to a developing region with initial hopes of igniting the engines of social development (Odedra-Straub, 1996; Morales-Gómez and Melesse, 1998; Madon, 1999, Sein and Ahmad, 2001; Sein and Harindranath, 2004).

While we do not claim that there is a complete unlimited access to technology for those who live in developed countries such as the United States, it is hard to deny the relative ease of outright ownership or access to ICTs by those who live in developed countries through various means such as public libraries, schools, hotels, recreation centers, work places, etc. Therefore, we desire to analyze situations prevalent in countries or regions of the world where technologies are not readily accessible. Such situations are reminiscent of developing regions of the world, such as Sub-Saharan Africa. For example, out of the 690 million people in the region, a paltry 150,000 (or 2 out of 10,000) people had Internet dialup access in the year 2001 (Jensen, 2001).

The level of socio-economic development and sophistication in the use or application of the ICTs is also much higher in developed countries because they have had years of exposure to technology, going back to the most basic forms. The situation that prevails in a region such as Sub-Saharan Africa that has battled with a long history of deprivation in the most basic amenities is understandably different.

Prior to proceeding to present background research in this area, we mention a couple of limitations with this research. First, it is an exploratory study of antecedents to TAM specific for regions where technology accessibility is not a given. In this regard the predicated variables are examined in light of their influence on the 'independent' constructs in the TAM model namely Perceived ease of use and perceived usefulness. Since the study adopts the PUR model, an additional TAM variable to which our antecedents are examined is the Perceived Resources variable. Second, our aim is to bring attention to the influence of these antecedents to the acceptance and use of technology. Consequently, the discussion section limits itself to explaining the implications of these antecedents to the diffusion if ICTs. We stop short of discussing the implications of TAM variables on use since these have been adequately addressed in many previous studies.

TAM in the Context of Sub Saharan Africa

Several theoretical frameworks have been used to explain innovation adoption. Among them are the theory of planned behavior, theory of reasoned action, diffusion of innovations, social cognitive theory, technology acceptance model, etc. (Gallivan, 2001). An area of innovation adoption and diffusion that has received considerable attention, especially in Information Technology, is research that predicts whether individuals will

accept and voluntarily use a given technology. One of the most referenced models in this research stream is the Technology Acceptance Model (TAM). TAM proposes that successful adoption (acceptance) of technology is dependent on its usefulness and its ease-of-use (Davis, et al., 1989).

Researchers have studied TAM from various perspectives. One perspective looks at the influence of perceived user resources (Fishbein and Ajzen, 1975; Mathieson, et al., 2001). The Perceived User Resource (PUR) model (Figure 1) is an extension of the original TAM model that accounts for the user's perception of the relevance or adequacy of a given technology. Continuing along the genealogical lineage, TAM's roots come from the Theory of Planned Behavior (TPB), which came from psychological research in the area of the Theory of Reasoned Action (Fishbein and Ajzen, 1975; Mathieson, et al., 2001). Unlike the theory of planned behavior, TAM was developed to study the decision-making processes of users as to whether or not to adopt some information technology in various settings. Certainly, TAM has made major contributions to the field of Information Systems. A major reason for TAM's popularity is its practicality (relative to TPB). It is more parsimonious than TPB. Unlike TPB in which every situation requires unique operationalization, calling for the development of customized instruments for behavioral, normative, and control beliefs, TAM does not require such. Also, TAM has less constructs than TPB, making it easier to apply when predicting IS usage (Mathieson, et al., 2001).

In spite of its relevance and practicality, the original TAM model has some potential limitations when it comes to Sub-Saharan Africa. For example, TAM was based on studies in industrialized countries where accessibility to technologies already existed. When it comes to Sub-Saharan Africa where technology availability is grossly inadequate, using the TAM model in its original form would be a stretch. Therefore, this paper investigates the influences of access and individuals' perceptions of their socio-economic environment on acceptance and use of ICTs as articulated by the PUR (Mathieson, et al., 2001) extension of TAM (Figure 1). A detailed theoretical discussion of the perceived user resource model will not be presented in this paper, as that has already been presented by Mathieson, et al., [2001].

