# A collaborative design process for educational digital resources in African higher education

## Thesis

# A COLLABORATIVE DESIGN PROCESS FOR EDUCATIONAL DIGITAL RESOURCES IN AFRICAN HIGHER EDUCATION

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Some text bound close to the spine.

# *Dedication*

*To my parents who have worked very hard over the years to give me quality education,*

*To Prof. K.P. Dzvimbo, my former boss and mentor who believed I could get a PhD and encouraged me to go for it,*

*To my nieces and nephews, I pray that you will have the desire to pursue academic excellence.*

# Abstract

Within Africa, access to digital library systems is critical in supporting higher level teaching, learning and research. Currently there is a high demand with inadequate resources which often produces poorly supported learning outcomes. The effectiveness of current resources is further limited by poor design processes, which is worsened by stakeholders (academics, e-learning technologists and digital librarians and designers) often working in isolation. Ultimately, designed resources become less user-centred and sustainable. This thesis sought to provide empirically developed collaborative design process guidance for design stakeholders developing educational digital resources within African higher education.

Following a Human Computer Interaction research approach, eleven best practice digital library projects identified from three case studies of African universities (in Kenya, Uganda and South Africa) were investigated. Data was drawn from interviews, observations and an examination of documents.

This investigation identified three interrelated factors that impacted on the design process (i.e. human relationships, innovative technologies and policies). The human relationships factor comprised multidisciplinary design stakeholders and included a subset i.e. design champions (multidisciplinary and domain champions) whose role changed the facilitation and eventual output of the other stakeholders in the design process. The multidisciplinary champions took on a participatory approach to engagement while the domain champions assumed an approach that was less engaging. The innovative technologies factor comprised universal technologies and 'flexible' technologies (i.e. Web 2.0 applications and the Open Source Software) which supported the design process and enhanced user-centeredness and sustainability of the projects. Existing institutional and national policies supported stakeholder collaboration and

application of the innovative technologies. The absence of any of these factors in the digital library projects weakened the design process and reduced effectiveness of digital resources.

These three factors have been used to develop the Collaborative Educational Resources Design (CERD) process model as a guidance tool to support multidisciplinary design stakeholders in designing effective digital resources.

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# Table of Contents

**Abstract** ..... i
**Acknowledgements** ..... iii
**Table of Contents** ..... iv
**List of tables** ..... vii
**List of figures** ..... vii
**List of abbreviations** ..... viii
**Chapter 1: Introduction** ..... 1
*1.1 Research motivation* ..... 3
1.1.1 Why research African HE? ..... 8
*1.2 The problem statement* ..... 11
*1.3 Research approach* ..... 12
1.3.1 A HCI perspective ..... 12
1.3.2 The influence from information science with reference to digital libraries ..... 13
1.3.3 The influence from education and educational technology theories ..... 14
1.3.4 The influence from application of educational digital resources in African HE ..... 15
*1.4 Research scope* ..... 15
*1.5 Definition of terms* ..... 16
*1.6 Thesis structure* ..... 18
**Chapter 2: The African Higher Education** ..... 20
*2.1 Development of African higher education* ..... 20
2.1.1 Phase I: post-World War II period ..... 20
2.1.2 Phase II: post-colonial period ..... 21
2.1.3 Phase III: era of crisis ..... 22
2.1.4 Phase IV: towards recovery ..... 26
*2.2 Educational digital resources* ..... 34
2.2.1 Status of digital libraries and institutional repositories in African HE ..... 35
2.2.2 An overview of OER deployment in African HE ..... 40
*2.3 Chapter summary* ..... 43
**Chapter 3: Digital Library Design Processes** ..... 44
*3.1 Theoretical approaches to collaborations in digital library design processes* ..... 44
*3.2 Identification of factors affecting design processes* ..... 48
3.2.1 The role of policies in digital library design ..... 48
3.2.2 The role of stakeholders in the design process ..... 54
3.2.3 The role of innovative technologies in supporting the design process ..... 60
*3.3 Chapter summary* ..... 64
**Chapter 4: Methodology** ..... 67
*4.1 A qualitative HCI investigation* ..... 67
4.1.1 Case studies ..... 69
4.1.2 Influence of grounded theory in HCI research approach ..... 76
4.1.3 Pilot studies ..... 81
4.1.4 Mixed methods of data collection ..... 86
*4.2 Data collection and analysis procedure* ..... 91
4.2.1 Selection of the case studies ..... 91
4.2.2 Identification of 'best practice' projects ..... 93

4.2.3 Participants selection ..... 94
4.2.4 Data collection techniques ..... 95
4.2.5 Data analysis ..... 99
4.2.6 Ethical considerations ..... 103

*4.3 Chapter summary ..... 105*

**Chapter 5: Identifying collaborative design process factors ..... 107**

*5.1 South Africa case study ..... 108*
5.1.1 E-learning status ..... 110
5.1.2 Digital library status ..... 110
5.1.3 Policy status ..... 111
5.1.4 Digital library projects ..... 113

*5.2 Kenya case study ..... 118*
5.2.1 E-learning status ..... 119
5.2.2 Digital library status ..... 120
5.2.3 Policy status ..... 121
5.2.4 Digital Library projects ..... 123

*5.3 Uganda case study ..... 127*
5.3.1 E-learning status ..... 128
5.3.2 Digital library status ..... 129
5.3.3 Policy status ..... 131
5.3.4 Digital library projects ..... 132

*5.4 High level analysis: Collaborative design process factors ..... 141*

*5.5 Chapter summary ..... 146*

**Chapter 6: The role of the human relationships factor in collaborative design process ..... 147**

*6.1 Description of stakeholders ..... 147*

*6.2 Stakeholders' skills and knowledge ..... 149*

*6.3 The role of design stakeholders in the design process ..... 150*
6.3.1 General multidisciplinary stakeholders ..... 151
6.3.2 Multidisciplinary champions (MC) ..... 152
6.3.3 Domain champions (DC) ..... 155
6.3.4 Comparisons between the two types of design champions ..... 157

*6.4 The contribution of the human relationships factor to the project outcomes ..... 161*

*6.5 Implication for the HCI design process ..... 167*
6.5.1 Design champions in the collaborative design process ..... 167
6.5.2 Stakeholder collaboration and policies ..... 172

*6.6 Chapter summary ..... 173*

**Chapter 7: The role of innovative technologies and policies in the collaborative design process ..... 175**

*7.1 The role of Innovative technologies in the design process ..... 176*
7.1.1 Flexible technologies in the design process ..... 178
7.1.2 Absence of flexible technologies in the design process ..... 182

*7.2 The role of policies in the design process ..... 184*
7.2.1 Nature of policies in the collaborative design process ..... 186
7.2.2 Policies supporting project initiation ..... 192
7.2.3 Policies supporting collaboration in the design process ..... 194
7.2.4 Policies absent in the design process ..... 196

*7.3 The contribution of the policies and innovative technologies to the project outcomes ..... 198*

*7.4 Implications for the HCI design process ..... 201*
7.4.1 The role of innovative technologies in the collaborative design process ..... 201

7.4.2 The role of policies in the collaborative design process ..... 204
7.5 Chapter summary ..... 208
**Chapter 8: The CERD process model in an African HE Context** ..... 210
8.1 The rationale for the CERD process model ..... 211
8.2 The Development process ..... 212
8.3 The CERD process model ..... 214
8.3.1 Introduction ..... 214
8.3.2 The CERD process model detailed ..... 217
8.4 Expert reviews of the cerd PRocess model ..... 231
8.4.1 Model's strong points ..... 233
8.4.2 Model's limitations ..... 234
8.5 The CERD process model application ..... 238
**Chapter 9: Conclusion** ..... 244
9.1 The role of the policy factor ..... 245
9.1.1 Implications for HCI design processes ..... 247
9.2 The role of the human relationships factor ..... 252
9.2.1 Implications for HCI design processes ..... 253
9.3 The role of the innovative technologies factor ..... 255
9.3.1 Implications for HCI design processes ..... 255
9.4 Implication for African technology design processes ..... 257
9.5 Practical implication: A guidance tool ..... 258
9.6 Reflections ..... 259
9.6.1 Reflection on the research questions ..... 259
9.6.2 An alternative methodological approach for HCI research? ..... 261
9.6.3 Research limitations ..... 261
9.6.4 Recommendation for future research ..... 263
9.7 Summary ..... 265
**References** ..... 266
**Appendices** ..... 283
Appendix 1: Case study selection criteria ..... 283
Appendix 2: List of interview participants ..... 287
Appendix 3: Semi-structured interview schedule ..... 288
Appendix 4: A print-out sample NVivo codes ..... 296
Appendix 5: a sample of the analysis process ..... 297
Appendix 6: The Open University Human Participants and Materials Ethics Committee (HPMEC) approval letter ..... 298
Appendix 7: Participants' information sheets ..... 299
Appendix 8: Consent form ..... 301
Appendix 9: Summary of the CERD process model presented to experts ..... 302

# List of tables

Table 1: Summary of similarities and differences between Education and HCI case studies.....75
Table 2: Summary of case study contexts .....108
Table 3: A summary of digital library projects in the South Africa Case study.....113
Table 4: Summary of digital library projects in the Kenya Case study .....123
Table 5: Summary of digital library projects in the Uganda Case study .....132
Table 6: Summary of the different multidisciplinary stakeholders.....148
Table 7: Summary of policies and their impact across the three countries .....186
Table 8: Human relationships factor and related outcome indicators at the initiation stage.....218
Table 9: Policies factor and related outcome indicators at the initiation stage .....220
Table 10: Innovative technologies factor and related outcome indicators at the initiation stage .....223
Table 11: Human relationships factor and related outcome indicators at the development stage .....225
Table 12: Policies factor and related outcome indicators at the development stage.....228
Table 13: Innovative technologies factor and related outcome indicators at the development stage...230
Table 14: Model's multidisciplinary model reviewers.....232

# List of figures

Figure 1: Change in new enrolment numbers of African HE students, 1982-2006 and projected through 2015 .....24
Figure 2: Map of African undersea cables, Sept 2010 .....31
Figure 3: Literacy program game in library's innovative technologies project .....114
Figure 4: A screenshot of the institutional repository.....116
Figure 5: A screenshot of the VLE.....117
Figure 6: Relationships between the stakeholders in the agricultural knowledge management project .....125
Figure 7: A screenshot of the institutional repository.....135
Figure 8: Music librarian sharing her digitization skills .....136
Figure 9: Listening booths.....136
Figure 10: Students using dedicated PBL service in the library computer laboratory .....139
Figure 11: Summary of the case study comparison.....143
Figure 12: A blog's notice in the library.....182
Figure 13: CERD process model development process .....213
Figure 14: The CERD process model in an African HE context.....240
Figure 15: Modified interaction design research model with policy makers .....249

# List of abbreviations

| | |
|---|---|
| AAU | Association of African Universities |
| ACU | Association of Commonwealth Universities |
| ACM | Association of Computing Machinery |
| AGORA | Access to Global Online Research in Agriculture |
| AMREF | African Medical and Research Foundation |
| AVU | African Virtual University |
| BERA | British Educational Research Association |
| BPS | British Psychological Society |
| CABE | Commission for Architecture and the Built Environment |
| CLICK | Concept Learning Services for Concept Knowledge |
| COBES | Community Based Education and Service |
| CERD | Collaborative Educational Resources Design |
| DATAD | Database of African Theses and Dissertations |
| DEEP | Digital Education Enhancement Project |
| EASSY | Eastern African Submarine System |
| EIFL | Electronic Information for Libraries |
| EPSRC | Engineering and Physical Sciences Research Council |
| FAO | Food and Agriculture Organization of the United Nations |
| G8 | Group of Eight |
| GDP | Gross domestic product |
| GER | Gross enrolment ratio |
| GPRS | General packet radio service |
| HCI | Human–Computer Interaction |
| HCI4D | HCI for development |

| | |
|---|---|
| HE | Higher education |
| HEQC | Higher Education Quality Committee |
| HINARI | Programme for Access to Health Research |
| HPMEC | Open University Human Participants and Materials Ethics Committee |
| JCDL | Joint Conference on Digital libraries |
| JISC | Joint Information Systems Committee |
| ICT | Information communication technology |
| IDRC | International Development Research Centre |
| IP | Internet Protocol |
| IPR | Intellectual property rights |
| ISP | Internet service provider |
| IT | Information technology |
| IUCEA | Inter-University Council for East Africa |
| KLISC | Kenya Library and Information Services Consortium |
| MDGs | Millennium Development Goals |
| MIT | Massachusetts Institute of Technology |
| NDLTD | Networked Digital Library of Theses and Dissertations |
| NEPAD | New Partnership for Africa's Development |
| NRENs | National Research and Education Networks |
| OARE | Online Access to Research in the Environment |
| OCLC | Online Computer Library Centre |
| OECD | Organisation for Economic Co-operation and Development |
| OER | Open Educational Resources |
| OA | Open Access |
| PBL | Problem Based Learning |
| PDA | Personal Digital Assistant |

| | |
|---|---|
| PERii | Programme for the enhancement of Research Information |
| PHEA | Partnership for Higher Education |
| PHI | Partnerships in Health Information |
| REN | Research and Education Network |
| SARUA | Southern African Regional Universities Association |
| TEAMS | The East African Marine System |
| TESSA | Teacher Education in Sub-Saharan Africa |
| UCH | Uganda Chartered HealthNet |
| UCL | University College London |
| UHIN | Uganda Health Information Network |
| UK | United Kingdom |
| UNEP | United Nations Environmental Programme |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNISA | University of South Africa |
| UPeTD | University of Pretoria Theses and Dissertations |
| VeSeL | Village e-Science for Life |
| VLE | Virtual learning environment |
| WHO | World Health Organization |
| WWW | World Wide Web |

# Chapter 1: Introduction

The structures of higher education in Africa[1] have been under extreme pressure. Acute financial constraints over the last thirty years have led to a marked decline in the quality of infrastructure and resources, including staff. At the same time, the expansion of basic and secondary provision, albeit slowly in some places, has created significant unmet demand for entry to higher education. The failure to achieve equitable access to higher level learning is an issue of concern not only among the student community but also the emergent industries and institutions benefitting from strong economic growth across the continent. Such growth is creating the need, particularly in some sectors, for an enlarged cadre of more highly educated personnel.

In this context, the application of some of the new forms of information and communication technologies (ICT) holds the promise of a new vision of higher education; one that is more flexible and distributed in its modes of working, and at the same time, less dependent on buildings with fixed site and staffing. It is difficult to conceive of a future which provides for mass higher education in most parts of Africa without some form of rethink of the existing structures derived mostly from the colonial heritage.

This thesis is about the way in which academics in higher education can work with those who have expertise in the potential of new ICT (i.e. information and elearning experts) to realise the transformative potential available today. A particular area of interest is the emergence of educational digital resources and how they are developed and made accessible. These resources are critical in supporting learning, teaching and research in this sector. There is much significant work taking place in this area (see Borgman *et al.*, 2000;

[1] In this thesis the term 'Africa' has been used to mean 'Sub-Saharan Africa' (see definition of terms in Section 1.5 for the definition of Sub-Saharan Africa).

Mutula, 2007; Cassel *et al.*, 2008). But there is also evidence that lack of understanding and comprehension between different stakeholders (e.g. information specialists, academics and e-learning experts) is slowing development (OCLC, 2003). The effectiveness of these resources is further limited by poor design processes, often resulting from the stakeholders working in isolation. This ultimately results in these resources being unsustainable and less effective in serving learners' needs.

The thesis explores the interface between the established communities of practice (academics, librarians) and the newly emergent groups driving the development of new modes of working. The need to think innovatively about designing educational digital resources along learning outcomes (Dong and Agogino, 2001), the crucial importance of collaboration among stakeholders in the design process (Bunker and Zick, 1999; Littlejohn *et al.*, 2006; Lankes *et al.*, 2007), and the importance of considering these stakeholders' different needs, backgrounds and contexts (Marchionini *et al.*, 2003) are central to these deliberations.

Three case studies, situated in Kenya, South Africa and Uganda, provide the basis for analyzing contemporary practice. A particular focus is given to forms of collaboration between elearning and digital library developers in the process of designing educational digital resources. Building from existing literature in the field and findings of two previous pilot studies, including Human-Computer Interaction (HCI) design principles, the case studies provide an important basis for thinking about how a collaborative design process could be integrated into the expanding African higher education (HE) systems. This first chapter considers the motivation for undertaking this research and it provides an overview of the thesis as a whole, including some definitions of the key terms that will be used.

## 1.1 RESEARCH MOTIVATION

The increased utilization of modern technologies to improve the quality of education has created a global need for effective access, usage and sharing of educational digital resources. E-learning is now integrated in most universities worldwide. In North America, for instance, over 96% of higher education institutions offer e-learning courses (Allen and Seaman, 2006). To effectively support this emergence of e-learning, a vast number of educational digital resources including digital libraries and open educational resources (OER) are being developed.

At the same time, new digital technologies now make it easier to access and share these digital resources for the benefit of teaching, learning and research (see Borgman *et al.*, 2000; Straw, 2009). In Africa, the Association of African Universities (AAU) (AAU, 2000) observes that HE institutions are progressively exploiting these educational technologies as they deal with certain historical challenges in relation to equitable access to education and the quality of educational resources. This thesis is motivated by the need to improve the exploitation of innovative technologies in the development of effective and learner-centred educational digital resources in universities in Africa.

The important role played by educational digital resources such as digital libraries in learning has been highlighted in previous research. For example Borgman *et al.* (2000) observe that some outcome-based studies have reported a positive correlation between integrating digital resources in learning and increased scholastic success. Cassel *et al.* (2008) also note that digital libraries reduce barriers to education by providing access to high-quality and sometimes free educational resources. However, more recent studies have also revealed some factors that impact on the effectiveness of these resources to support

meaningful learning.

First, there is often a disconnection between how information professionals, and academics and students engage with digital resources as noted in the OCLC (2003) report. This report raises some pertinent questions:

> *...how can libraries bridge the gap between their own services and systems and those of the courseware and e-learning environment? ...what are the libraries' best strategies for engaging with their particular institution's e-learning strategies...?* (OCLC, 2003, p.6)

This gap can be perceived as a "design chasm" between the designers of technology systems and the users, which some researchers interested in user-oriented designs like Nardi and O'Day (1999) have highlighted. In this thesis, this design chasm is seen as existing between designers of digital library systems (i.e. information professionals and technologists) and designers of learning processes (i.e. academics and e-learning technologists) who form part of the users of these resources along with their learners. This design chasm ultimately results in poor design process for these resources.

The second factor is largely a consequence of the first one – a mismatch between these resources and the learning objectives, which often results in these resources not being utilized adequately. If the users (academics and students) are not involved in the design process of these digital resources, how can their needs and interests be represented? The obvious result of this lack of user involvement in the design process is 'quality resources' that unfortunately are not aligned to learning processes, and hence irrelevant to the needs of the learners and educators. Such digital libraries tend to remain isolated from the learning process, thus becoming 'passive warehouses' (Brewer *et al.*, 1996) in which users' experience with them is passive and less engaging. A study conducted by Hartley (2007) is

a good example that highlights failure to support academics' teaching approach as a major reason why academics do not utilize digital libraries. Other studies (e.g. Adams and Blandford, 2002; Appleton, 2006; Grierson *et al.*, 2008) show a preference for freely available web-based resources among academics and students rather than using digital resources from their own university libraries even though these library resources might be of better quality.

The "design chasm" can be minimised by including users in the design and development process as has been evidenced by existing research in digital library designs (e.g. Davis & Dawe, 2001). A policy report for the American Library Association (Lankes *et al.*, 2007) also highlighted the importance of participatory design in developing digital libraries. Besides, applications that support annotation, situational data (Spoerri, 2002; Morris and Barnard, 2004) and Web 2.0 technologies such as social tagging (Lund *et al.*, 2005; Hunter, 2008) are moving digital libraries into a new era of end-user control and engagement. These trends agree with studies on participatory designs (e.g. Muller, 2008) and user-centred designs (e.g. Vredenburg *et al.*, 2002) that have for a long time supported the design of systems according to user needs.

The above examples provide a motivation for an investigation on how to design educational digital resources collaboratively with users, but this is by no means an easy matter for a number of reasons. First, designing digital resources that connect with the learning processes is generally challenging because, as observed by Dong and Agogino (2001), technology designs on their own often overlook the pedagogical requirements for the educational systems. This is echoed by Champeny *et al.* (2004) in their work on design of digital learning environments, which they acknowledge is a complex process as it must

factor in both technical and pedagogical expertise.

Second, bringing together educators, information professionals and learners in a collaborative design process is complex because of their diverse expertise, characteristics, needs and contexts. Brandt (2006) observes that organizing such a design process that involves people with different expertise, interests and professional languages is complicated. She suggests that designers need a framework that can help in organizing participation in such a way that various competencies are utilized in an inclusive manner. Preece *et al.* (2002, p.306) agree with Brandt: *"Involving users in design decisions is not simple...cultural differences can become acute when users and designers are asked to work together to produce a specification for a system"*. These complexities do not just occur within the design field but have also been highlighted in other areas as well. Edwards and Kinti's (2009) study on working relationally at organisational boundaries highlights how challenging it is for work systems that aim at inter-professional collaborations. They advocate for the unpacking of differences and finding ways of working together in fluid and responsive ways assisted by what they call 'complex and expanding objects of activity'.

To understand the differences between the different stakeholders in the context of this thesis, we need to recognise that academics have a different perspective of educational resources from that held by information professionals. Their perspective is that learning resources support knowledge-creation and sharing (as noted by authors such as Sumner *et al.*, 2003), whereas the librarians' perspective is that information resources must be well organised for easy retrieval (information management being a core librarianship competence). Besides, today's 'Net Generation'[2] learners have different needs and

[2] The term 'Net Generation' is a concept used to refer to the generation of young people born after 1983, who are seen as different from preceding generations because they have grown up with digital technology. It is

information seeking and usage behaviours. They see the library as a sophisticated and time-consuming facility (Lippincott, 2005; Mia and Nesta, 2006) and hence prefer to exploit their information technology (IT) adeptness and guidance from their lecturers to access information they require for learning. This is likely to get even more complicated with the emergence of the 'Google generation' (those born after 1993 growing up in a world dominated by the Internet) as defined in a study by the University College London (UCL) commissioned by the Joint Information Systems Committee (JISC) and the British Library (UCL, 2008).

The third reason is the fact that development of human-centred systems like digital libraries is highly dependent on their contexts as confirmed by Marchionini *et al.* (2003). These contexts are not static. They are constantly changing and being influenced by external factors such as rapidly evolving technologies. Developing regions such as Africa are faced with certain limitations as they try to catch up with these new technologies. Yet, the process of designing these systems must be understood within these dynamic contexts (see Subsection 1.1.1 below).

This thesis seeks to address these gaps by studying the 'best practices' in collaborations that occur between digital library programs and learning processes in the African HE context and how these practices can provide guidance in the process for designing effective collaborative digital libraries. The following sub-section justifies why it is important to research the African HE context.

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suggested that this exposure to the technology has profoundly impacted on their attitudes and approach to learning (see Jones and Ramanau, 2009).

### 1.1.1 Why research African HE?

The motivation for situating this thesis in Africa is two-fold. First, it is intended to make a direct contribution to a region where access to quality educational digital resources is of extreme importance. African HE is emerging from a historic crisis that plagued the continent in the 1980s and 1990s (see in-depth discussion in Section 2.1). The crisis was manifested in underfunding of teaching, learning and research activities. This in turn affected among other things the universities' ability to meet resource and infrastructural requirements necessary to cater for the ever-increasing numbers of qualified students. Therefore the gross enrolment ratio (GER) in the Sub-Saharan Africa is one of the lowest globally, estimated at below 5% (UNESCO Institute for Statistics, 2008). University libraries remain under-resourced and the information communication technology (ICT) infrastructure poorly developed with unreliable electricity supply, inadequate computers and lack of access to affordable high-speed Internet connectivity (Farell & Shafika, 2007).

These challenges create enormous opportunities for the innovative deployment of emerging educational technologies. At the beginning of the millennium, the Association of African Universities (AAU), which represents African HE, acknowledged that educational technologies could help in overcoming challenges of equitable access to education and quality educational resources (AAU, 2000). E-learning initiatives are being rolled out in most of the universities with the hope of meeting the demand for HE and consequently raising the GER. Digital libraries have been acknowledged as having an important role in the improvement of teaching and learning (see AAU, 2000 and Mutula, 2007). Already there is a lot of effort around making digital resources accessible in universities as well as supporting creation of local content (see Subsection 2.2.1). Open education resources (OER) offer cheaper alternative access to educational resources (Wolfenden, 2008a).

Teacher Education in Sub-Saharan Africa (TESSA)[3] and OER Africa[4] are some of the leading OER projects that are already contributing significantly towards creation of educational digital resources.

Clearly, African HE is at its best time in history to benefit from advancements in educational technologies. However, the technology infrastructural challenges already highlighted impede the spread of these technologies. Besides, as Manda (2008) points out, some of the libraries lack appropriate leadership and commitment to adoption of innovative technologies in enhancing digital library systems. Innovative ways are needed especially with the exploitation of educational digital resources if African HE is to reap the benefits of modern technologies. This thesis therefore seeks to provide innovative solutions for developing digital resources that are effective and appropriate to learners' needs, and one major way of achieving this is to include key stakeholders (i.e. academics and librarians) in the design process for the resources.

The second motivation for choosing Africa as a focus for this research relates to the main research perspective taken by this thesis (see Sub-section 1.3.1). Researching the design processes for digital resources in this context helps to present a different perspective for understanding HCI design research in the developing countries. HCI for development (HCI4D) is a new body of knowledge that tries to understand how universal designs coming from developed countries can be adapted to fit developing contexts. These are premised on the fact that innovations designed in the developed world introduce the problem of Western universality of technologies (see Dray *et al.*, 2003; Brewer e*t al.*, 2006; Sambasivan e*t al.*, 2010; Wyche *et al.*, 2010), which assumes that the same conditions exist

[3] http://www.tessafrica.net/

[4] http://www.oerafrica.org/

all over the world. One classic example is the emergence of the Internet, which has supported extraordinary innovations that are designed to operate on broadband. Once these innovations penetrate to the developing countries that have a deficiency of broadband, many of them become unusable. Thus, focusing on African HE provides an interesting area of study for HCI4D, ultimately making an important knowledge contribution to this relatively young field of HCI research (see Chapter 7).

Africa presents an interesting area of HCI study because of its great diversity across the different countries in terms of socio-economic, cultural, political and technological contexts, as well as in institutional capacity, policy formulation and implementation, among other development indicators (see Bateman, 2008; Visser, 2008). These diverse contextual factors provide interesting complexities for customization of universal innovations (i.e. Internet- based technologies) in order to meet context-specific needs. This often results in some key innovations that are changing livelihoods in these developing contexts. One example is in the area of mobile technology use, an innovation that has successfully been transformed to meet specific needs of users such as in areas of mobile banking (Medhi, 2009) and health (Hwabamungu and Williams, 2010). By researching universities in three different countries, contextual variety has been achieved, bringing out invaluable findings that support these customization issues for universal technologies (see Chapter 7).

Lastly, researching digital resources provides a relevant example for reviewing universal design approaches. These digital resources are mainly designed for universal access (e.g. the Association of Computing Machinery (ACM) digital library). However, the need for personalization at the levels of institutional and individual users is forcing designers of these resources to try to create flexibility. Users want freedom to customize resources to

their needs and preferences. Some modern applications such as Open Source Software (e.g. DSpace, EPrints, and Greenstone) and the Web 2.0 are increasingly being used to support this customization. Hence, they allow universal technologies to be customized to fit specific needs. Research on the design of digital resources in this context provides useful insights into the customization process of universal designs and hence an invaluable contribution to this growing area of HCI4D.

## 1.2 THE PROBLEM STATEMENT

The aim of this thesis is to provide guidance on how learning designers and digital library designers (see Section 1.5 for definition of terms) can be supported to collaborate in the design process to enable them to create learner-centred educational digital resources in African HE. This thesis is about a high level design of a collaborative design process for developing educational digital resources. To this end, the thesis has sought to answer the following two research questions:

i. ***What are the existing factors that can be used to support a collaborative design process for educational digital resources in African higher education?***

This research question seeks to identify general aspects present in institutions of higher education in Africa that can influence or support the process of designing educational digital resources collaboratively with key stakeholders. Such aspects could be how key people collaborate, policies and processes, technologies, etc.

ii. ***What are the characteristics of these factors and the roles they play in the collaborative design process?***

This question seeks to establish specific characteristics of the factors identified, the role they play in supporting the collaborative design process, and how they interact with each other as they contribute towards the process.

## 1.3 RESEARCH APPROACH

This thesis is framed within a multidisciplinary approach that embraces four research trajectories, namely: (i) HCI design, (ii) information science, (iii) education (educational technologies), and (iv) African higher education. It is therefore important at the onset to define how they intersect to support the thesis development. This section defines this convergence by first placing the thesis development within the HCI design domain. It then considers to what extent the information science knowledge base has been used. Next, it reviews how theories in educational technologies interface with HCI and their influence on the thesis. Lastly, the section briefly highlights how literature from African higher education has been used.

### 1.3.1 A HCI perspective

> *"...HCI is a vast and multifaceted community, loosely bound by the evolving concept of usability, and the integrating commitment to value human concerns as the primary consideration in creating interactive systems"* (Carroll 2011, p.2)

This thesis in several ways reflects Carroll's notion of HCI. It is about providing guidance for the design process of educational digital libraries. These are essentially interactive systems that reside in social spaces because they are developed to serve communities of people, i.e. learning communities. Alongside these interactive systems, the thesis seeks to advance the concept of collaboration between key multidisciplinary stakeholders involved in the process of designing these systems. At the heart of this design process is the

commitment to the systems' values, i.e. learner centeredness. The thesis is also framed within a multidisciplinary research approach as highlighted in Section 1.3.

In light of the above background, it is appropriate to situate the main research approach for the thesis within the HCI domain. Furthermore, HCI is a design discipline and hence can be used to support the development of a collaborative design process. Consequently, this thesis focuses on some of the HCI design principles that support the development of user-oriented and collaborative approaches such as participatory design. It is further shaped by existing knowledge-bases of the other related disciplines (as noted in subsequent sections).

This thesis places a strong emphasis on the African HE context (see Subsection 1.1.1). As pointed out, this is a relevant area of study for HCI4D, and hence appropriate to HCI research. Designing educational digital resources that are context-relevant is important as echoed by Marchionini *et al.* (2003). But Marchionini and colleagues also argue that contexts, especially those heavily influenced by social factors, are complex to research because they relate to people's behaviour within a technological context that is constantly evolving. Adams *et al.* (2008) have recommended a qualitative approach to data collection as a way of dealing empirically with such complex HCI phenomena. As such, most of the research data in this thesis is qualitative in nature and has been gathered following some grounded theory research principles (Strauss & Corbin, 1990) (see Chapter 4).

### 1.3.2 The influence from information science with reference to digital libraries

The design process aspects of developing African HE educational digital resources such as digital libraries are at the core of this research. Therefore, it is necessary to consider existing knowledge constructs that shape the nature and usage of educational digital

libraries. However, concentrating on major theories of and research approaches applied in information science for this research has been considered less important because those aspects that relate to the digital library designs have been supported by HCI knowledge base (see section 1.3.1). Indeed very little information science literature has been utilized and this mainly has related to debates on the emerging technologically enabled resources such as the work of Nardi and O'Day (1999) and the study by Borgman *et al.* (2000) on academics' and students' response to educational digital resources. Furthermore, the multidisciplinary nature of HCI that extends to information sciences (Carroll *et al.*, 2006) does allow us to review research with a component of information science within the HCI domain.

