Enhancing collaboration and knowledge transfer on e-learning and the teaching of web application development within universities in developing countries

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ABSTRACT

This study uses a case study document review methodology of interpretive research paradigm to address the enhancement of effective collaboration and knowledge transfer on e-learning and the teaching of web application development within universities in developing countries. A proposed partnership project between Tshwane University of Technology in South Africa and the Uganda Martyrs University (UMU) in Uganda is used as a possible lunch pad. While South Africa is a leading country on the use of Internet-based services in Africa, much of the other African countries are lagging behind in technological developments especially e-learning and web application development. Given that e-learning progress, economical developments and other technological developments stand to benefit from reciprocal developments from countries in close proximity with one another, the overall e-technological progress in Africa is therefore being eroded and possibly being diminished unless most of the developing countries are carried along. The uniqueness of this study lies in the provision of insights into ways in which the developments in e-learning and the teaching of and web application development can be transferred and shared within the African continent while at the same time enhancing the technological progress of South Africa in general.

Keywords: Knowledge transfer, collaboration, universities, e-learning, web application development.

1. INTRODUCTION

The overall goal of this study is to enhance collaboration and knowledge transfer on e-learning and the teaching of web application development within universities in developing countries and specifically between the Tshwane University of Technology (TUT) in South Africa and the Uganda Martyrs University (UMU) in Uganda. This could also assist in the bridging of the digital divide between higher institutions in developing countries.

The remaining part of section 1 discusses the background of the research problem. Section 2 looks at the relevance and the uniqueness of the study in the context of literature review. Section 3 presents the research methodology for the study with findings in section 4. Section 5 looks at the sustainability of the action while section 6 concludes the study.

1.1 Background of the problem and the need

The use of Information and Communication Technologies (ICT) is permeating every sphere of today’s society including business, government, education and social life. Handzic and Zhou [8:60] argues that apart from using IT itself in various aspects of an organization’s business, it is important for an organization to be able to creatively use ICT for competitive advantage. This is even more important in this era of knowledge economy where Singh [18] states that:

To be successful in the emerging knowledge economy, new processes, skills, and techniques that help to generate, manage and handle new knowledge need to be developed and practiced by information specialists.

Specifically, Becerra-Fernandez and Sabherwal [2] highlight how the utilization of leading-edge ICT systems enables dramatic improvement in services by supporting existing systems in new ways not earlier possible. One of such ways involves the use of Web-enabled technologies which has matured rapidly in the last decade.

Universities and Higher Education Institutions play a big role in the diffusion of technologies within and across societies. Beets and le Grange [1] confirms this statement by indicating that “Education is considered as a primary source of transformation”. However, in a previous study, Dehinbo [7] in the statement below observes a disparity between higher education institutions in developed countries and those in developing countries:

In improving the above situation and recognizing that higher institutions are a leading agent in technological use and diffusion, Dehinbo [7] highlight the need for higher institution in developing countries to join in “dancing to the tune of Web applications development”. This is based on
the premise that such impact would be more relevant with in-house developments of systems that will cost less, increase adoption and use, and takes cultural factors into account.

Gopalakrishnan [10] indicates that South Africa, like India have gate crashed into the hi-tech first world while leaving a large section of the population to languish in the third world. Given that South Africa unlike Sub-Saharan Africa is having a relatively high penetration of Internet and Web-enabled technologies, it would be of much relevance for the rest of Africa to tap some knowledge from South Africa.

The Tshwane University of Technology is one the Higher Education Institutions in South Africa that could assist in the technology transfer across Africa. The Faculty of Information and Communications Technology (ICT) is well established with diverse knowledge base and skills in various aspects of Information and Communications Technology (ICT). This is evident in the existence of ICT as a separate Faculty rather than being embedded in Faculty of Science or Business, as well as the existence of eight specialized departments within the Faculty. The department of Web and Multimedia applications is one of such specializations to cater for the growing relevance of Web and Multimedia applications in the society and is therefore be in a good position to assist in knowledge and technology transfer across Africa.