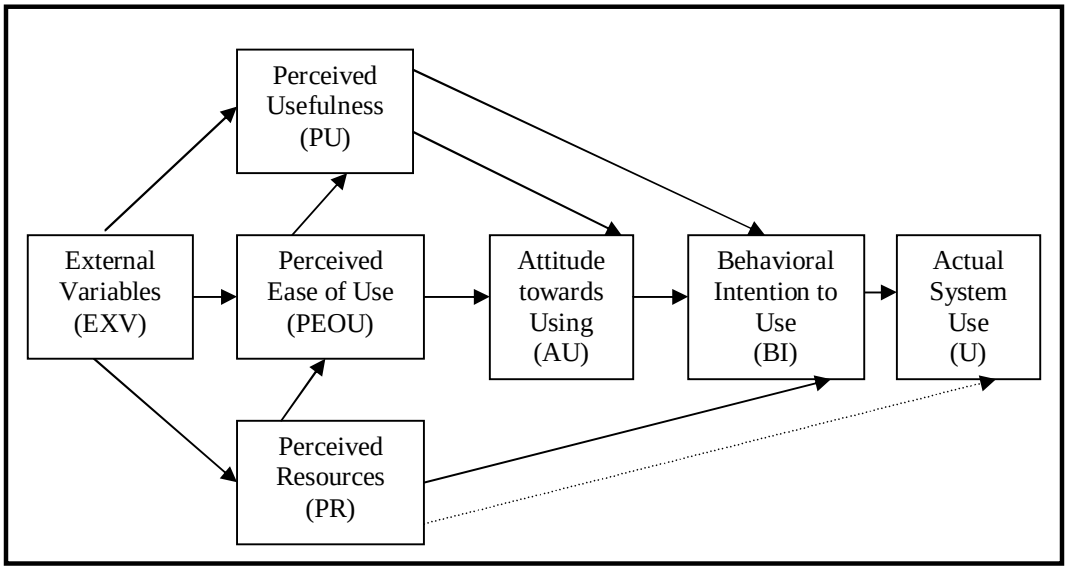

Figure 1: Influence of Perceived User Resource Model Extension from TAM [Adapted from Mathieson, et al., 2001]

The justification for focusing on and extending from here stems from the fact that the perceived user resource model already extends the original TAM model to account for users' perceptions of the resources at their disposal. In the Mathieson model (Figure 1), perceived user resources is designated by "PR", which is the extent to which an individual believes that he or she has the personal and organizational resources needed to use an Information System. The perceived user resources include factors such as skills, human assistance, hardware, software, time, documentation, and money (Mathieson, et al., 2001). In actuality, the factor "PR" is made up of reflective and formative components. The reflective component measures an overall perception of resource availability, while the formative components measure the perceptions of individual resources, such as expertise, training, hardware, money, etc. Since these items capture different resources, they are not necessarily correlated (Mathieson, et al., 2001). Previous research papers show that perceived usefulness and perceived ease of use are both predictors of technology adoption by individuals, with perceived usefulness being the stronger of the two

(Davis, et al. 1989; Gefen and Straub, 1997; Gefen et al., 2003; Malhotra and Galletta, 1999; Mathieson, et al., 2001; Venkatesh and Morris, 2000).

Another reason for selecting the Mathieson model as a logical point from which to develop and launch our model is that it is already resource-oriented. The rationale for focus on resource issues was based on the belief that it allows researchers, policy makers, and private investors a better delineation of factors over which managers may have some degree of control. It also helps keep the construct distinct from previously created constructs that deal with perceptions of users' abilities such as self-efficacy and skill (Compeau and Higgins, 1995; Mathieson, et al., 2001).

From here, we are able to explore potential antecedents to TAM that may be relevant and significant in the context of Sub Saharan Africa - for example, the factors that explicitly recognize the non-availability of technology in this region and similar developing regions of the world. Therefore, the model we develop shows interactions between socio-economic development and accessibility to technology in less developed countries. We also point out the effects of what we call negative and positive impact factors to development, and account for them in our new model.