### 1.3.3 The influence from education and educational technology theories

This thesis addresses a design related problem that exists within the application of educational technologies. Hence it is important to recognize and consider theoretical arguments that have applied to the field of educational technology. As such, theories of learning that are applied in HCI research have been assessed for their suitability and relevance in this thesis. Issroff and Scanlon (2002) recommend taking a multi-level approach in order to understand complex learning situations when considering theories for educational technology. They argue that such an approach should consider institutional context, culture of the students, location of the learning situation within the curriculum and the design of the technology and software. To cover these aspects, they categorize educational technology theories into two (i) HCI theories that aid in designing effective learning and teaching materials and systems in order to have theoretically informed systems and materials, and (ii) theories derived from education which help in understanding the

culture and context of learning situation and their impact on students' learning. These latter theories impact on empirical methodologies and data interpretations. This thesis has negotiated between the two theoretical approaches and applied each of them where necessary. Subsection 1.3.1 above describes how the HCI knowledge base has been followed, while the second approach supports interpretation of students' engagement with digital library resources (e.g. in some of the digital library projects presented in Chapter 5).

### 1.3.4 The influence from application of educational digital resources in African HE

A review of existing literature that documents the development of African HE provides the research context. Additionally, past studies and professionals' anecdotal reports on development and deployment of educational digital resources including research on the application of open educational resources (OER) in African HE (e.g. Wolfenden, 2008a) have been reviewed. OER has emerged as an important contribution to educational digital resources, especially in this context.

## 1.4 RESEARCH SCOPE

For a multidisciplinary research that also has a broad range in terms of contexts and studies, it is necessary to define its scope. Firstly, this thesis sought to identify good practices of collaboration between learning and library activities in African HE. This guided the choice of the different contexts. Hence the research was limited to universities that had innovative projects and programs (i.e. technologies applied in libraries and e-learning) with potential to bring academics and librarians working together collaboratively. As Africa is such a huge continent with many universities, this was narrowed down to just three universities with such pockets of innovation (a detailed account of the case study selection criteria is

provided in Chapter 4). Undoubtedly, three universities are not representative enough for such a huge continent, and more cases would have enhanced the generalizability of the research findings. However, going beyond this number was not practically possible due to time and financial constraints. Nevertheless, these three cases provided variety in terms of contextual similarities and differences, and hence enriched the research findings.

A second consideration in defining the scope of the research was the type of the universities chosen. As noted in Subsection 2.1.4, this HE sector has seen recent growth in private universities emerging to complement the government-sponsored universities, otherwise known as public universities. Although some public universities also have their own private sections (often referred to as parallel or module two programs), these private universities are governed differently from the public universities. They are also usually better resourced (Oketch, 2003). Whereas there could be certain similarities in the design and development of digital libraries, this research was carried out within the context of public universities.

## 1.5 DEFINITION OF TERMS

Due to the multidisciplinary nature of this thesis, the meaning of certain terms can vary across the different disciplines involved. There are also certain terms that have been used specially in this thesis but could have different meaning different when used conventionally. This section therefore defines some terms as they have been used throughout the thesis.

The term **'Africa'** as used in the thesis refers to the Sub-Saharan African region, a geographical term for the African continent which lies south of the Sahara, excluding the North African region. Thus it covers the East African, West African, Central African and

Southern African regions.

The term **'Digital library designers'** has been used broadly to refer to both design experts who have technical design expertise, and non-technical people involved in the development of digital resources (e.g. digital librarians). Similarly the term **'Learning designers'** has been used to refer to creators of learning materials as part of a formal curriculum as well as OER according to Conole and Weller (2008). In this thesis, they include academics and e-learning technologists or experts. The two types of designers have further been combined to constitute the **'Educational digital resources designers'**. The underlying reason behind this term is that both categories of designers (digital library designers and learning designers) are involved through a development process for educational digital resources where they are using their expertise. Hence going by Brandt's (2006) affirmation that designing is a social act among people who have different expertise, these two categories can be seen as designers.

The term **'Educational digital library'** has been used to include *"a variety of electronic and digital sources of information available to university teachers and students in an academic context"* (Appleton, 2006 p. 619). This thesis acknowledges that there is a slight difference between these resources and educational digital resources that directly feed into the e-learning programs such as learning-object repositories and OER. Nevertheless, for the purpose of this thesis, both educational digital library resources and these other e-learning resources are jointly referred to as **"Educational digital resources"**, and have been used interchangeably.

**'Learning-library engagement'** is a term that has been used to refer to engagement or collaboration between people directly responsible for learning processes such as academics

and e-learning specialists on one hand, and on the other hand, people directly responsible for library and information services such as librarians including digital librarians and other related information professionals.

The term **'Silo'** or **'Siloed'** has been used to refer to individual approaches as opposed to collaborative ones. It is a term coined from storage towers (silos) and has been used in some HCI literature (i.e. Dantec and Edwards, 2010; Bentley *et al.*, 2010) with similar connotation.

## 1.6 THESIS STRUCTURE

Following this introductory chapter, a detailed description of African HE is presented in *Chapter 2* to provide a contextual understanding of, and a general rationale for, research in Africa. It traces the HE from its early beginnings in Africa through a crisis period that has greatly affected this sector, and then looks at how emerging educational technologies have been used to mitigate challenges faced during this period. The status of educational digital resources is also provided.

*Chapter 3:* This chapter reviews related literature in order to situate this research within the broader body of knowledge to which it belongs and to identify existing gaps that this thesis seeks to fill.

*Chapter 4:* In this chapter, a detailed account of the methodology that informed and shaped the investigation of the three case studies is discussed. This includes a justification for the choice of the research approach taken and the choice of the criteria taken to identify the case studies. Finally, it presents a summary of the methods used to generate and analyze

data across the three case studies.

*Chapter 5:* This chapter presents a high level analysis of research findings by first describing individual case studies and their characteristics of particular relevance to this research, namely: status of e-learning, digital library and policy landscape. Secondly, it provides an account of digital library projects that were identified in each of the case studies and reviewed for this research. The chapter concludes with a synthesis of main findings, identifying three key design process factors.

*Chapter 6 and 7:* The three identified design process factors are presented in detail and discussed in light of HCI domain.

*Chapter 8:* Using the contextual case study background presented and the identified research findings presented in *Chapter 5, 6 and 7*, the development of the Collaborative Educational Resources design (CERD) process model is discussed and presented in this chapter. Additionally, the chapter provides experts' review of the model for its suitability and applicability.

*Chapter 9:* This final chapter summarises the findings and presents conclusions. It provides the thesis contributions and their implication in the wider HE practice in Africa as well as globally, and sets out how they can be used to shape future research in the domains of digital library and HCI.

# Chapter 2: The African Higher Education

This chapter sets out the context for this thesis; the development of higher education in Africa (with a focus on the Sub-Saharan Africa)[5]. It is divided into two sections. The first section provides an analysis of recent history of the higher education sector in the region. The second section presents a description of the specific focus of the thesis, i.e. educational digital resources, and the impact this phenomenon is having on the development of the sector.

## 2.1 DEVELOPMENT OF AFRICAN HIGHER EDUCATION

Analysis of existing literature suggests that African HE has undergone four major phases, each resulting in significant impact on the development of the HE system to what it is today. This section describes each of these phases and highlights the unique elements that characterized each phase and how they shaped the current HE context.

### 2.1.1 Phase I: post-World War II period

Some scholars such as Sawyerr (2004) and Teferra and Altbach (2004) date African HE to the 1st Century AD with institutions like the Egypt's AL-Azhar and Karawyyin in Fez. However, contemporary African universities particularly in Sub-Saharan Africa (SSA) were largely established in the period soon after the Second World War[6]. Although there was limited contribution from missionaries, these universities were mainly set up by colonial administration (see Sawyerr, 2004; Teferra and Altbach, 2004; Visser, 2008).

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[5] In this thesis the term 'African HE" has been used to mean the higher education in Sub-Saharan Africa' (see definition of terms in Section 1.5 for the definition of Sub-Saharan Africa).

[6] This thesis acknowledges that a few of today's universities did exist during pre-war period mainly as technical colleges. Examples include Fourah Bay College (1827), University of Cape Town (1829), University of Khartoum (1902), University of Cairo (1908), Makere University (1922). Some of these became university colleges affiliated to Western universities during the colonial period, i.e. Makerere University which became a university college affiliated to University of London in 1949.

Examples include universities of Ghana and Ibadan, created in 1948 and Makerere University in 1949 (initially started as a technical college in 1922) and later joined by University of Nairobi and University of Dar es Salaam in 1961 to become the University of East Africa.

Two features characterized these universities. First, they were very few and only produced a small elite of educated Africans who were intended to fill lower-ranked government positions (Mazrui, 2003; Visser, 2008). For example, Sawyerr (2004) observes that by 1960, only 18 out of 48 countries of Sub-Saharan Africa had universities and colleges. According to Teferra and Altbach (2004), the University of East Africa had just produced 99 graduates for the combined East Africa's three countries' population of 23 million in 1961.

The second characteristic was that these universities were modelled on the Western education system (based on the host countries of colonial administration) in terms of the pedagogy, curriculum and language (see Teferra and Altbach 2004; Lebeau, 2008; Visser, 2008). Indeed some of them were affiliated to universities in these host countries, i.e. University of East Africa which was part of the University of London. As will be argued in Subsection 2.2.1, this partially had influence on the relatively low amount of locally produced and published scholarly content.

### 2.1.2 Phase II: post-colonial period

In the 1960s and 70s, African HE entered the era of post-colonial education according to Sawyerr (2004). This was a period of steady expansion as noted by Gakusi (2010). More local universities were established while those that had affiliation with Western universities attained their own university status. For instance, the University of East Africa was

dissolved in 1970 and each of the three universities became independent universities of Nairobi[7], Makerere[8] and Dar es Salaam[9] respectively. Most of the African nations had become independent of the colonial rule and saw universities as a major part of post-colonial development. It was critical that these newly independent nations develop their human capacity to manage their resources and help reduce poverty among their people.

This steady expansion was facilitated by the fact that these governments sponsored the entire cost of establishing and developing infrastructure and facilities as well as running costs (Sawyerr, 2004). Visser (2008) observes that this included students tuition and in some cases students' maintenance where they were given a stipend.

Another important aspect was that despite these universities being independent of the former colonial administration's host universities, they continued to be modelled on the Western education system. Moreover, the structure of these universities in terms of facilities and operation did not change with the changing trend of enrolment expansion. As will be seen in the subsequent section, this has had huge implication on the capacity of the universities to accommodate the ever rising student enrolment.

### 2.1.3 Phase III: era of crisis

The period of the 1980s and 90s was marked with stagnation leading to decline of the HE advancements gained during the colonial and post-colonial periods. This was a period of crisis that has resulted in the present African HE being the least developed in the world as observed by Teferra and Altbach (2004).

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[7] http://www.uonbi.ac.ke/about/profile

[8] http://mak.ac.ug/index.php?option=com_content&task=view&id=41&Itemid=64

[9] http://www.udsm.ac.tz/about_us/index.php

A number of things happened during this period. First, some governments started to experience political instability with internal conflicts, coups and civil war (see McGowan, 2005; Teferra and Altbach, 2004). This instability, along with economic challenges described below adversely affected the growth of the HE sector. The example of Makerere University, which until the 1970's had been among the top four or five African universities illustrates the extent of this impact. The instability and economic challenges reduced this university to bare laboratories, empty library shelves, overcrowded student accommodation and departure by demoralized and underpaid academics (see Sawyerr, 2004). This example was characteristic of many other African universities during this period.

Second, these governments experienced a collapse of national economies which led to their inability to continue financing education adequately. Sawyerr (2004) attributes this to a decline in the price of primary products and export volumes at the world trade in the 1980s and 1990s; the mishandling of exchange rates and external reserves; and huge external debts. This in turn led to countries of Sub-Saharan Africa depending heavily on foreign aid. As a result, governments were forced to introduce measures designed to reduce costs. The World Bank report on financing higher education in Africa (World Bank, 2010) notes that these measures included freezing of staff salaries and recruitment, eliminating expenditure on books and equipment, foregoing basic repair and maintenance, and reducing students' social aid and scholarships. Public spending on HE drastically reduced from 12.22% of GDP per capita per student in 1975 to 7.32% in 1990, according to estimates provided for 18 Sub-Saharan African countries (World Bank, 2010).

Third, the demand for higher education increased resulting in rapid student enrolment as reflected in Figure 1. Sawyerr (2004) explains that this expansion was caused not just by

the historic factor of the need to fill up demand arising from colonial and post colonial conditions, but also because of high population growth rate, large pool of school-age children pressing to join secondary education, and a subsequent youthful population qualified to join university.

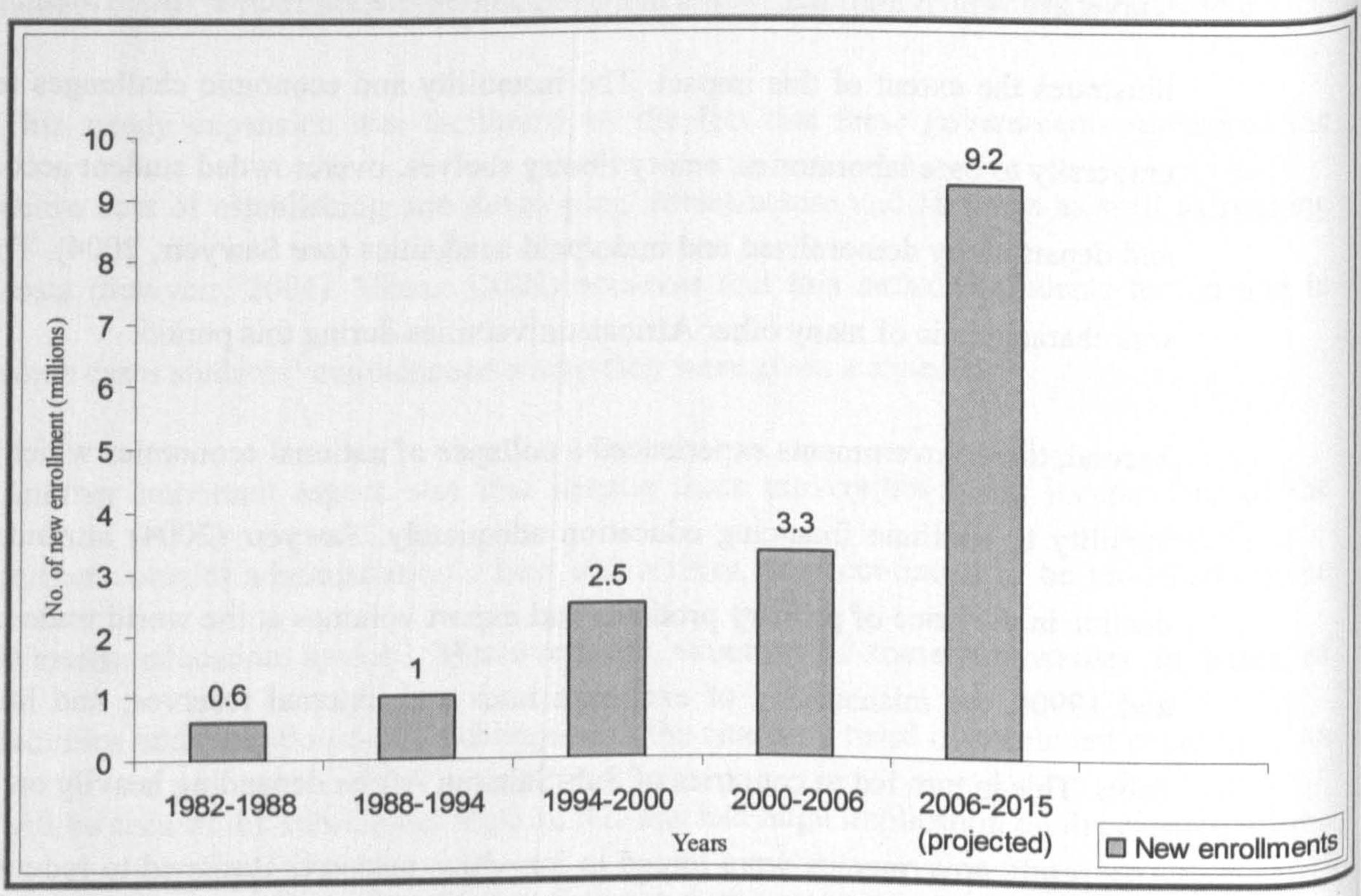


**Figure 1: Change in new enrolment numbers of African HE students, 1982-2006 and projected through 2015 (Adapted from World Bank, 2010)**

These high numbers of students were being admitted into universities that were initially designed for fewer students. However, the governments' inability to keep up with financial requirements as noted by Teferra and Altbach (2004) meant that the universities were not being expanded to match this expansion. This resulted in a strain on existing resources such as classrooms, library, laboratory, workshops and lecture halls. For example, 100 student places theoretically available in a public university in Benin were stretched to accommodate 350 students in 2007; in 2006, Uganda had just 1.3 square metres per

registered student while the OECD ratio is 4.0 square meters (World Bank, 2010).

Fourth, the 1990s witnessed a change of focus by development agencies to primary education (Sawyerr, 2004). Following the 1990's Jomtien World Education Conference "World Declaration on Education For All", these development agencies believed that contribution could only be made at lower level education, and hence the focus on primary education. While this change of focus was good to the extent that it improved lower education, it resulted in a significant reduction of the financial support directed at the tertiary education. For example, the World Bank's global spending on HE dropped from 17% between 1985 and 1989 to 7% between 1995 and 1999 (Bloom *et al.*, 2006). Neglecting tertiary education as a means of improving the economic growth and mitigating poverty resulted in growth stagnation.

All the above factors had a detrimental impact on the development of this sector resulting in what is now well researched and documented state of crisis[10] (see Teferra and Altbach, 2004; Visser, 2008; Gakusi, 2010; World Bank, 2010). The infrastructure fell into a state of disrepair while existing facilities became extremely overcrowded. Teaching equipment was not replenished. Libraries were not purchasing new textbooks and renewing their journal holdings. Power and telephone bills were unpaid resulting in outages for several hours. Moreover, the overall quality of education was compromised (Gakusi, 2010).

The inability to offer competitive remuneration to the university personnel particularly the teaching staff affected staff morale as well as retention. Visser (2008) notes that one of the effects was a brain drain where academics left for places which had better opportunities.

[10] This thesis acknowledges that the HE in Africa has suffered from other social related factors such as gender disparity and the effects of the HIV/Aids pandemic which have also contributed to the crisis. However, these factors have not been discussed in this thesis because they do not directly affect the development and deployment of digital resources which are its focus.

The low staff morale, brain drain and underfinanced research activities in turn resulted in reduced academic output in terms of research quality and publication volume. According to the Task Force on Higher Education and Society, 2000 (cited in Bloom *et al.*, 2006. p.4), the region produced just 5,839 published academic papers in 1995 compared to regions such as South Asia which produced 15,995 published papers. This undoubtedly affected African HE institutions' ability to produce local knowledge hence reducing this continent's ability to participate fairly in the global knowledge sharing as argued by Mutula (2007) and discussed further in Subsection 2.2.1.

Meanwhile, the huge demand for higher education with an ever rising number of students qualified to join tertiary education each year was and continues to be largely unmet because of the above factors. Hence the gross enrolment ratio (GER) remains one of the lowest globally with most countries falling below 5% (Unesco Institute for Statistics, 2008).

In short, this 3rd phase was characterized by what the Report of the Commission for Africa (2005, p.137) sums as:

> *...many of Africa's higher education institutions are still in a state of crisis. They lack physical infrastructure, such as Internet access, libraries, textbooks, equipment and laboratory space...yet demand for higher education is increasing: in 2000 Nigeria had the capacity to accept only 12% of qualified candidates.*

### 2.1.4 Phase IV: towards recovery

The turn of the 21st century has been an exciting moment in time for African HE. This is a period of marked recovery efforts from the 1980s and 90s crisis described above. There are a lot of international, regional and national initiatives directed towards improvement of African HE. This coincides with unprecedented growth in educational opportunities enabled by the emergence of the World Wide Web (WWW) and the African leaders'

recognition of its potential to provide growth and recovery for African HE. This section provides specific examples of some of the key HE related initiatives taking place on the continent.

In the first instance, this is a period marked with a renewed interest in tertiary education and the acceptability that it holds great potential for socio-economic growth for the African continent. This has brought about increased international activity around the extent and quality of higher education in Africa. The Commission for Africa report in 2005 recognized the role of African HE in development. This report was seen as blueprint for action at the G8 summit of world leaders in Gleneagles, Scotland in July that year and a pledge was made to support what the Commission report had asked for in terms of doubling aid. More specifically, the Summit gave recognition of the HE institutions' contribution in helping develop skilled professionals for Africa's private and public sectors, and pledged their support in the Summit's communiqué[11].

Additionally, Bloom *et al.* (2006) highlight a number of international activities around expanding the development agencies' efforts to include the tertiary levels as well. Some of these efforts include: (i) the UNESCO/World Bank's Task force on Higher Education and Society which in their report 'Higher Education in Developing Countries: Peril and Promise' emphasized that the knowledge generated in HE in the developing countries is essential for national competitiveness in world economies; (ii) the World Bank's report on 'Constructing Knowledge Societies: new challenges for tertiary education', which stressed the role of tertiary education in building technical and professional capacity as well as strengthening the lower levels; (iii) the African Regional Training Conference on Tertiary

[11]http://www.unglobalcompact.org/docs/about_the_gc/government_support/PostG8_Gleneagles_Communique.pdf

Education held in 2003 in Ghana which acknowledged the crisis in African Higher Education and came up with innovative solutions.

Moreover, it is now recognized that the achievement of some of the Millennium Development Goals (MDGs) depends largely on an effective HE system. For example, training of additional teachers required to cater for the 30% of primary school children yet to access schooling as per the midway review of the MDGs (United Nation Department of Public Information, 2007) is HE's responsibility. It is estimated that by 2015, this region will require to have raised its current stock of teachers by 68% (Unesco Institute for Statistics, 2008). This has been echoed by both the Report of the Commission for Africa (2005) and the Commission on Growth and Development Report (2008) which stress that while educational development is clearly important at the basic level, there is need for sustained commitment at the secondary and tertiary levels.

At national and institutional levels, there are innovative initiatives aimed at diversifying HE to offer lower costs and more efficient delivery alternatives. Universities have introduced cost-sharing schemes as well as other income generating activities such as consultancy services aimed at making them sustainable and reducing the financial burden on the governments. According to Materu (2006, p.4),

> *70 percent of expenditures at the University of The Gambia are derived from student fees. At the University of Nairobi, student cost-sharing produced 37 percent of the institution's recurrent budget in 2002. In Ghana, student fees contributed 31 percent of university budgets in 2005.*

The enhancement and expansion of distance education in the continent has been made in order to expand access to tertiary education. A number of open universities (i.e. Tanzania, Zimbabwe, Nigeria, and Sudan) have been opened in recent years. Most other universities

have distance education programs alongside their mainstream programs. The University of South Africa (UNISA) is an exclusive distance education institution and has huge enrolments across the Southern and Eastern Africa region. In addition, most universities are involved in some form of e-learning. The African Virtual University (AVU)[12] initiated by the World Bank to leverage technologies in order to improve access to tertiary education in this region, is now an independent pan-African organization, working with local universities to enhance their capacities to create e-learning programs.

HE privatization is growing as an attempt to expand access. For example, some public universities have introduced parallel streams of privately sponsored students studying alongside those with grants provided by governments. Private universities now exist in a number of African countries. According to Visser (2008), Kenya has one of the well established private higher education systems with 13 private universities out of the 19 Kenyan universities and caters for about 20% of the overall HE enrolment in the country. Though a small percentage, this is an important step towards alleviating the ever rising demand for access to HE institutions.

Regionally, partnerships and organizations that support HE have been developed. The AAU provides a strong voice for the development and integrity of African Higher Education. In response to the HE crisis of the 80s and 90s, The New Partnership for Africa's Development (NEPAD) has HE as one of its top priorities and in its report on 'Developing African Higher Education'[13] has outlined specific areas of intervention to improve this sector. Other regional partnerships include the Southern African Regional Universities

[12] www.avu.org
[13] http://www.nepad.org/2005/files/documents/22.pdf

Association (SARUA) and the Inter-University Council for East Africa (IUCEA) which promote cross-institutional partnerships and resource sharing.

Several initiatives have emerged to harness the benefits of technology in HE. Though the WWW and associated ICTs gained some prominence in HE in the 1990s, it was not until the new century that African HE administration started realising its great potential and accepting it as a way out in easing some of the existing pressures. For instance, the AAU has now acknowledged the potential of ICT in transforming African HE and in reducing the knowledge, technological and economic gaps that exist between Africa and the rest of the world (AAU, 2000). Additionally, a number of initiatives aimed at improving Internet connectivity exist. For example, the AVU in 2005 initiated a program to aggregate demand for bandwidth in a number of its partner universities so as to negotiate for cheaper costs. It succeeded in bringing down the price to US$2.3 per kilobyte per second from around US$20 per kilobyte per second (see Steiner *et al.*, 2004). This initiative was taken up by the Partnership for Higher Education (PHEA)[14] and expanded to include more universities on the continent.

The arrival of broadband on the continent between 2009 and 2010 is dramatically changing the state of the connectivity. Three projects namely: the East African Marine System (TEAMS), the SEACOM, and the EASSy (Eastern African Submarine System), have brought the submarine fibre optic cable to the eastern coast of Africa. NEPAD is engaged in similar efforts on the Central, Western and Northern Africa (see Figure 2 below). There is also accompanying terrestrial infrastructure connecting with the mainland and landlocked countries. Already prices have reduced in Kenya according to Chege (2010) although not to

[14] (http://www.foundation-partnership.org/pubs/press/bandwidth.php)

the expected levels as Internet service providers (ISP) have pre-existing costly satellite contracts still running. The HE sector is expected to take advantage of this relatively cheaper broadband availability and expand technology use in teaching, learning and research activities.

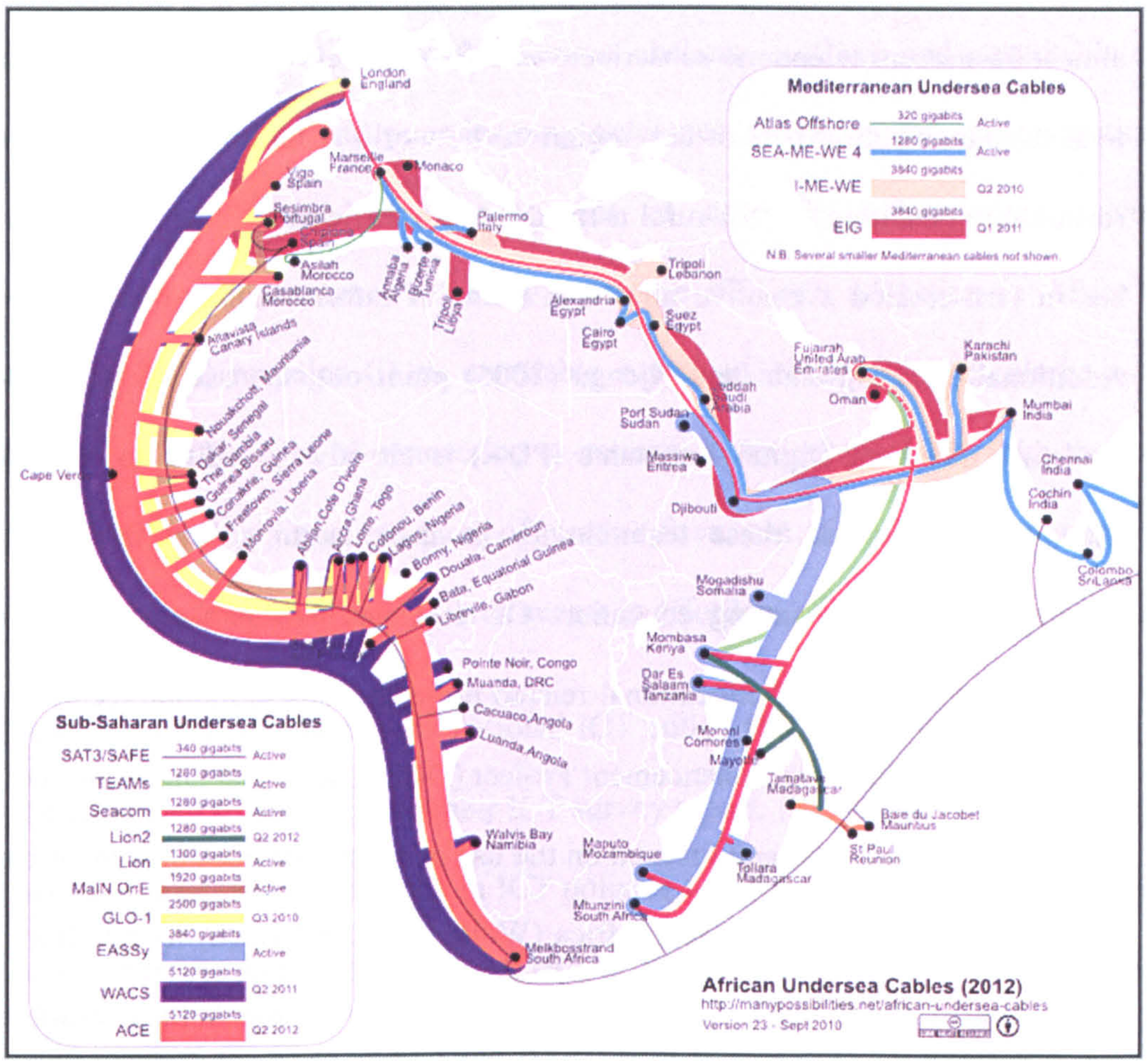


**Figure 2: Map of African undersea cables, Sept 2010 (Source: Steve Song[15])**

The National Research and Education Networks (NRENs) in Kenya, Malawi, Mozambique, Rwanda and South Africa under the auspices of the UbuntuNet Alliance for Research and Education Networking[16] were formed to *"capitalize on the emergence of optical fibre and other terrestrial infrastructure opportunities and thus become the Research and Education*

[15] http://manypossibilities.net/african-undersea-cables/ (accessed on 27 Nov 2010)

[16] ww.ubuntunet.net

*Network (REN) backbone of Africa"* (Farrell & Shafika, 2007, p. 40). In so doing they connect African HE and research institutions with the rest of the world.