On the other hand, while Uganda is one of the less developed Sub-Saharan African countries, the Uganda Martyrs University (UMU) demonstrates potential as a pioneer and a leading agent of change and development even in the midst of social, economic and technical challenges. This is evident in a recent study, Rejswoud and Mulo [17] which note that the university was the first in Uganda to implement Open Source Software (OSS) with various attendant challenges, but with the goal of saving cost and enhancing capacity building in Software development and support among other OSS benefits.

This OSS implementation project at UMU was done through research from the department of Computer Science and Information Systems in very close collaboration with the ICT department.

The objective of this study therefore is to propose a project for enhancing collaboration and knowledge transfer on e-learning and web application development between the department of Web and Multimedia applications of the ICT Faculty in TUT and the department of ICT of the Faculty of Science at UMU. With the credentials highlighted above, this partnership project could assist in the technology transfer within and across Africa.

1.2 The Research question

The research overall question for this study then is: How can we enhance effective collaboration and knowledge transfer on e-learning and the teaching of web application development within universities in developing countries using a partnership project between TUT and UMU as a lunch pad?

2. LITERATURE REVIEW

It is observed by Sadik in Dehinbo [7] that “technological progress diminishes differences within the group of countries that adopt technologies but increases the gap between those countries and the rest of the world”. Sadik illustrates this by stating that between 1960 and 1992, the ratio of per capita income in the USA to that of Japan diminished from 2.9 to 1.1 while the ratio for USA to Ghana increased from 9.1 to 21.4. While the developed countries are moving in line with the opportunities provided by software on the World Wide Web, mobile devices and producing mass of graduates to drive the move, developing countries seem to be lagging behind.

Similarly, while South Africa and much of the other African countries are on opposing ends in technological developments especially e-learning and web application development. There is the need to avoid the situation in which the overall e-technological progress in Africa is therefore being eroded and possibly being diminished unless most of the developing countries are carried along. The uniqueness of this study lies in the provision of insights into ways in which the developments in e-learning and the teaching of and web application development can be transferred and shared within the African continent while at the same time enhancing the technological progress of South Africa in general.

Colle [5] argues that “the eReadiness of African universities is a vital issue in African development”. This study is aimed at achieving eReadiness of African universities. General constraints to development in Africa include poverty, under-development, and illiteracy. By stimulating and enhancing knowledge transfer, this study will address illiteracy which will improve employability and job creation capability of citizens. This would reduce poverty and stimulate development.

More specifically, the ICT academic staff profile at UMU will be enhanced and they will in turn produce more graduates. Web development skills will also be enhanced by the short courses. These would lead to the production of necessary skills in the Ugandan society. The ICT academic staff at TUT will be exposed to IT practices in other environment giving them more experiences. This will enhance their research collaboration efforts due to the availability of possible contacts for cross-national research efforts. At the administrative level, TUT stand to learn from the experiences of UMU with regard to Open Source Software (OSS) implementation. This could further stimulate software development and support capacity building and could further free more funds for the acquisition of relevant infrastructures.

3. RESEARCH DESIGN AND METHODOLOGY

3.1 The overall research design and approach

The overall research design is qualitative research which involves an interpretive research approach. According to Wolcott [20], the characteristics of qualitative research are
The followings: Understanding – Seeks to understand people interpretations; Dynamic – Reality changes with changes in peoples’ perceptions; Insider- Reality is what people perceive it to be; Value bound- Values will have an impact and should be understood and taken into account when conducting and reporting research; Holistic – A total or complete picture is sought; Discovery – Theories and hypotheses are involved as from data as collected; Subject – Data are perception of the people in the environment; The focus is on procedures to gain data.

Ngwenyama and Lee [14] note that interpretivism focus on the development of sound explanations and understandings of research phenomenon of interest. Stahl [19] explains that interpretivism emphasizes context and singular occurrences in the hope of extracting meaning and making sense typically using qualitative methods. Orlikowski and Baroudi [15] state that “Interpretive studies assume that people create and associate their own subjective and inter-subjective meanings as they interact with world around them" thereby rejecting the possibility of an “objective” or “factual” account of events and situations as well as generalization to a population. Rather, it seeks a relativistic and shared understanding of phenomena.