ANTECEDENTS TO TAM FOR SSA: ACCOUNTING FOR ACCESSIBILITY AND EXPOSURE TO TECHNOLOGY

Figure 2 elaborates the antecedents to TAM that we posit as having a significant bearing on acceptance and use of ICTs. The new model incorporates the linkages between individuals' perceptions of factors of national development (socio-economic development) and technological infrastructure (as captured by accessibility to technology). The model also captures the linkage between accessibility and diffusion of ICTs as operationalized by TAM variables. Before we present the validation of the new model, we first give a discussion of and rationale for its constituent parts.

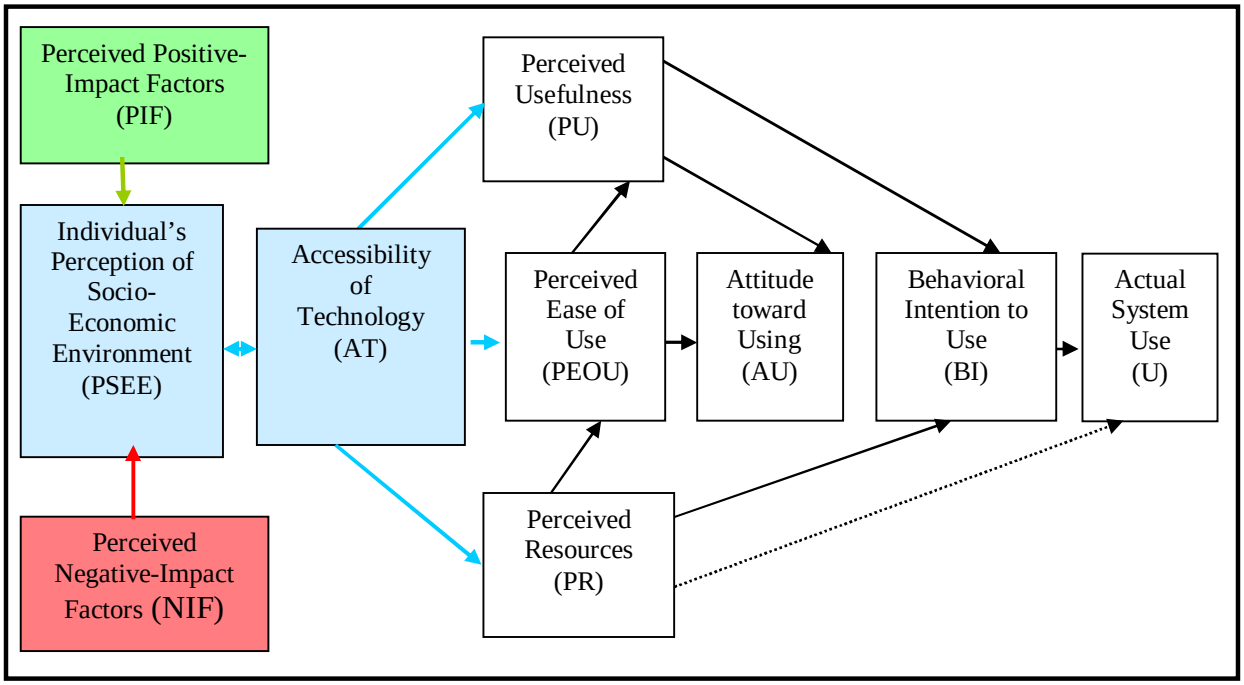

Figure 2: The Antecedents of TAM for SSA: Accounting for Accessibility of Technology

Need To Account For Accessibility and Exposure to Technology In TAM

The "Accessibility of Technology" in the new model shown in Figure 2 refers to the technology that is in place and available for use. This would include related ICTs such as computers, telecommunications networks, Internet, or any machinery or equipment that constitutes "a technology" in a user's world. Of relevance here is the fact that merely having access to technology is one thing, but the maturity and exposure of a user in the use of related technologies over time as well as the existence of appropriate technological infrastructure in a given region

significantly helps users to use a given technology to its full potential. In a 2004 study, it was reported that despite the proliferation of cellular phones across Sub-Saharan Africa in recent years, most of the use is limited to socialization and status symbol, with little or no business application such as M-Commerce (Meso, et al., 2004). This underscores our call for systematic exposure rather than sudden overdose or inundation by technologies without the supporting infrastructure, proper learning curve, relevance, or education to make it sustainable or meaningful.

