

**BRINGING THE HUMAN IN COMPUTER SCIENCE: THE CASE OF MOBILE DEVICES IN
EAST AFRICA**

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By

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**BRINGING THE HUMAN IN COMPUTER SCIENCE: THE CASE OF MOBILE DEVICES IN
EAST AFRICA**

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ABSTRACT

BRINGING THE HUMAN IN COMPUTER SCIENCE: THE CASE OF MOBILE DEVICES IN EAST AFRICA

Human Computer Interaction is a very broad discipline with emphasis on the relationship between the machine and the user, through design and evaluation of interactive computing systems; while putting in to account the differences among the users needs, desires, and the environments surrounding them. Over the years software engineering solutions through technologies like, computers, Internet, mobile phones among others, have been able to address and solve human problems. However most of these technologies are designed and based on the western societies rendering them inadaptable in African societies. This study applied the human computer interaction approach in trying to understand how mobile phones are being used and adopted. Taking an East African Country Uganda as a case study, both quantitative and qualitative research methods were used; primary data was gathered from users in a sub urban town in Uganda and analyzed. The results indicated performance expectancy (usefulness of the mobile phones), effort expectancy (easiness to use the mobile phone), social influence (personal imitative to use the mobile phone) and facilitating conditions (various factors that would influence the use of the mobile phones) not only have a positive impact towards increasing the interactions between the users and their mobile phones, but also the requirements and specifications

for any mobile technology to be adopted. The increased interaction with mobile phones among the respondents indicated behavioral change and direct technology transfer. The main contribution of the study is in the areas of human computer interaction and software engineering solutions in a developing country perspective.

Dedicated to my Father

Prof. Waswa Balunywa

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Praise is to God the most gracious and most merciful, for enabling me go through my educational goals and dreams. I owe gratitude to my entire thesis committee,

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LIST OF ABERIVIATIONS AND NOTATIONS

ACM	Association of Computing Machinery
DOI	Division of Innovation
GUI	Graphical User Interface
HCI	Human Computer Interaction
ISO	International Standard Organization
IT	Information Technology
ITU	International Telecommunications Union
RQ	Research Question
SW	Software
TPB	Theory of Planned Behavior
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
UCC	Uganda Communications Commission

CHPATER 1

INTRODUCTION

1.0 Background

The study of mobile phones and poverty has a foundation in human computer interaction a discipline in computer science that focuses on the relationship between the machine and the users, thus the study of computer usability (Diaper et al 2006). The interaction is based on how computers can be used to solve human problems. On the human side, the human machine interaction focuses on the ease of use, do people find the computers easy to use, the performance expectancy, what are the conditions that enable people to use mobile devices, electricity, talk time, data etc. Sub-Saharan Africa is one of the regions with the largest number of poor people. More than 40% of the people in this region live on less than a dollar a day. Shan. D.E (2009), Poverty is characterized by lack of income, vulnerability, powerlessness and above all social exclusion. Social exclusion is denial of rights and resources that are ordinary available to other people, those who are social excluded are marginalized, insulted and at times humiliated, Gerster & Zimmermann, (2003). Governments world over have incited efforts to reduce or eradicate poverty. This is contained in the various macro-economic policies and programs intended for the purpose. However, not much has been achieved with these policies and programs. Unfortunately poverty continues to reign in many parts of Africa.

In recent years the game changer has been technology; ordinarily technology is available without gender bias. While is not exactly gender neutral, it has been found to be a tool that is promoting inclusion easily. The technology that has emerged is mobile technology while the computer has created tremendous change globally; it has not been able to promote change among the poor people. This is because of the cost involved and the availability of electricity to make the computer work properly. The Internet as also contributed to the process of promoting change in society and among the poor people. It has been important in providing information, which was not ordinarily available to the poor; the Internet has also hard it challenges, lack of access to broadband and electricity. Mobile technology with the mobile phone has been the key change agent that has impacted on the world more fundamentally. The International Telecommunication Union (ITU), indicates Mobile phone penetration in the world at 96% (ITU 2013) while in the developing countries 89% (ITU, 2013), while the availability of computers in developed world at 74% (ITU, 2011) and for the developing countries it's at 25% (ITU, 2011), access internet globally is at 39% (ITU 2013), and for the developing countries it's at 31% (ITU 2013). These figures reveal higher adoption of the mobile phone in the developing countries and, this means the mobile phone is creating more impact in society than other technologies. One must note that this calls for the design of client based Graphical User Interfaces (GUI), directed at addressing the human needs in this particular areas.

With this in mind, this thesis is directed at understanding, if mobile devices, particularly the phone are addressing human needs and values. Do the adoption and an increase of human machine interaction with these technologies transit in to growth of economies; creation of jobs; promotion of social; and financial inclusion that will lead to poverty eradication? To explain how individuals adopt technology, there various technology models that have been proposed by researchers among them are: Technology Adoption Model (TAM), Diffusion Of Innovation (DOI), Theory Of Planned Behavior (TPB), Theory Of Reasoned Action (TRA), model of PC utilization, social cognitive theory, Unified Theory Of Acceptance and Usage of Technology (UTAUT), is one of the most researched models, formulated by, (Venkatesh et al 2003) in "*User acceptance of information technology*". The UTAUT aims to explain user intentions to use an information systems and subsequent usage behavior. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behavior. Gender, age, experience, and voluntariness of use are posited to moderate the impact of the four key constructs on usage intention and behavior.

1.1 Mobile Phone Usage

ITU estimates that there are 5 billion subscribers to the mobile phone. This is one of the tools that have spread widely and globally without a lot of limitations and in a very short time. The mobile phone is one of the modern technological tools that are reshaping the

way we work. The mobile phone has traditionally been seen as an information and communication tool however it has more or less become a computer in its own right (Burton et al, 2005). Because of its size and its mobility and of course costs, it is becoming more users friendly than the computer. The mobile phone has originally been used as a communication gadget primarily as a phone used to transmit voice. The computer was primarily used for data and it could not be used for voice communication unless gadgets and software like Skype were added.

The phone has since evolved to perform such functions as the computer has performed them. Among the functions of the phone, the following are core, it works as a clock, radio, recorder, TV, compass, diary, calendar, calculator, notebook, dictionary, an atlas, storage device, and a business directory and depending on the type it can have other functions. While the computer

1.2 Statement Of The Problem

The ITU indicates there is higher penetration of mobile devices in developing countries at 89% (ITU, 2013). However, the users do not use many of these devices for commercial purposes, which is partly due to low understandability of the device. This is despite the fact that today's mobile phone comes along with so many functions and applications that can be used in business. Examples are digital cameras, SMS, e-mail, social media, etc. All these can be used to eradicate poverty. Unfortunately they are not being used in most developing countries. A mobile is limited to making and receiving phone calls.

Jenny C et al (2010). This is partly due, to a number of factors; Lack of studies in understanding the requirements and specifications of the people for which the technology is developed for, knowledge gaps that exist among users in developing countries. The software processes, graphical user interface (GUI) are tested and designed based on western cultures and users. Moreover, there is little effort and studies among software engineers, mobile device companies in understanding the requirements and specification for the African users to ensure that mobile devices designed for developing countries are enhanced to address the core human problems and the existing knowledge gaps.

This study therefore seeks to apply a human computer interaction approach in trying to understand the requirements and specifications of mobile phone users in Africa, and whether usage, adoption of mobile phones in developing countries can transit in to the eradication of poverty.

1.3 Objectives Of Study

This study will be guided by the following objective:

1. To analyze the factors influencing usage of mobile phones in developing countries;
2. To examine the impact of mobile phones on poverty eradication in developing countries

1.4 Research Questions

RQ1: What factors influence usage of mobile phones in developing countries?

RQ2: What is the impact of mobile phones on poverty eradication in developing countries

1.5 Research Hypothesis

H1: Performance expectancy, Effort expectancy, Social influence, Facilitating conditions, and Behavioral intention are the factors influencing usage of mobile phones in developing countries.

H2: Mobile phones have a positive impact on poverty eradication in developing countries

1.6 Significance

This study will help in showing that every community has a different culture and history that cannot be replicated. Thus indicating the different requirement and specification for each and every software that is amid at serving the African Countries, which will help software engineers in developing application and mobile device GUI's which are Africa user centered and addressing the African values and needs. This research will examine the factors limiting the application of mobile devices in business for poverty eradication among the people in Sub-Saharan Africa.