The spread of mobile telephony has also changed the ICT landscape, and holds a lot of potential for use in HE. By 2004, there were 76 million mobile phone users, representing almost 75 percent telephone subscribers in Africa, which is the highest ratio of mobile to total telephone subscribers of any region in the world according to Gray (2006). This has remarkably penetrated to the rural areas that were difficult to reach with fixed line[17]. This has in turn created a positive impact in terms of information and knowledge exchange. Additionally, as Ng'ambi and Njenga (2006) point out, the use of mobile technologies especially Personal Digital Assistants (PDA) is already spreading to clinical education. Medical students use these technologies in their learning and in later professional development and continuing education. Of relevance to this thesis, there are past and ongoing information and educational related projects that use mobile technologies such as (i) the Digital Education Enhancement Project (DEEP), an Open University project that ran between 2002 and 2005 and focused on the use of mobile devices in some urban schools in Egypt and rural schools in South Africa (Wolfenden, 2008a); (ii) mobile-library service at University of South Africa (Mbambo-Thata, 2008) (iii) the Village e-Science for Life (VeSeL) project; and (iv) a case study reported by Iluyemi (2008) that focused on less-developed countries' usage of mobile technology to build a mobile-learning system to provide access to health information and continuing medical education. These last two

[17] ITU estimates 41.4 mobile phone users per 100 inhabitants in Africa in 2010, compared to 9.6 internet users per 100 inhabitants (http://www.itu.int/ITU-D/ict/statistics/index.html)

projects were identified for inclusion in this research (see subsections 5.2.4.1 and 5.3.4.6 respectively).

African HE still continues to experience most of the challenges of the 1980s and 1990s despite the above noted recovery initiatives. According to Gakusi (2010)'s recent report, the continent still continues to face serious challenges of low and inequitable access with irrelevant curriculum and poor learning outcomes. Governments and institutions are still struggling to finance the development of adequate infrastructure including ICT infrastructure. For instance a survey report on ICT and education in Africa (Farrell & Shafika, 2007) revealed (i) an unreliable supply of electricity particularly in rural areas because of difficulties of connecting to national electrical grids, (ii) with the exception of South Africa, Mauritius and most of North Africa, use of ICT is constrained by a lack of computer stations, and (iii) a lack of access to affordable high speed Internet connectivity.

Most countries still have weak national ICT policy frameworks in reference to application of educational technology. In their ICT survey report, Farrell and Shafika (2007) noted that there is a great deal of variance in ICT policies for education among the countries included in their survey. Although South Africa and several countries of North Africa appeared to make positive progress in meeting their plans, majority of the sub-Saharan countries are struggling to implement their ICT educational plans. This was recently highlighted in an anecdotal newspaper article in Kenya citing a university vice chancellor and the Kenya E-learning Centre coordinator calling on the government to create an enabling environment for e-learning (see Obura, 2010). They noted that inadequate policies on e-learning in the country hamper efforts of embedding ICT in education.

In conclusion, Africa is still a long way from full recovery. However, most of these

challenges including weak infrastructure and the increasing demand for access to tertiary education create enormous opportunities for the deployment of the emerging educational technologies. Of particular interest to this thesis is the potential for the educational digital resources in meeting the demand for quality, relevant and up-to-date information resources; encouraging creation of local knowledge and in supporting expansion of education through e-learning (see Section 2.2). An enabling ICT environment opens up opportunities to leverage emerging educational technologies such as educational digital resources. The next section discusses how African HE has taken advantage of these educational digital resources in order to improve the quality of teaching and learning.

## 2.2 EDUCATIONAL DIGITAL RESOURCES

Educational digital resources broadly include the resources in any digital format that support teaching and learning as well as research (see definition of terms in Section 1.5). These scholarly resources have been made widely available as a result of the Internet, although they still come in other formats such as CDs and DVDs. They consist of e-journals and e-book databases as well as other scholarly resources such as institutional repositories of research outputs, etc. More recently, e-learning development has resulted in a proliferation of learning object repositories and Open Education Resources (OER). Although these developments started from the West, African HE has embraced their possibilities. This section reviews the status of their deployment in reference to this thesis. It first presents an overview of the status of university digital libraries. It then highlights the OER deployment.

### 2.2.1 Status of digital libraries and institutional repositories in African HE

The higher education crisis highlighted earlier had advance effects on the existence and survival of university libraries. Libraries experienced severe budget cuts resulting in overcrowding, disrepair, outdated books and journal holdings lagging years behind. This seriously limited the academic community's access to quality and up to date scholarly information. However, with the introduction of the information, communication and technology (ICT) in African HE at the beginning of the new millennium, the situation started to improve. The transformation had begun with the introduction of CD-ROM databases in the late 1990's. The new millennium brought about increased appreciation of the World Wide Web by universities. They started investing in Internet connectivity, hence making access to online resources possible. Kiondo (2008, p.52) sums up this development as follows:

> *ICT investments offered opportunities for libraries to revitalize themselves and regain their status as reliable information and knowledge centres, and included the installation of network infrastructure, Internet connectivity, computer hardware and software as well as user competence-building through computer and information literacy programmes. Others included making accessible a wide range of electronic information resource packages such as electronic databases and journals.*

It is out of this development that digital libraries in these institutions have emerged. But what is the status of their development and deployment? A survey on the state of digitization in university libraries in Anglophone Sub-Saharan Africa by Rosenberg (2006) confirmed existence of digital libraries in majority of university libraries. The survey highlighted that the pace of development varied from institution to institution. This is confirmed in another study carried out by Manda (2008) in 23 academic and research institutions in Tanzania. Several other studies and anecdotal reports (i.e. Muswazi, 2000; Kebede, 2004; Mutula, 2004; Ajegbomogun, 2007; Kinengyere, 2007; Mutula, 2007) focus

on the challenges experienced in developing and implementing these libraries. These include inadequate ICT infrastructure, unreliable electricity and telecommunication networks, high cost of bandwidth, underfunding of digital libraries, underutilization of digital resources due to low levels of information literacy caused by limited library expertise, low publicity, and lack of a good mechanism for measuring and monitoring the actual utilization of digital resources.

A recent survey conducted by the Association of Commonwealth Universities (ACU) on four African university libraries (Harle, 2010) however noted that the challenge is no longer with the availability of digital information resources. For instance, several access schemes and initiatives present in this sector have resulted in access to discounted or free high quality peer-reviewed materials and leading journals from major international publishers. Some of the main access schemes and initiatives include:

i. Programme for the enhancement of Research Information (PERii)[18];

ii. Research4Life[19], a public-private partnership of the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), United Nations Environmental Programme (UNEP), Cornell and Yale universities, International Association of Scientific, Technical and Medical Publishers, and Microsoft. Collectively, they provide access to free or low cost academic and peer-reviewed content online focusing through three programmes, namely: Access to Global Online Research in Agriculture (AGORA)[20], Programme for Access to

[18] www.inasp.info/perii

[19] http://www.research4life.org/

[20] www.aginternetwork.org

Health Research (HINARI)21, Online Access to Research in the Environment (OARE)[22];

iii. EIFL[23] (Electronic Information for Libraries)

iv. PHI (Partnerships in Health Information) which promotes flow of timely, relevant and appropriate health information, by facilitating partnerships between health libraries in the UK and those in developing countries.

Additionally, National consortia such as Kenya Library and Information Services Consortium, Zimbabwe University Libraries Consortium, Consortium of Uganda University Libraries have been formed to help bring down cost of subscriptions by aggregating demand in order to have a greater bargaining power with the publishers. As noted in Subsection 2.1.4, the ICT infrastructure is improving in terms of connectivity hence facilitating the access to these resources, despite availability of adequate computers still being an issue.

The ACU's survey singled out the complex issues around usage of these resources as being the main challenge currently encountered in the deployment of digital resources. These include unfamiliarity with the digital educational information landscape, overreliance on Google for information discovery and an unawareness of subscription-paid resources. For instance, only 40% of digital resources users had an awareness of available resources in the universities surveyed. Library websites were underused as a point of access (usage being only 34%). The report observed that these websites have been designed by librarians

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[21] www.who.int/hinari

[22] www.oaresciences.org

[23] www.eifl.net

according to their approach to collections and utilizing limited new web applications, rather than designing them from the user's perspective. This is an important point for this thesis which seeks to support the design process for design digital libraries that meet the needs of the users.

Despite the above challenges, these universities are experiencing an upsurge in the development of digitization projects targeting local content such as theses and dissertations as well as academics' publications e.g. conference papers and articles. Several universities are developing institutional repositories, e.g. University of Namibia's institutional repository of specialized databases, theses and dissertations, examination papers and archival resources; University of the Western Cape's project on Electronic Theses and Dissertations (van der Walt, 2005); University of Zimbabwe (Mbambo-Thata, 2007); University of Dar es Salaam (Kiondo, 2008); University of South Africa (Nkosi, 2008). Institutional repositories are a part of the Open Access (OA) movement (Suber, 2004) which promotes publishing of scholarly literature on the Internet and makes it freely available. Institutional repositories are online databases containing scholarly materials such as journal articles, reports and datasets to promote sharing, discovery and archiving of institution's scholarly resources (Rieger, 2008). They make use of existing innovative technological applications that support content management and can be tailored to meet specific requirements. Most of these applications are based on Open Source Software such as DSpace[24] and Greenstone Digital Library software[25].

[24] http://www.dspace.org/

[25] The Greenstone Digital library Software has been piloted in some southern African countries and an unpublished pilot report is available from http://plip.eifl.net:8080/eifl-foss/greenstone/pilot/pilot-final-report/downloadFile/attachedFile_f0/pilotfinalreport.pdf?nocache=1223995492.82 (accessed 14 March, 2011)

The Association of African Universities has also created an all-African index of past and present theses and dissertations called DATAD (Database of African Theses and Dissertations)[26], using a common format and disseminating it through Internet and CD-ROM.

This increased interest in local content production is an encouraging development. As observed in Subsection 2.1.3, certain factors present in the development of African HE have for some time affected the ability of the continent to produce local content effectively. One of these factors was the influence from the Western educational system in terms of language of instruction, curriculum and pedagogy. Visser (2008, p.69) notes that, "*...because of the widespread legacy of colonialism, Western knowledge systems have the appearance of universal truth and rationality.*" Consequently, there has been a general trend among African academic community to prefer publishing their articles in the Western journals which are more internationally recognized. This often results in reduced scope of the amount of African content published locally. The other factor is that there are still a lot of African academics residing outside the continent as a result of the brain drain experienced during the crisis period. Hence, a lot of good African knowledge is published by these African academics but it ends up residing in the West with little finding its way back to the continent.

To conclude, this section has provided an overview of the development and implementation of digital libraries. Although availability of these resources is no longer the major challenge, users' ability to exploit these resources is greatly hampered by the way they are designed and presented. This is manifested by the existing unfamiliarity with these

[26] http://www.aau.org/datad/index.htmproject

resources among users as well as low level of awareness of their existence. These resources need to be designed with the users in mind and a framework that can guide designers achieve this is the intention of this thesis.

### 2.2.2 An overview of OER deployment in African HE

The continent has already embraced the open educational resources (OER) movement despite being a late entrant. There are a number of successful OER projects going on and a lot of interest coming from universities. It is now recognized that these resources provide a way of improving quality of teaching and learning, and have potential to improve accessibility and affordability of educational resources. Wolfenden (2008b) observes that OER could contribute considerable support where there is scarcity of high quality pedagogically sound learning materials which the African institutions are not always able to afford. The following discussion highlights examples of how these resources are being implemented on the continent.

One of the most successful OER projects to be implemented on the continent so far is the Open University's Teacher Education in Sub Saharan Africa (TESSA) initiative. Its success is mainly due to its multi-faceted nature and approach. Wolfenden (2008b) describes TESSA as a consortium of institutions interested in collaboratively developing original OER to support teacher development. This means that partner institutions are not just consumers of imported educational resources but collaborate to produce and use these resources. In so doing, the process provides for contextualization of the resources developed into the local situations, hence making the content more relevant as well as indirectly contributing to creation of local knowledge. The development process recognizes the learning process of the teacher (user) by introducing scaffolding activities i.e. case

studies. This is an important step as it aligns educational resources along the learning needs and objectives of the learner, an aspect that is sometimes ignored in the development of digital libraries (OCLC, 2003). The project has also considered the technological capacity of the African environment in terms of affordability and the amount of bandwidth available by using Open Source Software and minimizing file sizes to reduce download time. In addition, the project has adopted a blended approach to actual production of the resources which can be used as online or electronic format as well as print to suit different technology access levels. The portal is designed to encourage community participation through provision of discussion forums and the TESSA Share area.

The OER Africa project[27] is a home-grown initiative that provides leadership in driving OER projects on the continent. Some of the projects under this initiative include a health science programme in Ghana, a midwifery course in Malawi and an agricultural programme.

Thutong South African Education Portal[28] is a nation-wide initiative which was launched in 2005 to provide a repository of resources that include: curriculum and learner support materials; professional development programs for teachers; administration and management resources and tools for schools; education policy documents; general news and information on recent developments in South African education. The teaching and resource materials are aligned to the country's quality assurance framework. The project also encourages teachers to create their own materials and share them with others.

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[27] http://www.oerafric.org

[28] http://www.thutong.org.za

The Open University's OpenLearn project uses the university's course materials and makes them available to learners through an environment called LearningSpace. In addition, the system also provides a set of tools for interaction with others (i.e. Compendium knowledge mapping tool and the Flash Meeting video conferencing tool) and a place (LabSpace) for educators to make changes to existing content or upload new content. Although this project has a global reach, it has particularly been tried out in Africa through a study on supporting open educational practices in cross-cultural contexts (Mwanza-Simwami *et al.*, 2008).

The widely publicized MIT OpenCourseware as a premier of the OER movement has also been used on the continent. In 2005, the AVU partnered with MIT to provide these resources in some of the African Virtual University (AVU)'s partner institutions. Because of the Internet connectivity challenges at the time, mirror servers were used to provide a copy of the entire content. This was successfully piloted in Addis Ababa University in Ethiopia and Kenya's University of Nairobi (Ngimwa, 2008).

It is important to see how the OER concept is being advanced in this region. OER are premised on the principles of openness, shareability and re-usability. They have been included in this section because they form an important component of education digital resources. However, although linked to the learning processes and objectives, they do not take a comprehensive approach which integrates skills and resources from other relevant knowledge creators such as university library personnel. Indeed though broadly speaking these resources are actually digital libraries, they are rarely perceived so. A recent study on OER readiness in Africa (Ngimwa, 2010) revealed that librarians had limited knowledge of OER despite them being extensively engaged in the Open Access (OA) movement. It is important to note that some of the approaches taken by projects like TESSA would be

appropriate for providing design process guidelines that can be used by digital resources designers. However, the fact that they do not incorporate input from librarians makes them limiting. This thesis takes a more integrative and collaborative approach involving key stakeholders and exploring ways that they can be supported to collaborate in the process of designing learner-centred educational digital resources in African HE.

## 2.3 CHAPTER SUMMARY

This chapter has set the context for the thesis by presenting a chronological transition through the various stages of the development of African HE. HE in Africa is often discussed in the light of existing challenges brought about by the crisis experienced in the 1980s and 1990s. This chapter has sought to briefly outline how this crisis came about and efforts being made towards recovery of this sector. The chapter has also provided a snapshot of the status of educational digital resources including digital library resources and OER, which are the main focus of this thesis. It has also described the status of their deployment.

# Chapter 3: Digital Library Design Processes

This chapter reviews past work related to stakeholder collaboration within digital library design processes with a focus on the African HE context. It presents a review of studies that have identified factors that affect design processes with reference to digital libraries.

## 3.1 THEORETICAL APPROACHES TO COLLABORATIONS IN DIGITAL LIBRARY DESIGN PROCESSES

A review of literature suggests that little research has sought to provide theoretical insights into stakeholder collaborations within digital library design processes. This is especially true for educational digital libraries within African HE. Most of the existing work focuses on identifying processes of integrating education theories and principles within digital library designs.

The work done by Grierson *et al.* (2008) provides a workflow model that gives some insights into collaborative design processes for educational digital libraries. This model was developed following their previous work that integrated learning theories (i.e. constructivism) in the design of a digital library called 'LauLima' for engineering design students. These students learn through project-based and problem-based approaches which depend largely on content that is of an informal and tacit nature such as sketches, reflective logs, etc. To meet this need, they designed a library system that combined an informal wiki-supported workspace where students could create dynamic wiki pages and share them, with a formal searchable and browseable section. Their workflow model focused on the role of students in generating content. It also focused on the role of academic staff and library staff in managing the process of populating the system with student-generated content. This model provides pathways for stakeholders to follow when designing such educational

systems. However, it is not a design process model per se, as its primary objective was to ensure that these different stakeholders supported the development of quality resources through academic vetting and library inspection for intellectual property rights standards. Secondly, it focused on student-generated content aimed at fulfilling needs of a particular discipline. There is a need to extend insights gained from this research to include other academic disciplines and a range of digital resources.

Similar work that integrated educational theories into the design of educational digital libraries was carried out by Dong and Agogino (2001). They conducted an evaluative study of principles that distinguished between designing digital libraries for education and for information retrieval in general. To do this, they focused on designing an educational digital library (for science, mathematics, engineering, and technology) around principles based on constructivist theories of learning with reference to information processing as a model of mental cognitive tasks. These principles included information organization, labelling, navigation, and searching. Considering these principles provided a way of designing an educational digital library that supported information processing tasks associated with learning, i.e. inquiry-based learning. However, this evaluation study was not focused on understanding a design process for such an educational information system. Furthermore, the research was not about understanding stakeholder collaborations in a design process.

Another example is work carried out by Abdullah and Zainab (2008) that used the Zachman Framework for Enterprise Architecture for a collaborative digital library design in a Malaysian secondary school. They used this framework as a holistic tool for capturing user requirements and defining digital library organization, resources, processes, technology and

information flow. This framework provided stakeholders with an experience in collaboratively designing a digital library which allowed them to be aware of and actively involved in the design process. However, it focused on the needs of digital library stakeholders and how a collaborative digital library might be designed to meet these needs. It therefore does not offer relevant ideas that can support designers interested in designing digital resources with stakeholders. Moreover, this framework focused on development of a history digital library for a secondary school. Like the other two highlighted studies, there is limited scope for understanding how multidisciplinary stakeholders can be assisted to design educational digital libraries collaboratively.

Sumner *et al.* (2010) report their on-going work on the 'Curriculum Customization Service' which aims at embedding educational digital resources into the teaching practice. This involves working in close partnership with science teachers to develop a tool that is helping them to plan and customize science curriculum using digital library resources in order to meet the diverse needs of learners. Results of their preliminary field trials suggest that the 'Curriculum Customization Service' is a useful instructional planning tool and has had positive uptake among teachers. While this is an important way of bringing teachers into the design process which has clear benefits for the users (teachers), it does not offer specific guidelines on the process of bringing users to collaboratively design these digital resources with designers.

A similar collaborative project was carried out by Davis and Dawe (2001). They experimented on the collaborative design of educational digital libraries using two design methods: a task-centred method that drew on a group's strength for eliciting and formulating tasks, and a use-case design that required a focus on defining an explicit

process for tasks. The task-centred method worked well for group collaboration as it focused on first understanding the user and the user's situations, and then facilitating their participation throughout the design process. However, the use-case approach was problematic as it assumed collaborators' readiness to commit to a pre-formatted sequence of design steps. The collaborators had no direct ownership or buy-in to the process and hence lacked readiness to commit to the process. This example offers crucial insights into the importance of having users participate in the design process as this brings ownership of the product being designed. However, like Sumner *et al.*'s work, this work does not provide guidelines for involving users in the design process.

One model that comes close to the collaborative design process is the Zimmerman *et al.* (2007)'s model of interaction design research. Although it does not refer to educational digital libraries, it is relevant for reviewing collaborative design processes. This is because it represents pathways and deliverables between different stakeholders and their relationship with interaction designers who act like gatekeepers of design artefacts before they feed into HCI practice. It is therefore a useful model for making reflections of how different stakeholders engage among themselves within a collaborative process.

In reviewing models of collaboration in design processes, it is important to consider six meta-principles for design process which have been proposed by Cockton (2009). These are receptiveness, expressivity, committedness, credibility, inclusiveness and improvability. While all these six meta-principles are important, the fifth one on inclusiveness is perhaps of particular relevance to collaborative design processes as it emphasizes the need for design process to be more inclusive, bringing on board all concerned stakeholders.

To conclude this section, it is important to note that a common feature in all the above

reviewed collaborative models is that they are framed outside African HE context. This is a context that has its unique constraints which have potential to impact on collaborative design processes for any technology. Such constraints and their effects need to be understood. For example, while all the above studies are based within technologically advanced contexts, African HE suffers technology limitations such as low Internet bandwidth. Such a limitation can impact negatively on the potential of stakeholders to effectively participate in the design of systems that depend on the availability of good Internet connectivity. Therefore, there is need for an investigation not only of how to design educational digital resources collaboratively with multidisciplinary stakeholders, but one that seeks to identify useful insights that are relevant to African HE context.

## 3.2 IDENTIFICATION OF FACTORS AFFECTING DESIGN PROCESSES

Design processes for any technology system are often affected by certain factors that are present within the contexts where design is taking place. Such factors have potential to improve or weaken design processes. This section identifies such factors and their specific roles within the design process. It also highlights existing knowledge gaps with reference to digital library design processes in African HE context.

### 3.2.1 The role of policies in digital library design

Policies are crucial as they determine how functions within organizations are carried out. However the concept of policies is very broad and can be understood from different perspectives. Trojman (2005) for example takes a public policy perspective and considers policies as broad frameworks of ideas and values within which governments make decisions and take actions in response to certain issues and problems. Innocenti *et al.*

(2010) take a broader definition that considers policies as political, management, financial and administrative mechanisms which are structured to ensure delivery of certain outcomes and behaviours. A review of literature suggests that there is little research that unpicks the role of policies in digital library design processes, especially within the African context.

To begin with, policies from a digital library perspective are mainly understood as conditions, rules, terms, regulations that govern the operations of users and digital resources (Rubin, 2000; Innocenti *et al.*, 2010; Anunobi and Ezean, 2011). From this broad understanding, there has been an attempt to classify the different types of policies relating to digital libraries. For instance, Crawford (2005) attempts to make a distinction between library policy and digital library policy. He considers the library policy as mandating effective access to the library collection, including collection management and preservation. Meanwhile, digital library policy entails the control of technology, encompassing access versus ownership issues, support for open access, control of costs and support of digital preservation. Innocenti *et al.* (2010) approach this classification from an operational level which includes policies that define acceptable user behaviour; policies concerned with digital rights management; privacy and confidentiality policies; usage charges policies; and collection delivery policies. Lesk (2005) provides a more general classification by considering some types of digital library policies such as (i) funding policies, i.e. decisions about institutional support and charges to apply to some services; and (ii) legal policies, i.e. the protection to be given to the digital content.

While important in providing some parameters within which policies relating to digital library operations can be understood, these definitions do not directly link policies with the design process of digital libraries. Nevertheless, it should be noted that there is a general

acknowledgement of the value of policies in this field. For example, Law (2004) believes that the sheer volume of electronic materials that are being produced so rapidly requires thoughtful consideration of policies on collection building and the technology and practices to support it.

Another important example to consider concerns the development of the 'DELOS digital Library Reference Model', where policy was perceived not just at the operational layer but also at the metalayer, which exists above and beyond the digital library. While carrying out policy and quality interoperability investigations of this model, Innocenti *et al.* (2010) argued that policy exists at a metadomain that is situated outside the digital library and technologies that support it, and also inside the library. They perceived policies as:

> *"an intellectual construct that is deployed to frame the construction of the digital library and its external relationships and then these and other more operational policies, are represented in the functional elements of the digital library"* p. 46

They therefore recommended that policy be considered at all levels of digital library from conceptualization through to operation. What is crucial in this argument is the inclusion of policy consideration at the conceptualization or construction stage. By making this argument, Innocenti and colleagues appeared to acknowledge the important role of policies not just as governing digital library operations but also in terms of supporting the design process stage. However, this does not show us how policies can actually impact at this stage. Innocenti *et al.* (2010) also made another important observation. They pointed out that a policy can be affected by quality parameters of digital library programs. Hence they suggested that a quality assurance measure is required to ensure that the policies developed are compliant with the standards and 'best practice' to be implemented in these programs. This seems to suggest a correlation between policies and best practice that is determined by

the quality of digital libraries developed.

Within African HE context, Kanyengo (2009) observes that the situation found at the University of Zambia which lacks strategic plans on how to interact with the digital library is characteristic of other African universities. While such a generalization can be deemed as unfair, it is hard to confirm the actual situation as there is not much written about policies and digital libraries in this context. Kanyengo further suggests that policies on how information is handled are yet to be enacted because Africa is still struggling to fit into the digital environment. Citing the United Nations Economic Commission of Africa's observation she notes that national information policies in most African countries are not holistic and strategically aligned within national development priorities. Thus a comprehensive bottom-up approach that links national information policies with national priorities is needed. While these assertions can be debated, there is again not much evidence known to support a counterargument. What is indubitable nevertheless is the synergistic relationship between information policies and the wider institutional and national environments. Indeed Hanna (2008) perceives this synergy as one of the pillars in developing a knowledge society. This means that the processes involved in designing systems for this information society are also affected by such information policies. However, there is a gap in knowledge about how these policies impact on collaborative design processes for such information systems. We need to understand the role these policies can play in the design of digital library systems especially within African HE context, which as already highlighted by Kanyego (2009) has a weak policy structure.

### *3.2.1.1 Policies from a design process perspective*

The role of policies in HCI design has attracted some attention in the recent past and it is important to understand to what extent and level of treatment these policies are given with regards to design processes of information systems such as digital libraries. To begin with, a review of literature shows that CHI[29] has taken a lead in trying to understand policies in HCI. For instance there is a special interest group committee on US public policy formed in 2004 and recent CHI conferences have dedicated workshops to try and understand the role of public policies in this field (see Bederson *et al.*, 2006; Lazar *et al.*, 2008). However, these activities only focus on public policy with regards to wider public issues such as accessibility, privacy and voting. They leave out effects of other types of policies such as those at national and institutional levels influencing technological developments and usage within institutions like schools and universities.

Inglesant and Sasse (2007) have reviewed the role of public policy within London transport systems. Their focus was on the usability of the transport system, where they drew upon the lived experiences of users in three case studies. This study reviewed the important role of designing public policies that prioritize the usability of these systems. It established that if such public policies are missed out, organizations avoid paying attention to important usability issues of the systems they design. The result is that people have negative experiences with such systems that ignore usability issues and thus fail to meet their needs. Consequently, this can lead to a loss of trust and legitimacy not only with the systems themselves but also with the public policies that supported them. This study made an important contribution to HCI design with regard to the relevance of policies in systems

[29] This is the Association of Computing Machinery (ACM) ACM CHI Conference on Human Factors in Computing Systems

design. However, the focus was on the role of the public policy and not the broader policy context where policies are not necessarily the origin of the system designs but nevertheless influence the design process as a whole.

Another similar example of how public policy affects technology designs comes from Winter (2006). She reports on a multi-phase study which examined the introduction of pervasive computing in the State of Hawaii, which brought together ICT specialists, government policy makers and members of the public. The result was that differences in perceptions between the specialists, policy makers and non-specialists (i.e. members from the public) were identified and understood at all the stages of the process. This was important as it considered the influential role of the policy makers. However, their focus on public and policy makers was driven by the potential impact of technologies on the general public's lives.

Shneiderman and colleagues' research has also extended to the role of public policy in social participation within the design of systems for public interests e.g. community emergency response (see Jaeger *et al.*, 2007; Shneiderman, 2009; 2010). The arguments proposed suggest that public engagement systems may start as a grassroots activity but can become national initiatives that change the way we live. The national impacts of these systems mean that they can be taken onboard by government bodies and change policies from within (Shneiderman, 2010). This then advances the importance, within a design framework, of interlacing policy and system design whether this takes bottom-up or top-down dimensions.

Although the studies highlighted above make an important contribution to the design of systems, they all have tended to narrow down to just one area of policy (i.e. public policy).

We need to understand what other policies influence the design processes of systems not just those meant for public interest but also those that serve specific institutions. What other relevant policies exist at national and institutional levels and to what extent do they affect the design process for systems meant for institutions like universities? Simply by looking at security policies, for example, it is easy to observe how institutional policies dramatically impact on the design of communication systems within some institutions like healthcare (see Adams and Sasse, 2005). There is a need for a more holistic approach that extends treatment of policies to include those developed at national and institutional levels. Such an approach would help in understanding the effects these policies can have on shaping the collaborative design process for educational digital resources at higher education institutions.

### 3.2.2 The role of stakeholders in the design process

A review of literature suggests that studies seeking to understand different design stakeholders and their role in the design process design are limited. Usually, design related fields such as HCI tend to focus on understanding human interaction with technology systems. Such studies produce socio-technical models that attempt to make sense of the interaction between human beings and systems in order to improve the design process and ultimately, performance of interactive systems. For example, Nardi and O'Day (1999) have looked at human-technology relationships in situations and contexts and have used the metaphor of information ecology to depict this interplay. In this ecology metaphor information systems are depicted as complex systems of people, practice, values and technologies existing in a complimentary way. This is relevant in helping us to comprehend the interdependencies of the human relationships and technological factors involved in the design process. Such a metaphor demystifies the complex interrelationships between

human and technologies. However, it does not extend our understanding to the role of human (design stakeholder) in the design process for these technologies.

Other related studies have tried to understand users of technology systems within different contextual settings in order to improve the design of these systems by incorporating context specific aspects in the design process. These studies tend to use participatory design and user-centred design approaches. For example, Kam *et al.* (2006) studied participatory design with rural school children in underdeveloped regions and concentrated on the value of working with these children in prototyping low-tech and hi-tech English language learning games. Similarly, Ramachandran *et al.* (2007) studied social dynamics in the early stage of co-designing technologies with rural communities in Uganda and India. They focused on design lessons gained on how to elicit feedback and participation of the local stakeholders. These two studies followed the conventional HCI design approaches where designers seek to understand current tasks, needs and practices of the potential user through methods such as needs assessments, contextual inquiry, task analysis and participatory design. These processes are important as they bring the user's needs and interests to the fore in the design process. However, these approaches avoid the important issue of understanding the changing roles of these systems' users as design stakeholders in the design process.

Some of these participatory design and user centred approaches define users of the systems as design partners and hence design stakeholders. While the design experts provide systems knowledge as well as design guidance, these users provide systems requirements from the user's perspectives. They also participate in design decisions. For example Theng *et al.* (2000, 2001) report on their work with 11-14 year-old children designing their own digital

library through a process in which learning activities were integrated and support provided. Children were allowed to engage among themselves to identify their needs and preferences and then make decisions of how they wanted their library to appear. Similar work with children as co-designers has been carried out by Druin and her team at the University of Maryland where they have been developing the International Children's Digital Library (ICDL) with children since 2001 (Druin *et al.*, 2009). Using participatory design approaches, they have engaged children in America, New Zealand, Honduras, Mongolia and Germany as co-designers. In Lustria *et al.* (2010)'s study on participatory design of a health information system, they included as design stakeholders, health practitioners and breast cancer survivors who were the intended users of the system being developed. Their role was also to provide systems' requirements based on their user needs.

Some participatory design researchers have extended the stakeholder base and included others whose participation is similar to that of the users. Flechais and Sasse (2009) for instance in their study of design on usable security in e-Science included multiple stakeholders in their four case studies. Besides the users and developers, they added owners of the systems, security experts and a data provider. One of the conclusions of this study was that these multiple stakeholders provided a very effective means of identifying system needs such as security requirements, which was an important contribution in the design process for these systems. This resulted in the design of a system that was well suited to its intended users. Gil *et al.* (2008) also included informal carers and physiotherapists besides the intended users (i.e. the elderly) and the design experts who were the technologists and researchers. They found that these different stakeholders provided different perspectives and expectations which helped clarify system requirements.