As indicated in our new model, they impact the object labeled "Individual's Perception of Socio-Economic Environment". The positive impact factors are a collection of factors that tend to nudge a nation towards making substantive improvements in its socio-economic development in various areas such as: health, democracy, good governance, economic productivity, social well-being, the physical environment, roads, water and power supply, education, employment, pressure or desire to integrate into the world economy, etc. (Musa, et al., 2004; Meso and Duncan, 2000). On the other hand, the negative impact forces include: lack of vision, bribery and corruption, lawlessness, military and civilian dictatorships, investments in obsolete or hand-me-down technologies, apathy, colonial master-plans, religious/tribal strife, minimal efforts to provide the populace with the basic amenities in life such as water, roads, electricity, healthcare, education, employment, etc. (Musa, et al., 2004; Meso and Duncan, 2000).

Interaction between Socio-Economic Development and Accessibility

As noted in the diagram, there is a two-way interaction between "Individual's Perception of Socio-Economic Environment" and "Accessibility of Technological to Individual". We believe that the chicken-and-egg analogy applies here. We suggest that basic technology (those that support farming, healthcare, education, etc.) provide the initial jolt in the positive feedback loop between the two. Ceteris paribus, the initial introduction of appropriate technology serves as a catalyst to socio-economic development. From here, national governments, international agencies, and other investors could design appropriate policies and programs that enable poor countries to harness basic ICTs for development in their own contexts (Morales-Gomez and Melesse, 1998). Given the right atmosphere, the re-enforcing positive feedbacks would then keep feeding on itself.

While E-Commerce and other technologically-enabled ways of life are great, Sub-Saharan Africa has more basic needs and capabilities at this point in its development (for the most part). Once the basic seeds are in place, we expect that the region will progress at a sustainable pace that would result in the much needed growth for the region. Not only does our new model capture the importance of actual availability of technology, it ties it to socio-economic development.

VALIDATION OF TAM ANTECEDENTS IN SSA

We used a survey and the structural equation modelling statistical approach to empirically examine and validate the model offered in this paper. We developed the survey instrument—a questionnaire—to measure individuals' perceptions of technology and core factors that we thought would influence an end-user's propensity toward adoption. Appendix 1 provides results of the factor loadings of the instrument's items to research variables. Due to space limitations details of research design, instrument validation, data analysis and methodology will be presented at the conference.

In constructing the instrument, we gave preference to previously tested questions and followed generally accepted guidelines for building survey instruments (Gefen et al., 2003; Wixom and Watson, 2001). We developed all survey items from validated instruments and used them only when the existing literature adequately supported them. Of the 600 survey instruments the distributed across two Sub-Saharan African countries, we received 198 responses from 122 males and 76 females—a satisfactory 33% response rate. The 198 respondents ranged in age from 18 to 60 years, and had an average work experience of 8.18 years. On average, the respondents indicated that they had completed at least a high school education. We used the Likert scale to measure all survey items, except those that provided personal information about the individual.

We tested the research model using Partial Least Squares (PLS); a structural modelling technique well suited for highly complex predictive models (Chin, 1997; Gefen et al., 2003; Joreskog and Wold, 1982; Wixom and Watson, 2001). PLS has several strengths that make it appropriate for this study, including its ability to concurrently test the psychometric properties of scales used to measure variables in the model (the measurement model) and analyzes the strengths and directions of the relationships among variables (the structural model); and, handle formative constructs, small sample sizes, and missing values (Chin, 1998; Wixom and Watson, 2001).