This study will propose useful recommendations for improving human computer interaction in mobile phones for developing countries. Suggestions on improving the human machine interaction, in relation to Africa for future policy makers in the area for technology and development will be made. Further, the study will also help in maximizing the potential benefits of mobile technology solutions; closer attention must be paid to poverty's dynamics, causes, and consequences

CHAPTER 2

LITERATURE REVIEW

2.0 The Concept Of Human Computer Interaction

Computers are an important driver for increased capability and productivity through human interaction or interfacing. The machine side is focused on techniques in computer graphics, operating systems and programming languages in order to design computer interfaces that are easy, reliable and relevant for the user (Karray F et al 2008). On the human side Computer interactions include, sending SMS, voice calls, video calls, and images among others. The benefits of this interaction are; allows humans to interact with machines more precisely through the provision of interaction support such as, beeps, ring tones, error messages, and of recent voice recognition technologies like Siri, developed by apple IOS technologies, as a natural language intelligent personal assistant (Li Deng F, 2013), thus resolving issues as they arise. Of course, one needs to note that these technologies are English language based. In developing countries those with the phones usually only use them to making and receive phone calls (Jenny C, 2010). Which has resulted in phone being worthless, this might be attribute to lack of knowledge from the users, most people cannot, read and write in the language in which the user interfaces are based, since more of the GUI are written in English, Arabic and Chines. With this in mind any device is difficult to use if one cannot navigate freely through the settings and

other functions of the system, making easy and maximum utilization of the device limited. This is regardless of the age differences among the users. (Karray F et al 2008) States, “Usability of a system with certain functionality, as the range and degree by which the system can be used efficiently and adequately to accomplish certain goals for certain users, the actual effectiveness of the system is achieved when there is a proper balance between the functionality and usability of a system”. An increase of mobile technology in Africa has led to a new group of users in a different area with different languages, needs. However, is this increase more negative than positive? What’s the use of navigating through GUI’s; in the language I cannot read? Are these technologies solving and improving human needs, since unemployment and poverty are the current human problems, in these areas, as indicated in the World Bank report of (2013). Various researchers have noted that being able to understand how any device works, through reading, navigation, voice command, ring alerts, automatically trigger interest by the user thus leading to an increase in human computer interaction. (Kaber Db, 2002; M Baker, 2004; Maxion R, 2005; Emery V, 2003

2.1 The ISO Usability Definition

As defined by the (ISO, 9126, 2000), usability is the degree to which specific software meets goals of the user, with effectiveness, efficiency, satisfaction in relation to the environment and what the software is being used for. When we understand the user environment and the needs then designing user-centered software that is relevant to an

organization, society and institution becomes much more easier. (J Gullksen 2003), since the user is put at the forefront of the design.

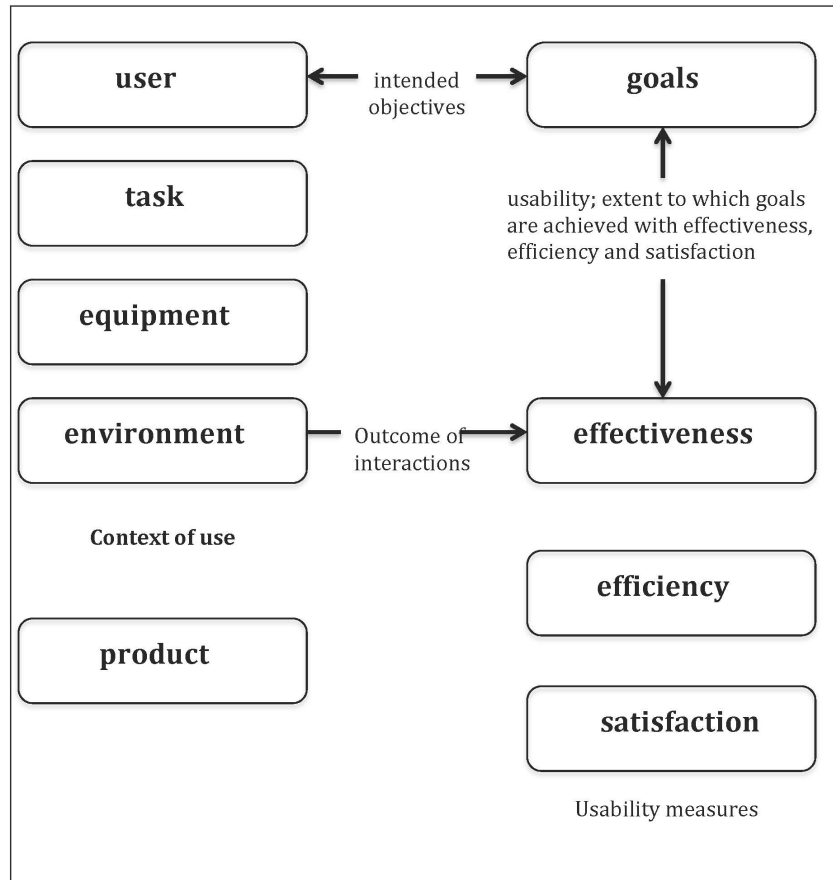


Figure 1 Usability Framework (Source; ISO 9241, 10- 17)

2.2 Approaches To HCI And Usability Standards

The International Standard Organization (ISO) defines usability as “The capability for a product to be understood, learned, used and interactive to the user, when used under specific conditions” (ISO /IEC 9126, 2000), In order to meet the specific requirements in relation to HCI and usability. The ISO over the years has set standards for design of software application and Graphical user Interfaces, for bettering interaction of the SW and the users. Research by Alian, A et al (2003), states that; the usability standards are in four categories which include .1) product effect (output, effectiveness, time of use). 2) Product attributes (interface and interactions). 3) Processes used to develop the product. 4) Organization’s capability. However, big companies and software industries tend to have their own standards, which have been more influential, than the (ISO) Standards. This is largely based on the companies’ economic muscles, locations and the competition in a research paper by, George T (2000), the author argued that software design is based on detailed principles and guidelines with a view of a better end product, interface and increased interaction with the user, when big companies fail to follow the guides of the soft wear process. There is a positive and negative impact to the consumer. Of course, the positive being a better and more innovative product, negative a product that does not meet in the set standards the ISO. And thus products that are below standard might mostly likely be sold.

2.3 Characteristics Of Quality Software

The general-purpose software category quality characteristics module by ISO defines functionality, reliability, usability, efficiency, maintainability and portability ISO/IEC 9126, (1991). Which are further broken down in to further sub characteristics providing a useful checklist for good quality software, as per (Nigel B, 1997), this should be based on the purpose of the evaluation of the software.

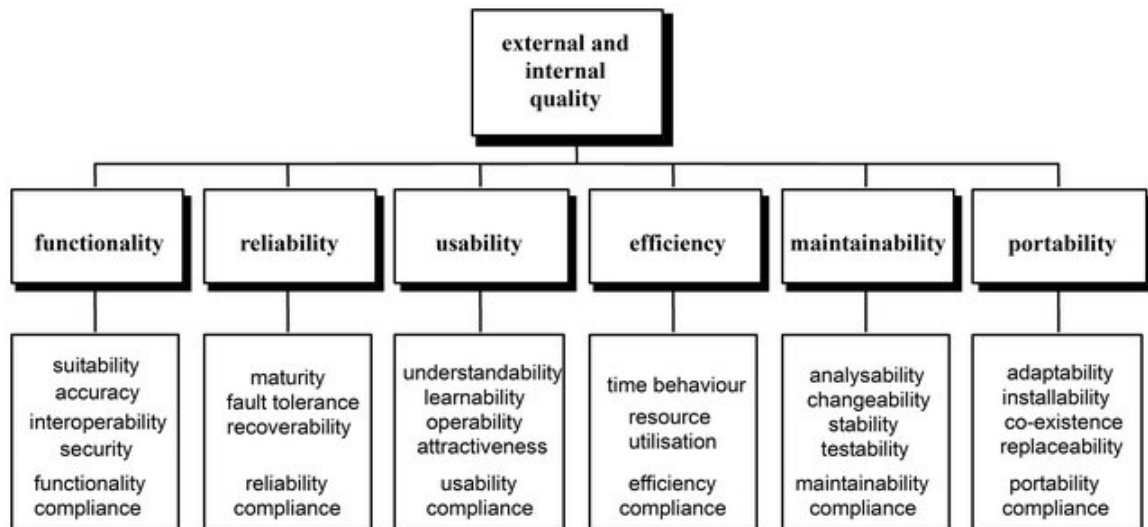


Figure 2: Product Quality Model (Source; Kazuhiro E, 2013).

