



COMMUNICATION FOR SUSTAINABLE DEVELOPMENT

R&D RESEARCH STUDIES 2012-2014

eREPORT

INTRODUCTION

The Uganda Communications Commission, is mandated to promote research into the development and use of communication techniques and technologies, including those which promote accessibility of persons with disabilities to communication services.

In fulfilling this mandate, UCC through the R&D Unit supported various research studies between 2012 - 2014 on a broad range of topics across the sector with the overall objective being *“to generate knowledge to support the development, innovation and usage of services in the sector with particular focus to regulation”*.

This eReport is a high level summary of the findings of five (5) studies that were successfully concluded in the research cycle 2012-2014.

1 QUALITY OF SERVICE IN SPECTRUM MOBILITY TECHNIQUES FOR COGNITIVE RADIO

There has been growing interest in the area of cognitive radio (CR) technology which enables opportunistic use of licensed spectrum by unlicensed users. The key advantage of this approach is to enhance spectrum efficiency and accommodate more services in the radio spectrum.

The objective of this research was to investigate and propose improvements to the existing and proposed spectrum mobility techniques to achieve better Quality of Service (QoS) of secondary users in a cognitive radio network. The study was undertaken through literature review and modeling of traffic for voice and wireless data networks. Probability models were used to estimate the actual throughput for a wireless network.

It was found that Poisson-based models are not adequate to model data traffic and hence a parametric traffic model was developed for various data transmission protocols on the Community Wireless Resource Centre (CWRC) IEEE 802.11b/g secondary user cognitive network. In addition, a cooperative model to facilitate handoff, and hence QoS of the secondary user, based on the cooperation of the secondary cognitive radio links was developed.

The results demonstrate that cooperation can be beneficial in improving the transmission rate, especially when the interference temperature constraint is more stringent. Further, as the number of potential cognitive relays increases, the probability that the relays can obtain high transmit power and high cooperation gain increases. Thus, the best relay also has a high probability to provide better performance as the number of cognitive relays increases. This model thus enables the determination of the best link to be used for secondary transmission, particularly where relays are required, in-order to enhance QoS.

Further work in this area could involve studying QoS issues based on other traffic models such as the Modulated Markov Poisson process (MMPP), fluid models and regression based models.

2 ASSESSMENT OF POSTAL AND COURIER BUSINESS MODELS IN UGANDA

Market Liberalisation of the postal sector has led to stiff competition amongst postal and courier operators in Uganda and around the world. Additionally, the proliferation of electronic Information and Communication technologies such as email and SMS has posed challenges to long standing business models used within the postal sector. Consequently postal operators have had to actively adapt to these changes to mitigate declining traditional business revenue streams.

The objective of this research was to assess the sustainability of current business models in the Postal and Courier sector in Uganda and to recommend regulatory interventions that could further promote the provision of modern and innovative postal and courier services in Uganda. The study applied a mixed methods approach, where both qualitative and quantitative methodologies were used to collect data for analysis.

The study revealed that the sustainability of the current business models is driven by diversification into products and services that are complimentary to the traditional mail and parcel business. In addition to this, postal and courier operators have strategically leveraged emerging ICT services to improve the efficiency of delivering traditional mail and parcel services. Segmentation of the existing market and tailoring of services to meet specific needs will help to sustain these new business models in the future.

In terms of regulatory interventions, a need for the development of cost-based pricing models and review of the reserved area and Universal Service Obligations was highlighted. In reviewing the need and implementation of Universal Service Obligations by postal operators, the mismatch between the requirement for universal access to postal services and the low demand for post mail services needs to be addressed.

3 ADAPTIVE TECHNOLOGIES FOR HEARING AND VISUALLY IMPAIRED PERSONS IN UGANDA

Information and communication technologies (ICTs) are key enablers of social and economic development for all of the world's people. However, in Uganda the hard-of-hearing and visually impaired persons are yet to fully harness the benefits of ICTs.

The objective of this research was to establish the means by which persons with Hearing and Visual Impairments (HVIs) use mobile phones and the Internet, the challenges they face when using existing adaptive technologies and proposals of possible strategies and technologies that could be adopted to enable use of mobile phone and Internet services by the hearing and visually impaired persons.

Data for the study was collected through face to face interviews, Focus Group Discussions (FGDs) with key stakeholders, community organizations for hearing and visually impaired persons, representatives of persons with disability and a random sample of disabled Persons.