While the details of the results will be presented at the conference, we would like to mention that the results of the PLS graph analysis showed the paths that had statistically significant relationships are as follow:

i) Perceived Negative-Impact factors on Individual's Perceptions of Socio-Economic Environment (path coefficient=0.401, t= 1.5166). We suggest that this finding is a reflection of the respondents' feelings of apathy with regards to the socio-economic environment within which they struggle to survive.
ii) Individual's Perceptions of Socio-Economic Environment on Accessibility of Technology (path coefficient=0.568, t=8.0862). If the perception of socio-economic environment were dominated by the positive-impact factors (instead of the current domination by the negative-impact factors), then respondents' perception of accessibility would have been better.
iii) Accessibility of Technology on Perceived Ease of Use of Technology (path coefficient=0.653, t=9.5582). Again, this points to the general belief that with access, we have an enhanced perception that they would be able to use the technology easily. But it should be noted that past research shows perceived usefulness to be a stronger predictor of ultimate adoption than perceived ease of use (Davis, et al., 1989; Malhotra and Galletta, 1999; Mathieson et al., 2001).
iv) Perceived Ease of Use of Technology on Perceived Usefulness of Technology (path coefficient=0.867, t= 17.1755). Someone just introduced to technology, would tend to perceive its usefulness to how easily they think they can use it.

RECOMMENDATIONS AND PRESCRIPTIONS

From the revised TAM model for Sub-Saharan Africa, coupled with the fact that the region lags far behind when it comes to technology and socio-economic development, our belief is that the region is best served by a strategy of incremental development. We do not believe that meaningful and sustainable developments would be realized by flooding the continent with even the best and latest technologies. Sudden exposure to technology does not guarantee meaningful usage or concomitant acquisition of knowledge. It should be noted that the vast majority of Africa's population is still grappling with the day-to-day problems of poverty, joblessness, and various diseases of immense proportions, as well as inadequate/poor education. Our recommendations are supported by lessons learned from research in other parts of the world (Odedra-Straub, 1996; Madon, 2000; Sahay and Avgerou, 2002; Sein and Harindranath, 2004).

Furthermore, it has been shown that exposure to information sources such as the Internet tends to be correlated to income and socio-economic status. Therefore, Africa is less likely to realize the potential benefits of modern technologies due to its predominantly low income groups and the certain unequal utilization of such technologies (Oyelaran-Oyeyinka and Adeya 2002). A programmed strategy of technology and socio-economic development would work better.

Therefore, we propose that a more reasonable starting point would be to harness ICTs in areas such as the improvement of basic health, education, steady electricity and water supply, telecommunications networks, governance, the alleviation of hunger, poverty, and the conservation of the physical environment, etc. Pursuing these key areas would enhance human development across the region, and also allow for the culturation of technology in the local and cultural contexts.

While much of Sub-Saharan Africa remains a technological desert, there is evidence that technology is making some inroads in some urban areas. There are some successes made possible by the use of technology across the region already. These are in their infancies, and we call for a strategy of steady deployment or acquisition of technology for the region to avoid what has become all too common when technologies are dumped in a region that has not had the time to develop the requisite acclamation to modern technology.

In order for the masses to benefit from the potentials of modern information technologies in the delivery of education and other needs, basic infrastructures such as school buildings and steady electricity supply that support such technologies must be put in place. ICTs that reach out to rural areas could then be implemented to support education and other needs such as healthcare, agriculture, and manufacturing. There are some efforts in the region to implement tele-education in some large cities already; these could be copied to a broader scope when the requisite accessibility and exposure to technologies are gained by the populace (World Bank / SAIDE, 1999; Nasri, 2002).

With the proper strategy, the world's technological desert could become an oasis of technological use, development, and production before too long. Not too long ago, countries such as India, Malaysia, Singapore, and Mexico were little known in terms of technology. Today, these countries are generating billions of dollars by winning lucrative systems design, coding, and production contracts from the most industrialized parts of the world to a point that some U.S. manufacturers are reeling from the resulting loss of jobs.

While the average person with entrepreneurial spirit in Sub-Saharan Africa does not have the means to embark on major ICT business endeavors they are capitalizing on the recent proliferation of cellular phones in the region. These entrepreneurs have opened up small business centers (cyber cafés, kiosks, etc.) where people could send and receive e-mails, recharge and purchase cellular phones, and chat about their new-found abilities to communicate (Meso, et al., 2004). Another example of how technologies are being used in the local social and cultural context in Sub-Saharan Africa is the bourgeoning movie-making industry in Nigeria. Started just a few years ago, production quality has steadily improved, while keeping content in line with local values. The numbers of movies produced each month is alarming. We have observed that the industry does not rely on movie theatres, rather they retail newly released movies on DVDs and VHS tapes as a way of reaching millions of potential customers who would otherwise never get to go to a theatre. These entrepreneurs are using technology to generate income and contributing to the local economy.