The exact human computer interaction varies across the globe from country to country; this is due to the diverse culture and language difference across the global. If mobile devices are to be easy to use, relevant and appealing to a certain group of users, there is

need for soft wear engineers to consider the different cultural aspects and embark on producing indigenous technologies that can easily be used and understood by the local users, (Aron, 2011). Most of the user interfaces are in the English languages, which can only be read by hand-full of people. In most developing countries 80% of the population lives in rural areas and have a very low digital illiteracy rate. Due to the high level of digital literacy among developing countries there is need to develop application that are picture, visual and texting platforms designed in indigenous languages that can easily be understood. This will enable maximum and full utilization of the various mobile devices. Picture talk application concept was further proposed by, (Mark B, et al 2009). They propose three sketch concepts for the platform, rice talk which enables various farmers in the region to discuss issues concerning their crops. Health talk designed in the shape of a human body, for discussing problem in line with health and solutions and tinker talk to indicate the need for transportation from one area to another designed in form of Google maps indicating the various locations of people in different areas. Designing user interfaces that can easily be understand by the local people will increase the human computer interactions in this area and thus might improve the livelihood of people in these areas. Analysis of the literature reveals that Ease of use, performance expectancy and better understanding of mobile devices has been the key enabler of the human computer interactions. Due to times we spend interacting with computer devices, people have become, personal and emotional with their mobile devices, which has led to, built relationships, connections or attachments to computers (Timothy W, 2005).

2.4 Technology Adoption Models And Theories

For better understanding of human computer interaction in the context of developing countries, I looked at few technology theories surrounding the reasons why people might adapt technology.

2.5 Technology Acceptance Model (TAM)

The Figure below is a model by Fishben et al (1977), illustrates that the intention to use a certain technology depends on the attitudes of the user, perceived ease of use, and perceived usefulness of the technology regardless of age differences among users. Shu

Feng et al, (2013) states that; the model is very useful in trying to understand the user requirements and specification in the agile soft wear developing processes, through user requirement feedback, and helping in assessing process of user acceptance and satisfaction. The variables used in this model where used in the theoretical under pinning of this study.

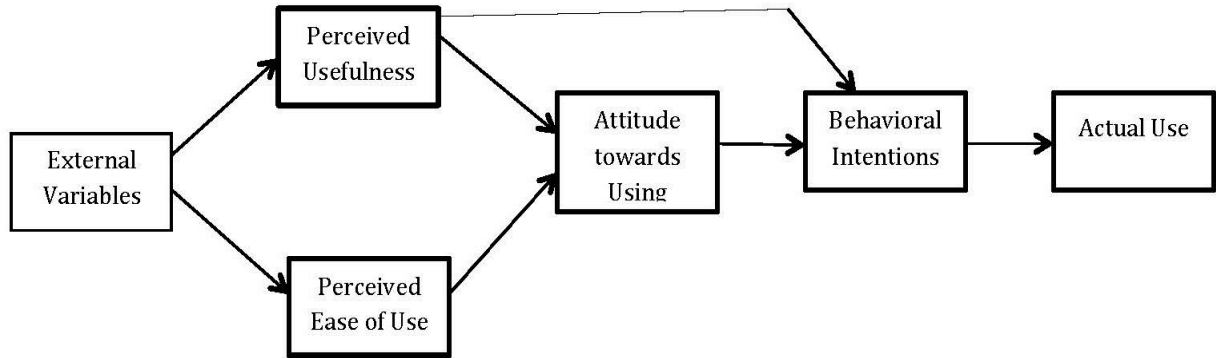


Figure 3: Technology Acceptance Model (TAM) (Source: Davis Et Al 1989)

2.6 Diffusion Of Innovation Technology Theory

Figure 4 represents Rogers and shoemaker’s (1971) theory, which states that same user, adapt to a technology earlier than other users. While others adopt late, or never adopt at all. The theory states five stages through which users adapt to a technology. 1) if the people know how to use it, 2) if they know the advantages and value addition benefits they get from the technology through persuasions , Rogers and Shoemaker’s (1971), theory furthers indicates two type of users; earlier adopters and late adopters. Who are able to continuously use the technology? One needs to note that; some users might not adopt despite knowing how to use the technology. Thus continued rejection according to Rogers and Shoemaker’s (1971).

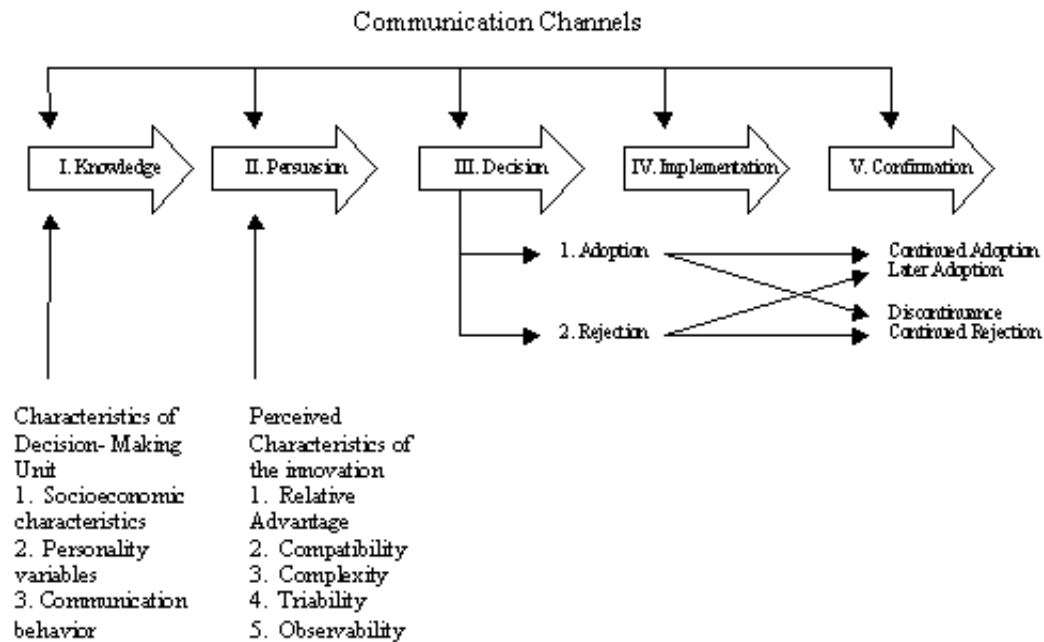


Figure 4: Diffusion Of Technology Innovation Theory (Roger And Shoemaker 1971)

2.7 Theoretical Underpinning Of The Study

Unified theory of acceptance and use of technology (UTAUT) is a technology acceptance model formulated by Venkatesh et al (2003), in "*User acceptance of information technology: Toward a unified view*". The UTAUT aims to explain user intentions to use an information systems and subsequent usage behavior. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behavior. Gender, age, experience, and voluntariness of use are posited to moderate the impact of the four key constructs on usage intention and behavior. The theory was developed through a review

and consolidation of the constructs of eight models that earlier research had employed to explain information systems usage behavior (theory of reasoned action, technology acceptance model, motivational model, theory of planned behavior, a combined theory of planned behavior/technology acceptance model, model of personal computer use, diffusion of innovations theory, and social cognitive theory). Subsequent validation of UTAUT in a longitudinal study found it to account for an impressive 70% of the variance in BI and about 50% in actual use. Research design is in line with the UTAUT model; this research will take the same direction and acquired a technology that captured these four contrasts of the model. Performance Expectancy (*usefulness of the mobile phone*), effort expectancy (*easiness to use the mobile phone*), social influence (*personal imitative to use the mobile phone in business*) and facilitating conditions (*various factors that would influence the use of mobile phone in business*) which will eventually lead to the intention to use the mobile phone in poverty eradication.