Other participatory design studies have identified stakeholder roles beside the conventional ones within system requirements and knowledge provision. For example, a study carried out by Puri *et al.* (2004) identified a 'mediating agency' role for some stakeholders. In order to get user participation in the development of a health information system, a partnering university in Mozambique was used as a stakeholder to break down the bureaucracy that existed within the organizational structure for one of the other stakeholders (i.e. the Ministry of Health). This university facilitated interaction and communication between ministry officials and health fieldworkers in the provinces and districts, which meant that users were able to participate in design decisions and provide valuable input to the design process.

Studies that have a more user-centred design nature also consider end users as design stakeholders. However, their (stakeholders) involvement tends to be restricted to the beginning of the design cycle for requirements elucidation and at the end during final testing. They may include other stakeholders to clarify requirements as noted in Newell & Dickinson (2006)'s work of designing a portal for older users. This project did not just focus on the users who were the elderly (over 60 years) and the designers who were commercial developers. They brought in academic researchers who represented the interests of users by appropriately articulating their (users) needs and wants. In addition they also brought in the client (i.e. department for education and skills), represented by a usability engineer. By including these other stakeholders, conflicting issues were clarified. For instance, the academic researchers were able to underscore the need for simplicity in the design. By ensuring that the users were present to demonstrate their technology skills levels and needs, design experts were also able to empathize with the users' system needs

and requirements and thus understand why it was important to keep the system simple.

The above studies help us to understand how system users become design stakeholders and the different roles they can play in the design processes. However, as already mentioned, all these studies have concentrated on design approaches such as the participatory design and user centred design that bring users to the design process. Does this mean that only such approaches support users as design stakeholders? The issue with such approaches is that they narrow the scope of stakeholders to system users and design experts. We need a holistic approach that can reveal other types of stakeholders and their role in the design process.

Another point about the above studies (with the exception of Puri *et al.*, 2004's study which involved a university in Mozambique) is that they do not extend our understanding to what happens in African HE context. Some of these studies (i.e. Druin *et al.*, 2009; Kam *et al.*, 2006 and Ramachandran *et al.*, 2007) involved developing contexts. However, these were also not focused on Africa. It would be important to establish if African HE shares some of the findings revealed in these studies in relation to the nature and roles of design stakeholders likely to be present in design of educational digital libraries.

### *3.2.2.1 Stakeholders as design champions*

A review of related literature also highlights a certain key type of stakeholders identified as *design champions*. These according to the UK's Design Council (Design Council, 2010) are design leaders who drive the development of a company's design function ensuring its recognition internally and externally. Downs and Chen (2004) have highlighted that design champions are a key stakeholder category in the design process whose main role is to

provide project leadership. The UK's Commission for Architecture and the Built Environment (CABE)[30] and the UK's Department of Health (Department of Health, 2008) have both been campaigning for the inclusion of design champions in design processes. The notion of a champion in the field of technology is not new. The Decision Support System (Curley and Gremillion, 1983) depends on implementation champions for the successful introduction of these innovations in companies and organizations.

Whether implementation champions or design champions, what these concepts seem to share in common is the description and roles of these champions. For example, the Design Council identifies design champions as leaders who steer the development of design functions and its recognition internally and externally. They view them as charismatic and passionate people who share an interest in the development of talents amongst the team members. They are also highlighted as being skilled in design. This profile is similar to that of the Curley and Gremillion's (1983) description of their system's champions. They too perceive them as leaders who actively and enthusiastically promote the development and adoption of the system. They are knowledgeable in the system's operations and the organizational functions it supports, they demonstrate commitment and enthusiasm for the system and act as internal change agents and missionaries influencing the attitudes of others towards the system whilst helping other stakeholders to understand and use it. A more recent report on champions for integrated design solutions (Tatum, 2009) also agrees with previous literature that these champions are change agents who are enthusiastic and passionate about the technologies they are supporting. While such examples distinguish champions from general stakeholders, they are largely based on anecdotal reporting with little empirical work to support and substantiate it. Besides, none of this relates to the

[30] http://www.cabe.org.uk/design-champions

collaborative design process for digital libraries and in particular within the African educational context.

While important additions to the knowledge of design stakeholders from a HCI perspective, the above reviewed studies and anecdotal findings provide limited insight into the roles and facilitation of multidisciplinary design stakeholders within collaborative design processes of information systems such as digital libraries. Such perspectives lack a detailed account of how to engage these design stakeholders and get their collaboration in the design process. We need to have some guidelines on how design champions can be supported to use their skills and facilitation capability in order to achieve the sustained engagement and collaboration of multidisciplinary design stakeholders in the design process.

### 3.2.3 The role of innovative technologies in supporting the design process

HCI studies are increasingly looking at the role of innovative technologies and more particularly how universal technologies can be tailored to suit specific user groups. These range from studies that focus on users with special needs such as the elderly or the disabled to designing for different contexts. For instance, research within accessibility with the design for all perspectives has tended to focus around models of universal design adapted to specific users needs. An example is Ornella and Stephanie (2006)'s research that applied universal design recommendations on a user-centred design process for mobile phones that would cater for the needs of visually-impaired, hearing-impaired and elderly people. Another study by Beecher and Paquet (2005) developed a usability testing survey instrument meant to assess how products complied with set principles of universal design. Of specific relevance to this thesis are those studies that seek to understand how these technologies can support collaborative design processes for educational information

systems that are adaptable to the needs of the African higher education context.

HCI for development (HCI4D) is a new area of research that tries to understand how universal designs coming from developed countries can be adapted to fit developing contexts. These are premised on the fact that innovations designed in the developed world introduce the problem of 'Western universality of technologies' which assumes the same conditions exist all over the world. This is a subject now widely debated by a number of HCI4D researchers (e.g. Dray *et al.*, 2003; Brewer *et al.*, 2006; Sambasivan *et al.*, 2010; Wyche *et al.*, 2010). For example Dray *et al.* (2003) argue that the global economy has assisted the spread of technology originating in the developed world into the developing world. She asserts that these exports of technology may not necessary fit well into the culture of others and hence would need adapting to a wider range of users and situations. Dray's concerns are substantiated by numerous studies especially those carried out in developing countries. Brewer *et al.* (2006) for instance report that despite their projects in developing regions resulting in life changing innovations such as in the area of telemedicine, they ran into many technical, cultural and environmental challenges. For example they encountered equipment failure because typical specifications were not realistic for developing countries with different environmental and climatic conditions.

Another example is the emergence of the Internet which has also enabled unprecedented gains in all sectors especially education, health and banking. However, most of these Internet-based technologies are designed to operate on broadband which is not always available in most developing countries. Hence, such innovations become inappropriate for these contexts and would therefore need customization in order to make them usable. Wyche *et al.* (2010)'s study in Kenya provides a good example. They noted that a financial

system designed in the developed countries to operate on broadband created frustrating experiences with the local employees because there was not enough bandwidth to support it. For such an innovation designed around universal technology (i.e. Internet) to work, it would require customization that allows it to operate in contexts that have low bandwidth.

There also exist studies that focus on understanding how existing universal technologies can be adapted to suit different types of users, contexts and cultures. These studies are mainly carried out within the area of mobile technology which dominates cross-cultural usability studies (e.g. Choi *et al.*, 2005; Nettamo *et al.*, 2006; Sambasivan *et al.*, 2010; Smyth *et al.*, 2010). For example Choi *et al.* (2005)'s cross-national study of cultural influences on mobile data services design identified certain design attributes across Japan, Korea and Finland which they used to explain user requirements for mobile data services. This study also identified relationships between these attributes and the cultural characteristics across the three countries. A similar study was also carried out by Nettamo *et al.* (2006) in New York City and Hong Kong where they investigated cross-cultural retrieval, management and consumption of mobile music. This study highlighted some cultural differences in the user behaviour between the two settings. A related study on mobile technologies for developing contexts was recently carried out by Camara *et al.* (2010). Using findings of previous studies that sought to understand the context needs of rural communities in Africa, they proposed an offline mobile solution (WikiReaders) to support e-learning needs for rural populations.

Digital libraries as a field of study have potential to offer some useful insights for reviewing universal design approaches. Digital libraries are mainly designed for universal access (e.g. ACM digital library). However the need for customization to fit certain

institutional or personal preferences is becoming more and more important. For example, de la Chica *et al.* (2009) have designed a tool called the Concept Learning services for Concept Knowledge (CLICK) for personalizing learning opportunities with digital library resources. The CLICK system has a web-based application that identifies knowledge gaps and misconceptions in students' essays and then recommends resources from appropriate digital library resources to use.

Some studies also reveal that cultural issues have an impact on the digital library design outcomes. For instance, universally designed digital libraries usually end up being used by international users from a range of different cultures (see Duncker, 2002 and Smith, 2006). This can affect usability of these systems as identified by Duncker (2002). Her study on the Maori people's acceptance of the library metaphor established that the Western library metaphor clashed seriously with the Maori culture. The metaphor was also found to be counterintuitive to the Maori people, thus affecting their acceptability and ability to use these resources. For example the mere use of the Western classification system scattered and misrepresented Maori knowledge which is considered sacred and tribal property. These people had little experience with this system and therefore were excluded from effectively using digital resources because of the way they were designed. Komladi *et al.* (2004) also had similar findings in their usability evaluation study of five national libraries. They established that user interfaces and content did not serve international users. In an attempt to provide solutions for these cross-cultural usability problems, Smith (2006) has recommended combining cognitive theories, cultural theories and HCI design principles to form a framework that can effectively be used to understand the complexities around this research area. But such a framework does not offer any insights into how these

technologies can support collaborative design processes for these digital resources in order to make them relevant to people within specific contexts.

All these studies shed some light into the approaches being used to make existing universal technology innovations fit specific contexts and user needs. They help us understand how products, applications and systems can be re-designed appropriately to address unique needs of the developing world and cope with the infrastructural, cultural, socio-economic factors unique to these contexts. However, none of them is specific on the application of these technologies to support the collaborative design of digital libraries especially in a context with varied socio-cultural and technological settings such as those present in African HE. We need to have some investigation into how these innovative technologies can support collaborative design processes for digital libraries that are relevant to the African HE context.

## 3.3 CHAPTER SUMMARY

This chapter has undertaken a comprehensive review of existing literature on theoretical approaches to collaborative design processes. It has highlighted existing research on the nature of collaborative design process models that have been developed especially those that relate to the design of educational digital libraries. Such models however have been carried out mostly in developed countries whose technological contexts are different from those found in Africa. This therefore presents a knowledge gap of useful design process insights that can be used to guide the process of collaborative design of educational resources that is relevant to African HE.

The chapter has also reviewed studies that have focused on factors that impact design

processes. Policies have been identified as an important factor supporting design processes. However, this review has identified a gap in the application of these policies in the sense that most studies only focus on public policies and avoid other levels of policies. Additionally, the role of stakeholders in the collaborative design process has been identified as crucial but the nature of these stakeholders and their specific roles in the design process is not well understood. Moreover, most research in this area has been identified as focusing on design approaches that concentrate on system users as design stakeholders (e.g. the participatory design and user-centred design). Such approaches limit the scope of design stakeholders to users and offer no insights into other potential design stakeholders.

The review of literature has also highlighted studies that have identified presence of design champions. However, these studies offer limited insights on the specific role of these design champions especially in regards to facilitating engagement among other design stakeholders within collaborative design process. Moreover, none of these design champions identified have related to the design process for digital libraries and in particular within African HE.

The role of innovative technologies in customizing universal designs has been highlighted as relevant for digital library design processes especially in contexts such as Africa that have varied socio-cultural and technological settings. However, reviewed literature has identified a knowledge gap on how such technologies can support collaborative design process for digital libraries especially in African HE context.

In conclusion, while the reviewed literature has provided useful insights into the nature of existing collaborative design process models, it has not provides us with relevant guidelines that can be used to support designers of educational digital libraries to design

collaboratively with relevant stakeholders. There is need for an investigation that will provide such design process guidelines which are relevant to African HE.

# Chapter 4: Methodology

This chapter provides a detailed and systematic account of the methods used in this thesis in order to effectively answer the following two research questions:

- *What are the existing factors that can be used to support a collaborative design process for educational digital resources in African higher education?*
- *What are the characteristics of these factors and the roles they play in the collaborative design process?*

The first part discusses the methods and provides a rationale for their suitability in answering the research questions. The second part provides an account of how data was collected and analyzed. It also demonstrates how the credibility of the research and ethical considerations were ensured.

## 4.1 A QUALITATIVE HCI INVESTIGATION

This thesis investigated the design process in the development of educational digital resources and how key stakeholders can be supported to collaborate in this process. In view of this, the methodological approach adopted was largely informed by Human Computer Interaction (HCI) as a technology design discipline (see Subsection 1.3.1). There exist various research approaches that have been applied to HCI research. Cairns and Cox (2008) highlight the fact that the multidisciplinary nature of HCI has forced researchers to look back to their traditional disciplines for research methods and adapt them. They further list experimental designs, cognitive modelling and qualitative research as approaches that are increasingly being used in HCI.

In this thesis, a research method that combined qualitative and quantitative data was

adopted. However, use of qualitative data was more dominant whereas the quantitative approach related only to one data source (documentary evidence) which included some quantitative data. Qualitative data was utilized more because of the potential to address challenges surrounding the phenomenon under investigation. First, in order to answer the research questions, it was necessary to understand stakeholders' contexts and experiences relating to their work practices, communities and organizational social structures including political and social drivers. This is a process that has previously been observed by some HCI researchers (e.g. Marchionini *et al.*, 2003; Adams *et al.*, 2008). Qualitative data makes achieving this understanding possible as it enables a deeper understanding of social phenomena (Silverman, 2000; Maxwell, 2005). Ormerod *et al.* (2004) have also noted that HCI developers and researchers are increasingly turning away from laboratory-based controlled experiments to more contextually-rich methods which provide descriptions of user activity patterns. Hence, by using qualitative data more than quantitative data, this research was able to obtain deeper and richer insights on how stakeholders engaged with each other and with technology in the design process.

The second challenge arose from the fact that this thesis did not only cut across different knowledge domains (i.e. HCI, education, information sciences), but also considered different kinds of stakeholders (i.e. librarians, students, academics and e-learning technologists) in multicultural settings of African HE (Uganda, Kenya, South Africa). In order to navigate through this complexity, an in-depth understanding of these various factors was necessary, which could best be provided from qualitative data. Focusing on quantitative data alone would have been limiting and not adequate enough to address this complexity as pointed out by Adams *et al.* (2008, p. 138) *"... there are many complex,*

*socially based phenomena in HCI that cannot be easily quantified or experimentally manipulated"*. Sellen et *al.* (2009, p.66) concur that the diversity, scope and complexity of the technologies HCI has to deal with requires *"asking questions about the qualitative...rather than quantifiable attributes and capabilities alone"*. Thus, by using qualitative data more, this research was able to navigate through the complexities highlighted.

### 4.1.1 Case studies

As mentioned above, this research cuts across different knowledge domains and different contexts involving a number of different stakeholders. Therefore, in order to ensure a more holistic, in-depth and context-sensitive approach to support these complexities, this research was carried out within a case study approach. Patton (2002) and Merriam (1998) agree that case studies provide a holistic, in-depth, and context-sensitive picture of what is being researched. This is partly because case studies can support multiple sources of data that provide an in-depth and holistic picture of the researched phenomenon as acknowledged by several social researchers (i.e. John & Packer, 1996; Bassey, 1999; Gillham, 2000; Yin, 2003; Stake, 2005; Gerring, 2007). These data sources include documents, archival records, interviews, direct observations, participant-observation and physical artefacts. Thus, in applying a case study approach for this research, it was possible to accommodate these mixed data methods.

Case study strategy can be based on one case or multiple cases. Stake (2005) has classified case studies into three types: intrinsic, instrumental and multiple or collective case studies. 'Intrinsic case study' is when the researcher is interested in a particular case because he or she has an intrinsic interest in the case rather than in trying to understand a generic

phenomenon represented in that case. 'Instrumental case study' is where a case represents some external phenomena or characteristics of interest to a researcher and by studying the case in details, he/she is able to understand these external interests. In multiple case studies, a number of instrumental cases are studied jointly in order to investigate a particular phenomenon. This means that it is possible to study cases in different contexts. Noor (2008) argues that examining different cases can enhance the accuracy, validity and reliability of the results if replication is followed across the cases as described by Yin (1993). As will be seen in Subsection 4.2.1, this research adopted the third category. Three case studies of universities located in different African contexts (Uganda, Kenya, and South Africa) were carefully identified using set criteria. In the end, this enhanced richness of the data that was obtained.

#### *4.1.1.1 Resolving tensions between two research approaches*

The multidisciplinary nature of this thesis (highlighted in Section 1.3) greatly influenced the application of the case study approach. This approach in the end provided an appropriate way of eliciting data from different sources within a multidisciplinary research setting. It was clear from the onset that there would be potential tensions between the different research approaches taken by the main knowledge domains shaping the thesis development. This was particularly apparent with two disciplines (Education and HCI) that have distinct research approaches and their treatment of case studies (influence from Information Science was not considered strongly as explained in Subsection 1.3.2). Rather than disregarding these tensions, it was decided that only elements relevant to the research would be identified from each of the disciplines and applied to inform the case studies.

In the first instance, the HCI aspect of the thesis entailed a review of collaboration taking place within a design process of digital libraries from a technical perspective. Such a review of the design process is not very common in educational-type case studies. Secondly, most conventional HCI research (e.g. Participatory Design approach) tends to be carried out as the design process is happening. Indeed a lot of studies considered in the literature review of this thesis had their investigation conducted during the design process (i.e. Dray *et al.*, 2003; Brewer *et al*, 2006; Sambasivan *et al.*, 2010). Such an approach provides a comprehensive and in-depth review of design processes of particular products or interactive systems. It also often involves methods such as ethnographic studies, scenario building, products prototyping, etc (see Shneiderman *et al.*, 2009). This would have been one approach to follow in this research but it turned out not to be practical for the following two reasons:

(i) As will be seen in Subsection 4.2.2, eleven digital library projects were identified for investigation. Reviewing all these projects was necessary in order to provide an overview of the different design processes across the three countries. However, carrying out a comprehensive and in-depth review of each of these eleven projects would have required many months to complete and more human and financial resources. Such an investment goes far beyond a three-year PhD project;

(ii) All these projects had different stages of design processes. Some were already completed projects and were being reviewed and tailored to meet users' needs. Others were being redesigned utilizing existing designs. One of them was being designed from scratch. These different stages limited the scope for participation in the design process for most projects except the one which was being designed

from scratch. Furthermore, it would not have been feasible to have the design process for all the projects happening simultaneously in such a way that would have allowed reviewing of all their design processes within a given timeframe. The only way this would perhaps have been possible was to do a longitudinal project. Even then, reviewing ten projects would have taken a long time beyond the timeframe for this PhD research.

As a way forward, it was found necessary to review some of these types of design processes retrospectively. This is not usually very common with HCI case studies but tends to happen a lot with education case studies. The focus of HCI case studies often tends to be on what is 'happening now'. They concentrate on evaluation of existing systems and their ongoing performance. As Furniss (2008) puts it, they usually provide one-off insights and first hand reports of the contexts in which people work. This is in contrast to generation of other academic theories that normally build on existing knowledge. A case study on usability for instance would be aimed at finding out potential usability issues as the system or product is being developed, and would therefore be aimed at finding out what these issues are and deal with them in the design. So real-time consulting becomes of essence. However, there are some exceptions in a few recent documented examples including the 'Retrospective Think Alound' usability method to collect data on the performance of users after the performance is over (Guan *et al.*, 2006); retrospective reporting of online search track (Eger *et al.*, 2007); 'Day Reconstruction method' used to elicit user's experiences with technologies from memory (Karapanos *et al.*, 2010), and Critical Decision Method (Wong and Blandford, 2003). Even when applied, these methods still refer to a short span of time in contrast to the educational case studies which often review things that happened

a long time ago. A rare counter example is the retrospective review of Greenstone software (Witten and Bainbridge, 2007) that studied the development and implementation of the software and documented lessons learnt over an extended period time. This example can be singled out as having the longevity usually common in some education type case studies.

In contrast, educational case studies do allow for retrospective review of phenomena being studied. Several educational research authors have listed different ways this happens within a case study. For example Freebody (2004) observes that case studies can be used for reflection where the consequences of action taken are examined to produce basis for new action. For illustration purposes, researchers can reflect on reasons behind development of certain educational policies in order to understand the effects of these policies and suggest redesign or strategies for improvement. In such a case, they would require to look retrospectively at how these policies were developed. Merriam (1998) explains that educational case studies can have a historical aspect focusing on the description and analysis of a school, program, intervention or practice as it has evolved over a period of time. Yin (1994) states that case studies can be used to examine contemporary events that have happened over a period of time, thus employing historical techniques of relying on documents and artefacts, but also include direct observation and systematic interviewing. These examples entail a retrospective review of what has happened in the past to inform what is being researched.

This research also required an approach that would support a comprehensive review of all the 11 projects' different types of design process, across three different geographical locations. Different data sources were necessary to support the investigation. Such a comprehensive approach is common in educational case studies which tend to use multiple

sources of data including interviews, observations, transcripts, notes, and schools and national documents of policy, syllabus, assessment records within a single case (Freebody, 2004). In terms of sample population, Merriam (1998) states that sampling does not focus on people alone but involves selection of research site, time and events. Interviews might include a wide range of stakeholders who might not necessarily be directly involved but are relevant because of influence they might have on the phenomenon being researched. Such people would for example include policy makers.

In contrast, HCI case studies tend to include a comparatively narrower selection of data sources including interviews, focus groups, questionnaires and observations. Moreover, as Fallman (2011) states, HCI traditionally has tended to concern itself with usability, focusing on a single user using a single operation and has moved on to situations and contexts, trying to incorporate users as part of the design team. More recently, the focus has shifted to experiences of the user. However, unlike with the education type case studies which tend to concern themselves with a range of stakeholders, HCI's focus over time has rather been limited to those related or affected by technology designs i.e. as users or designers. For example in a study of the design of electronic patient booking systems (reported in Blandford *et al.*, 2009), the sample population included stakeholder groups who interacted with and around systems (including medical staff, nurses, Allied Health Professionals, patients, carers and health technologists).

One common aspect shared by both HCI and education studies is the concept of 'best practice' although from different perspectives. For instance, while education studies would have a wider application of the term to include processes and factors influencing these processes, HCI ones would be emphasizing on the design aspects. This research

acknowledges concerns around the negative perception this term could bring and perhaps a better phrase to use is 'good practice'. Falconer (2011) observes that the term is flawed because it acts as a placeholder for proper management practice, hence displacing accountability for effectiveness. It also weakens innovation as it assumes the 'best known' as benchmark, thus discounting the emergence of better and novel ideas. Nevertheless, this is a concept that is still commonly used within both education and HCI domains. For example, it has featured in studies related to education (Coffield and Edward, 2009; Robbins, 2009; Asperin and Castillo, 2010; Christianakis, 2010), and education and policy (e.g. Rodriguez, 2010; Lam, 2011). Some of the HCI case studies that have been developed with an aspect of 'best practice' include Damsma *et al.* (2005), Smalley & Herman (2005), and Alsos and Dahl (2008). In this research, 'best practice' as a concept was critical in the identification of case studies and eventual selection of digital library projects that were reviewed. This was measured against a set of criteria developed according to the needs of the research. These criteria are described in Sections 4.2.1 and 4.2.2. In the end, the research was developed within a case study approach that benefitted from the strengths of both education and HCI case studies, as summarized in the highlighted areas of Table1:

**Table 1: Summary of similarities and differences between Education and HCI case studies**

| EDUCATION-TYPE CASE STUDY | HCI-TYPE CASE STUDY |
|---|---|
| Supports retrospective review over a period of time | Tends to emphasize review of situations as they happen |
| Not usually focused on design processes that have a technical angle to them | Supports the review of design processes from a technical perspective |
| Supports wide range of data sources | Tends to emphasize on a relatively narrower range of data sources |
| Has scope for inclusion of a wider range of stakeholders | Tends to have a narrower range of stakeholders |
| Supports 'Best practice' from a broader perspective | Supports 'Best practice' from a design perspective |

Ultimately, this approach had certain advantages, which would not have been possible by just focusing on one of the two discipline traditions alone. First, it was possible to review all the 11 projects within the allocated resource limits. Second, by stepping back and reviewing different types of design processes, this allowed a broader and richer understanding of concepts that sprung across institutional and national boundaries. This in turn provided comparative data across all the projects. For example, issues at national and institutional levels i.e. policy differences and influences were uncovered as will be seen in the data analysis and presentation chapters. This would possibly have been difficult to achieve under conventional HCI approaches or educational type case studies, if applied on their own.

### 4.1.2 Influence of grounded theory in HCI research approach

This research was focused on identifying factors that would support the development of collaborative design process guidance, leading to a theory that would explain how to effectively support the collaborative design process for educational digital resources in African HE. Grounded theory provides an inductive approach in data gathering and analysis, so that the theory is allowed to emerge from data. Strauss and Corbin (1998, p.22) define theory as:

> *...a set of well-developed categories (e.g. themes, concepts) that are systematically interrelated through statements of relationship to form a theoretical framework that explains some relevant social,...educational...or other phenomenon. The statements of relationships explain ...how, and with what consequences an event occurs.*

In this grounded theory approach, data collection and analysis repeatedly refer to each other in an iterative process until theory is generated. Compared to other qualitative analytical methods (e.g. content analysis, discourse analysis and thematic analysis), grounded theory's

uniqueness is found in its analytical framework where data collection, analysis and eventual theory stand in close relationship with each other (Strauss and Corbin, 1998 and Bryman, 2008). In light of this, some elements of grounded theory were employed through data collection and analysis. This approach also fitted well within the case study design method adopted for the research. Both Yin (2003) and Bryman (2008) assert that case studies support theory generation, which is the hallmark of the grounded theory's inductive approach.

The richness of grounded theory as an inductive method for theory generation is supported by the rigorous processes through which a number of tools are employed to provide a depth of analysis through different levels of abstraction. First, it follows theoretical sampling which is an ongoing process of data collection where data is collected, coded and analyzed, and then the researcher decides what data to collect next and where to find it in order to develop the theory as it emerges. Three types of data coding are involved i.e. open coding, axial coding and selective coding (Strauss and Corbin, 1990). In open coding, data is broken down, examined, compared, conceptualized and categorized. Axial coding puts data together in new ways after open coding by making connections between the categories. Charmaz (2004) has simplified these coding processes by condensing them into two phases i.e. initial coding and selective coding. In the initial coding, data is scrutinized and coded line-by-line. The researcher asks questions such as 'what is happening here?' and constantly compares codes. This paves way for the selective coding where the researcher looks for the most frequent codes and those that are more conceptual. Some of the initial codes are dropped as new codes are generated by combining these selected codes. Data is then re-explored and re-evaluated in light of these codes for implicit meaning, and

subsequently, generating categories for the emerging theory. The process continues by systematically relating these categories with each other and validating these relationships and filling in categories that require further refinement and development. The iterative process goes on until no new or relevant data seem to emerge, categories are well developed and relationships between categories well established and refined. When no new or relevant data seems to emerge, this is referred to as theoretical saturation.

Memo writing aids the researchers in the conceptualising and category generation as they develop their analyses into narrative form and statements. Charmaz (2004) sees memo writing as the pivotal intermediate stage between coding and writing the first draft of the report, and as useful tools for discussing hunches, ambiguities, raising questions, clarifying ideas and comparing data with data. Furniss *et al.* (2011) found use of analogical and metaphorical reasoning at this stage helpful in developing a conceptual picture that aided the sense-making of emerging ideas and how they would be developed into a narrative suitable for readers' comprehension. According to Charmaz (2004), these strategies foster rich data gathering, making the analysis progressively more focussed and abstract.

There have been several different approaches to the use of grounded theory since it was first developed. As this research has been grounded within the educational and HCI domains, it was necessary to align the application of grounded theory along HCI and educational interpretations and practice, as described below.

In HCI research, grounded theory has increasingly been used for example in projects such as multimedia communication privacy (Adams, 2000) and games (Bond and Beale, 2009). This is because it facilitates insights into people's values, understanding and expertise with technologies (Furniss *et al.*, 2011). Additionally, Adams *et al.* (2008) have listed the

following four reasons for its suitability in HCI research. These include its appropriateness for:

- building HCI theory (in research fields that are conceptually immature) which is empirically based and systematically developed;
- integrating current interdisciplinary knowledge into the theory;
- dealing with the complex nature of the phenomena (e.g. user perceptions, privacy, trust, technology engagement);
- providing designers with accessible and applicable guidance.

These four reasons were particularly important in supporting this research. First, the ultimate outcome of this thesis is a HCI directed collaborative design process framework empirically and systematically developed. Second, this thesis is multidisciplinary. This multidisciplinary support has also been highlighted by Charmaz (2004). Third, the research conducted is surrounded by complexities around understanding of multidisciplinary stakeholders' engagement amongst themselves and with a range of different digital library technologies across different geographical and cultural contexts. Fourth and related to the first point, the research outcome is aimed at providing educational digital library designers and key stakeholders with applicable guidance in collaboratively developing learner-centred and effective educational digital resources.

In the education domain, constructivist interpretations have featured extensively and this extends to the application of grounded theory in educational research (Mills *et al.*, 2006). This constructivist grounded theory approach according to Charmaz (2005 p. 509) is a

departure from the "*original objectivist cast with its emphases in logic, analytic procedures, comparative methods, and conceptual development and assumptions of an external but discernible world, unbiased observer, and discovered theory*". The constructivist approach gives close attention to empirical realities and does not assume that data simply lie out there in an external world waiting to be discovered. This approach does not assume impartial researchers entering the field without an interpretative frame of reference; rather what they see and hear depends on what they knew prior to the research. Hence, researchers construct what they define as data and their conceptual categories arise through their interpretation of data not from methodological practices. This approach supports flexibility in the use of research tools to suit specific needs of the research being undertaken. This means that researchers can make methodological deviations from the original grounded theory principles according to the needs of the research, as long as this helps them in understanding the data, developing ideas and creating insights that fit with the developing theory. Furniss *et al.* (2011) describe how they made some deviations by using existing theory in their study which resulted in more theoretical weight, insight and creativity than if they relied on the traditional inductive approach which ignores prior theory.

The constructivist approach supported the needs of this research in the following ways. First, a pilot study that had been carried out prior to the main study had shown that by approaching the study with an open mind, inadvertent discoveries were made that enriched data and provided an in-depth understanding of the phenomenon studied. This flexibility is what Patton (2002, p. 40) calls 'emergent design flexibility', in which "*openness to adapting inquiry as understanding deepens and/or situations change, the research avoids*

*getting locked into rigid designs that eliminate responsiveness and pursues new paths of discovery as they emerge"*. When it came to the actual research, the process was open to such discoveries where one interview guided identification of the next in pursuit of the developing ideas. For example, initial interviews frequently made reference to the role of e-learning specialists which necessitated subsequent interviews with e-learning specialists. Consequently, this deepened the understanding of how collaboration in the design of digital resources took place and who was involved in this process.