The ontology of interpretivism “seeks explanation within the realm of individual consciousness and subjectivity” [9]. There isn’t necessarily a single ultimate “truth” to be uncovered in a qualitative study, and that multiple perspectives with equal validity or truth could be held by different individuals [6 : 9].

However, Leedy and Ormrod [12 : 133] indicate that qualitative research assumes that the researcher’s ability to interpret and make sense of what is observed is critical for understanding any social phenomenon. Therefore, the research orientation of this topic assumes that the reality for different situations could differ. But by and large, this study will provide detail context that could enable understanding and the application of this study in other contexts. Thus, qualitative research design that provides rich qualitative context is deemed appropriate for understanding the phenomenon.

3.2 Methodology
The research methods will involve the use of a case study and document review to obtain relevant data on the topic. These are analyzed and presented using descriptions that are less structured and more responsive to the need for the study. In a case study the researcher explores a single entity or phenomenon (‘the case’) bounded by time and activity (e.g., an event, institution, or social group) and collects detailed information through a variety of data collection procedures over a sustained period of time. The case study is a descriptive record of an individual’s experiences and/or behaviors kept by an outside observer [6 : 12]. Research instruments used includes email questionnaire and telephonic interviews with some members of staff at both TUT and UMU. The population for this research consists of the members of the community, staff and learners/students from UMU in Uganda and TUT in South Africa.

4. RESULTS AND FINDINGS
Below are the summaries of findings of the study. These are structured in line with the specific problems addressed by the action as listed above.

4.1 Production of Postgraduate ICT scholars
The ICT academic staff profile at UMU shows none with doctorate degree in ICT related field. TUT on the other hand have some doctorate degree holders in ICT related fields and offers doctorate degree course in ICT related specializations. UMU will therefore benefit by enrolling some of their staff for postgraduate studies at TUT. The objective is to increase the number of UMU ICT staff with postgraduate qualifications so that UMU can also offer postgraduate courses in future. The expected result will be a specified number of UMU ICT staff graduating with postgraduate qualifications yearly in the next few years. Suitably qualified TUT ICT staff has expressed interest in supervising UMU staff’s Master’s dissertation and Doctorate thesis. In addition, TUT has engaged the service of professors Extra-ordinaire based at other neighboring universities to assist in postgraduate supervision.

4.2 Periodic interchange of ICT academic staff
The periodic exchange of ICT academic staff will enable UMU to get first-hand experience on teaching, research and postgraduate administration at TUT. The IT academic staff at TUT will be exposed to IT practices in another environment giving them more experiences. This will enhance their research collaboration efforts due to the availability of possible contacts for cross-national research efforts. The interchange can range from weekly, monthly or yearly stay. This could also result in benchmarking activities between the two participating institutions.

4.3 Short courses on in-house Web application development
In a previous study, Dehinbo [7] emphasize the need to encourage and motivate web applications development students and eliminate the phobia involved in in-house use of web-based platforms for the development of Web applications that can enhance teaching, learning, business and development. However, given the current reliance on off-the-shelf-purchased Web applications which many institutions in developing countries can hardly afford, Dehinbo [7] asserts that the impact of Web applications would be more relevant with in-house developments of such systems that will cost less, increase local adoption and use, enhance capacity development and takes cultural factors into account.

Therefore, in line with Banville and Landry’s [1] assertion research should identify perceived obstacles to progress and propose means to eliminate them, and suggest actions deemed appropriate towards accelerating the pace of progress, we believe that there is the need for short courses on in-house Web applications development. This will encourage and stimulate in-house development of Web applications thereby affording the comfort and usefulness of “e-learning” systems to departmental staff and students whose budget could not afford the commercial “off-the-shelf” e-learning systems.
Such courses can be conducted over short period of 2 to 4 weeks. The author have been teaching Web applications development using various platforms such as Java Servlets, Java Server Pages (JSP), Active Server Pages (ASP) and PHP Hypertext Processor for the past six years and would therefore be in a position to assist in this regard along with other staff.