Conceptual Framework

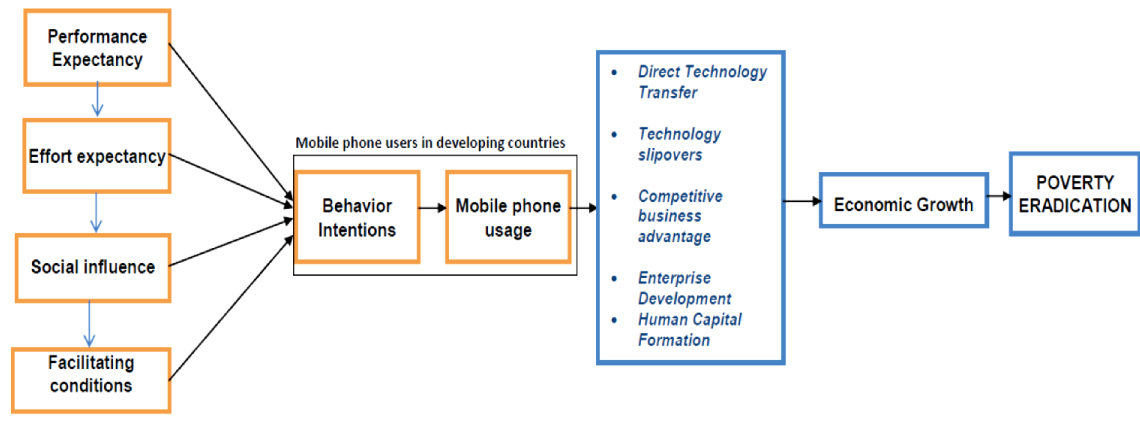


Figure 5: Conceptual Framework (Adopted From Venkatesh Et Al (2003))

The conceptual framework is an improved version of Venkatesh's UTAUT model. Having the four constructs, performance, effort, facilitating conditions and social influence constant from the figure it's indicated that people's behavior change. And they are easier drawn towards using a technology, with the assumption that it will add value in their lives, thus leading to an increase in usage and adoption of a technology, regardless of the sex of the owner. According to the Mobile Marketing Association (2008), Mobile Operating System (MOS) are equipped with GUI's that are empowered with user developed applications such as, social media, examples of this can be; Facebook, instagram, twitter, whatsapp among others, which are leading to social inclusion of a user to numerous clients, market. Additionally mobile phones have commercial apps examples can be; MoneyGram, western union, mobile banking. With a combination of such application software to the user there is; 1) direct technology transfer. Diogo, C. (2009) argued that users are able to download a massive number of application software in the

phone application stores. That was not possible 15 years back, and to developing countries this is a massive leap of what technology holds in society transformation. 2) Competitive business advantages. Easy communication, marketing and ecommerce with a figure slides is visible to the user. Ming H (2009), further states that in western countries consumers are rapidly migrating from physical stores to online shopping. People spend more time online shopping than in physical stores, of course cheaper and with a global cliental. 3) Enterprise development and human capital development. The three factors are enablers of economic growth directly leading to poverty eradication. With above in mind the mobile phones and the increased number of application is tremendously changing the way business is done depending on the user's knowledge. Research by Rashedul et al, (2010), Supports that this might be a new type of Information Technology Infrastructure (ITI) for the case of developing countries.

CHAPTER 3

METHODOLOGY

3.0 Research Design

A survey was conducted on mobile users in Uganda. Both quantitative and qualitative research methods were used. Quantitative data was gathered using a survey questionnaire while qualitative data was gathered using an interview guide.

3.1 Quantitative Research Methods

These methods were developed in natural science to study natural phenomena. The research methods allow researchers to answer questions like; human machine or computers, system and application interactions, Avison et al (2005). The data is numeric format and is analyzed using quantitative methods. The data collection methods include surveys, laboratory experiments and numerical methods. Thus the surveys form a data base and give an over view of the characteristics or relationship of the population, Kothari (2009).

3.2 Qualitative Research Methods

This method is directed at understanding the users, behaviors, attitudes, fears (Ewings et al 1997). Researchers Myers (2009) states that, qualitative research methods are directed

at enabling researchers to study social and cultural phenomena in subjective assessment of attitudes, opinions and behavior of process overtime.

3.3 Study Population And Sampling Procedure

The study was conducted in Uganda, a Sub-Saharan Africa country with a population of over 37 million people. The number of mobile phone users in the country is 16.8 million, Uganda Communications Commission, (UCC, 2013) with an estimated internet penetration of 0,26% (UCC, 2013 and a mobile phone penetration of 47.1 (UCC, 2013). The study built on study to understand the adoption and usage of a mobile phone as a tool of poverty eradication in Uganda as a developing country.

The people have different backgrounds and speak different languages. 500 correspondents will be targeted using purposive random sampling. Self-administered questionnaires will be used to collect the information and from each group two correspondents will be selected for in-depth interviews.

A total of 500 mobile phone users were selected purposively for the interview. Interview and survey questions will focus on the ease of use, usefulness and facilitating conditions and social influence while using the mobile phones.

Validity And Reliability Of The Questionnaire

For purposes of having questioners that were valid and reliable Crombach, A (1951) Coefficient was used to test for reliability. On the other hand, Content Validity Index Krishanveni and Ranganath (2012) was used to test for validity

3.4 Data Collection Methods

Permission was sought from the leaders of the villages to interview the correspondents. In-depth interviews were used to collect qualitative data while questionnaires were used to collect survey data.

3.5 Data Analysis

Interview data was transcribed and analyzed using content analysis method. Each correspondent was recorded using an interview guides for 15 to 20 minutes and was asked what they were using their phones for. Some of the challenges were: diverting from the topic and outside interruption, which interrupted the interview. This data was transcribed and retyped in MS Word. On the other hand, quantitative data was coded and entered in statistical analysis for quantitative analysis.

CHAPTER 4

RESULTS

4.0 Background Information

In order to understand the age of respondents, data were collected in five different age groups including 1) 16-25 years, 2) 26-35 years, 3) 36-45 years, 4) 46-55 years and 5) 56 years and above. Descriptive statistics, including frequencies and percentages were used to analyze the age of respondents. Table 1 presents the findings:

Table 1: Respondents Age

Age Group	Frequency	%
16-25 Years	206	38.7
26-35 Years	71	13.3
36-45 Years	77	14.5
46-55 Years	122	22.9
56 Years and above	56	10.5
Total	532	100.0

Source: Primary Data.

Results in Table 1 above indicate that majority of the respondents were in age group 16-25 years (Frequency = 206, 38.7%). Those respondents followed this: in age group 46-55 years (Frequency=122, 22.9%) and age group 36-45 years (Frequency=77, 14.5%). The least respondents were in age groups 26-35 years and 56 years and above (frequency = 71, 13.3% and Frequency=56, 10.5% respectively). From the above data, the age groups of (16-25) are more drawn to adoption of new technologies. This might be due to social influence, fashion, style social media, chatting, pictures and western cultures. I further argue that this has nothing to do with innovation and entrepreneurship, and yet they are the highest unemployed group in developing countries. With this current knowledge, mobile technology is worthless. However, with further education, western methods and knowledge of how to use mobile technology for poverty eradication, this young age group can become the new age of business and innovation in developing countries

4.1 Marital Status

In order to examine the marriage status of the respondents, data were collected based on three objectives, single, married and widowed, Descriptive statistics, including frequencies and percentages were used to analyze the age of respondents. Table 2 presents the findings:

Table 2: Marital Status

Status	Frequency	%
SINGLE	294	55.3
MARRIED	206	38.7
WIDOWED	32	6.0
Total	532	100.0

Source: Primary Data.

Results in Table 2 above indicate that majority of the respondents were single (frequency 294), 55.3%). Thus indicates that there are more young people in this region who are still in school and who are more technologically savvy. The following afterwards are married respondents (206, 38.7) who are more than likely the middle age who are conservative with technology. These are more likely the educated group whom work or own businesses and lastly the widowed with the lowest frequency of (32, 6.0%

4.2 Level Of Education

In order to understand the level of education of respondents, data were collected in different education backgrounds, diploma, masters, PhD, certificates and above.

Descriptive statistics, including frequencies and percentages were used to analyze the education backgrounds of respondents. Table 3 presents the findings

Table 3: Education Level

Education	Frequency	%
DIPLOMA	96	18.0
BACHELORS	94	17.7
MASTERS	42	7.9
PHD	16	3.0
CERTIFICATE	284	53.4
Total	532	100.0

Source: Primary Data.