The study found that HVI persons operated mobile phones majorly through personal assistants, with the majority of them requiring assistance to 'communicate' while others required assistance to 'operate' the phone. The study also established that only two types of adaptive technologies were in use by the visually impaired persons in Uganda; these technologies included Screen Magnifiers and Screen Readers. No adaptive technologies for the deaf were found to be in use. Communication for the deaf is still dependent solely on the limited sign language interpreters available.

The limited availability of adaptive technologies and prohibitive costs of acquiring these adaptive devices for use was cited as one of the biggest challenges by the HVIs.

The study recommended that deliberate effort needs to be made to fund and support the provision of adaptive technologies for HVIs.

4 INTEGRATING MOBILE LEARNING IN OPEN AND DISTANCE LEARNING AT MAKERERE UNIVERSITY

The increased proliferation of Information and Communication Technologies (ICT) is playing a vital role in enhancing Open and Distance Learning (ODL) on a large scale. However, due to diverse and complex needs of learners in ODL environments, the integration of ICT solutions is quite challenging.

The objective of the study was to design, develop, and test an m-Learning application to support academic activities of Open and Distance eLearning (ODeL) students at Makerere University. Qualitative and quantitative techniques were used to acquire information that was used for the design of the m-Learning application. This included profiling the learning support activities, the capabilities of the mobile phones available to the students and mobile technologies available to support ODeL.

The study revealed that the most common learner support activities included peer to peer learning (coursework discussions with fellow students), and sharing of information on learning events with administrators, lecturers and fellow students. Other less commonly used online activities were registration, counseling and tutorials. While 100% of the students involved in the study reported having access to mobile phone services, only 97% actually owned mobile devices. Therefore, given that all learners could comfortably utilize SMS technology, as opposed to Internet based applications, SMS was chosen for use with the system.

The m-learning application developed included a Virtual Cooperative and collaborative module, where students could register in various groups through SMS to discuss coursework assignments and respond to collaborative learning challenges posed by their lecturers. A virtual Notice board was also developed which could be queried for information on face to face class schedules, exam schedules and results as well as student fees balances.

The system passed tests on functionality, performance, stress and usability.

5 DESIGNING COMPUTER GAMES FOR HEALTH EDUCATION IN SECONDARY SCHOOLS IN UGANDA

Interactive video games offer unique advantages over conventional methods of health education. The widespread appeal of video game playing, along with its use of interactivity to involve players in challenging situations, creates a unique opportunity to reach young people with health messages. With Only 39% of the young people aware of HIV prevention facts¹, and virtually, a significant number of people living with HIV in Uganda being either students or teachers², there is need to increase awareness and learnings amongst such groups using more appealing techniques and devices - computers, mobile and internet channels.

This study aimed to design, develop and evaluate a digital learning environment for educating secondary school students in Uganda about the dangers of HIV/AIDS in order to foster behavioral change in them as a strategy to fight and guard against the HIV/AIDS epidemic, and the digital learning environment further provides online counseling services to infected children and orphans affected by HIV/AIDS epidemic.

The study used the control and experimental methodologies, the results of which gave remarkable differences in performance when computer game is used as intervention for HIV/AIDS education in schools.

The acceptance behavior of digital learning among students was investigated. The study findings confirmed a high acceptance level for HIV/AIDS prevention education with usage of digital learning environments among students. Similarly, the use of mobile interfaces for digital learning like NETAIDS adds value to student learning and would be a unique approach in the education and prevention of HIV/Aids among schools.

Among other benefits, the digital learning environment enabled counselors and health workers to respond to students' queries through mobile phones and also established counseling relationships which would otherwise have been a challenge in geographically dispersed areas.

¹ PlusNews (September 21st 2012) 'UGANDA: Condom use infrequent despite rising HIV rates'

² Daily Monitor (2012) ' 400,000 suffer HIV/AIDS in education system

The study proved that computer games, online lessons and discussion forums can be integrated to create a digital environment for HIV/AIDS education, counseling and support services. Time lags and technical challenges were the major challenges faced during the implementation of the project.

The study recommends that this intervention should be scaled up in other education institutions in the country. However, there is a need to redesign the computer game using another development environment, as opposed to running it on CD, in the future so that students access and play the educational game online. This could be done through a PPP arrangement where education institutions, relevant government agencies and private sector pool resources for further research and implementation. Further still, that ICT-mediated health education be integrated into the high school computer science curriculum and schools be persuaded to make significant investments in establishing and strengthening of ICT Labs.