Second, this made it possible to spot opportunistic projects by *"taking advantage of whatever unfolds as it unfolds"* (Patton, 2002, p.240), a factor that helped to manage practical constraints of carrying out fieldwork across three countries, i.e. time and financial limitations. It would have taken a lot of time and more financial resources for instance, if strict theoretical sampling was followed. The constructivist approach ultimately supported the development of guidance for the collaborative design process, comprising three interrelated abstract factors that can be used to produce a collaborative design process for educational digital resources (as detailed in Chapter 6 and 7).

### 4.1.3 Pilot studies

In order to focus the thesis research and explore what sort of factors that might be considered for the model building, two pilot studies were undertaken. The first one was based in a Kenyan public university while the second one was located in a UK university. These pilot studies also provided an insight of what kind of a method approach would work in generating the required data. This section provides summaries of the two studies.

### *4.1.3.1 The Kenya pilot study*

This study was focused on understanding the interplay between e-learning perspective towards digital resources and that held by information professionals. As educational digital resources are mainly provided to support students, this study sought to explore their perception of the two perspectives. The following four research questions guided the study:

i. What is the students' level of awareness and general usage of the digital resources available to them?
ii. How do they perceive the support provided to them by librarians and academics?
iii. Does subject discipline of students play any part in their perception of digital resources?
iv. In the context of the responses to questions 1 to 3 above, do any cultural (including technological) issues impinge on students' perceptions of digital resources?

***Research protocol***

A mixed methods approach was employed with qualitative method being dominant, and was carried out within a case study design approach involving students from two disciplines (agriculture and computer science), lecturers and librarians. Data was collected in the middle of 2008 and involved 13 formal interviews with students and 8 informal interviews with lecturers, librarians and the university's ICT director (who was also a lecturer). Thus a total of 21 participants comprising 13 students, four lecturers and four librarians were involved in the study. Interviews with students lasted between 30 minutes to an hour while the informal interviews with lecturers and librarians took between 15 minutes to 90 minutes. Interviews were triangulated with observations and documented quantitative

data. The data were analyzed using thematic analytical approach.

***Findings***

The findings revealed that:

i. Although the university places high importance on the role of library in research and scholarship, there was poor usage of library's digital resources, usability difficulties and inappropriate provisions of digital resources.

ii. Lecturers seemed to take the role of facilitating access and usage of these resources in addition to their role as e-learning facilitators. Students engaged more with their lecturers than librarians as they accessed and used the resources. At the same time, students were taking more charge in their use of digital resources in an e-learning environment despite contextually related challenges i.e. poor technological infrastructure. These students were tenacious, self directed and exhibited exploratory learning skills. In this mix, the librarians' role as facilitators of access and usage of information resources was overshadowed as they appeared to be excluded from active participation in the learning process.

iii. There was limited collaboration between lecturers and librarians and between librarians and students.

iv. Presence of a project using innovative technologies appeared to promote collaboration between designers of digital resources and users in the design process. This project focused on the use of mobile technology to create resources for rural farming communities and involved some of the pilot study participants. It provided a useful model of collaboration between designers of digital resources and users in the development of these resources.

v. An absence of institutional policy support in the development and usage of the digital resources.

### *4.1.3.2 The UK pilot study*

This pilot study was more focused on understanding the nature of engagement taking place between academics and librarians in relation to design and usage of educational digital resources. Three research questions guided the study:

i. What is the academics and librarians' concept of digital resources for learning?

ii. What sort of engagement do librarians and academics have with each other in regard to design and usage of digital resources for learning purpose?

iii. How are academics engaging with existing educational digital resources?

***Research protocol***

This study was spread between November, 2008 and March, 2009 as it was carried out along other thesis preparatory work. In total five academics and four librarians were selected through snowballing sampling technique. This method was used as it helped identify participants involved in some form of projects or tasks that made their engagement with digital resources more apparent. Data were collected mainly through in-depth, open-ended interviews with participants lasting between one and two hours. Available documentation also provided useful data. Data were analyzed thematically by identifying main themes that were emerging.

***Findings***

The following key findings emerged out of the data analysis:

i. Existence of unclear collaboration models between the university library system and the learning process. It was evident that there was some form of collaboration going on between the academics and librarians. This mainly came out during the interviews with librarians and academics in the process of writing courses. However it emerged that there was an issue of vagueness on what, when and how to collaborate. This lack of clarity could be illustrated in form of a scenario of an e-book that was required for a course but there was no clear discussion to articulate the exact need for the resource and how it would be delivered or accessed. The result was that access to the e-book did not match the needs of all the students as it was restricted access.

ii. It was not clear at what stage in the learning process to integrate digital information resources. In some cases the library was involved at a very late stage of the course production.

iii. A general lack of awareness and relevance of how educational digital libraries can contribute to the learning process.

iv. End-user ownership and control of digital resources: academics and students creating their own content using Web 2.0 applications such as social book marking tools.

### *4.1.3.3 Lessons learnt from the two pilot studies*

These findings provided some insight into the sort of factors needed for building a model for collaborative design of educational digital libraries. Specifically, it appeared that a clear collaboration process, specification of when to integrate resources in to the learning process, as well as decisions on the ownership of these resources were all important issues

for factor consideration. In addition, it emerged that students are involved in creation and ownership of these resources for their own learning, and thus they were an important stakeholder.

Policies and innovative technologies (i.e. mobile technology and Web 2.0 applications) appeared to have a role in supporting collaboration between stakeholders in the design of digital resources.

From a methodological perspective, these pilot studies helped in scoping the case studies and best practice projects that were eventually included for the research. Because only few case studies and projects were pragmatically possible to be investigated, it was necessary to develop a set of criteria based on existing knowledge of the research setting. Consequently, the identified role of policies and innovative technologies in supporting collaboration amongst stakeholders guided the development of the selection criteria. This is detailed in Subsections 4.2.1 and 4.2.2.

Additionally, one of the pilot studies proved that it is possible to review retrospectively people's experiences while collaborating to design digital resources. While the first pilot study had a project that was being designed during the study period, the second pilot study depended on participants reflecting on what had happened before the study. Consequently, when it came to the actual research, it was possible to use this retrospective review approach for most of the identified projects where design processes had already taken place.

### 4.1.4 Mixed methods of data collection

In order to counteract potential problems arising from the research complexities discussed

earlier, it was important to include different sources of data. This maximized the chance of capturing rich and diverse data as argued by Stake (2005). That was invaluable in discovering and illuminating the nature of existing collaborations within the design process. Ultimately, a broad high-level perspective of these collaborations and related factors across all the projects in the three countries was achieved.

Mixing data sources had another benefit to the research. It allowed data triangulation which has been extensively discussed by several social researchers (e.g. Seale, 1999; Patton, 2002; Denzin & Lincoln, 2005; Maxwell, 2005). According to these social researchers, data triangulation is used to provide cross-data validity checks because over-reliance on one source can be susceptible to errors linked to that source. It also provides potential to enrich data and enhance its credibility.

The following is a description of data sources that were used to provide data, and a rationale for their inclusion in the research.

### *4.1.4.1 Interviews*

There are different levels of verbal data within research using qualitative data. Gillham (2000) provides a continuum of what he calls the 'verbal data dimension'. On one extreme end of this dimension is the unstructured verbal data obtained from listening to other people's conversation, which he says is a kind of verbal observation. On the other extreme end is structured questionnaire of simple, specific and closed questions. In between are semi-structured interviews with open and closed questions. Britten (1995) has also tried to categorize different types of interviews into (i) structured interviews, a form of structured questionnaire; (ii) semi-structured interviews containing a set of questions or topics to

guide the interview where open-ended questions are asked with possibilities for probing; and (iii) in-depth interviews where limited topics are covered in detail with the interviewer probing the responses being provided.

For this research, semi-structured interviews were used as the main source of data. This supported a systematic in-depth investigation yielding a comprehensive picture as the researcher was also able to make some probing for clarifications where responses were unclear. Participants were able to describe their experiences, explain their answers and give examples as observed by Rubin and Rubin (2005). According to Rubin and Rubin, a schedule of open-ended questions to guide the interview process is useful as it creates flexibility for interviewers to seek clarifications or probe further as issues emerge in the course of the interview. Additionally, participants can freely provide information. Productive and unexpected data can be obtained when interviewers occasionally depart from the plan and *"go with the flow"* (Gubrium and Holstein, 2001, p.111).

It was also important to adhere to good interview practices such as choosing natural settings and the use of 'Student-Tutor' style of interaction as they enhance the quality of interview data. Adams and Cox (2008) recommend the 'Student-Tutor' style for information technology studies because it emphasizes how much the opinions of the interviewee (who takes up the role of the tutor) are valued. In order to boost naturalistic responses, note-taking during the interviews can be kept at minimum so as to maintain eye contact. Instead, Blaxter *et al.* (2006) recommends use of an unobtrusive voice recorder as long as the necessary ethical considerations (e.g. participant's consent) are followed. Participants should be interviewed in their natural settings where possible, although Blandford *et al.* (2008) in their PRET A Rapporter framework of digital library evaluations caution that

there may be certain settings with constraints to consider in studies such as those involving clinicians where timing and location are important. For example they cite Adams, Blandford and Lunt's study (cited in Blandford *et al.*, 2008, p 11) on digital library usage by clinicians in which an interview with a surgeon was held inside surgery ante-room between operations.

### *4.1.4.2 Observations*

Observations have the advantage of providing deeper understanding of complex issues that cannot just be obtained by mere asking of questions, a view that is shared by Wilkinson and Birmingham, 2003 (cited in Blaxter *et al.*, 2006 p.178). Additional data which is difficult to elicit from interviews such as in situations where users have devised alternative ways of dealing with technology systems that have failed to fulfil their needs can be obtained as noted by Burke & Kirk (2001). Another example is where novice system users are not confident to talk freely about their experiences with the system. In light of this, observations were necessary for this research in order to uncover socio-technical issues that were missed out during interviews.

Observations can be passive or non-participant whereby the interviewer is simply a passive observer of the phenomenon unfolding and does not participate in what is happening (Bryman, 2008). There is also participant observation where the researcher is 'in' the setting in an active way or even working there (Gillham, 2000), and seeks to observe the behaviour of members of that setting (Bryman, 2008). In this research, diversity in the types of design processes across the different projects necessitated use of both forms of observations. Where a project was being designed from scratch, it was possible to get

involved in the process as a participant observer whereas in other projects, one could only make passive observations of what was happening (described in Subsection 4.2.4.2).

### *4.1.4.3 Documentary analysis*

The retrospective aspect of this research required the support of documented evidence in order to provide a comprehensive understanding across the different contexts and time-frames. Documentary analysis is common especially in educational research (Merriam, 1998) where documents are mined to obtain relevant data. According to Bryman (2008) documents can include:

- Personal documents in both written form (e.g. diaries and letters) and visual form (e.g. photographs);
- Official documents deriving from the state (e.g. public inquiries);
- Official documents deriving from private sources (e.g. documents produced by organizations);
- Mass-media outputs;
- Virtual outputs e.g. Internet resources.

Documentary analysis is also important for triangulation purposes in the sense that it helps to confirm and enhance findings from other sources (Yin, 2003) and can be used as evidence to support emerging findings.

## 4.2 DATA COLLECTION AND ANALYSIS PROCEDURE

This second part of the chapter presents an account of how the methodological approaches were implemented to collect and analyze data required to identify factors necessary to develop guidance for collaborative design process. It first describes the selection of the case studies, projects and participants. This is followed by the procedure used to collect and analyze data. Ethical considerations and how data validity, reliability and generalizability were ensured are then presented.

### 4.2.1 Selection of the case studies

As previously highlighted, the purpose of this thesis was to develop guidance for a collaborative design process in African HE. In the first instance, Africa is such a large heterogeneous continent and contexts are different from one country to the other (see Subsection 1.1.1). Thus, doing one case study (i.e. in one country) was in no way going to be representative of African HE. Secondly, financial and time constraints meant that not many representative cases could be studied. This led to a balancing act between the number of case studies that could be included within the research confines and the need to maintain a reasonable level of contextual representation. To achieve this, case study selection criteria were carefully developed and these guided the selection of the three case studies. This agrees with Maxwell (2005) who advises on the importance of carefully deciding where to conduct the study and whom to include. He particularly emphasises the need to have considerable knowledge of the study setting when making selection decisions.

In order to gain knowledge of the research setting required to develop the selection criteria, experiences and findings of two pilot studies that had previously been conducted were used.

The first pilot study had been conducted in Kenya prior to the main research. The second pilot study of a smaller scale intended to help focus the research topic had been carried out in a UK university. Both studies provided considerable knowledge of what to expect within the setting of the research, i.e. what were the factors supporting or affecting collaboration between academics and librarians in the design of educational digital resources. For example, the Kenyan pilot study highlighted the importance of two main aspects that had potential to shape collaboration between learning designers and information professionals. The first aspect was presence of pockets of technological innovation in library and learning programs in mainstream university functions, but also extending to any relevant affiliated initiatives such as life-long learning projects. This arose from a life-long project based on the application of innovative mobile technologies that was found to be a good example of collaboration process in an information environment. This was also underscored by the UK pilot study that had shown how academics and students were collaborating to create information content using social bookmarking tools. The second aspect related to policy support in educational related projects. The Kenya pilot study highlighted presence of weak collaboration between academics and librarians in the university. One way this could be explained was the apparent absence of clear policies to support educational digital library development across the national and institutional levels. Consequently, these two aspects (i.e. presence of innovative technologies and policies) were used as a measure of 'best practice' in understanding collaborative design process, and formed the criteria applied to identify the case studies.

Two further universities were identified using the criteria by going through existing documentation to understand the underpinning policies and innovative technologies. The

Kenyan one was retained and expanded for more in depth understanding as well as providing relevant comparative data. One of the other two is a university in South Africa (University of Pretoria) which employs excellent technological innovation in the library and e-learning departments and had a component of life-long learning (although this was later subsumed in the e-learning and library examples). It also had an elaborate policy environment where national policies were interpreted and integrated in institutional policies. The second university is based in Uganda (Makerere University) and was selected because it had two life-long projects which utilized innovative technologies. Like the South African university, this one also enjoyed good policy support where policies at national level guided those at the institutional level.

An analysis of the criteria providing a detailed and full account of how they were used to select case studies, plus documentation that was consulted is provided in Appendix 1.

### 4.2.2 Identification of 'best practice' projects

'Best practice' digital libraries were identified and reviewed in order to obtain factors that can be used to provide guidance for stakeholder collaboration in the design process. To do this, identification criteria for 'best practice' were developed. These included the two points considered for inclusion in the case study selection plus an additional one that related to presence of collaboration taking place between digital library programs and learning programs across the three case studies. Therefore, 'best practice' projects that had presence of (i) collaboration activities between information professionals i.e. digital librarians and learning design professionals i.e. academics and e-learning technologists (those which had collaboration between librarians and students were also considered); (ii) policies; and (iii) use of innovative technologies, were identified. Initially, there were 11 projects identified.

However, as the investigation progressed, one of the Kenya's projects was found not to entirely match 'best practice' but was retained for comparative reasons as this enriched the research findings. The identification process mainly depended on recommendation by research participants through purposive sampling approach described in Subsection 4.2.3 below. A detailed description of all the projects is presented in Chapter 5.

### 4.2.3 Participants selection

The main participants included key stakeholders in the development and usage of educational digital libraries (academics, e-learning specialists, students, and librarians) as well as related projects staff. Purposive sampling technique was adopted in identifying these research participants. This technique is favoured in most qualitative research (see Patton, 2002; Maxwell, 2005; Bryman, 2008) because it allows researchers to sample their participants on the basis of their relevance to the research questions. In support of purposive sampling technique, Weiss, 1994 (cited in Maxwell, 2005, p.88) argues that qualitative research uses *"people who are uniquely able to be informative because they are experts in an area or were privileged witnesses to an event."* Initial access to a small group of stakeholders was negotiated and appointments for interviews secured in advance. As the interviews progressed, more participants were identified through snowball sampling. This is a technique that involves building up a sample through informants where the research makes initial contact with a smaller group of people who are relevant to the research questions. It then uses this group to identify others (Bryman, 2008). For example in this research as mentioned earlier, e-learning experts were not initially part of the planned participants. However, as interviews progressed, interviewees kept mentioning their interaction with particular e-learning specialists and referred the researcher to them.

In total, 38 participants were identified across the three case studies. This included 10 librarians, an information intermediary, 12 academics, three e-learning specialists, 11 students and one project administrator. The number of participants differed per case study in line with the number of projects reviewed. A detailed breakdown of these research participants is provided in Appendix 2.

### 4.2.4 Data collection techniques

With the exception of participant observations made during Participatory Design sessions carried out in 2008 and 2009 (described in Subsection 4.2.4.2), most of the data collection took place between September and December 2009. As noted in Subsection 4.1.3, mixed methods were employed to collect data. This included interviews, participant and non-participant observations and documentary analysis. These data collection methods were interrelated where one would lead to the other. For example there were instances where an interview led to an invitation to a seminar, hence providing opportunity to gather observational data. Certain interviews led participants to demonstrate some of their innovative technology usage, or technological devices in use such as mobile devices, hence opening up opportunities for further observational data. Similarly, many documents were obtained in the course of interviews. The following is a full account of the process used to collect data across the three case studies.

#### *4.2.4.1 Interviewing process*

Semi-structured interviews lasting between 30 and 90 minutes were conducted with all the 38 participants. A semi-structured interview schedule (Appendix 3) was used to guide the interview process. Good interview practices such as the use of 'Student-Tutor' style of

interaction and choosing natural settings were followed. For example most of the interviews were conducted in participants' natural settings such as academics' offices, library computer laboratory or outside the library. However, some of the medical students (participants) were extremely busy and the only time to get them was during breaks in between their hospital wards visits. This meant that some of the interviews were conducted on the wards corridors. All the participants agreed to be audio-taped, which helped boost naturalistic responses as no note-taking was done and hence it was easy to maintain eye contact throughout.

Interviews began with general questions about participants' understanding of digital libraries. This helped in creating a rapport between the participants and the interviewer. A debrief marked the closure of the interview session. This is where participants were invited to ask questions, clarify issues or add more information. This was found to be helpful as important data that had not been obtained in the course of the main interview usually arose at that point.

#### *4.2.4.2 Observation process*

As already mentioned, participant observations were carried out during the Participatory Design process for one of the projects. This was Project 4 (Community-based agricultural knowledge management system) that was being developed in partnership between institutions in UK (facilitated by the London Knowledge Lab)[31], the Kenya case study institution and rural communities (see details in Subsection 5.2.4.1). The researcher attended some of the design meetings at the London Knowledge Lab which took place between 2008 and 2009 and participated in the design process. This direct engagement in

[31] http://www.lkl.ac.uk/

the design process as a participant observer provided the researcher with invaluable first-hand experience and understanding of the way this project was being developed together with other stakeholders. For example during these meetings, the researcher participated with the rest of the stakeholders in making design decisions jointly. Later, this was supplemented by interviews with some of those who had participated in the design process in Kenya.

Non-participant observations were made of how participants engaged with digital resources and with each other in the learning process. For a research like this one concerned with the way people interact with technologies, this method enabled access to certain data which would not possibly be obtained through other sources. Due to the flexibility employed in mixed data collection methods, opportunities for observational data arose during interviews. For instance, in the Ugandan case study one participant talked about journal clubs (seminars to review digital resources in form of journal articles reporting latest medical research). This appeared an interesting concept and because there was one such seminar the next day, an invitation to attend as a passive observer was extended. This provided very useful observational data on how students were engaging amongst themselves, with academics and with digital resources. A similar example in South African case study involved an invitation to attend an Open Access Week[32] event which resulted in more observational data. Additionally, librarians made demonstrations of how they have implemented innovative technologies by showcasing their websites during the interview process.

[32] This is an international activity observed by the Open Access Movement to promote open access in research and scholarship (see http://www.openaccessweek.org/)

There were circumstances where participants showcased some of the devices they were using. One example was the use of personal digital assistants (PDA) in Uganda. After an interview session, the participant demonstrated how this device was connected to wireless network routers to enable data gathering from remote sites and dissemination of information. PDA being used by medical students in Uganda and parts of the mobile kit used in one of the Kenya case study projects were also examined. This provided relevant observational data that aided understanding some of the innovative technologies that were being utilized in the design process.

Data from these observations were captured by taking field notes while photographs were taken to augment observational data and provide the research context.

#### *4.2.4.3 Documentary analysis*

In this research, documentation provided a lot of data that were used to augment data from interviews and observations. This included national and institutional policy documents, directives and strategic plans. Additionally, specific institutional and departmental documentation (i.e. reports, emails and blogs print-outs) as well as related national reports such as those from national quality assurance bodies were included. Projects related documents such as implementation and monitoring tools as well as donor reports were collected and studied. Some of these have been most useful in providing evidence and supporting the research findings. These have been reported in boxes marked 'evidence' in the data presentation chapters.

Most of this documentation was obtained during the interview process where in most cases participants willingly provided relevant documents in their possession as well as printing

off online-based materials such as email correspondences and blogs. However, additional documentation was obtained through mining institutional and national websites after the interviews had taken place and mainly during the analysis stage in order to confirm claims or support findings.

### 4.2.5 Data analysis

In order to generate guidance for a design process from the data obtained, grounded theory analytical framework was utilized selectively to analyze data (see Subsection 4.1.2). A certain level of flexibility in its application was observed to meet the needs of the research. For example, relevant knowledge bases were reviewed initially to shape the development of the thesis. Secondly, selection of the population (case studies, digital library projects and participants) did not entirely follow theoretical sampling due to practical limitations, i.e. the researcher was only in the field for a set period of time due to resource constraints. Instead, a set of criteria was developed for identification of cases and projects while participants were identified through purposive sampling technique as described in Subsections 4.2.1, 4.2.2 and 4.2.3.

The analysis process started with transcribing recorded interview data word by word. Following Charmaz's simplified approach of initial and selective coding, transcribed data were then coded line-by-line using NVivo 8 software. This software also served the purpose of managing the huge corpus of data. Codes were initially stored as 'Free nodes' but as the coding progressed and data re-evaluated, more codes emerged, while some of the 'Free nodes' were combined and stored as 'Tree nodes'. Using NVivo was advantageous since grouping initial codes as 'Tree Nodes' meant that the original names given to the initial codes were not lost in case one needed to go back to them. However, it is important

to note that most of these computer aided qualitative data analysis software only provide clerical support in managing the data but the actual coding is really the work of the researcher. This initial coding resulted in key codes or concepts which were considered in the next stage of selective coding. Appendix 4 provides a print-out sample of these codes. To facilitate this selective coding, a series of brainstorming sessions with the support of one of the PhD supervisors were held. This helped to clarify emerging implied meanings and categories for the emerging theory. It also served the important role of checking the researcher's bias and hence reducing scope for subjectivity. The researcher developed analytic memos in the form of tables which further helped clarify the emerging theory (collaborative design process). A major aspect of collaboration process emerged from the relationships which appeared to be ignited by something that had elements of a catalyst. This was captured as a '*catalyst element*' metaphor (see an excerpt from a table used to develop the metaphor in Appendix 5) and used to help in the understanding of emerging ideas and development of narratives. More brainstorming with the supervisor helped clarify how this metaphor was affecting the collaborative design elements and the factors that were influencing it. This meant that ambiguities and gaps were spotted and additional data obtained. For example, a lot of documented evidence was obtained at this analysis stage (as mentioned in Subsection 4.2.4.3.) and used to confirm or clarify analytic statements.

It is important to underscore the fact that although the entire data collection and analysis process was heavily influenced by the principles of grounded theory, the depth of the application did not match the Strauss and Corbin's process. Rather, this research only followed some of its core processes within the practical limits (financial and time) of the research. This was according to Charmaz's (2005) constructivist approach described in

Subsection 4.1.2.

### *4.2.5.1 Transcription annotation and participants naming conventions*

Interview transcriptions were typed verbatim. The researcher's questions and statements were bolded to make them stand out from the participant's responses. This is how they appear where they have been used in this thesis. Participants' quotations have been typed in italics. However, square brackets are used inside the quotations to emphasize or clarify a point.

In order to anonymize the participants, they have only been identified by a given code assigned by occupation and numbered in the sequence in which they followed each other during the interviews (see Appendix 2).

### *4.2.5.2 Validity, reflexivity and generalization*

Critics of grounded theory find it to be subjective, open to bias and lacking repeatability and generalizability (see Adams *et al.,* 2008). These same criticisms are levelled against case study research approach. Though these issues can impact on the validity and credibility as well as quality of research findings, they are not unique to grounded theory or case studies and do apply to other qualitative approaches. However, Strauss and Corbin (1990) note the importance of acknowledging subjectivity as an issue and therefore the need to take appropriate measures to minimize its intrusion in the data analysis. In the case for grounded theory, the systematic rigour and thoroughness involved from initial data collection through to analysis and eventual theory generation aid in reducing subjectivity (Patton, 2002). Defending the problem of generalization, Bryman (2008) argues that

qualitative research is concerned with the quality of the theoretical inferences made out of the qualitative data. Hence, data obtained is generalizable to theoretical propositions rather than to populations or universe as Yin (2003) puts it. Strauss and Corbin (1990)'s advice is that data should be comprehensive with conceptually broad interpretations to develop theory that is abstract enough to enable its applicability in different contexts. This research endeavoured to overcome the issues raised in a number of ways as discussed below.

The researcher's past experience in African HE as a digital librarian supporting academics as they developed e-learning programs meant that she came to this research with pre-existing knowledge of the context and of those being researched. This created potential for personal bias and subjectivity in the investigation process. Rather than assuming this inevitable impact on research, social researchers (i.e. Maxwell, 2005; Hammersley & Atkinson, 2007; Bryman, 2008) including those involved in HCI research (i.e. Adams *et al.*, 2008) agree on the need to reflect on research design decisions and how they match with the analysis. The practice of reflexivity aids researchers in identifying their own interests, experiences and beliefs that shape and potentially bias their research (Adams *et al.*, 2008). Consequently, the researcher approached the research process with self-reflection and sensitivity of her own professional background and its potential to introduce personal bias.

Another way of dealing with subjectivity and biases is to acknowledge them and present them for scrutiny by professional counterparts as suggested by Adams *et al.* (2008). Consequently, the final product of analysis (collaborative design process model) was presented to experts for review (see Section 8.4). This review provided checks for completeness, consistency, relevance and generalizability. On generalizability, experts'

views were sought on the extent for its applicability not only in Africa but globally. This review was also extended to potential users. One of them had participated in the research and provided what Maxwell (2005) calls respondent validation. According to Maxwell, this is a systematic soliciting of feedback about data and conclusions from those who participated in the research. This has the advantage of eliminating misinterpretation of what the participants communicated or meant as they provided data. It also helps to identify one's own biases and misunderstanding of what was observed.

The openness of the interviewing process and the line-by-line coding kept the research open to fresh ideas, thereby reducing the possibility for forcing data into preconceived categories, a fact that is supported by Charmaz (2004). Moreover, approaching the research process with an open mind allowed the researcher to listen to the 'voices' of the respondents and hence learn from the data. The use of brain storming sessions with a supervisor acted as a check for personal bias.

Triangulation of data sources and the inclusion of three case studies in three different geographical contexts contributed towards enhancing validity of the research findings. Mixed methods ensured cross-data validity, while the variety in terms of socio-economic, cultural and political landscape across the three different contexts created richness of data gathered. Covering three countries also expanded the scope for generalizability.

### 4.2.6 Ethical considerations

Due to the multidisciplinary nature of this research, it was prudent to consult ethical guidelines that support the key related disciplines. Therefore concerned professional bodies' codes of practice were reviewed. These included (i) the British Educational

Research Association (BERA)'s Revised Ethical Guidelines for Educational Research (2004)[33] which support educational research; (ii) the British Psychological Society (BPS) Code of Ethics and Conduct (2009)[34] which supports HCI research; and (iii) the Association of Computing Machinery (ACM)'s Code of Ethics and Professional Conduct[35] which also supports HCI research. All these guidelines agree on certain overarching principles namely: informed consent, privacy and avoidance of harm and exploitation. These guidelines have also been identified as critical in similar studies of digital libraries, i.e. Blandford *et al.* (2008)'s *VIP* ethical considerations within their PRET A Rapporter Framework, standing for *V*ulnerable participants which is the same concept as avoidance of harm and exploitation; *I*nformed consent; and *P*rivacy, confidentiality and maintaining trust.

Consequently, this research undertook the following ethical considerations. It first sought approval from the Open University Human Participants and Materials Ethics Committee (HPMEC) (Appendix 6) prior to commencing fieldwork. The HPMEC requires that all the above named ethical considerations are met. During fieldwork, informed consent was obtained from participants and their privacy and confidentiality of the information they provided safeguarded. In addition to verbal explanation, they were given information sheets (Appendix 7) detailing the nature of the research, their rights (i.e. right to participate voluntarily and to withdraw participation without consequences), and the fact that their privacy and anonymous treatment of the information they provide would be safeguarded. Further, their consent to participate was obtained by signing a consent form (Appendix 8). Consent to audio record was obtained before each interview where participants were

[33] http://www.bera.ac.uk/files/guidelines/ethica1.pdf

[34] http://www.bps.org.uk/sites/default/files/documents/code_of_ethics_and_conduct.pdf

[35] http://www.acm.org/about/code-of-ethics

reassured of confidentiality. The research also complied with the Data Protection Act (1998)[36] for any personal data provided. This was achieved by locking away all signed consent forms which contained participants' personal data in a cabinet only accessible to the researcher. These forms will be securely disposed after the full completion of this thesis.

To further protect their privacy, participants have only been identified by codes allocated to them (see Appendix 2) in the data presentation chapters. Another point worth noting is that while the South Africa and Uganda case studies have been named (including referencing of documentation related to these institutions), it was decided to completely conceal the identity of the Kenyan case study. This was reached on the basis that this case study had one project which failed as a 'best practice' example and has been used to contrast the 'best practice' projects. Consequently, the university is not named and all related documentation that would reveal the identity has not been referenced according to the required referencing conventions.

Lastly, comments provided by the reviewers of the CERD process model (Section 8.4) do not bear the identity of the reviewers. This was in order to protect the identity of the experts who reviewed the model.

## 4.3 CHAPTER SUMMARY

This chapter has provided a detailed account of and justification for the methodological steps taken to conduct this thesis research. The multidisciplinary nature of this thesis

[36] www.legislation.gov.uk/ukpga/1998/29/contents

influenced the choice of the methodology. In particular, methodological norms guiding educational research as well as those for HCI research were reviewed and those found relevant to support this research were applied. Consequently, the research benefitted from HCI qualitative methods principles and was carried out within a rich case-study design that was supported by educational and HCI research norms. The chapter has also described steps followed to ensure that the data obtained were valid, credible, generalizable and ethically generated.

# Chapter 5: Identifying collaborative design process factors

The design chasm referred to in Chapter 1 is a reflection of the disconnection that often exists between designers of digital libraries and designers of learning programs (educational digital resources stakeholders). This leads to a situation where these stakeholders fail to exploit the expertise and technological advancements currently taking place in the fields of information sciences and e-learning. More importantly, this lack of connection between the stakeholders often leads to educational digital resources being developed which are not always aligned to learners' needs. One way to reduce the chasm is to involve key stakeholders (librarians, academics, students) in the design process when developing these resources. This thesis focuses on providing guidance in the collaborative design process for educational digital resources for African HE. In order to obtain this collaborative design process guidance, 11 digital library design projects across three case studies in African universities (located in South Africa, Kenya and Uganda) were identified following a set of criteria (see Subsections 4.2.1 and 4.2.2) and investigated.