Results in Table 3 above indicate that majority of the respondents were certificate holders, which is equivalent to united states junior high, and high school frequency (284, 53.4).

3%) Followed by Diploma holders (96, 17.7%), Bachelors (94, 17.7%), masters (42, 7.9%) and lastly PhD holders (16, 3.0%) as the lowest frequency. With 284 certificate holders of mobile phones owners show simple reading and writing capabilities but illiterate in general and full understanding of modern technology.

Table 4: Professional Backgrounds

Professions	Frequency	%
Accountant	44	8.3
Business Women	28	5.3
Businessmen	24	4.5
Enrolled Nurse	26	4.9
HRM	16	3.0
Lawyer	18	3.4
Peasant	50	9.4
Student	250	47.0
Teacher	26	4.9
Total	532	100.0

Source: Primary Data.

Results in Table 4 above indicate that majority of the respondents were; students and unemployed with a frequency of (250, 47.0%). Peasants with (50, 9.4%) accountants with

(44, 8.3%), business women (28, 5.3%) indicating more women in business than the business men at (24, 4.3%), Enrolled nurses at (26, %), teachers (24, %), lawyers (18, %) and finally HRM at (6, %).. from this results this indicates that majority of the phone owners who are more likely influenced by western culture, the peasants who are unemployed are second in ownership. They can afford a phone but no other luxuries of life. Even in poverty areas status is important and a mobile phone can possibly represent a level of achievement. Although they are concerned about status they are unaware how empowering the usage of mobile phones can empower them business wise and improving their lives.

4.3 Ownership

In order to understand at how many people had mobile phones in the area, respondents were asked if they had mobile phone.

Table 5: Mobile Phone Ownership

Respondents	Frequency	%
YES	532	100.0

Source: Primary Data.

Results in Table 5 above indicate that all (532, 100%) respondents had mobile phones.

Indicating that sample population was fit for our study, and at the same showing the

increased penetration of mobile devices in developing countries, yet they are unlike western countries where phones are contracted out. The phones are paid for in cash.

4.4 Phone Types

In order to understand, the type mobile phones, operating systems the users where interacting with respondents were asked which type of mobile phones they had, categorized in smart phones android, apple, chines or ordinary phones. This would respectively tell us what type of operating system they were interacting with most, affordability, and the levels of income of this people.

Table 6: Type Of Mobile Phones

Mobile Phones	Frequency	%
SMART PHONE	226	42.5
CHINESE	176	33.1
ANDROID PHONE	80	15.0
ORDINARY PHONE	50	9.4
Total	532	100.0

Source: Primary Data.

Results in Table 6 above indicate that majority of the respondents, had smart phones (226, 42.5%), chines phones (176, 33.1%) android phones (80, 15.0) ordinary phones (50, 9.5%). Most of the respondents used smart phones from various manufacture, mostly chines phones, and with the android operating systems being the most interactive system they are using. From the previous information this has to do with the youth who are influenced by the western cultures.

4.5 Performance Expectancy

In order to examine the factors that influenced usage of mobile phones in Uganda, the constructs of UTAUT including Performance Expectancy, Effort expectancy, Social influence, Facilitating conditions and Behavioral intention were used. Data were gathered and analyzed using descriptive means on each of these constructs as shown in tables 7-12. Table 7 presents findings on Performance Expectancy.

Table 7: Results For Performance Expectancy

Usage	N	Min	Max	Mean	Meaning
Mobile phones are useful	532	3.00	5.00	4.5940	Strongly agree
Mobile phones will increase my productivity.	532	2.00	5.00	3.6203	Neutral
Mobile phones are time saving.	532	1.00	5.00	3.6241	Neutral
I use mobile phones because they are cheap.	496	1.00	5.00	3.5887	Neutral

Source: Primary Data.

In the Table N represents the number of phone owners, the minimum and maximum reflect the rate at which the questions were answered from a scale of 1 to 5.

Results in table 7 reveal the respondents strongly agreed that Mobile phones are useful (Mean=4.5940). Respondents also agreed that Mobile phones help in accomplishment of activities more quickly (Mean=4.1278).

However, the respondents reluctantly agreed that mobile phones help to increase productivity (Mean=3.6203), mobile phones are time saving (Mean=3.6241) and also that they use mobile phones because the phones are cheap (Mean=3.5887).

4.6 Effort Expectancy

In order to examine the factors that influenced usage of mobile phones in Uganda, the

Table 8: Results Of Effort Expectancy

Expectancy	N	Minimum	Maximum	Mean	Meaning
I find mobile phones easy to use.	532	2.00	5.00	3.9586	Agree
Mobile phones are clear and understandable.	532	2.00	5.00	3.8872	Agree
I find it easy to go through the different settings and applications.	532	2.00	5.00	4.1654	Strongly Agree
Valid N (list wise)	532				

Source: Primary Data

constructs of UTAUT including Performance Expectancy Effort expectancy, Social influence, Facilitating conditions and Behavioral intention were used. 12. Table 8 findings on Effort expectancy .Results in Table 9 reveal the respondents agreed that Mobile phones are easy to use (Mean=3.9856). Respondents also agreed that Mobile phones are clear and understandable despite the difference in the languages in which the mobile settings are configured (Mean=3.8872).

Furthermore, the respondents strongly agreed that mobile phones are easy to go through the different settings and applications, and can easily navigate through them. (Mean=4.1654).

Table 9: Results Of Social Influence

Influences	N	Minimum	Maximum	Mean	Meaning
Owning a mobile phone is prestigious.	516	1.00	5.00	3.0310	Disagree
Every important person owns a mobile phone.	532	4.00	5.00	4.4436	Strongly Agree
Owning a mobile phone raises my status.	532	1.00	5.00	2.9737	Strongly Disagree
Valid N (list wise)	516				

Source: Primary Data.

Results in Table 9 reveal the respondents disagreed that owning a Mobile phones is prestigious (mean = 3.0310), S strongly agreed that every important person owns a mobile phone (4.4436), Strongly dis agreed that owning a mobile phone rises there status (2.9737) this indicates that majority of the people do not believe that mobile technology cannot change their economic and social status.

Table 10: Facilitating Conditions

Conditions	N	Minimum	Maximum	Mean	Std. Deviation
I can access recharge from my phone.	516	2.00	5.00	4.3062	Strongly Agree
I can access the internet from my phone.	532	1.00	5.00	3.8947	Agree
I can access road maps to various places on my phone.	498	1.00	5.00	2.7390	Disagree
I can afford to pay for the internet on my phone.	532	1.00	5.00	3.9474	Agree
I can afford money for the recharge / credit/ talk time.	532	2.00	5.00	3.9361	Agree
The people I deal with use and own mobile phones.	532	1.00	5.00	3.7820	Agree
It's easy to learn how to use the mobile phones.	532	2.00	5.00	3.8571	Agree
Valid N (list wise)	482				

Source: Primary Data.

Results in Table 10 reveal the respondents disagreed that owning a Mobile phones is prestigious (mean = 3.0310), Strongly agreed that every important person owns a mobile phone (4.4436), Strongly dis agreed that owning a mobile phone rises there status (2.9737) this indicates that majority of the people do not believe that mobile technology cannot change their economic and social status

4.7 Behavioral Intention

Table 11: Results Of Behavioral Intention

Intention	N	Minimum	Maximum	Mean	Std. Deviation
I find the using and owning the mobile phone useful and cheap.	532	1.00	5.00	3.2782	Disagree
I intend to stop to continue using the mobile phone.	508	1.00	5.00	2.3701	Disagree
I intend to use the mobile phone.	506	2.00	5.00	4.1581	Strongly Agree
I intend to try out different phone types.	514	1.00	5.00	3.7860	Agree
Valid N (list wise)	464				

Source: Primary Data.

Results in Table 11 reveal the respondents disagreed that owning a Mobile phones is use full and cheap (mean = 3.2782), Disagreed to stop using the mobile phone, (2.3701) and finally agreed on trying out the different types of mobile phones. (3.7860), the people are willing to adapt to new technologies, despite them being expensive.

In order to understand, what people use their phones for, and how often they use their phones a questionnaire was generated. The statistics are shown from table 13-14.