We believe that one of the fears that African leaders tend to have with regards to openness or transparency is that of loss of control. However, e-government (the use of information technologies for the delivery of government services and the execution of governance mechanism within a given country) could enhance the relations of government with its citizens and legal entities (businesses, trade-organizations, institutions, not-for profit organizations, etc.), other nations, and the relationships among the various institutions of governance within a country (Thomas, et al. 2005).

Given the history of poor governance in most of the sub-Saharan African countries, E-government applications may provide a feasible and affordable platform for the enhancement of governance in these countries. Deployed with the right coordination by independent world organizations (such as UNDP, WHO, ITU, etc.), donor organizations, and private investors, Sub-Saharan African leaders could be convinced to adopt computer-based information systems and the more recent distributed web-based enterprise information systems to leverage and improve not only governance, but the quality of customer services and customer relations in corporate entities. The same applies to governmental entities where these systems can optimize the effective delivery of government services to the individuals and organizations that transact business with the given governments' various departments and agencies.

We believe that providing the populace with these and other basic needs, starting with the infrastructures that target basic healthcare and education would allow them to move to higher levels in their hierarchy of needs. It is when one has basic health and education, access to potable drinking water, roads, electricity, television, telephone, etc., that his or her horizon could extend to other matters such acquiring and applying more modern technologies to their full potential. We feel that sustainable development will continue to elude Africa until the factors (mentioned above) that curtail improvements in socio-economic, human, and technology development are addressed in a programmed manner. Until this is achieved, the conventional Technology Acceptance Model would be of limited applicability in studying IT adoption in Sub-Saharan Africa. It is in light of this that we offer what we believe is a more appropriate model.

CONCLUDING REMARKS

The contribution of this study has been to enhance our understanding of the interactions that come to bear between socio-economic and human development needs and factors generally innate to Sub-Saharan Africa and other less developed regions that manifest to impede technological accessibility, exposure and therefore adoption. We have argued that Sub-Saharan Africa has some factors that do not show up in the conventional Technology Acceptance Model, whose premise was based on settings that are essentially applicable to industrialized nations. By extending the influence of the perceived user resource model, which in turn was developed from the original TAM literature (Davis, et al., 1989; Mathieson, et al., 2001), and borrowing from ideas espoused in socio-economic development literature, we developed an extended model that accounts for technology availability. This new model enhances our understanding of technology adoption that captures the context of Sub-Saharan Africa and other developing regions of the world. We believe that the new TAM model presented here would be more relevant to less developed regions such as Sub-Saharan Africa where universal access to ICTs and sustainable economic development remain illusive.

Follow-up studies as proposed in this paper would shed more light on the validity of the new model. We have attempted to show the links between socio-economic development and technology adoption. On a global scale, it could be argued that these findings may be applicable to certain situation in developed countries such as the U.S. and others, where a digital divide exists along income and education levels, as well as along race, age, and other variables (Moreles-Gomez and Melesse, 1998).