This chapter presents the findings of the initial analysis of this investigation in order to answer the first research question: ***What are the existing factors that can be used to support a collaborative design process for educational digital resources in African higher education?*** The chapter begins with a detailed description of the three case studies by providing a general overview of relevant contextual aspects of each of the case studies. This includes a status overview of existing e-learning initiatives, digital libraries and policies (summarized in Table 2). Then, a detailed account of each of the 11 digital library projects identified, highlighting the type of data used to review them and the type of design process present is provided. The type of design processes differed across the projects

and ranged from designing a whole system, to tailoring an existing system to situational needs, and finally to designing social processes for using an existing system. The last part of the chapter brings out key similarities and differences across the three case studies and identifies high level findings of collaborative design process factors.

**Table 2: Summary of case study contexts**

| | E-LEARNING STATUS | DIGITAL LIBRARY STATUS | POLICY STATUS |
|---|---|---|---|
| South Africa | • Mainstreamed into academic programs<br>• Virtual Learning Environment (VLE)<br>• Promotes learning-library engagement | • Well established<br>• Use of innovative technologies<br>• Integrates with learning processes | • Comprehensive<br>• Relationship between national, institutional, departmental levels<br>• Supports learning-library integration |
| Kenya | • Fragmented<br>• Not fully mainstreamed into academic programs<br>• Does not promote learning-library engagement | • Established<br>• Absence of innovative technologies<br>• Excluded from learning processes | • Weak<br>• National policies do not cascade to institutional and departmental levels<br>• No digital library institutional mandate |
| Uganda | • In the process of being mainstreamed in to academic programs<br>• Promotes learning-library engagement | • Established<br>• Limited use of innovative technologies<br>• Integrates with learning processes | • Comprehensive<br>• Relationship between national, institutional, departmental levels<br>• Supports learning-library integration |

## 5.1 SOUTH AFRICA CASE STUDY

This case study is set in University of Pretoria, which is one of the largest and leading South African academic research universities with around 50,000 students. The university offers 181 qualifications involving a very wide variety of academic programs, i.e. around 1800 in two South Africa's official languages (namely Afrikaans and English). These are offered in nine faculties and a business school, and comprise a total of 140 departments and

85 centres, institutes and bureaus, all distributed across six campuses.

The university is well resourced compared to most universities in Sub-Saharan Africa. Besides the government's subsidy, it generates an income from other sources such as investment, services rendered and tuition fees. It is therefore able to provide students' financial aid and finance other activities such as research and infrastructural development. For example, it has a comprehensive research program that ensures funding for researchers development, research capacity and equipment, conferences, research publications and fellowships. It has a modern and elaborate IT infrastructure which consists of a fixed and wireless network, and approximately 20,000 computers, of which 4,770 are located in 100 computer laboratories spread across the campuses and student residences. All the computer laboratories are connected to the Internet and the University's intranet, enabling access to online library resources as well as the virtual learning environment (see University of Pretoria, 2009).

The projects identified as 'best practice' projects spread between the main university library located in the main campus and the Faculty of Education located in its own campus, hence the research was carried out between these two campuses. The Faculty of Education is one of the country's largest trainers in initial and advanced teacher education and has achieved excellence in research and innovation in this field. It serves around 23,000 students (both contact and distance education) following diploma, undergraduate, masters and doctoral programmes (University of Pretoria, 2009). The library in this faculty has a key representation in the e-Information Strategy (described Subsection 5.1.3) in which the college librarian is an active member of its committee.

### 5.1.1 E-learning status

E-learning is well mainstreamed in this university and all related functions consolidated within an e-learning department called Education Innovation. This university is credited as the first in South Africa to use a technology-enhanced flexible learning environment (University of Pretoria, 2009). E-learning is provided online through a virtual learning environment (VLE) called *clickUP* which is supported by WebCT[37]. This is populated with around 2000 modules and serves both contact and distance education students. The Education Innovation department has a primary focus on supporting and developing the academic staff to improve teaching and learning using innovative technologies. Its innovative approach towards development of educational electronic resources was commended by the country's Higher Education Quality Committee (HEQC) in 2008 (University of Pretoria, 2008).

It is a requirement for all academics to make their teaching content available on this platform. Of relevance to this study, the university library has a key function in collaborating with e-learning experts and academics in integrating learning content with digital library resources on the clickUP (see Sub-section 5.1.3).

### 5.1.2 Digital library status

The university library is charged with the responsibility of providing an online information service for all its faculty libraries. This service is well established and resourced. It can be accessed remotely, which means that students and academics are able to use it from their homes, offices and student residences. This service includes electronic books and journals,

[37]WebCT is an online proprietary virtual learning environment system to support e-learning. It is owned by the Blackboard company.

customized web pages, a presence in the VLE, an institutional repository containing digitized full text local collections, an electronic thesis database, a digital reference service and electronic newsletters. These digital services are supported by an e(electronic)-Information Strategy (see Subsection 5.1.3) that deploys a range of innovative technologies in order to create this digital environment for academics and students.

### 5.1.3 Policy status

The university has a detailed policy system where national policies influence institutional policies which in turn guide departmental level policies. For example, South Africa's Department of Education identifies the application of ICT in teaching and learning as one of its guidelines contained in the National White Paper No. 7 (Republic of South Africa, 2004) on 'E-education'. The university has an 'e-strategy' in its current strategic plan which supports the National White Paper guidelines:

> *"New technologies have made it possible to access academic information here and abroad more efficiently than in the past. Furthermore, increasingly, information sources are being received in digital format by the University's libraries. We believe it to be essential that the opportunities afforded us by these developments should be fully exploited. We intend ensuring that this is the case"*. University of Pretoria Strategic Plan 2007-2011[38]

At the departmental level, it is a policy requirement for all teaching practices to use the VLE by uploading their teaching content:

> *"All teaching practices, in both contact and distance, should use appropriate combinations of resources to support learning, such as ...technology-based learning platforms."* Education Principles[39]

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[38] University of Pretoria Strategic Plan 2007-2011
http://web.up.ac.za/default.asp?ipkCategoryID=2995&subid=2995&ipklookid=2

[39] University of Pretoria Education Principles
http://web.up.ac.za/default.asp?ipkCategoryID=105&ipklookid=2

The library has established an e-information strategy to support the institution's strategic plan which is centred around:

> *"Exploiting new technologies and continuously developing facilities for the advancement of learning and research".* AIS Strategic Plan 2007-2010[40]

This is then translated into individual librarians' performance contracts, as confirmed by a research participant:

> *"...the university supports the Government's Department of Education, and university in their strategic plans say that we are going this e-route, that helps the library because we support the e-strategy of the university plus what we do is that each staff member has performance contract brought in line with that strategy."* Librarian 1 -SA

The library's e-Information Strategy is quite detailed and establishes guidelines for the implementation of a number of electronic services within the library. These include e-learning, e-resources, open scholarship, digitalisation, Web/library 2.0, repositories, library web and e-research, and a seamless integration of library digital resources within the university's VLE. Additionally, the library has developed Open Access Mandates[41] to support the implementation of open scholarship. Implementation of this strategy is supported by a governance structure that has a deputy director, an e-service unit and a number of e-steering committees for each of the services.

Ultimately, these various policies support learning-library integration. On one hand the library endeavours to have a presence in learning processes and on the other hand, the learning end interfaces with the library especially within the VLE.

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[40] University of Pretoria AIS Strategic Plan 2007-2010

[41] University of Pretoria Open Access Mandates http://www.library.up.ac.za/openup/mandates.htm

### 5.1.4 Digital library projects

This case study identified three 'best practice' digital library projects (Subsection 4.2.2), as summarized in the Table 3 and described in the following sub-subsections.

**Table 3: A summary of digital library projects in the South Africa Case study**

| Project no. | Project name | Level of system design | Design stakeholders | Type of data used |
|---|---|---|---|---|
| 1 | Digital library supported by Web 2.0 applications | Tailoring existing system | • Students<br>• Academics<br>• Digital Librarians | • Six interviews<br>• Non- participant observations<br>• Documents |
| 2 | Institutional repository | Tailoring existing system | • Students<br>• Academics<br>• Digital Librarians | • Five interviews<br>• Non- participant observations<br>• Documents |
| 3 | A comprehensive virtual learning environment (VLE) | Designing social processes to utilize existing designs | • Digital librarian<br>• Academics<br>• e-learning specialist | • Five interviews<br>• Non- participant observations<br>• Documents |

*(**NB:** Some participants were involved in multiple projects and were interviewed for these projects. Hence the number of interviews is not the same as the number of participants interviewed.)*

#### *5.1.4.1 Project 1: Digital library supported by Web 2.0 applications*

Review of this project relied on a combination of data (interviews, non-participant observations and documents). The project focused on tailoring existing designs (based on web-based online resources) to make them fit the needs of library services by using Web 2.0 applications. This was intended to help the library reach out to students who were using the library resources less, but were very active in the virtual world space. Librarians designed digital resources around these innovative applications, such as creating library catalogue widgets and encouraging users to link them to their Facebook pages. They also

adapted a virtual game within a Web 2.0 context to design an information literacy program and invited other stakeholders (students) to provide input and pilot it (see Figure 3). This game turned out to be appealing to these students who found the program more interesting.

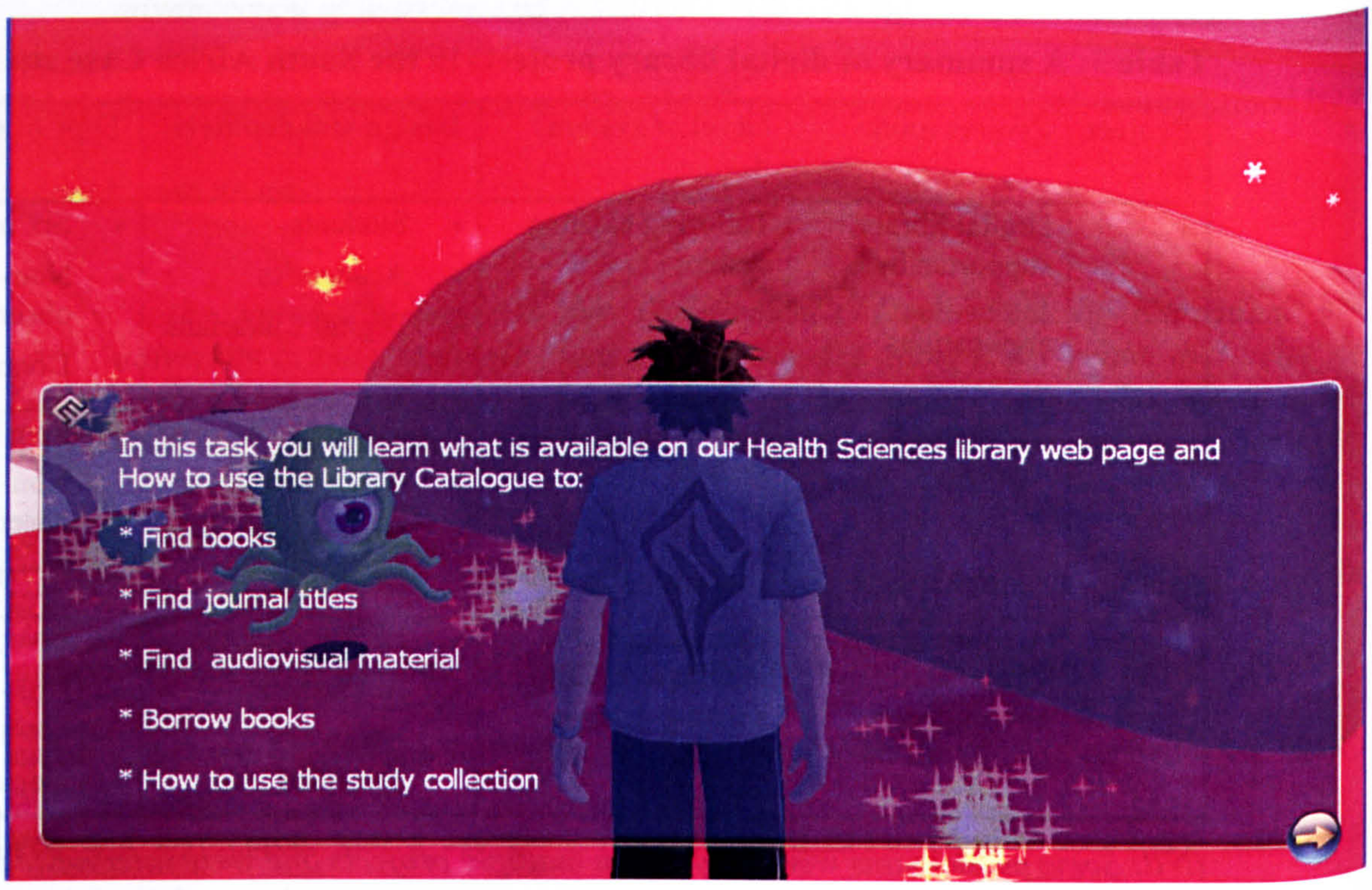


**Figure 3: Literacy program game in library's innovative technologies project (Source: Van Wyk, 009)**

This project was identified as 'best practice' because the presence of innovative technologies and supporting policy environment enabled librarians to design digital resources that were more engaging to users. This brought stakeholders (librarians and users) into a joint participation in the creation and usage of these resources.

### *5.1.4.2 Project 2: Institutional repository*

This project was based on tailoring an existing system to fit library needs. Data from interviews, documents and non-participant observations were used to review this project.

The project was part of the Open Access (OA) Movement incorporated in the e-information strategy and hence mainstreamed within the library operations. This covers a range of OA functions including archiving of research papers in what they refer to as the OpenUP, archiving of theses and dissertations referred to as the University of Pretoria Theses and Dissertations (UPeTD), and advising on and facilitating OA journal initiatives within the university. These OA resources constitute the institutional repository and are hosted in the UPSpace (customised DSpace described in Subsections 2.2.1 and 7.1.1.1). This research identified that librarians were designing the system and inviting other stakeholders (academics and students) to contribute their research output, theses and dissertations which were uploaded into this institutional repository. The use of the UPSpace provided a foundation which allowed the system reuse to be more accessible by stakeholders with varied skills. At the same time, there were policies that supported this practice such as Open Access Mandates which enforced the depositing of research output by academics and students.

This shared participation in the development of the institutional repository made this project stand out as 'best practice'. Innovative technologies (DSpace and the OA movement) were used to create a shared participation between the librarians, the academics as well as their students. On one hand, the academics and students became co-creators of the digital collection with the librarians. On the other hand, librarians facilitated this process by introducing these technologies and promoting their application among the university community. Figure 4 is a screenshot of this resource showing educational resources.

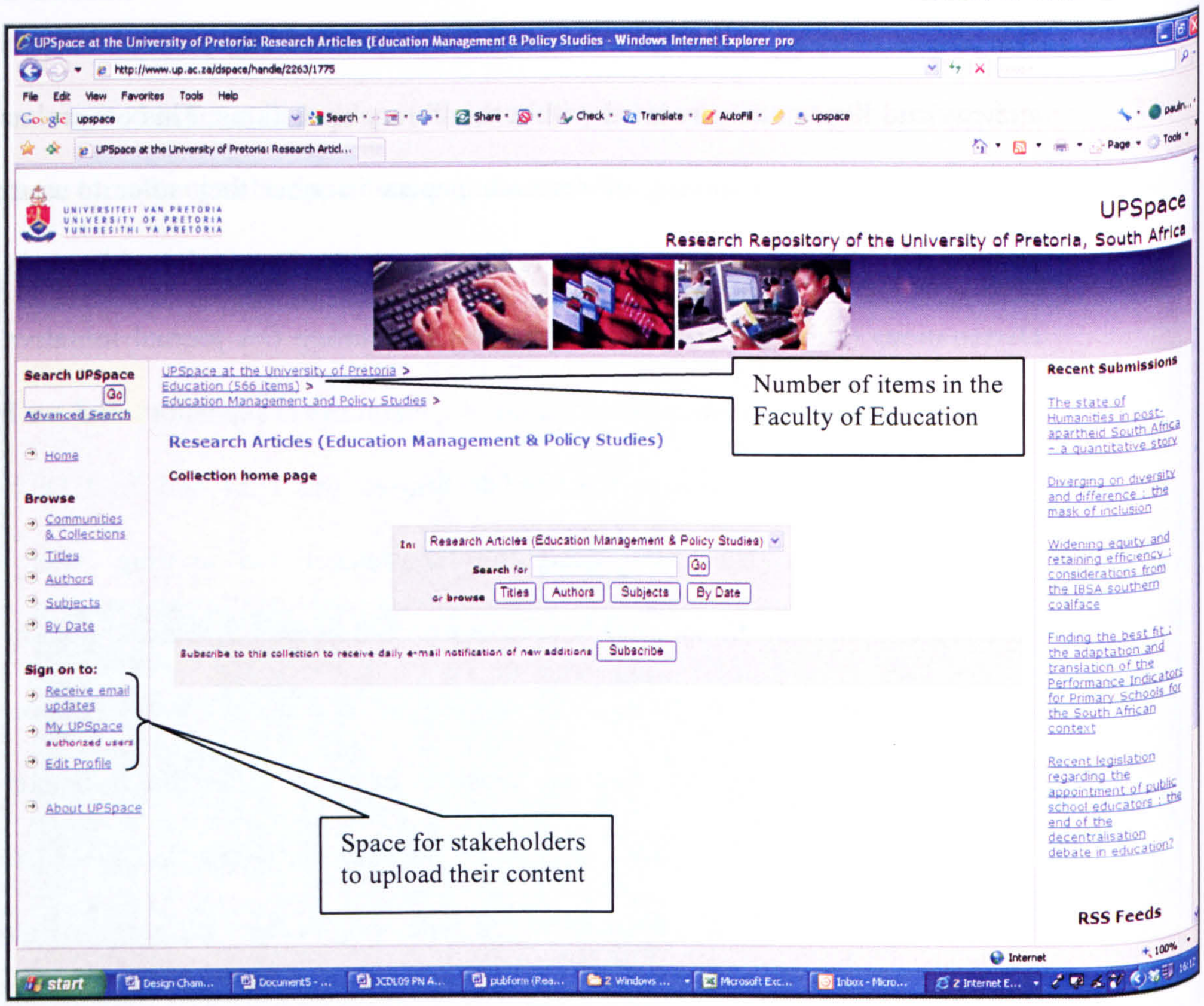


**Figure 4: A screenshot of the institutional repository**

### *5.1.4.3 Project 3: A comprehensive virtual learning environment (VLE)*

This project focused on designing systems that utilized existing digital resources which were merged together to create a comprehensive system of learning materials. Data from interviews, documents and non-participant observations were used to review this project. As mentioned in section 5.1.1, the e-learning program in this case study is well established. Most of the academic programs are already in the university's VLE (clickUP). The study identified a collaboration process where academics and librarians participated mutually to develop learning resources in the VLE. Although librarians and academics all over the world have always interacted in creating a library presence within the VLE, what was

outstanding about this collaboration process was the facilitation of e-learning experts who ensured that there was this mutual engagement between the two sides. When academics were developing their modules to be uploaded to the VLE, e-learning experts ensured that librarians were involved so that they could contribute required digital resources from the library to support learning objectives of academic modules. The librarians on their part were keen to participate and gain an understanding of what the learning objectives were and how they could contribute to support them. This resulted in a VLE that integrated learning resources with digital library resources (see Figure 5) while the normal practice is to have VLE with links to the digital library. This joint participation in the design process for the VLE resources made the project stand out as a 'best practice' project.

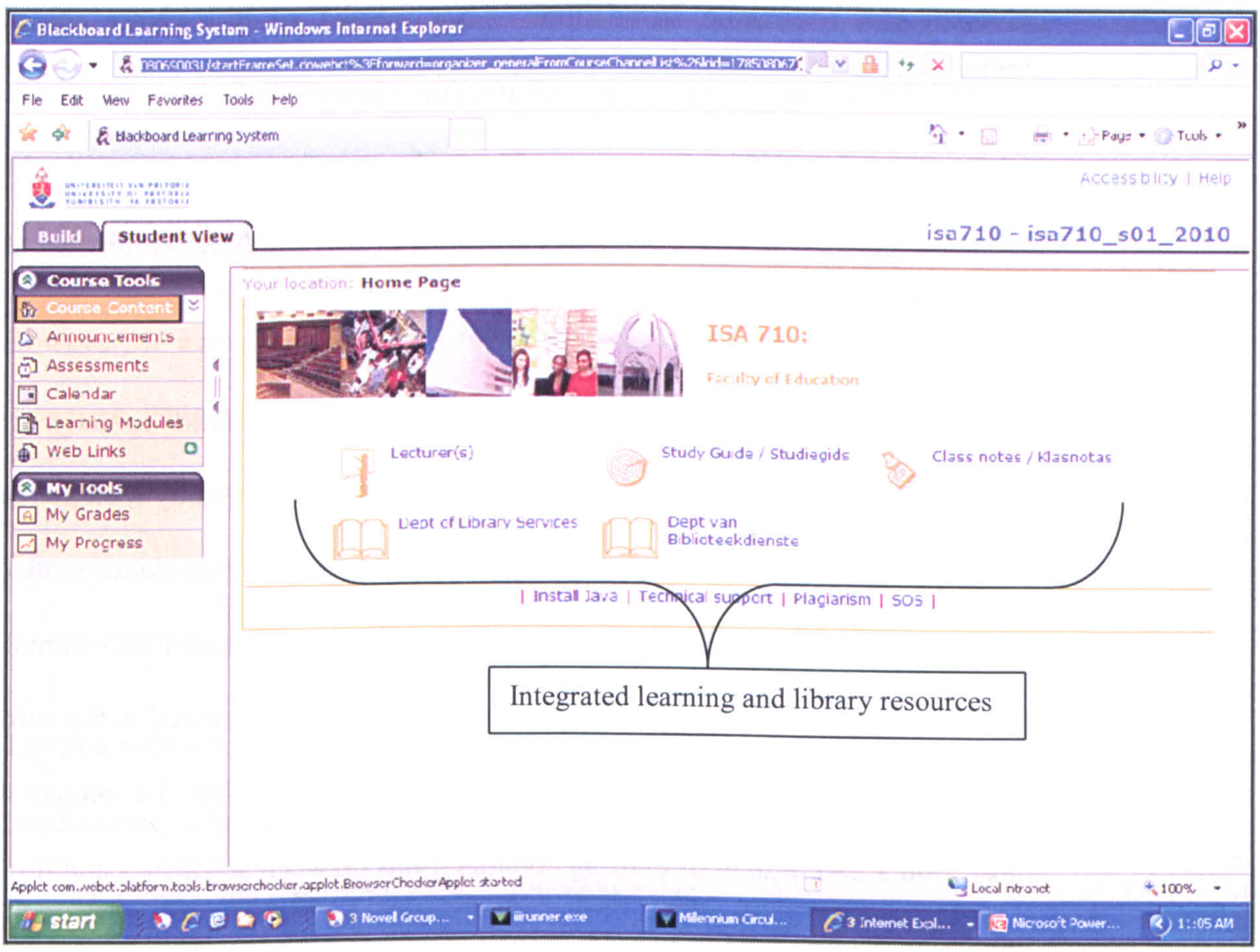


**Figure 5: A screenshot of the VLE**

## 5.2 KENYA CASE STUDY

The setting of this case study is in one of the main Kenyan state-owned universities with a student population of around 36,000. The university offers a wide range of programs covering about 10 academic disciplines. This university is fast growing with a number of physical infrastructural developments coming up as well as expansion to several towns and cities in an attempt to meet the ever growing demand for its programs. However, it still experiences some of the challenges encountered by most Sub-Saharan African universities (highlighted in Chapter 2). In terms of ICT infrastructure, the university is keen to move with the technological advancements and has therefore invested heavily in this area. Hence there are networked computer laboratories in almost every faculty as was indicated by the university's ICT director. In addition, it has created an ICT centre charged with the responsibility of managing all its information systems including the development and maintenance of the ICT infrastructure. The high cost of bandwidth is still a burden to the institution and does not have sufficient broadband (total bandwidth estimated at 15Mbps as of 2009)[42].

This case study was expanded from one of the two pilot studies initially carried out as preparation for this research (see Subsection 4.2.1). This pilot study focussed on the use of library's digital resources by two faculties (Faculty of Agriculture and School of Computing and Informatics). It also identified a community-based agricultural knowledge management system (VeSeL project). This pilot study was expanded in the current research and a more in-depth investigation carried out on the two projects i.e. project 4 and 5 (see Subsection 5.2.4) in light of existing collaborations between academics and librarians in the design process for digital resources.

[42] http://www.uonbi.ac.ke/ICT/ICT_devs04_09_Summary_PClevelOfAutomation_18Dec09.pdf

### 5.2.1 E-learning status

The research established that e-learning is in the process of being mainstreamed within this university and there is a department charged with this responsibility. This department is housed within the university's ICT centre. This was confirmed during an interview with the e-learning coordinator who was also the ICT director:

> *"...we have institutionalized e-learning in this university, because we realized the importance of providing flexible learning methodologies and access to sources in quality format. Also we recognize that e-learning has an important role to play in terms of reaching out to people... We have developed procedures to develop e-learning component..."* E-learning coordinator –KEN

This being a technical department, there was more emphasis on the technical aspects such as digitization aspects of e-learning rather than pedagogical as illustrated in the following comment:

> *"...we have a strong e-learning section within the ICT centre, comprising of people who are able to digitise materials and convert to e-learning format and CDs."* E-learning coordinator –KEN

However, it was observed that a number of faculties have their own form of e-learning programs. This portrays a fragmented picture of the way e-learning is implemented. For example, during the interview with the e-learning coordinator, he mentioned the Centre for Open, Distance and E-learning at the college that deals with distance education but there was no connection between this centre and the ICT one.

The link between e-learning and the library through e-learning facilitation appeared blurred. For instance, when asked whether this department has made any deliberate efforts to work with the library, the e-learning coordinator responded:

> *"No we do not have a deliberate arrangement with the library, the little component*

> *which is necessary for us to complete the training of e-learning in terms of our curriculum is handled within the curriculum itself. But students are responsible in ensuring that they learn how to access library materials, the training is there, there is a handbook, there is training program for new students, for continuing students, for students who are there on the campuses, the library is part of the learner support services, which is very important and strong in the university."* (E-learning coordinator-KEN)

This lack of connection between e-learning and library programs highlights a disjointed curriculum that is delinked from the library resources.

### 5.2.2 Digital library status

The main university library provides a digital library referred to as electronic resources service. There are over 20,000 online full text journals originally introduced through PERii (see Subsection 2.2.1). Most of these subscriptions are now being done through a national library consortium called Kenya Library and Information Services Consortium (KLISC), as a way of cutting down cost through bulk negotiations with publishers. Other online resources are provided by Research4Life (see Subsection 2.2.1) which includes access to subsidised journals through programs like HINARI, AGORA and OARE. Access to most of these resources is provided through Internet Protocol (IP) address which means that one must be within the university local area network in order to access them.

As mentioned earlier, the university provides access to networked computer laboratories. The library too has computer laboratories. These facilities provide access to library's digital collection. However, this research did not identify any examples of innovative technologies to support functions of the digital library in this university.

Research findings also established that the library was only brought in at a later stage of programme development in order to get the programme approved as remarked below:

> *"The engagement is at the level of the programmes, they have already designed the programmes, they are now tabling them and they want them to be approved, you see that is the level the librarian comes in ... So the librarian is being brought in at a very late stage."* (Librarian-KEN)

Hence the collaboration between librarians and academics in the learning design process was very minimal and only introduced much later.

### 5.2.3 Policy status

This research established the Kenyan case study had a poorly supported policy environment in relation to support given to educational digital resources. For example, educational related policies at the national level fail to support development of educational digital resources at the institutional level as well as in the exploitation of ICT for teaching and learning. The Ministry of Education, Science and Technology Sessional Paper No. 1 (Republic of Kenya, 2005) is a key policy document which defines the use of ICTs in addressing national educational challenges of the 21st century. Yet, it makes no mention of digital resources. The national ICT policy (Republic of Kenya, 2006) does attempt to make a connection by encouraging the use of ICTs in teaching and learning at the universities. However, there is no evidence that the university applies this policy explicitly in its operations. The university's strategic plan recognises the role of the library but only as a physical facility; hence there is lack of a clear mandate for development of digital resources. This is only captured indirectly in one of the strategic objectives that specify the application of modern ICT in research, teaching and learning, which could imply digital educational resources among others:

> *"To maximize student and staff productivity and service delivery, enhance teaching and learning and improve quality of research through ICT."* University Strategic Plan[43]

The library's current strategic plan however attempts to make a connection with the institution's strategic plan by aligning its own vision along the university's one. It is explicit on the importance of the provision of electronic information services to support teaching, learning and consultancy. It also provides for the use of ICT in the provision and dissemination of information and has a specific strategy for the provision of ICT infrastructure to support electronic library services as shown below:

> *"Library has set out the following as its strategic objectives: To provide access to information for teaching, learning, research and consultancy...To promote the integration of ICTs in the provision and dissemination of information"* Library Strategic Plan

Further analysis of this relationship between the library and institution's policy environment suggests lack of mandate from its institution to provide an electronic resource service. It appears like it provides this service out of its own desire to exploit benefits of digital technology as a way of improving service delivery to its clientele. This lack of institutional mandate was confirmed by one librarian:

> *"It is [mandate to provide digital resources] through the strategic plan which we have designed ourselves, the library's strategic plan. The university does not care much because there is no time they have told us that you have to get digital resources. The mandate comes from the library, it is not a mandate from the university."* Librarian –KEN

Another example is the absence of a clear mandate for the development of an institutional repository which the library considers as one of the digital library services. Furthermore,

[43] All Kenyan references have been anonymized (see Subsection 4.2.6)

other related university policies on Intellectual Property Rights (IPR), research and ICT are silent on this issue of institutional repository development.

The university policy structure is also not explicit on the development and advancement of e-learning activities. The strategic plan however does have an objective to enhance teaching and learning and improve research through ICT.

### 5.2.4 Digital Library projects

Two projects were identified in this case study. The first one (community-based agricultural knowledge management system) was identified as a 'best practice' project while the other one (University library digital resources) was a weak 'best practice' project but with interesting comparative issues within the case study. These two projects are discussed below and summarized in Table 4.

**Table 4: Summary of digital library projects in the Kenya Case study**

| Project no. | Project title | Level of system design | Design stakeholders | Type of data used |
|---|---|---|---|---|
| 4 | Community-based agricultural knowledge management system | Designing whole system | • Students<br>• Community-based collaborators<br>• Researchers/academics | • Five interviews<br>• Participant observations<br>• Documents |
| 5 | University library digital resources<br>*(weak 'best practice project')* | Designing social processes to utilize existing systems | • Digital librarian<br>• Academics<br>• e-learning specialist | • Four interviews<br>• Non-participant observations<br>• Documents |

### *5.2.4.1 Project 4: Community-based agricultural knowledge management system*

This project was designed from scratch using the participatory design approach. In addition to relying on data from interviews and documents to review the project, the researcher participated in some of the participatory design sessions. It is a research project called VeSeL (Village e-Science for Life)[44] which is an initiative of the Bridging the Global Digital Divide Network funded by the UK's Engineering and Physical Sciences Research Council (EPSRC). It involved researchers developing an agricultural knowledge management system for rural farming communities in Kenya which could be accessed through the use of mobile technologies. The team consisted of UK researchers and experts in telecommunications, renewable energy sources, sensor technology, education and design, working with local experts at the case study university and two local communities (see Figure 6). The case study university experts were drawn from the two faculties (i.e. Faculty of Agriculture and School of Computing and Informatics) that had originally been investigated during the Kenyan pilot study.