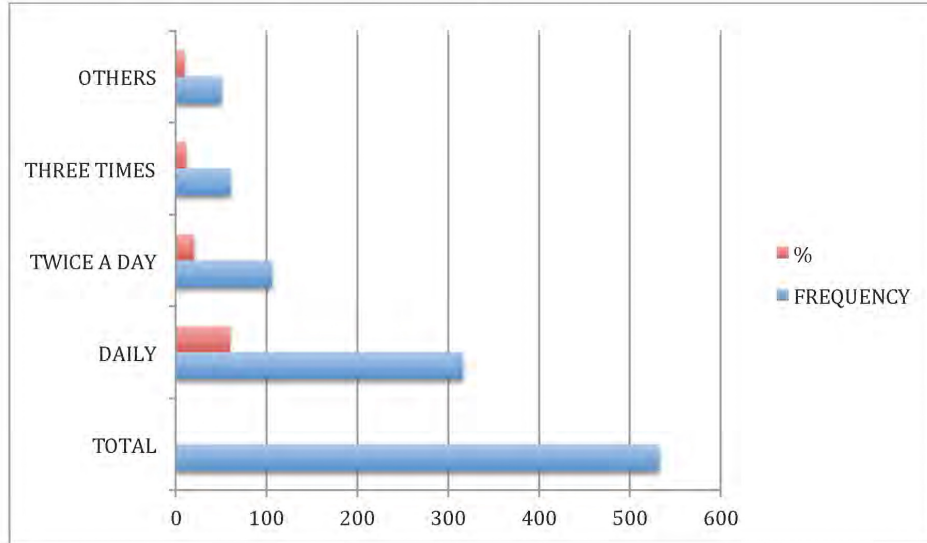
Table 13: What Do You Use Your Mobile Phones For?

Use	Frequency	%
CALLING	342	64.3
RECEIVING	32	6.0
CAMERA	80	15.0
OTHERS	78	14.7
Total	532	100.0

Source: Primary Data.

The Table shows that most of the respondents use the phone only for making phone calls. This is followed by the camera usage, which maybe correlated, to the other usages such as Facebook and other social media. None of these reflect any business usages and yet mobile phone driving force in business for western cultures. Advertisement in the western culture is usually done through use of mobile phones and mobile apps created by small business. Here innovation has not been developed henceforth the total use and knowledge is of lack to increasing productivity for small businesses. The mobile phone in this case is not acting as an agent of poverty eradication. In trying to examine how often people use their phones. Questions were asked in objectives of whether they use it on daily basis, twice a week, three times a week, and others that might not be mentioned.

CHART 2 PURPOSE OF CELL PHONE USAGE



Source: Primary Data.

The data in the Graph and chart above shows the level of interaction with the mobile phones being the highest percentage of (59.4%) daily which is based on making calls, and twice a week coming out as the a liability since most of the people are not using it for business.

4.8 Findings From Field Interviews

In order to examine the impact of mobile phones on poverty eradication in developing countries general view for the factors from the respondents that were interviewed, content analysis method was used. The findings indicated that most of the respondents find the mobile phone expansive, in terms of buying credit to make phone calls and further expressed views of high rates on facilitating conditions by the service providers. Most of the people who complained were the students, who have the highest number of mobile phones in these regions; one of the students expressed herself in the following quotations.

“Ever since I bought the phone, I load approximately 1,700 shillings every day, buying credit. Which I use to call and chat with friends, but I think these people are stealing my money because the credit moves first. Can only talk for 15 minutes”

The data further shows that the people know the basic functions of the phone, which is making phone calls and telling time. When asked what do they use the phone for, and if they used in business. One of the respondents replied;

“Yes I know how to check if my battery is low, check for my balance, and load more credit. I use my phone to make phone calls, check time and for setting my alarm. And I use it to call customers for my business and when I want a service from some one.

In relation to the above most respondents noted the use of a mobile phone to call for transportation, mobile money, send and receive money through their phones from their relatives on their devices.

Most of the people interviewed in the higher professions actually thought that the mobile phones are only used as communication tools and not actual business tools they argued that:

“The phone is very easy to use, everything is clear. I only use it to, schedule meetings, read newspapers, listen to radio, and flush light it just like any other device TV. Radio, and I use for my entertainment, loading music songs and videos”

4.8.0 Discussion Of Findings

The statistics presented in this chapter give an over view of the requirements and specification for a technology to be adopted, and the findings from the content analysis

based on the interviews, give an over view of the impact of mobile phones and poverty eradication in developing countries.

RQ1: *What factors influence the usage of mobile phones in developing countries?*

There is a significant relationship between Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Behavior Intention. Social Influence had the least influence on usage and adoption.

The respondents find the mobile phones easy to use; despite the problem of language, which has been the considered, has the major setback in the various literatures. However there is need to note that the use they refer to is to make and receive phone calls, set alarms, check time. These are one-button press options. There is hardly any application use or Internet use on the mobile phones. The results in figure 9 indicated the ease of use.

Results in table 9 reveal the respondents agreed that Mobile phones are easy to use (Mean=3.9856). Respondents also agreed that Mobile phones are clear and understandable despite the difference in the languages in which the mobile settings are configured (Mean=3.8872).

Furthermore, the respondents strongly agreed that mobile phones are easy to go through the different settings and applications, and can easily navigate through them.

(Mean=4.1654).

RQ2: *What is the impact of mobile phones on poverty eradication in developing countries?*

Findings from the interview guides indicate, that despite the respondents understanding how to use the phone, the phone is not used for business purposes, like mobile advertising, imaging, tele marketing, customer relations, social media. They use the phone to make phone calls to there clients once in a well, but not as business tools. Mobile phone are not transforming developing countries through creation of businesses for poverty eradication. They are being used, as ordinary means of communication. To make and receive phone calls.

“Yes I know how to check if my battery is low, check for my balance, and load more credit. I use my phone to make phone calls, check time and for setting my alarm. And I use it to call customers for my business and when I want a service from some one”.

In relation to the above, some respondents be expressed, that mobile phone were expensive, in relation to buying, loading credit to make phones calls. Thus turning out to be a liability to mean ones phone, which is contributing to increase poverty among people, as large sums of money are spent on the phone as the respondents indicated.

“Ever since I bought the phone, I load approximately 1,700 shillings every day, buying credit. Which I use to call and chat with friends, but I think these people are stealing my money because the credit moves first. Can only talk for 15 minutes”

4.8.1 Mobile Technologies Used

Results in Table 6 above indicate that majority of the respondents, had smart phones (226, 42.5%), chines phones (176, 33.1%) android phones (80, 15.0) ordinary phones (50, 9.5%). Thus making android operating system, the most widely used, this might be due to the fact that its open source increased number of manufactures using the OS on the phones, The iPhone and apple IOS, were omitted from this surveys and interviews, as they was no knowledge of the respondents of what that meant. The chines phones have been the cheapest phones in these regions.

4.8.2 Effects Of Adoption And Usage

There is very high willingness of the use of mobile phones in developing countries. However even though populations have adopted the mobile phones, they have not fully utilized it. They mainly use it for calls and haven't explored its other functions like Internet.

The mobile phone has various functions which if effectively taken advantage of by the people in business they will be able to experience profits which will enable them get loans and expand their business and also own property which will eventually lead to poverty eradication. . The attitudinal perceptions of Performance Expectancy and Effort Expectancy should be addressed when designing mobile phones. Since our study focused on one suburban area in Uganda, further studies are needed to be carried out in order to find out the effects of adoption of mobile phones in other areas.

CHAPTER 5

SUMMARY AND CONCLUSION

Chapter one presented the introduction and the specific objective of the study, which were archived in chapter four. Chapter two presented the research strategy and methods that were used to collect and analyze the data. These methods were used in chapter four accordingly, in chapter three, literature on the current state of HCI was reviewed, and this chapter presents the conclusion and recommendations of the study.

5.0 Limitations Of The Study

Most of the respondents were not interested in answering the questions that were asked, they either wanted motivation through money, or never wanted to answer the questions. Therefore, it was difficult to collect the data as, there was need to give handouts in form of money and enlighten the respondents about the objectives of the study and how it will benefit them. For example: An explanation of the various types of mobile phones had to be explained in detailed, operating system, application market among other features of the phone.