REFERENCES

1. Ansah, Paul A. V. (1985). "African Responses to the NWICO Debate", in Communication for All, ed. by Philip Lee, p. 68. New York: Orbis.
2. Chin, W. W. (1997, October 18, 1997). *Overview of the PLS Method. Retrieved November 19, 1999, from http://disc-nt.cba.uh.edu/chin/PLSINTRO.HTM*
3. Chin, W. W. (1998). *The Partial Least Squares Approach to Structural Equation Modeling. In G. A. Marcoulides (Ed.), Modern Methods for Business Research (pp. 295-336). London.*
4. Compeau, D. R., and Higgins, C. R., (1995), "Computer Self-Efficacy: Development of a Measure and Initial Test," *MIS Quarterly*, Vol. 19, pp. 189-211.
5. Davis, F. D., Bagozzi, R. P., and Warshaw, P. R., (1989), "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science*, 35, pp. 982-1003.
6. de Vreede, G.-J., N. Jones, and R. J. Mgaya (1999) "Exploring the Application and Acceptance of Group Support Systems in Africa," *Journal of Management Information Systems* (15) 3, pp. 197.
7. Fishbein, M. and Azjen, I. (1975), *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research.* Reading, MA: Addison Wesley.
8. Gallivan, M. J., (2001), "Organizational Adoption and Assimilation of Complex Technological Innovations: Development and Application of a New Framework," *Database for Advances in Information Systems*, summer 2001, Vol. 35 Issue 3, pp. 51-85.
9. Gefen, D., and Straub, D. W., (1997), "Gender Differences in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model," *MIS Quarterly*, Volume 21, Number 4, pp. 389-400.
10. Gefen, D., Karahanna, E., and Straub D. W., (2003), "Trust and TAM in Online Shopping: An Integrated Model," *MIS Quarterly*, Volume 27, Number 1, pp. 51-90.
11. Jensen, M., (2001), "The African Internet – A Status Report," http://www3.wn.apc.org/africa/afstat.htm
12. Joreskog, K. G., and Wold, H. (1982), "The ML and PLS Techniques for Modeling with Latent Variables: Historical and Comparative Aspects", In K. G. Joreskog & H. Wold (Eds.), *Systems Under Indirect Observation: Causality Structure and Prediction* (Vol. 1, pp. 263-270). Amsterdam: North Holland.
13. Madon, S., (1999), "International NGOs: Networking, Information flows and Learning," *Journal of Strategic Information Systems*, 8(3): 251-261
14. Madon, S. (2000), "The Internet and Socio-Economic Development: Exploring the Interactions," *Information Technology and People*, Vol. 13, No.2, pp. 85-101.
15. Malhotra, Y., and Galletta, D.F., (1999), "Extending the Technology Acceptance Model to Account for Social Influence: Theoretical Bases and Empirical Validation", *Proceedings of Hawaii International Conference on Systems Sciences* (HICCS).
16. Mathieson, K., Peacock, E., and Chin, W., (2001), "Extending the Technology Acceptance Model: The Influence of Perceived User Resources," *Database for Advances in Information Systems*, Vol. 32, Issue 3, pp. 86 – 112.
17. Mbarika, V., Musa, P. F., Byrd, T. A., and McMullen, P. (2002), "Teledensity Growth Constraints and Strategies for Africa's LDCs: "Viagra" Prescriptions or Sustainable Development Strategies?", *Journal of Global Information Technology Management*, vol. 5, No.1.
18. Meso, P., Musa, P., and Mbarika, V., (2004), "Towards a Model of Consumer Use of Mobile Information and Communication Technology in Sub-Saharan Africa: A Case of Kenya and Nigeria", Forthcoming in *Information Systems Journal* (ISJ).
19. Meso, P. and Duncan, N., (2000), "Can National Information Infrastructures Enhance Social Development In the Least Developed Countries? An Empirical Investigation," Journal of Global Information Management, (Volume 8, number 4, pp. 30-42).
20. Morales-Gómez, D., and Melesse, M (1998), "Utilizing information and communication technologies for development: The social dimensions," *Information Technology for Development*, (Volume 8, Number 1, pp. 3-13).
21. Musa, P. F., Meso, P., Mbarika, V., (2004), "Toward Sustainable Adoption of Technologies for Human Development in Sub-Saharan Africa: Precursors, Diagnostics, and Prescriptions", Under Review.