The project focused on designing technologies that are appropriate and sustainable for rural development and improvement of literacy levels. One of the project's objectives was to:

> *"explore the interface and interaction design of mobile, two-way information systems...to bridge remote sensor networks and centralized access points, with novel power solutions, usage scenarios, and device interfaces – all aimed at end users with little or no knowledge of digital technology, but with rich local agricultural and cultural knowledge"* Walker *et al.*, 2008 p.2710

[44] VeSeL project. 2009. http://www.veselproject.net/ (Accessed on 24 January, 2010)

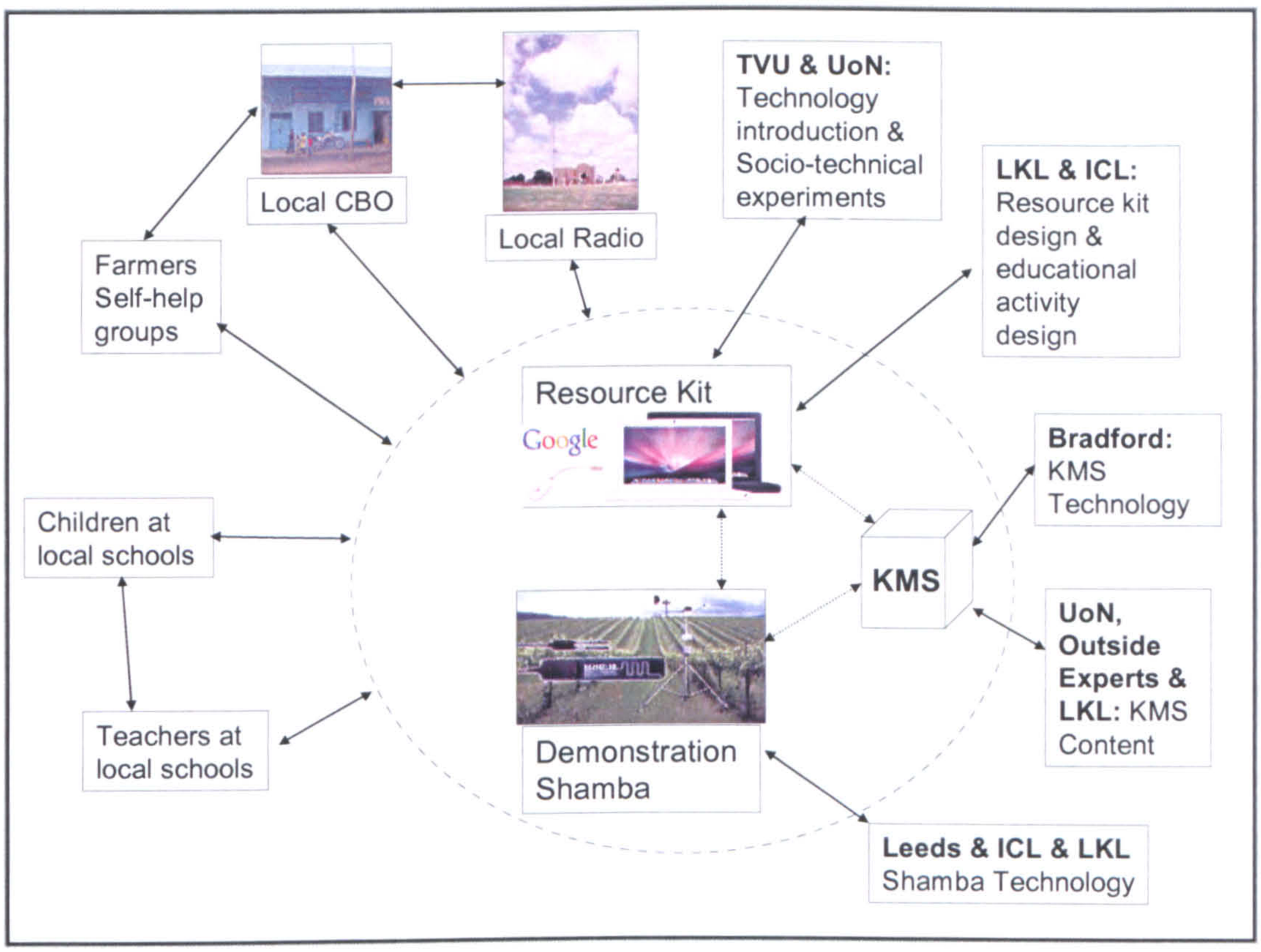


**Figure 6: Relationships between the stakeholders in the agricultural knowledge management project (Source: VESEL [45])**

The design approach taken on by the team was one that trains the local communities (users) to take on design roles and self report their progress with the technology. Communities were therefore involved right from the onset of the project where a mutual understanding (between the researchers, technologists and the communities) of each other's contexts and needs was established. To achieve this, field trips were carried out for ethnography (e.g. participant observation and cultural probes) and interviews on the two communities' ways of living, how they interacted with existing technology and their reaction to new technologies as they were introduced to them. Mobile resource kits comprising of a Macbook laptop, solar charger, General Packet Radio Service (GPRS) modem for access to

[45] http://www.lkl.ac.uk/cms/index.php?option=com_content&task=view&id=148&Itemid=91

the Internet, digital cameras and audio recorders were deployed to the communities to support information access and information capture, publishing and dissemination.

Farmers were encouraged to collect and post data from their farms as a simple blog posting. Similarly, school children and their teachers in the two communities were encouraged to post texts and images consisting of stories about their schools as well as their experiences with the technology to a blog in their school websites[46]. These bits of information were later linked to an online knowledge management system, a kind of a content management system, which has the basics of a digital library infrastructure.

This project thus presented a good example of stakeholder collaboration in the design process. However, it should be noted that there were some issues with this project. First, it was not a home-grown project, but was conceived and partially developed from outside, a distinct feature that differentiated it from the rest of the projects. Secondly, some supporting factors such as policies were absent. These issues impacted on the sustainability of the project which has since come to an end (see Subsection 7.2.4).

#### *5.2.4.2 Project 5: University library digital resources*

Review of this project relied on data obtained through interviews, documents and non-participant observation. The project focused on designing social processes to utilize existing digital resources in order to support learning processes. Its effectiveness and learner-centeredness depended on librarians, academics and e-learning experts collaborating in the development of learner-centred resources. However, this project appeared poorly supported as collaboration between these stakeholders was weak (see sub-

[46] http://veselproject.blogspot.com/

section 5.2.1 and 5.2.2). Stakeholders worked independent of each other. Research findings also showed that unlike the other projects identified in this research, this one lacked the application of innovative technologies. Existing policies also failed to support collaboration between the stakeholders which meant that they were not able to share their skills for mutual benefit. As a result, the digital library developed was not always relevant to the needs of the users, forcing them to turn to Internet resources and using other means to personalize existing resources to meet their needs. For example academics created their own personal portals where they uploaded information resources they found relevant for the courses they were teaching and encouraged students to access these portals. Students also created their own portals using Web 2.0 resources. Unfortunately these personalized approaches lacked sustainability. Ultimately, this project turned out to be an example of weak 'best practice' according to the criteria followed in this project.

## 5.3 UGANDA CASE STUDY

The setting of this case study is Makerere University, which is a conventional public university in Uganda with a student population of slightly under 40,000 (Okumu, 2009). This is one of the oldest universities in Africa and has therefore had a leading role in shaping higher education on the continent (see Section 2.1). Although there has been a lot of growth as well as infrastructural expansion as was observed during the field work, this university has had its share of some of the challenges highlighted in Subsection 2.1.3. In terms of technical infrastructure, the university has fully integrated ICT services and systems into its main functions of training and research including the library. This is supported by a university-wide fibre optic cable and a wireless backbone for enhanced Internet access. Like most African universities, the high cost of bandwidth still remains a

huge challenge (Tusubira *et al.*, 2008).

Some of the 'best practice' projects identified for the research were mainly based at the College of Health Sciences located at the main national referral hospital. Others were based in the main university campus. In total, six projects were identified for inclusion in this research and are described in Sub-section 5.3.4.

### 5.3.1 E-learning status

Several attempts have been made in the past to introduce an e-learning program in this university. However, it is only in recent years that the university has succeeded in consolidating these previous attempts into a dedicated e-learning unit. Earlier attempts to have an e-learning program were led by the university's ICT department but this being a technical support facility, the program lacked pedagogical input. In addition, there were other smaller projects and external partnerships that also had some form of e-learning. However, all these initiatives have now been centralized under one e-learning department placed within the Institute of Adult and Continuing Education.

While e-learning practice is not mainstreamed in the university's academic programs yet, renewed commitment and interest in e-learning was noted during the research. Something that stood out was presence of a series of university-wide e-learning training sessions which were being facilitated by the university e-learning specialist. These were targeted at academics who participated with noticeable enthusiasm; virtually all academics interviewed remarked positively about these training sessions. This was a strategy to create a critical mass of champions for e-learning implementation in the entire university and participation was thus voluntary. Another feature of these training sessions was the inclusion of an

electronic services librarian as a co-facilitator. This appeared an excellent effort to promote learning-library engagement.

### 5.3.2 Digital library status

The university's main library system has an established digital library service consisting of over 20,000 online full text journals. As with the Kenyan case study, this collection was initially introduced by PERii and hence most of it has similar databases i.e. HINARI and AGORA. Subscription to paid databases is currently done through a national library consortium with financial support from donor agencies. Additionally, the library hosts an institutional repository of research output (digitized theses and dissertations, conference papers, etc) and has made attempts to introduce use of innovative technologies (i.e. DSpace application) to support this service.

Access to these resources on campus is supported through provision of ICT facilities in the library. There is also training offered on information literacy to university staff and students in order to equip them with necessary skills needed to exploit these digital resources. This also includes a computer laboratory for library users with disabilities. Some students' halls of residence have Internet connectivity as well as wireless hotspots. These additional sources of Internet connectivity are necessary because the library's ICT facilities are not enough to cater for the entire student population. There are faculty libraries spread across the university which have similar facilities.

Digital library services are supported by a pool of qualified information professionals. The library operates a 'Two-Tier' system of recruitment for certain key professional positions; a system that distinguishes between academic and administrative staff. This is a system that

helps to break down any professional barriers between librarians and academics. This was identified as playing a role in enhancing collaborations between the two as demonstrated in the following verbatim extract from an interview with one librarian:

| | |
|---|---|
| ***Researcher:*** | ***What do you think about the fact that you feel engaged in the learning process?*** |
| *Librarian 4-UG:* | *I am not surprised per se, in the past here at the university they thought that the librarians were not academic until we had to write and defend our position so we became academic, we are now considered members of the academic staff. Of course not all the librarians, there is criteria followed, you have to do research, publish, entry point you are supposed to have second class upper and as a librarian at that level, you are at the level of assistant lecturer, so when you get masters and you have published, then you start climbing the ladder.* |
| ***Researcher:*** | ***So the library professionals here are at the same level with the academics in such a way you can go and lecture?*** |
| *Librarian 4-UG:* | *Yes, we have a two tier system, we have the academic, and then we have the administrative, those administrative are those with second class lower, but for the academic members of staff...We get the same salary as the teaching staff.* |
| ***Researcher:*** | ***Do you think this has changed the way people perceive the librarians?*** |
| *Librarian 4-UG:* | *Yes, a lot.* |

The greatest challenge faced in the implementation of the digital library is a low level utilization of these resources as commented by one librarian:

> *"But the usage statistics have not been very good...we try to think how can we really increase usage of these resources."* Librarian 5-UG

There was a general sense of frustration among librarians interviewed. They felt that a lot of effort and finances have been spent in developing the digital resources, yet utilization by students and academics was still quite low.

### 5.3.3 Policy status

This university operates under a reasonably good policy system. Policies guide almost all operations of the university. For example there are policies that support research and teaching as well as those that support functions like ICT and library services. There are institutional and departmental strategic plans that have clear policy statements. These policies are easily accessible and available to all staff members as online (hosted on the university intranet) and print resources. This means that most staff members are quite familiar with them, which was evident during the research.

The university's current strategic plan focuses on learner centeredness; research and knowledge transfer partnerships; and networking. All these three areas of focus were instrumental in supporting 'best practice' projects detailed in Sub-section 5.3.4. The strategic plan recognises the roles of the library and ICT as core functions within the support structure and provides strategic direction for their operations.

Other policies relevant to this study include; the ICT policy which has an e-learning component; Research and Innovations Policy; Intellectual Property Policy; and Library Strategic Plan. The ICT Policy in particular has an explicit role to support the library information systems. These policies help in promoting learning-library engagement.

The national policy framework is also quite developed and there is evidence of synchronisation with the institutional policy framework. For example, the university's current strategic plan[47] is a direct response to Uganda's Universities and Other Tertiary Institutions Act, 2001 (Republic of Uganda, 2001) which requires provision of quality higher education, promotion of research and advancement of learning:

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[47] Makerere University Strategic Plan 2008/09-2018/19

> *"The ...University Strategic Plan 2008/09-2018/19 is developed in the quest to provide quality higher education, promote research and advance learning as provided for in the Universities and Other Tertiary Institutions Act, 2001"*

Additionally, these national policies strengthen some of the functions of the university. Another example that relates to this study is the Ministry of Health Strategic Plan (Republic of Uganda, 2009) which supports the work of Project 6 (see Subsection 5.3.4.6).

### 5.3.4 Digital library projects

A total of six 'best practice' projects were identified in this case study as summarized in Table 5. Review of these projects relied on data obtained from interviews, non-participant observation and documents.

**Table 5: Summary of digital library projects in the Uganda Case study**

| Project no. | Project title | Level of system design | Design stakeholders | Type of data used |
|---|---|---|---|---|
| 6 | E-learning initiative | Designing processes to utilize existing designs | • Students<br>• Community-based collaborators<br>• Researchers/academics | • Six interviews<br>• Non- participant observations<br>• Documents |
| 7 | Institutional repository | Tailoring existing system | • Digital librarians<br>• Academics<br>• E-learning specialist | • Four interviews<br>• Non- participant observations<br>• Documents |
| 8 | Digitization of music collection | Tailoring existing system | • Digital librarians<br>• Students<br>• Academics | • Three interviews<br>• Non- participant observations<br>• Documents |
| 9 | College Knowledge Management system | Tailoring existing system | • Digital librarians<br>• Academics | • Two interviews<br>• Non- participant observations<br>• Documents |
| 10 | Problem Based Learning (PBL) digital resource support system | Designing processes to utilize existing designs | • Digital librarian<br>• Academics<br>• e-learning specialist | • Eight interviews<br>• Non- participant observations<br>• Documents |
| 11 | Clinical mobile digital library | Tailoring existing system | • Academics<br>• Government officials<br>• Projects donors<br>• Projects staff | • Three interviews<br>• Non- participant observations<br>• Documents |

### *5.3.4.1 Project 6: E-learning initiative*

As previously noted, e-learning in this institution had just been restructured to give it a pedagogic face by removing it from the ICT department (a technical unit) to the Institute of Adult and Continuing Studies (an academic department). Therefore at the time of research, the actual practice of integrating it into academic programmes was still at a very early stage and there was no example of any developed e-learning academic modules identified. This project focused on developing information pathways for stakeholders (academics, e-learning specialist and librarians) to appropriately develop and use a learning management system containing learner centred resources that combined e-learning content and appropriate digital library resources. An e-learning specialist from the Institute of Adult and Continuing Studies brought in stakeholders (librarians and academics) to collaborate in this process through workshops he conducted some training sessions. These were targeted at interested academics who would then lead e-learning integration into the academic programs throughout the university. Participants were drawn from all faculties and attendance was on voluntary basis. A librarian was invited to co-facilitate these sessions where she trained academics on the use of digital library resources and how they can support e-learning content development.

This facilitation was supported by the existing policies within the university. This support from policies plus the facilitation of the joint representation of the academics and librarians in the process made this project stand out as 'best practice'.

### *5.3.4.2 Project 7: Institutional repository*

This project was developed by the library to host the institution's academic and research

output (e.g. research papers, theses and dissertations, teaching and learning resources such as music files) and increase their accessibility by the wider university community. The system was developed using DSpace Open Source Software by librarians. They invited academics and students (stakeholders) to populate the system using their academic output.

This research established that the librarians were very active in encouraging academics and their students to contribute these resources (Chapter 6). The process was supported by existing policies (Chapter 7). The outcome was shared participation by librarians, academics and students as they all became collaborators in the creation of Open Access (OA) digital collection that was supported by innovative technology (DSpace Open Source Software) and policies. Hence, the project was identified as a 'best practice' project. Figure 7 is a screenshot of this resource.

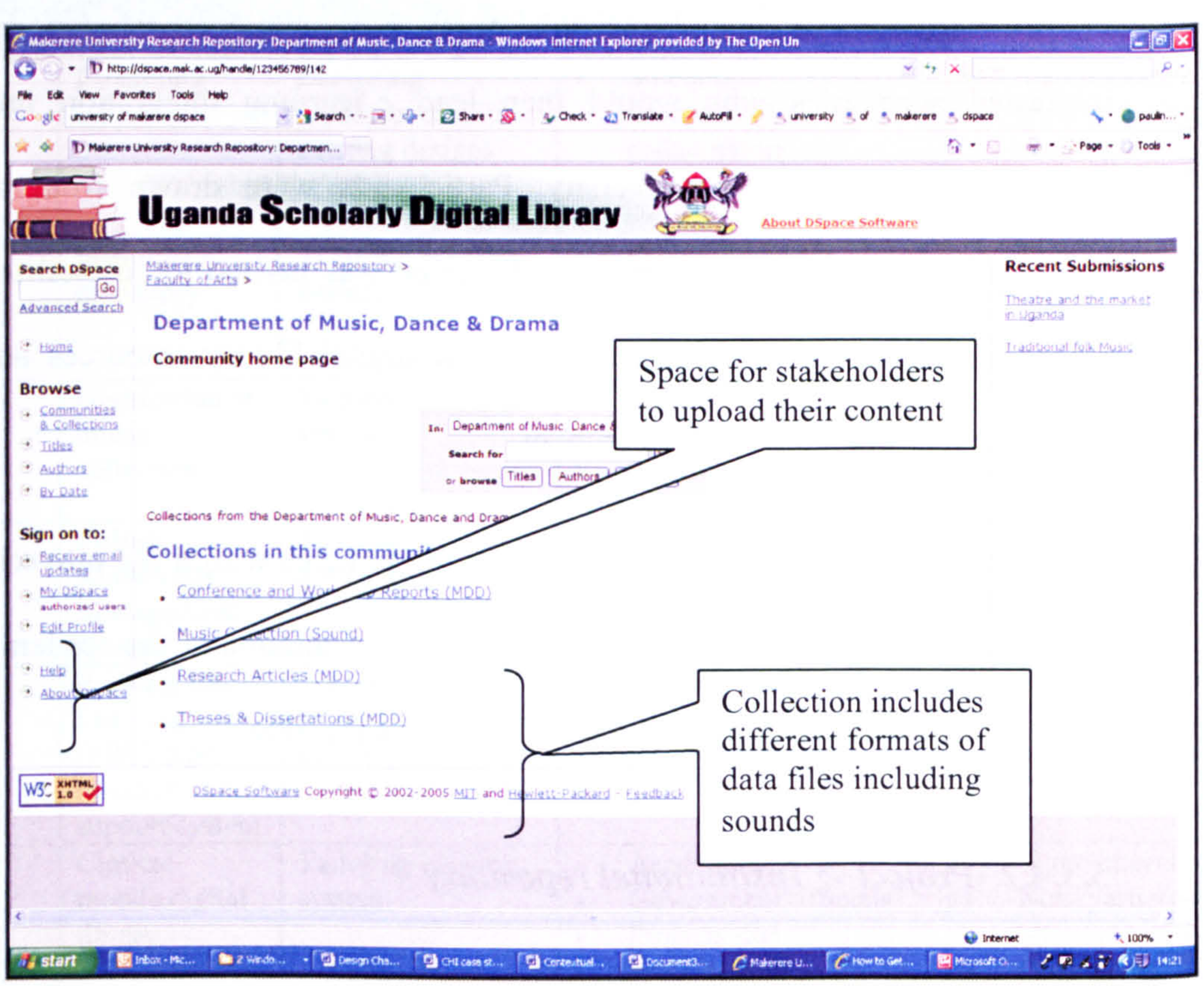



**Figure 7: A screenshot of the institutional repository**

### *5.3.4.3 Project 8: Digitization of music collection*

The university's Department of Music, Dance and Drama was involved in a digitization project to develop a digitized music collection for teaching and learning, as well as preservation for public access. This was collaboratively designed and developed by library digitization experts and music academics. Each of these stakeholders had different skill sets and roles which they engaged throughout the design process. Librarians provided specialized skills in digitization and organization of digitized music files (see Figure 8) while academics provided music descriptions for metadata development. Digitized files were hosted in the institutional repository (described above) which meant that they were organized using DSpace application. Additionally, librarians also worked with students and taught them how to digitize their own files as part of their learning process.

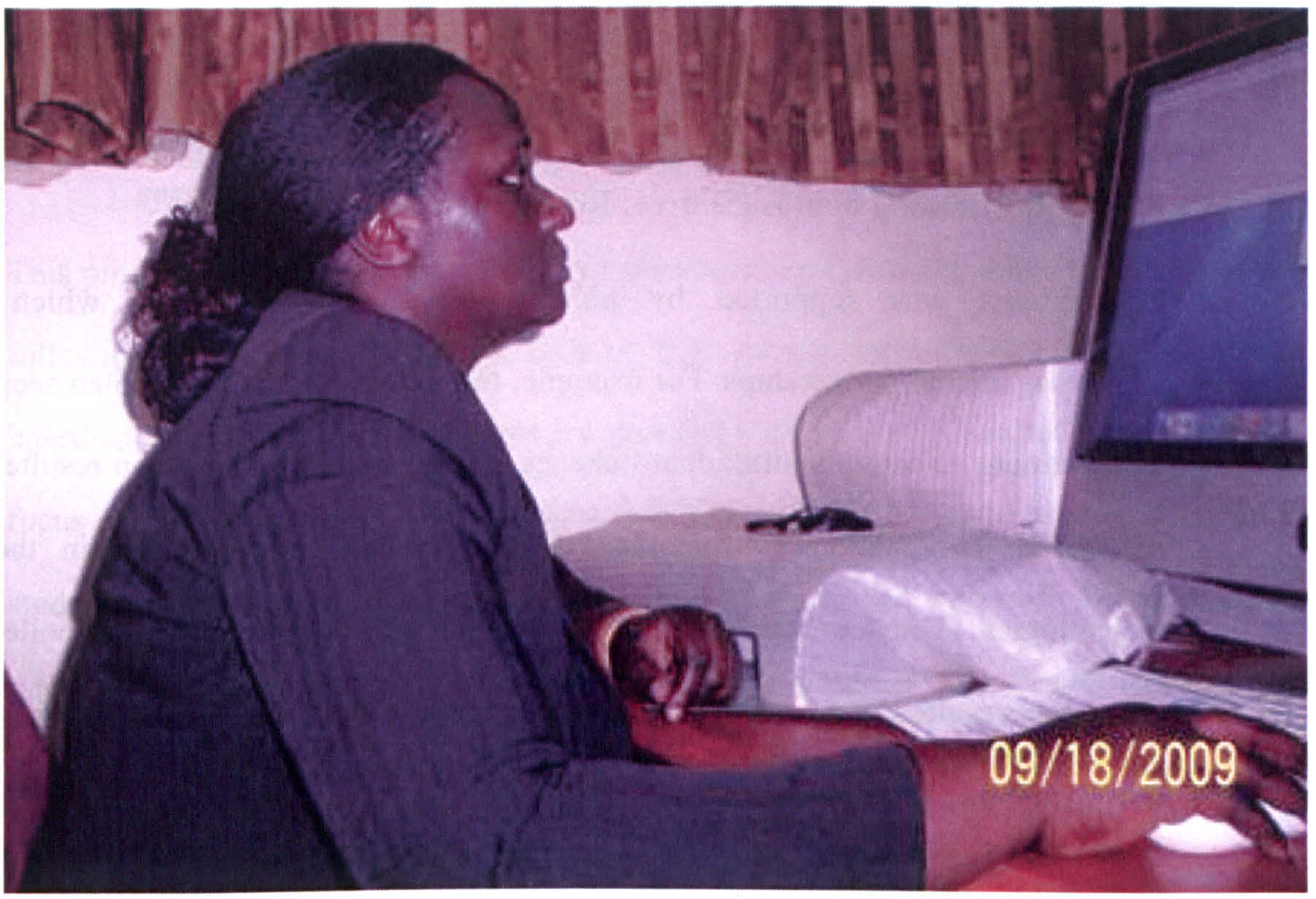



**Figure 8: Music librarian sharing her digitization skills (Source: Researcher fieldwork with participant's permission)**

This collection is housed in the library together with a sound-proof listening facility (see Figure 9) for use by music students and academics.

**Figure 9: Listening booths (Source: Researcher fieldwork)**

The project was supported by policies within the university which facilitated interdepartmental partnerships. For example, the university's strategic plan sees the library as sustaining effective institutional linkages. Stakeholder collaboration resulted in a form of shared participation between academics, students and librarians in the usage of technologies (DSpace and digitization) to design a digitized music collection. This ultimately resulted in a learner-centred resource collection that supported learning needs of music students and also had far reaching relevance to the general public of Uganda. This made the project stand out as a 'best practice' project.

#### *5.3.4.4 Project 9: College knowledge management system*

This project was part of a university-wide ICT task force charged with the responsibility of creating university's virtual visibility through making institutional knowledge electronically available. The College of Health Sciences initiated a knowledge management project for its own knowledge collection. An academic who was leading this project was a member of this ICT task team. He realised that there was a lot of expertise in the library which he could tap on and therefore started working with some librarians from the college library. Other academics were being mobilized to provide their academic output. Librarians on their part were to provide their expertise to digitize this college knowledge and later manage it using the DSpace software. This project brought together academics and librarians collaborating in the design of a digital collection and hence was identified as a good example of good practice.

#### *5.3.4.5 Project 10: Problem Based Learning (PBL) digital resource support system*

This project was specially developed to support students in the College of Health Sciences following PBL system. PBL is a form of instructional methodology that uses a tutorial based approach. Five to ten students are grouped together and presented with a problem to focus on. This approach is student-centred rather than teacher-centred and encourages students' participation. When effectively implemented, this approach helps students to develop problem solving skills. Some of the resources used to support problem solving are digital library resources because of the variety and currency of information content. Students draw assistance from information professionals and in the process they develop information skills such as ability to search, retrieve and evaluate appropriate information

resources. This process produces a more holistic approach to learning where students are able to take charge of their learning as they acquire critical thinking and problem solving skills as noted by one of the academics involved in this methodology:

> *"The new methods offer an opportunity for the students to be in charge of their learning. The students acquire the expertise in looking for their own learning resources and knowledge. They impart problem solving skills, critical thinking, help integrate rather than compartmentalise knowledge."* Kiguli-Malwadde, 2006 p. 129-130

PBL in this university has an extension of what is called Community Based Education and Service (COBES). This is where students study local communities and hence local information stored in the university's institutional repository (see Subsection 5.3.4.2) is very relevant in supporting this approach to learning.

The research findings established that in order to support these students, a digital collection of health related resources, partly supported by DSpace application was redesigned for this program's specific needs. The stakeholders (librarians, academics and students) collaborated in the design process for this resource. Librarians provided appropriate resources, enabling technology infrastructure (a networked computer laboratory, laptop connection points and hotspots for wireless Internet connection) and devised a system of supporting the information inquiry through an information intermediary. Students engaged intensely with digital library resources to fulfil their educational need and relied heavily on the support mechanism provided by the information intermediary in the library and the technical infrastructure in the computer laboratory. Academics too tapped into this support mechanism in order to support the PBL/COBES methodology. This created a joint representation of academics, library staff (plus an information intermediary) and students in the provision and use of the digital resources to fulfil this pedagogical need. Figure 10

shows students using this service in the library computer laboratory.


**Figure 10: Students using dedicated PBL service in the library computer laboratory (Source: Researcher fieldwork)**

The innovative use of technologies plus the joint participation in the design process for this PBL support system made this service stand out as an example of 'best practice' project for the research.

### *5.3.4.6 Project 11: Clinical mobile digital library*

This mobile library was developed by a health community-based project called Uganda Health Information Network (UHIN) that was housed at the university's College of Health Sciences. Its aim was to deliver a health information system using mobile devices to clinicians in rural Uganda. The project was a joint partnership of a number of organisations,

namely: AED-SATELLIFE, Uganda Chartered HealthNet (UCH), Faculty of Medicine in Makerere University (including academics and library professionals), International Development Research Centre (IDRC), and District Health Services in five districts in Uganda (Phipps *et al.*, 2003). The project made use of mobile devices, i.e. personal digital assistant (PDA) for:

- Health data capture at point of care and seamless transmission to district health offices via wireless access points;
- Dissemination of health content including peer-reviewed medical journals with a greater focus on Africa particularly Uganda, selected from credible sources such as the university library, Uganda Ministry of Health, and African Medical and Research Foundation (AMREF);
- Continuing professional development material associated with prevention, diagnosis, treatment, and care efforts on topics selected in consultation with the Ministry of Health;
- Relevant articles from local on-line newspapers broadcasted to the users on daily basis;
- User feedback.

Project stakeholders including end users participated in the design process where they discussed information needs and how to provide and present information to users. These stakeholders had specific roles in the development process (See Chapter 6). For example, the clinicians and Ministry of Health were the system users and provided system requirements. The university provided information resources (e.g. international peer-

reviewed journal articles) and advice. The funding agency (IDRC) provided financial support and project tools. The project staff provided technical expertise such as customizing the PDA to fit end user requirements and coordinated all the stakeholders' activities. There was also policy support from the Ministry of Health's strategic plan, the university's strategic plan and funding agency's directives.

This project was not entirely within the mainstream of the university academic activities but was chosen as 'best practice' because of its high collaboration features between users and facilitators of the information system. It also provided an alternative method where both academics and librarians could partner in shared representation in the design process for information resources, albeit for a different kind of learners (i.e. life-long learners).