5.1 Directions For Future Research

Further research is still needed in human computer interaction in relation to developing countries; the construct identified can be used to develop a set of hypothesis that can make the findings more general and focused. Furthermore focusing individual countries

the same constructs can be used to study mobile phone usage and adoption in different countries that would provide deeper insights on the requirements of the mobile devices in these countries.

5.2 Future Mobile Application For Non English Countries

In figures below 15 and 16, as with Siri, Intelligent Personal Assistant, the future language app would narrow the vocabulary language to the needs of each user. This would make the storage for vocabulary databases, web services if available less and more specific. It would narrow the language to the needs of such as markets, shops, local business and services, news and other entertainment. Thus bringing about better interaction and usability.

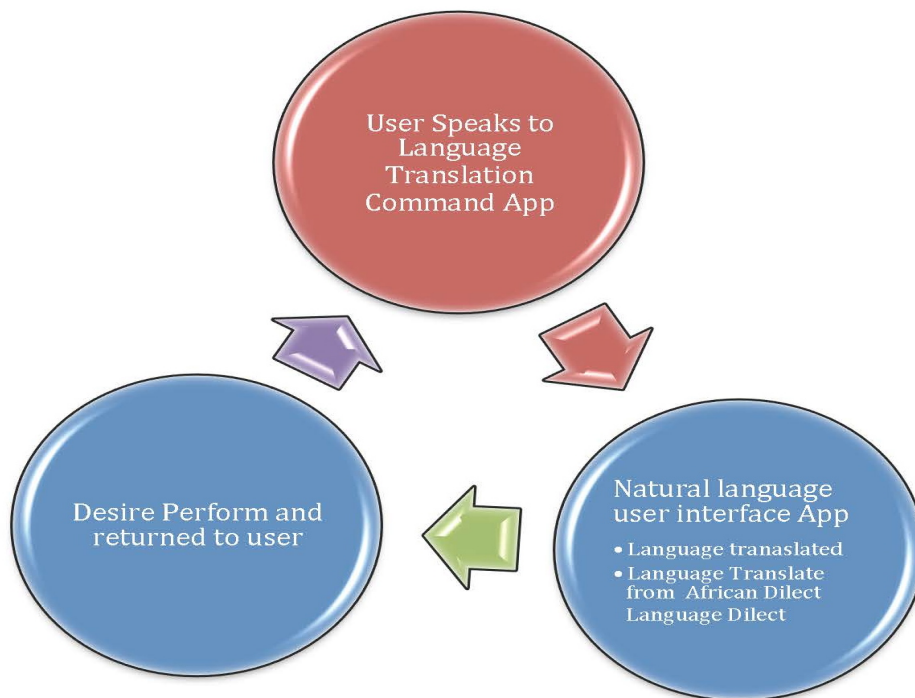


Figure 6: Infrastructures Of Siri (Stasys. B Et Al, 2011)

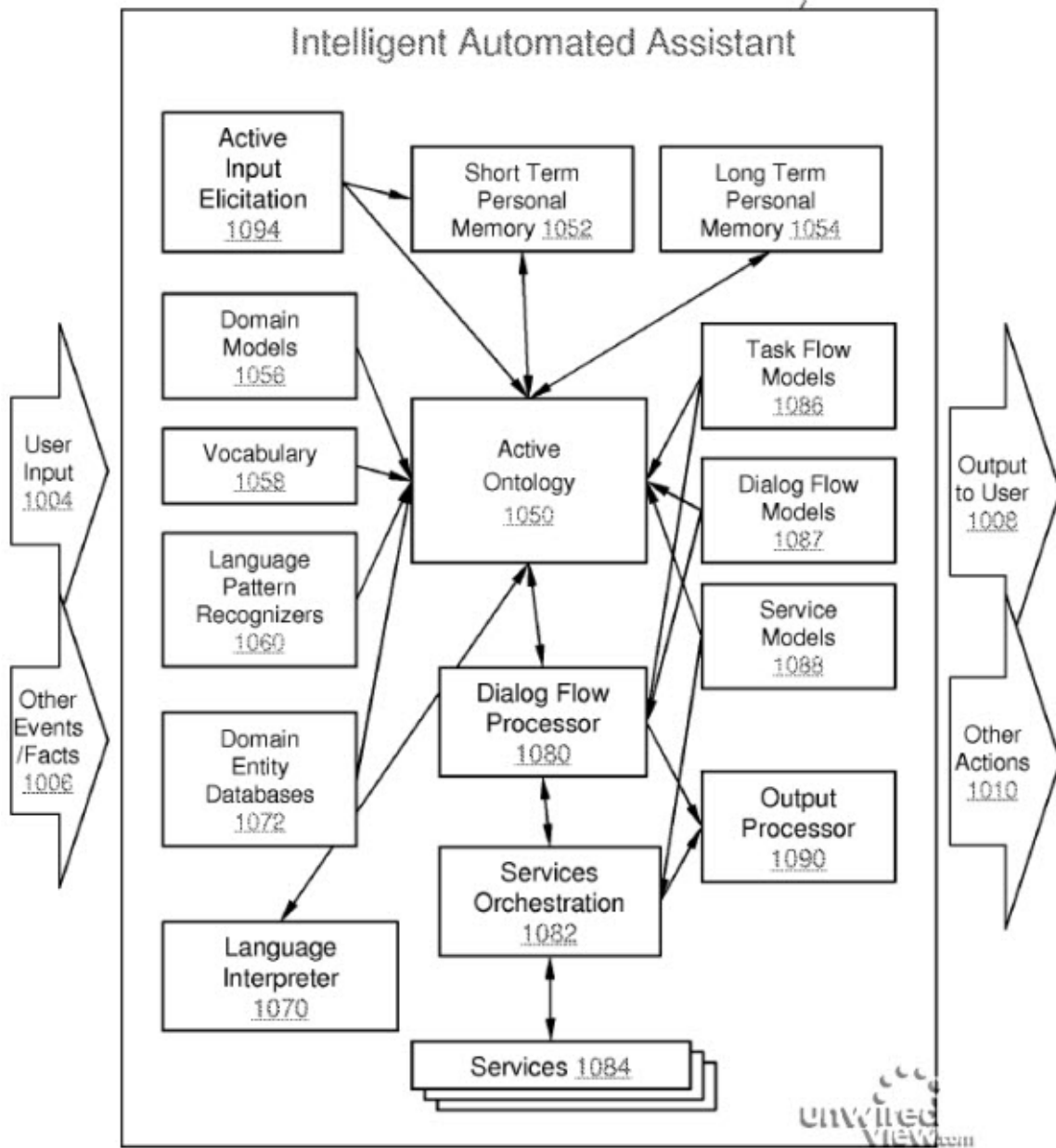


Figure 7: Infrastructures Of Siri IOS (Stasys. B Et Al, 2011)

5.3 Conclusion And Recommendations

This study is a step towards understanding the requirements and specifications that need to be in place, before users can adapt a technology in the case of Uganda and other developing countries. And why the current technologies are not being utilized for commercial and business purposes. The examined literatures in the study state that there are little efforts towards understanding the requirements and specifications of the users in these countries. The study therefore, consolidated. The constructs of the UTAUT model, performance expectancy, effort expectancy, facilitating conditions and social influence from the responses of Individual users, as the requirements an increased and easy adoption of technology in developing countries, companies interested in investing in software projects in this countries the figure below summaries the concept of human computer interaction found in this study and how it works