### 4.4 Development of relevant in-house Web application

Given the high cost of off-the-shelf-purchased Web applications and the expected slow pace of intervention of the short course approach, TUT could assist UMU in the development of relevant Web applications that would assist academic and administrative operations. The Center for Software Development at the ICT faculty in TUT conducts software development for the society and has developed systems such as Electronic Campus (http://ec.tut.ac.za) as an in-house e-learning platform for TUT students. Such system can be customized for use at UMU.

### 4.5 Open Source Software (OSS) use and implementation

Critical to the development of web applications by the Center for Software Development above is the use of Open Source platforms such as Linux, PHP, MySQL, Java etc. There are various benefits and reasons that can be said to be responsible for the rapid uptake of OSS. Top on this is economical costs. Low cost remains the main driver and primary motive for the use and adoption of OSS [4, 16]. GITOC [11] categorize the low cost as demonstration of value and explains that since OSS are usually not sold and with no licensing fees, only downloading, distributing and duplicating cost are borne by the recipient. Further demonstration of value includes non-obsolescence as OSS can readily be amended instead of buying new ones.

Moreover, savings can be made on equipment replacement as OSS often performs satisfactorily on older equipment which often can not run latest version of proprietary software. GITOC [11] further give broader economic values such as reducing imports of software, increasing significant investment in the local software industry, stimulating development of software by local SMMEs thereby supporting the “Proudly South African Campaign” that promotes the use of locally produced goods and services.

In summarizing the benefits, GITOC [11] indicates that OSS is a useful tool that could allow developing countries to leapfrog into the information age, especially due to the rapid evolutionary process that produces better products in less time than the traditional closed model and due to the choices it offers the users. Apart from the opportunity to obtain freely, the choice to probe, modify, learn from and customize the software, harness the power of many small contributions from a large network of individuals worldwide to suit one’s need demonstrate the implications for affordable IT solutions both in the public and private sectors with the potentials to stimulate a new wave of opportunities in IT.

Interestingly, apart from the use by the Center for Software Development at TUT, there has not been an institutional policy at TUT to promote and implement the use OSS. This is despite the fact that the government of the Republic of South Africa (RSA), like their counterparts in Brazil and China has endorsed the use of OSS. This is evident in the OSS policy [16, 11].

Furthermore, the government have set up bodies like Meraka institute to propel the OSS campaign. Various South African organizations are also championing the OSS cause. Mark Shuttleworth through the Shuttleworth Foundation and Canonical in conjunction with Meraka institute launched the “Go Open Source campaign – GOSC” in 2004 as an R18 million South Africa wide campaign. Jason Hudson invented the “Freedom Toaster” as a self-service reliant computer kiosk put at various public places like universities and shopping malls. People can use it to browse and select OSS, insert blank CDs and copy the selected OSS [10].

One then wonders why the level of OSS adoption is still low in TUT and other parts of South Africa. Is it that we have too much money and prefer to pay exorbitant licensing fees rather than use available funds to assist the less privileged? Is it because many people are not even aware of OSS due to ignorance? NACI [13] wonders about the domination of Microsoft Office despite the availability of many open source office suites such as KOffice, Gnome Office, and Open Office which offer equivalent functionality and ease of use. Hence, NACI [13] infers that “obstacles to the adoption of OSS desktops no longer include technical issues or ease of use, but seem to be based on a lack of awareness”.

Fortunately, Reijswoud and Mulo [17] describe the experiences of adopting OSS at the Uganda Martyr University with an agenda for improving the effectiveness of adopting OSS in less developed countries. As a privately owned university founded in 1993 and without government funding, their budget is limited. And based on Christian values such as “thou shall not steal”, the UMU’s software policy frowns at the use of pirated software. Yet, the university aims to optimize access to ICT for students and staff with the limited funds available. A feasible solution is to consider the adoption of Free and Open Source Software which was officially agreed to by the university senate in May 2003.