22. Nasri, S. (2002), TELESUN: A world wide multimedia TELEteaching System for Universities. *Laboratoire d'Automatique et d'Informatique Industrielle Ecole Nationale d'Ingénieurs de Monastir*: Tunisia.
23. Odedra-Straub, M., ed. (1996), *Global Information Technology and Socio-economic Development*, Nashua, NH: Ivy League
24. Oyelaran-Oyeyinka, B., and Adeya, C. N., "Internet Access in Africa: An Empirical Exploration", United Nations University Institute for New Technologies, Netherlands, May 2002.
25. Sahay, S., and Avgerou, C., (2002), "Introducing the Special Issue on Information and Communication Technologies in Developing Countries", *The Information Society*, vol. 18, pp. 73-76
26. Sein, M. K., and Ahmad, I. (2001), "A Framework to Study the Impact of Information and Communications Technologies on Developing Countries: The case of cellular phones in Bangladesh", *Proceedings of the BITWorld International Conference*, Cairo, Egypt, 4-6 June.
27. Sein, M. K. and Harindranath, G.,(2004), "Conceptualizing the ICT Artifact: Towards Understanding the role of ICT in National Development", *The Information Society*, vol. 20 pp. 15-24
28. Straub, D.W. (1994), "The Effect of Culture on IT Diffusion: E-Mail and FAX in Japan and the U.S.," *Information Systems Research*, 5:1, March 1994, pp. 23-47.
29. Thomas, C., Mbarika, V., Musa, P., and Meso, P., (2005), "An Appeal for Research in E-Government in Africa: A New Era for Better Governance in Sub-Saharan Africa", Under Review.
30. Venkatesh, V. and Morris, G.,(2000), "Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence, and Their Role in Technology Acceptance and Usage Behavior," *MIS Quarterly*, Volume 24, Number 1, pp. 115-139
31. Wixom, B. H., and Watson, H. J., (2001), "An Empirical Investigation of the Factors Affecting Data Warehousing Success," *MIS Quarterly*, 25(1), pp. 17-41.
32. World Bank / SAIDE (1999), "Report of the South African Institute for Distance Education: Country Visits", Worldbank: Geneva.

Appendix 1. Factor Loadings of Research Model Variables

Factor (Latent Variable)	item	Loadings	Mean of Sub-samples	Standard error	T-Statistic
U (Use)	q5	-0.8747	-0.8496	0.1524	5.7414
	q6	-0.8644	-0.8587	0.0645	13.3933
BI (Behavioral Intention to Use ICT)	q48_g	-0.9035	-0.8989	0.0253	35.6867
	q52_g	-0.9214	-0.9202	0.0157	58.8571
AU (Attitude Toward Using ICT)	q28	0.7509	0.7089	0.2214	3.3916
	q17	0.8375	0.7369	0.275	3.0457
AT (Accessibility to ICT)	q47_g	0.8695	0.8852	0.0439	19.8133
	q18_e	-0.5773	-0.5161	0.1329	4.3426
	q23_e	-0.6449	-0.5812	0.1323	4.8748
PEOU (Perceived Ease of Use of ICT)	q49_g	0.9212	0.9225	0.0223	41.2353
	q50_g	0.9417	0.9401	0.0171	54.9522
	q53_g	0.9382	0.9354	0.0187	50.0969
PU (Perceived Usefulness of ICT)	q51_g	0.9461	0.9451	0.0084	112.9872
	q54_g	0.9126	0.9035	0.0305	29.9672
PSEE (Perceived Socio-Economic Environment)	q66_b	0.8836	0.8851	0.0281	31.4628
	q66_c	0.833	0.8308	0.0431	19.3285
	q66_d	0.8821	0.8837	0.0283	31.1836
	q66_e	0.8641	0.8641	0.0363	23.7977
	q65_b	0.9348	0.9335	0.0143	65.4456
	q65_c	0.927	0.9267	0.0181	51.1864
	q65_d	0.9059	0.9036	0.0256	35.381
	q65_e	0.9459	0.9451	0.0111	85.1747
PR (Perceived Resources)	q39	-0.9277	-0.9035	0.087	10.6635
	q41	-0.9601	-0.9329	0.1036	9.2631
	q42	-0.7935	-0.7983	0.0914	8.6851
PIF (Positive Impact Factors)	q63	-0.9387	-0.8006	0.3282	2.8602
	q64	-0.9631	-0.9747	0.0237	40.6813
NIF (Negative Impact Factors)	q60	0.783	0.7066	0.2479	3.1585
	q61	0.9272	0.9032	0.1384	6.6995
	q62	0.9462	0.8976	0.168	5.632

**All items loaded significantly to their respective Latent Variables (t value > 1.96) at the 95% level of confidence*