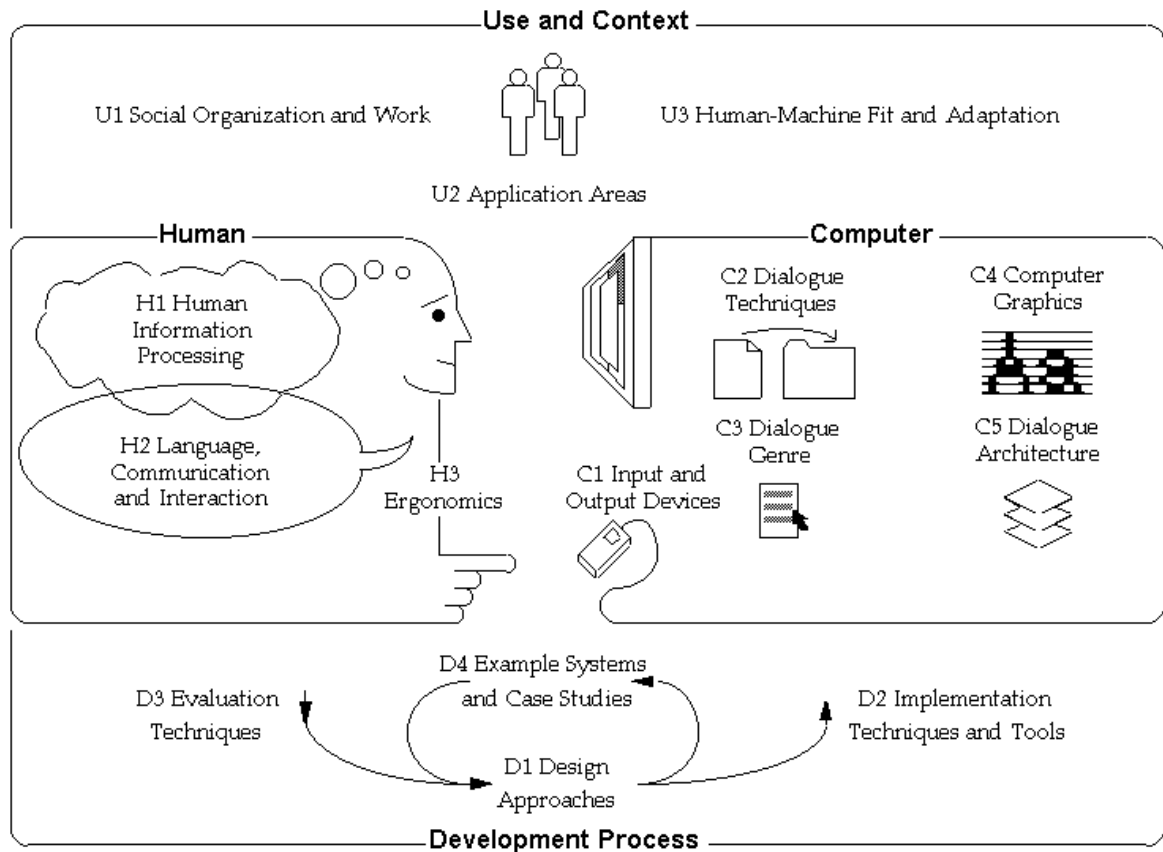


Figure 8: Summary Of The Concept Of Human Computer Interaction

(Hewett Et Al, 2002)

U1= Social organization and work, focusing on the user the information processing abilities, brain, visual, sensory through touch, audio, and the location he might be located putting in mind that ever user has different specifications and requirements

U2= Focusing on the user interface, application areas, that the user interacts with, input and output, monitor,

U3= Focusing on the machine fit and adaption. Dialogue technique for ease of communication, the languages used will render easier communication if the users understand it. And finally the figure shows that the development process is centered the users' interaction with the system example systems in form of prototypes and case studies, this research can be used as a case study in understanding the requirements of technology adoption in developing countries. As concerns with human computer interaction there is need to note that; most of this technologies, software applications computer and mobile phones are developed for commercial purposes, most companies cater for the needs of the clients who are able to consume there products. “ I think developing countries, most come up with their own be spoke technologies, designed in their own languages, easily understood by their communities and solving the problems, as they understand their needs better, of course through following the ISO regulations for software development. If this step is taken, then in future we will have an operation system based on African culture, language, icons and application store which will make them easy to use, more interactive and above all better understood, as this is happening in countries like China and India.

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APPENDIX I:

SOUTHERN UNIVERSITY A&M COLLEGE BATON ROUGE RESEARCH QUESTIONNAIRE FOR CORRESPONDENTS BACKGROUND

Dear correspondent

We are looking at the man machine interaction or human computer interaction usage of the mobile phone in the country for poverty eradication. Please take some time and fill this questionnaire for us.

Human computer interactions as a disciplined concerned with design, evaluation and implementation of interactive computing systems for human use and with the study of the major phenomena surrounding them.

The information you will provide is going to be used for academic purposes only.

Section A

Background Information

1. Age.....
2. **Marital Status** 1) Single 2) Married 3) Widowed 4) Others
specify.....
3. **Highest level of Education** 1) Diploma 2) Bachelors 3) Masters 4) PhD 5) Other
specify.....
4. **Profession**
.....
5. **Do you have a phone?** 1) Yes 2) No
6. **If you have what do you use it for?** 1) SMS 2) Calling 3) Receiving 4) Camera
5) others specify.....
7. **Where do you use it?** 1) Computer 2) Phone 3) Printed 4) Others
specify.....
8. **How often do you use the phone?** 1) Daily 2) Twice a week 3) Three times a
week 4) others specify.....
9. **If no, where do you access the phone?** 1) Office 2) Internet 3) others
specify.....

10. If you have access and you do not have a phone? Why is it so?

.....

11. Do you have a phone? 1) Yes 2) No

12. If yes, which one? 1) Smart phone 2) Chinese phone 3) Android phone 4)

Ordinary phone 5) Others specify.....

13. How often do you use it? 1) Daily 2) Weekly 3) others

specify.....

APPENDIX II:

SOUTHERN UNIVERSITY A&M COLLEGE BATON ROUGE RESEARCH QUESTIONNAIRE FOR FACTORS OF ADOPTION

Dear correspondent:

We are looking at the man machine interaction or human computer interaction usage of the mobile phone in the country for poverty eradication. Please take some time and fill this questionnaire for us.

Human computer interactions as a disciplined concerned with design, evaluation and implementation of interactive computing systems for human use and with the study of the major phenomena surrounding them.

The information you will provide is going to be used for academic purposes only.

The following statements seek to find out your perceptions about Mobile phones:

Evaluate each statement and tick in the appropriate box using the following scale:

1= strongly disagree (SD) 2 = disagree (D), 3 = Not sure (NS), 4 = Agree (A), 5 = strongly Agree (SA)

PU	Performance expectancy					
		SD	D	NS	A	SA
	Mobile phones are useful					
	Mobile phones helps in accomplishment of activities more quickly					
	Mobile phones will increase my productivity					
	Mobile phones are time saving					
	I use mobile phones because there cheap					
	Effort expectancy					
	I find mobile phones easy to use					
	Mobile phones are clear and understandable					
	I find it easy to go through the different settings and applications					
	Social influence					
	Owning a mobile phone is prestigious					
	Every important person owns a mobile phone					
	Owning a mobile phone raises my status					
	Facilitating conditions					
	I can access recharge from my phone					
	I can access the internet from my phone					

	I can access road maps to various places on my phone					
	I can afford to pay for the internet on the phone					
	I can afford money for the recharge / credit/ talk time					
	The people I deal with use and own mobile phones					
	It's easy to learn how to use the mobile phones					
Behavioral intention						
	I find the using ad owning the mobile phone useful and cheap					
	I intend to stop to continue using the mobile phone					
	I intend to use the mobile phone					

APPENDIX III:

SOUTHERN UNIVERSITY A&M COLLEGE BATON ROUGE RESEARCH QUESTIONNAIRE FOR CORESPONDENTS BACKGROUND

FIELD INTREVIEW GUIDE

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Section A: Bio data

Kindly provide your details on the following

Age.....Sex.....Bossiness title/type.....Phone name.....

Section B: Knowledge Of Mobile Phones

1. What do you know about mobile phones, as tools of business?
2. How did you get to know about mobile phones, as tools of business?
3. For how long have you used or known mobile phones for your business?

Section C: Mobile Phones And There Applicability In Businesses

1. Do you have well-established mobile phone business applications in your business?
2. Do you understand the business applications?
3. What mobile phone business applications does your phone use?
4. Who uses mobile phones in your business area?
5. In what aspect do you think mobile phones have been useful in business and poverty eradication?
6. What factors affect the use of mobile phones for business?

Section D: Challenges Of Adoption And Sustainability Of Mobile Phones For Business

1. Mention any challenges that you face in adopting the mobile phone/applications for doing your business?

Section E: Suggested Solutions.

2. What roles do you think the mobile phone and service providers companies should play for successful use of mobile phones in businesses?
3. What things do you think mobile phone companies should do for proper design of mobile phones for developing countries?
4. What other suggestions would you give for the design of mobile phones for developing countries?