Thereafter, Reijswoud and Mulo [17] report a decision was made that the implementation strategy will be staged, with computers for public access (library and labs) migrated first, followed by the computers for lecturing staff and finally the computers for the administration units. This was aimed at avoiding endangering the university’s main operations. The migration project started with the identification of the main applications and their usage towards selecting OSS alternatives in table 1 below.
<table>
<thead>
<tr>
<th>Task</th>
<th>Proprietary software</th>
<th>Open Source alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating system</td>
<td>Windows 9x, 2000, XP</td>
<td>GNU/Linux</td>
</tr>
<tr>
<td>Office productivity</td>
<td>Microsoft Office</td>
<td>OpenOffice</td>
</tr>
<tr>
<td>suite</td>
<td></td>
<td></td>
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<tr>
<td>Mail client</td>
<td>Microsoft Outlook Express</td>
<td>Kmail, Mozilla Mail</td>
</tr>
<tr>
<td>Internet browser</td>
<td>Internet Explorer</td>
<td>Konqueror, Mozilla</td>
</tr>
<tr>
<td>Database</td>
<td>Microsoft Access</td>
<td>MySQL/phpMyAdmin</td>
</tr>
<tr>
<td>Programming</td>
<td>Wordpad</td>
<td>Kate</td>
</tr>
<tr>
<td>Statistical analysis</td>
<td>SPSS</td>
<td>Eclipse</td>
</tr>
<tr>
<td>Web design</td>
<td>Microsoft Front Page</td>
<td>Bluefish/Nvu</td>
</tr>
</tbody>
</table>

Table 1. Main propriety software used and OSS alternatives (Source: [17]).

In summarizing, Reijswoud and Mulo [17] noted that the university was the first in Uganda to implement OSS with various attendant challenges, but recommends continuous information and training. Enhanced Internet access for users and further research on the development of better tools to bridge the compatibility problems would probably assist in OSS adoption.

At the administrative level, TUT can benefit from the experiences of UMU in the strategy for the institutionalization of OSS and learn from the various challenges faced by UMU. At present, none of the Open Source alternatives are in wide use at TUT. TUT can then hope to reap the various benefits of OSS.

4.6 **Research collaboration**

Research efforts stand to benefit by collaboration and partnerships. Even the well established researchers will benefit with access to cross-national research data. TUT and UMU researchers can collaborate and conduct joint researches. This could involve exchanging research visits. An obvious result of collaboration and partnerships efforts is the production of joint research publications. This would benefit both partnering institutions.

5. **SUSTAINABILITY OF THE ACTIONS**

For every action, there are risks, assumptions as well as efforts that should be put in place to ensure the sustainability of the actions. These are presented below for the proposed partnership.

i) Production of postgraduate ICT scholars: This assumes that the scholars will be dedicated and finish at the appropriate time. However, if not, they can continue the study by way of distance learning via the use of technologies.

ii) Periodic exchange of ICT academic staff: There is the risk that some staff may not be willing to relocate, especially staff from South Africa may not be willing to endure the challenges in Sub-Saharan African countries. Also, staff from Uganda may not want to return back to Uganda after experiencing the South African situations. Incentives should be put in place to encourage staff from South Africa to participate and agreements should be in place to require staff from Uganda to return on completion of their studies.

iii) Short courses on in-house Web applications development: There is the risk of having less time to complete the courses. The courses can be organized during holiday period to give time and allow dedications by the participants.

iv) Development of relevant Web applications: This assumes that UMU will be willing to pay minimum costs associated with the software development and the required infrastructure. Payments can be organized after savings have been made on the use of the developed systems.

v) Open Source Software (OSS) implementation: There is the risk that some of the challenges faced by UMU may not be relevant in the South African context. For example, the size of the network will be larger. Minimal technical support can be sought.

vi) Research collaboration: There is the risk of unavailability of funds to effect research visits. Fortunately, the Department of Education in South Africa gives funding to Institutions and researchers based on accredited research outputs. Strict requirements can be put in place to ensure that collaborations result in accredited research outputs such that funding secured from the research outputs can be used for fund future research efforts.

5. **CONCLUSIONS**

Enhancement of collaboration and knowledge transfer on e-learning and web application development within universities in developing countries is an important area with the potential to achieve social inclusion, bridge digital divide and lead to societal development. This study therefore fits into the overall objective of fostering capacity building and regional integration. The study will enable TUT and UMU to live up to the expectation of being agents of change in the society.

6. **REFERENCES**