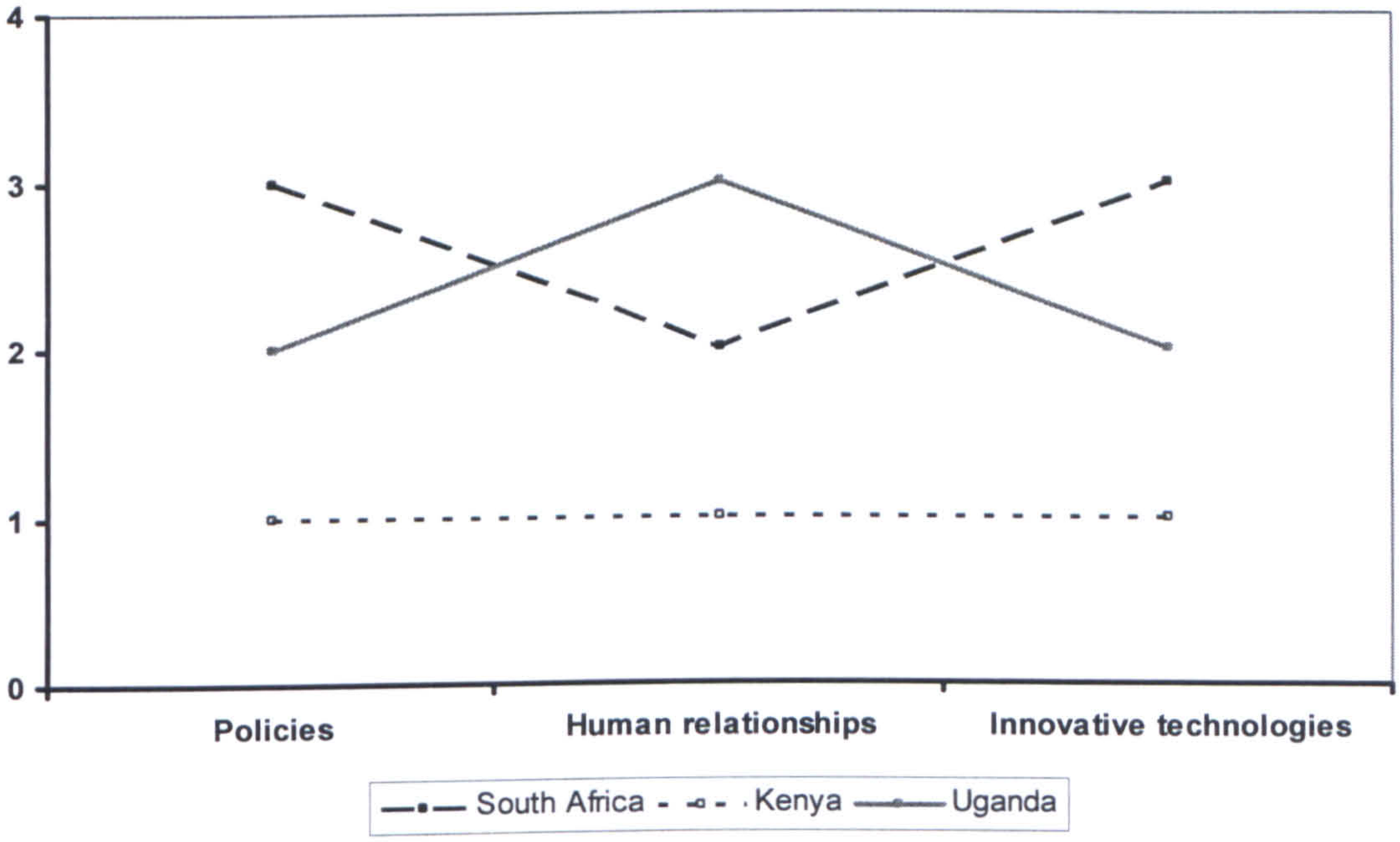
## 5.4 HIGH LEVEL ANALYSIS: COLLABORATIVE DESIGN PROCESS FACTORS

From the above description, certain interesting similarities and contrasts across the case studies can be identified. For example, although in each of the case studies there had been investment in educational computing facilities, the South African one appeared to be the most resourced institution, resulting in excellent technical innovations compared to the others. Of all the three case studies, the Ugandan one seemed to have more innovative approaches to making connections between digital library and other departments. This is evident from the fact that it had the majority of 'best practice' digital library projects. Both South African and Ugandan case studies had detailed policy systems compared to the Kenyan one. However, policies in the Ugandan case study appeared to be facilitating while those in the South African one had enforcing effects. Digital libraries in Ugandan and Kenyan case studies took a similar approach to developing their digital collections.

Another point of comparison was at the projects level. Some of the projects across the case studies had some similarities and were directly comparable with each other. For example, both South African and Ugandan case studies had an institutional repository and a virtual learning environment project. Both Kenyan and Ugandan case studies had a community-based digital library project (i.e. the community-based agricultural knowledge management system and the clinical mobile digital library, respectively).

Initial analysis of these research findings suggests that there were three comparable factors across the case studies and projects identified in them. These factors are: human relationships, innovative technologies and policies. Human relationships factor would have best been described as stakeholder collaboration factor but as will be seen in Chapter 6, its scope went beyond collaboration to include facilitation of stakeholder skills within the design process. To help draw this comparison, the section below provides an account of these factors per case study, judging their strength on a scale of strong, medium and weak (where strong represents at least two examples to support the factor; medium representing one example; and weak having no example). This comparison is summarized in Figure 11.

| | South Africa | Kenya | Uganda |
|---|---|---|---|
| **Human relationships** | Medium | Weak | Strong |
| **Innovative technologies** | Strong | Weak | Medium |
| **Policies** | Strong | Weak | Medium |




Key: 1= Weak; 2=Medium; 3=Strong

**Figure 11: Summary of the case study comparison**

The South African case study was identified as one that made connections between digital librarians, academics, e-learning specialist and students, thus making the human relationships factor stand at medium on the strength scale. As already mentioned, this case study was financially better than the other two, and hence well resourced in terms of ICT infrastructure. Additionally, there was innovative application of technologies in both e-learning and library programs. As a result of these two examples, this case study was regarded as having a strong innovative technologies factor. As far as policies factor is

concerned, the university was found to have a detailed policy structure that cuts across key levels i.e. national, institutional, departmental and individual employees. Another point is that policies were found to be well grounded in the operations of the university; some of them had key people charged with the responsibility of overseeing their implementation. As a result of these two examples, the case study was seen as having strong policies.

The Kenyan case study appeared to be almost opposite the South African one. Firstly, the connection between library programs and e-learning programs was relatively weak. This could be seen for instance in the absence of adequate collaboration between librarians and the e-learning specialist. Librarians were brought in at a very late stage to participate in the development of academic programs. Consequently, the human relationships factor was rated as weak. Secondly, despite the fact that the university was seen as making efforts in developing its ICT infrastructure, it was identified as not very well resourced compared to the South Africa one. More significantly, there was an absence of innovative technologies in e-learning and library services similar to what was present in the South African case study. Indeed, unlike in the South African case study, there was no evidence of e-learning integration into the university programs. Instead, e-learning implementation in the university appeared fragmented. Thus, the innovative technologies factor has been rated as weak. Thirdly, the policy situation appeared weak. For instance, there was no example of policy articulation across the national, institutional, and departmental levels. Further, institutional policy support to the library was weak. For example there was a lack of institutional mandate and support for the implementation of the digital resources including an institutional repository. Clearly this case study lacked any examples to support the three factors, and hence could be said to be weak in each of them. However, it was included in

this research primarily because it offers a good basis for comparison with other case studies. It is important to note that there were indeed good intentions among both academics (including e-learning coordinator) and digital librarians. For example, librarians were making efforts to have digital resources in the library. It appears like weak policy structure, application of innovative technologies and human relationships were affecting this case study.

In the Ugandan case study, the level of ICT infrastructural development seems to be almost similar to the Kenyan one. However, there was evidence of innovative technology application in teaching and learning (i.e. use of DSpace to manage institutional repository). This example places the case study at medium level in relation to the innovative technologies factor. This case study appeared to have a strong human relationships factor in comparison to the other two case studies, which can be judged on the basis of the following two examples. The first example was the e-learning facilitation that brought academics into collaboration with librarians. Perhaps this is one area that the Kenyan case study could learn from. Another example is the two-tier recruitment system in the library that was found to support collaboration among librarians and academics. As a result of these two examples, the human relationships factor was rated as strong. Although not as detailed as in South Africa, the policy structure was found to be stronger than in the Kenyan case study. For example, there was a relationship between the national, institutional and departmental policy framework. Policies appeared to support and drive the operations of the university, particularly those of e-learning and library. Hence, the policy factor was rated as medium.

## 5.5 CHAPTER SUMMARY

This chapter has first provided a detailed description of the case studies and 'best practice' projects identified in each of the case studies. It has further identified that these case studies could be compared against each other on the basis of three key factors (innovative technologies, human relationships and policies). This is an important aspect when considered at a higher level as it reveals interesting contrasts across different African countries, given that these case studies were located in different countries. For example, it can be inferred that the application of policies supporting educational technological projects differ across the countries. It can also be argued that institutional and national policies together with collaborations across different departments within universities can support educational innovations aimed at mitigating some of African HE challenges highlighted in Chapter 2 (i.e. access to quality educational digital resources).

The identified three key factors reveal a vital aspect of successful design process for digital resources. Their presence appeared to be linked with 'best practice' projects as was the case for both the Ugandan and South African case studies, while the Kenyan case study which had weak factors also had examples of weak 'best practice' projects. It is necessary to have a deeper understanding of the characteristics of these factors and the role they were playing in the design process. Taking this approach helps provide insights into how these factors can be used to support the development of collaborative design process guidance. Consequently, these factors have been subjected through a detailed analysis, whose findings are reported and discussed in the next two chapters (Chapter 6 and 7).

# Chapter 6: The role of the human relationships factor in collaborative design process

This chapter and the subsequent Chapter 7 present the findings of this research in order to answer the second research question: ***What are the characteristics of these factors and the roles they play in the collaborative design process?*** Detailed analysis of this research identified three key factors present in the 'best practice' projects, namely: (i) Human relationships factor, (ii) Policies factor; and (ii) Innovative technologies factor. This chapter presents and discusses research findings in relation to the role of the *human relationships factor* in the collaborative design process for the digital library projects reviewed in this research. The other two factors are presented and discussed in Chapter 7.

The rest of this chapter provides details of how this human relationships factor contributed to the design process across all the projects reviewed. It first provides a brief description of the various design stakeholders identified and their different skills. It then describes in detail how each of the stakeholder categories applied their skills in the design process. A description of the nature of resultant outcomes is then provided. The chapter ends with a discussion of these findings in the light of existing HCI design processes.

## 6.1 DESCRIPTION OF STAKEHOLDERS

The research findings identified that the human relationships factor consisted of different types of stakeholders who were facilitated to collaborate and use their skills (and sometimes their positions) for mutual benefits in the design process. These different types of stakeholders were (i) general multidisciplinary stakeholders and (ii) design champions. The latter category was further subdivided into multidisciplinary and domain champions.

These are summarized in Table 6 below, depicting them in their specific job roles.

**Table 6: Summary of the different multidisciplinary stakeholders**

| Projects | | Stakeholders | | |
|---|---|---|---|---|
| | | General multidisciplinary stakeholders | Design Champions | |
| | | | Multidisciplinary champions (MC) | Domain Champions (DC) |
| 1 | Digital library supported by Web 2.0 | • Students<br>• Academics | - | Digital Librarians |
| 2 | Institutional repository | • Students<br>• Academics | - | Digital Librarians |
| 3 | A comprehensive virtual learning environment (VLE) | • Digital librarian<br>• Academics | e-learning technologists | - |
| 4 | Agricultural library | • Researchers/academics<br>• Design experts<br>• Community-based collaborators (farmers, school teachers and pupils) | Researchers/ Academics | - |
| 5 | University library digital resources | • Digital librarians<br>• E-learning technologists | - | - |
| 6 | e-learning initiative | • Digital librarians<br>• Academics | E-learning technologists | - |
| 7 | Institutional repository | • Students<br>• Academics | - | Digital librarians |
| 8 | Digitization of music collection | • Digital librarians<br>• Students | Academics | - |
| 9 | College Knowledge management system | • Digital librarians | Academics | - |
| 10 | PBL digital resource support system | • Students<br>• Academics | Digital Librarians | - |
| 11 | Clinical mobile library | • Academics<br>• Government officials<br>• Projects donors<br>• Clinicians | Projects staff | - |

The first group consisted of stakeholders who were participating in the projects and represented a range of disciplines and job positions. They included academics and students from different disciplines, e-learning technologists, digital librarians, design experts, policy makers (government bodies and project donors), project administrators and the general

public (farmers, clinicians, school teachers and pupils).

The second group was a subset of the general stakeholders. Research findings established that this group was made up of two types, namely: (i) multidisciplinary champions (MC) and (ii) domain champions (DC). They facilitated engagement and collaboration among the stakeholders in the design process. A further analysis of the two design champions' roles identified that their ways of engagement differed, producing different practical and affective outcomes with the rest of the team. Their specific characteristics and roles are presented in Section 6.3.

## 6.2 STAKEHOLDERS' SKILLS AND KNOWLEDGE

Research findings revealed that through collaboration, all the stakeholders were able to contribute their skills for mutual benefit in the design process. There were two categories of skills namely: (i) domain-specific skills and (ii) skills related to contextual knowledge. The following is a brief description of these skills while section 6.3 describes in detail how they were applied in the design process.

***Domain-specific skills:*** These were skills specific to particular stakeholders (e.g. librarians, e-learning specialists and systems designers/technologists), who participated mainly to contribute these skills in the design process. These were mainly technical related skills such as ability to use applications like DSpace Open Source Software, Web 2.0 applications, mobile technology, and digitization technology as well as knowledge management skills. Academics and e-learning specialists also contributed their pedagogical skills.

***Context knowledge:*** Some projects tapped onto stakeholders' understanding of the contexts they were operating in, as well as their needs and systems requirements. For

example the two community based projects i.e. the Uganda clinical mobile digital library (project 11) and the Kenya's agricultural knowledge management system (project 4) benefitted from incorporating end-users' knowledge of how technology could be made more relevant to them. Project 4 conducted ethnographic studies to draw out users' socio-cultural dynamics and gain an understanding of how technologies could be contextualized to meet their needs (see Subsection 5.2.4.1). Project 11 worked with users in the initial design workshops in order to understand their information needs and how they preferred them to be met (see Subsection 6.3.1).

This contextual knowledge also included the understanding of the prevailing forces at play within those particular contexts. Specifically, understanding of contextual policies was an important contribution in the design of some projects. For example, in all the three South African projects, stakeholders understood the important impact of policies within their context and exploited them in the design process of these projects (see section 7.2).

## 6.3 THE ROLE OF DESIGN STAKEHOLDERS IN THE DESIGN PROCESS

As already highlighted, the research findings show that these stakeholders belonged to two main categories. The first category is the general multidisciplinary stakeholders. The second category is the design champions who comprise (i) multidisciplinary champions (MC) and (ii) domain champions (DC). These different groups had some distinct differences. For example the general multidisciplinary stakeholders were mainly contributing their skills while the design champions were facilitating use of these skills and collaboration among the stakeholders within the design process. This section discusses how each category applied their skills and roles in the design process.

### 6.3.1 General multidisciplinary stakeholders

The research findings identified that some of these stakeholders were system users whose role was to provide user needs, design ideas and reflections on system specifications and context knowledge (e.g. in the Kenyan community based agricultural based library- project 4) as noted in this excerpt:

> *"From the very first discussion with the project team, the farmers made it clear that they wanted a two-way information exchange system. They wanted information about markets, crops and pests, and they wanted to contribute content to publicize their products and work."* (Project documentation[48])

Within some projects, these stakeholders' role in the design process was to populate the library with content (e.g. within the two institutional repositories i.e. projects 2 and 7) as noted by an academic in project 7:

> *"...we have been able to put up some of what we have especially the research that comes out of the students, or putting up some of what we have been able to produce..."* (Academic 4-UG)

Among these stakeholders there were sometimes high profile participants such as the project's funding agencies and government officials (e.g. in the Clinical mobile library - project 11). These had the role of decision making and offering policies that influenced the direction of the project such as enforcing the collaboration between the stakeholders as noted below:

> *"...it was a requirement for us to use that approach [monitoring and evaluation method from the donor] ... a participatory Planning, Monitoring and Evaluation methodology where all the stakeholders including the primary beneficiaries meet in a workshop environment together with the donor and implementers and agree on results and how they will be attained."* (Project administrator-UG)

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[48] Walker, K (2009). The mobile resource kit. ICT Update, 51

As will be seen in the subsequent sections, the nature of participation of these stakeholders depended heavily on the facilitation provided by the design champions.

### 6.3.2 Multidisciplinary champions (MC)

This category of design champions was present in most of the 'best practice' projects (i.e. 7 out of 11). They represented different disciplines and domains (as seen in Table 6) e.g. academics (i.e. in music and health disciplines), digital librarians, HCI researchers, e-learning specialists and project administrators.

These champions were usually initiators of the design projects but they often brought into the design process different stakeholders to collaborate with them. For example, in the Digitized music collection project (project 8), the music academic (MC) was the initiator of this project but she worked collaboratively with the librarians:

> *"I felt that we needed to do something...and I wrote this grant and established collaborations with them [library staff]"* (Academic 5-UG)

Another example is in Uganda's e-learning project (Project 6) where the e-learning specialist (MC) initiated the project and immediately identified other stakeholders and included them in the project:

> *"... I realised I could not do it alone ... decided to expand the scope beyond what the faculty wanted. I went to the library to look for someone who could give us an insight into electronic resources."* (E-learning specialist-UG)

An important point to note was that some of the stakeholders included had a crucial direct contribution to the project outcome. More specifically, project 11 had representation from the Ministry of Health, which is part of the country's decision making system. The inclusion of this ministry has since benefitted the project by taking it up after the project

life has ended, thus ensuring sustainability and continuity.

Research findings also established that the MC did not just identify stakeholders. They also identified relevant skills among these stakeholders. Furthermore, they encouraged them (stakeholders) to use these skills in the design process as illustrated in the Uganda's digitization of music collection (project 8).

> *"... we knew we needed some technical skills, some cataloguing skills, these are library skills, so as to be able to manage this archive."* (Academic 2- UG)

This was corroborated by one of the librarians in the projects.

> *"...when they need me to do training for the students, they ask me to come and demonstrate how I do the actual digitization."* (Librarian 4 -UG)

The MC also acted as a facilitator for collaboration amongst all the stakeholders e.g. by creating collaboration spaces:

> *"We have instructional designers that help create templates for a virtual classroom in which the lecturers can go in and put the learning resources that they have for the students. We also collaborate with the library people where we create a library page and the library people work with the lecturers in defining which resources should be put on that library page..."* (E-learning specialist-SA)

Another example of how the MC facilitated collaboration amongst stakeholders was identified within the creation of networking between the stakeholders. For example in project 6, the MC linked academics with the librarians so that they could engage with each other. This excerpt from an email exchange between two collaborators where the e-learning coordinator was the MC illustrates this point:

> *"I am from Vet faculty ICT committee. We are currently undergoing training in use of e-learning in teaching in Vet faculty. We are supposed to cover use of e-resources as well.[e-learning coordinator name] advised me to contact you whether you would give us an appointment when a couple of people in Vet can be exposed to*

*one of the trainings by your Dept."* (Project. 10 email extract)

Those that took on this MC role also acted as coordinators of ongoing collaboration activities as noted by one of them:

> *"... if we have contact with lecturer that wants to put things onto [VLE] we will refer them to the librarian and if they have links from the library they will talk to us, so that we can create that environment for them, so we have a very good link between us and the library to support the lecturers in that environment."* (E-learning specialist-SA)

The research findings showed that these MC had the ability to pull people together to collaborate and remain motivated. For example in the e-learning project in Uganda (project 6), the MC observed that the librarian remained motivated and never missed any opportunity to collaborate and train the other stakeholders (academics). Meanwhile, these academics showed interest and motivation to get involved such that more time was needed for the librarian to train them:

> *"But the librarian has been very faithful; she has come to all my training. Every unit where I have trained she has been there.....the librarian's three hours have not been enough and she can go for six hours whereas in the past her problem was to get even three hours of training on how to use these e-resources and how to upload resources."* (E-learning specialist-UG)

Similarly, a stakeholder in the College knowledge management project in Uganda (project 9) noted how they were motivated to collaborate in the project despite high workloads:

> *"It is going to work, we appreciate it. There is a time he [MC] wanted me to do something, I told him am busy but am going to do it, I told him to avoid going to the faculties when we can do it. Recently they launched this college and when they were giving speeches, they emphasized collaboration with the library to ensure that it supports research, teaching and studying. This is very good."* (Librarian 2-UG)

The research findings also established that these champions were able to see beyond the present project and wanted to develop these projects together with the other stakeholders.

One MC aimed at starting small so that the other stakeholders could understand and then slowly grow expectation so that a bigger project would be possible:

> *"It's a very big ambition ... I thought that this would be something not only for the university but also for Uganda. So we are beginning at this very small level but my ambition is to have a bigger one for Uganda. ..At first they did not believe me, I wanted to show them what I had in mind, it's a very small room, at the centre is where I call the listening room and the inside part is the processing room."* (Academic 6-UG)

### 6.3.3 Domain champions (DC)

This category of champions was identified as having characteristics that retained the project within one particular domain whilst still involving multidisciplinary stakeholders. These appeared in three 'best practice' projects and they all happened to be digital librarians (see Table 6). They shared some common characteristics and roles with the multidisciplinary champions but also retained some crucially distinct differences as described in Subsection 6.3.4.

Research findings showed that like the MC, these champions were also initiators of the design projects. They saw the need for the projects and took the initiative to start them. For example, in the South African digital library project (project 1), the digital librarians (DC) saw the need to initiate Web 2.0 applications to support their digital library. They realized that they could use these technologies to connect with their younger clientele who had become more active in the virtual social world:

> *"We felt that many of our library users are involved in all these web 2.0 applications, ... they are using less and less the library databases...we said we have got to reach them. Take the library databases, the library articles, library tools to them by using these Web 2.0 tools ..."* (Librarian 1-SA)

Another example was in the creation of the institutional repositories in the South African

and Ugandan case studies (projects 2 and 7 respectively) where the librarians (DC) initiated the project:

> *"...it is a project where we are compiling research output from the lecturers and students at Makerere University in to an online database that can be accessed even by the general public."* (Librarian 3-UG)

These DC were also proactive, enthusiastic and committed to the design process and its successful completion. For example in project 2 the DC were keen to utilize their skills with the Web 2.0 applications:

> *"...we found out that the people had developed far more tools than we initially planned, people got involved in many more tools, they were using much more tools to engage the clients, to get the clients involved."* (Librarian 1-SA)

In developing institutional repositories, these DC removed potential hurdles such as helping stakeholders get copyright clearance of their articles from the publishers so as to ensure these stakeholders had no problems participating:

> *"We encourage lecturers to have their articles there, so we get copyright clearance from the publishers"* (Librarian 4-SA)

In Project 2, the DC exhibited such personal commitment to the excellence of the project that she was recognized and given an international leadership award for her specific role in the development of this institutional repository (see Evidence 1). This highlighted the key role she had as an individual in this process:

**Evidence 1:**

Librarian in charge of the OpenScholarship initiative at UP has been recognised by the Networked Digital Library of Theses and Dissertations (NDLTD) consortium and been awarded the ETD Leadership Award which recognises members of the university community whose leadership and vision has raised awareness of the benefits of ETDs, and whose efforts have improved graduate education through the use of ETDs.

***Source:***

NDLTD ETD Awards 2010 Winners

http://www.ndltd.org/events_and_awards/awards/ndltd-etd-awards-2010-winners

(Accessed on 4 May 2010)

### 6.3.4 Comparisons between the two types of design champions

A further comparative analysis of these findings showed that beyond the descriptions of these design champions, there were key differences in the way they facilitated the collaborative design process which led to interestingly different outcomes.

In the first instance, there were differences in the way each type of design champions engaged with the other general stakeholders. The MC tended to use a collaborative engagement style with these stakeholders throughout the design process. For example where they initiated the projects, they brought in the other stakeholders at an early stage in the process as shown below:

> *"We initially called a stakeholders workshop with users of health information, and people from the Ministry of Health... So people brought in their ideas and we said we shall go now to the grassroot and engage those people..."* (Project administrator –UG)

This approach was very different from that taken by the DC in similar digital library projects. It was noted that often the DC were driven by their domain specific goals and interests and only brought in the participation of other stakeholders much later in the design process. For example the initiation of the digital library in South Africa that used Web 2.0 applications (Project 1) was driven by the library's need to engage some of its clientele.

These stakeholders were then brought in at an evaluation stage after the systems had been developed. The quote below illustrates how they got some ideas from students who later were used to pilot its training functionality, leading to the next stage of system development:

> *"...with the game they did get some of the students involved to give ideas."* (Librarian1-SA)

Similarly the two institutional repositories that were developed as part of the Open Access movement were initially part of a library initiative. Academics and students were brought in after the initial system (DSpace) was designed to collaborate in populating the system as shown below:

> *"...they way we involve them is to ask them what collections they want to upload. ... in deciding what kind of collection they want we have"* (Librarian 4-SA)

Another way that the MC collaboratively engaged with stakeholders was through their ability to focus primarily on the identification and utilization of stakeholders' various skills and expertise whilst allowing this to remain for the mutual benefit of everyone. For example in the design of the College knowledge management system (project 9) the MC identified the knowledge management skills of the librarians and supported all the stakeholders valuing these skills within the project design process:

> *"The library has the expertise in how to handle information ... If we can take them at the centre of all the information going around, then we shall have a very powerful collection...Because the librarians have benefitted from training in information management which we as academics do not have...."* (Academic 2-UG)

Conversely, the DC's approach was to use their domain knowledge as a focus for the project. For example, the DC in the institutional repository projects (project 2 and 7) applied their skills in digitization and application of DSpace for creating and organizing

institutional repositories:

> *"... most of the content we have is not in digital format, we have to use scanners to scan and make it digital, you have to use the scanners and software, for us we are using DSpace"* (Librarian 1-UG)

Another contrasting approach to the design process between the MC and the DC was identified from their different methods for facilitating stakeholders' motivation to collaborate. The MC appeared to grow stakeholders' motivation towards collaboration organically throughout the design projects lifespan. As already pointed out, these stakeholders remained motivated and enjoyed getting involved in the project. Ultimately, although often with high workloads they did not need to be coerced into ongoing participation within the project.

In contrast, the DC had to use a number of methods to get the other stakeholders to remain motivated to collaborate within the project. One method they appeared to use was institutional reinforcement of practices. In the South African institutional repository project, the DC introduced a policy (The Open Access Mandates) that was institutionally approved. This forced the academics and students to collaborate with them by depositing their academic outputs in the institutional repository (see Subsections 7.2.1 and 7.2.3).

Another method used by the DC to increase stakeholder engagement was through active persuasion. They enthusiastically marketed their projects among the stakeholders where they encouraged them to get involved and explained the institutional and individual benefits of collaborating. In project 7 for instance, the DC took the advantage of an on-going discussion in a blog to talk about the project and encourage participation:

> *"In order to continue improving on ...University's web presence, the number of rich files both on unit websites and in the Institutional Repository has to be increased continuously... University's Institutional Repository is located at [url]*

> *Depositing research output in an Institutional Repository has added advantages to the individual researcher (i.e. internal visibility of output per individual) and the institution (i.e. institutional visibility through one central digital location to the outside world). Researchers [academics and students] are therefore hereby requested to vigilantly upload their papers or articles onto the Institutional Repository either by themselves or by sending them to [email address] for uploading by librarians."* (Project 7: ICT blog)

This proactive marketing was also identified in Project 2. The research fieldwork coincided with the Open Access Week (see Subsection 4.2.4.2). The researcher noticed a massive campaign around the institutional repositories and why academics and students (stakeholders) should get involved. This included an exhibition in the library showcasing views of those stakeholders who were already participating in order to encourage others to open up their research and get involved. One participant commented:

> *"The other day, the lady who is our subject specialist sent me an email asking me to send her my photograph and say something about Open Access, because they wanted to make posters ..."* (Academic 4-SA)

The researcher also participated in a half-day seminar at the climax of this campaign and observed librarians and invited publishers make presentations to academics in efforts to simplify the process of depositing their academic output. They also demystified the whole notion of open access publishing, hence encouraging participation.

Another interesting difference between the two design approaches was that whilst the MC facilitated collaborative ownership of the project, the DC took the approach of marketing designs that were perceived by all to be owned by the DC. The concept of ownership through engagement in the design process is an interesting issue (see Davis and Dawe, 2001) although not one that has been researched in detail within this thesis.

## 6.4 THE CONTRIBUTION OF THE HUMAN RELATIONSHIPS FACTOR TO THE PROJECT OUTCOMES

The presence of human relationships factor in the design process had an impact on the outcomes of the projects as was evidenced by the presence of the following three outcome indicators: (i) stakeholder engagement; (ii) transformation (in learner centred digital resources, changed practice among stakeholders, creation of projects' visibility); and (iii) project sustainability. The concept of sustainability in this case is viewed in terms of HCI projects that are long lasting (Khan *et al.*, 2011) and those that *"endure...through maintaining and prolonging services"* (Pade *et al.*, 2006, p.102). These outcome indicators are described in details below.

Firstly, this human relationships factor led to stakeholder engagement. This resulted in joint participation of key stakeholders in the design process for digital resources. This was particularly evident in projects facilitated by the MC where stakeholders were engaged all through the process. For example, the two e-learning projects in South Africa and Uganda (i.e. project 3 and 6 respectively) led to all stakeholders (academics, librarians and e-learning specialists) collaborating as illustrated in the following data excerpt from one of the librarians:

> *"... ... we put links to our electronic articles or books that are available for the students under the different modules and ... that comes with the module and the learning outcomes, it's set up by the lecturers, we work very close with the lecturers in setting that up, we do that together with the education innovation department of the university, it's a three way engagement between us, the lecturer and the education innovation department in setting up these learning management pages for the different course so that the students can access that and their assignments"* (Librarian 3-SA)

In the Uganda case study's e-learning project (project 6), it had been difficult getting all concerned stakeholders to participate prior to the project. However, this human

relationships factor in the design process led to shared participation of all stakeholders including students:

> *"...it has been a problem bringing [academics] to the library for any kind of training for e-resources or going to their faculties ... but now with this e-learning approach, they all come, ... and when they give us a slot we feel that it is the way to really sensitise these lecturers on what we have available, so that they can use the same resources, and they can also encourage the students, ... we are all benefiting mutually, we the librarians train [academics] on how to access, the lecturers use this and also give the same resources to the students and the students also refer it for the academic purposes... for us we want to see how we librarians can come in and participate in this e-learning environment"* (Librarian 5-UG)

Secondly, human relationships factor resulted in some kind of transformation within the projects. This was observed in a number of ways. For instance, these projects produced learning resources that were transformed to more learner centred resources which gave students good learning experience. This kind of transformation was quite noticeable. In the South African case study for instance, two projects (project 1 and 3 respectively) produced learner-centred resources. The effectiveness of these learner-centred resources led to the two projects being commended by South Africa's Council on Higher Education's Quality Committee (HEQC) as shown in Evidence 2 and Evidence 3 below:

**Evidence 2**

HEQC Commendation 6: *"The HEQC commends the University of Pretoria for its efficiently managed and well-resourced Library Service" pg. 38*

This commendation refers to the digital library (project 1). When unpacked, it includes proper representation in the faculties, with information specialists integrated into each faculty to provide support, and faculty libraries are resourced in line with the teaching, learning and research needs of each faculty.

**Source:**

Council on Higher Education (2008). Audit Report on the University of Pretoria: Report of the HEQC to the University of Pretoria, South Africa

http://web.up.ac.za/sitefiles/file/6657/UP%20Audit%20FINAL%20to%20Christa%20North.pdf (Accessed on 4 May 2010)

**Evidence 3**

HEQC Commendation 4: *"The HEQC commends the University of Pretoria on the work done by the Department of Education Innovation" pg. 36*

This commendation refers to the VLE (project 3). It is a commendation of the Department of Education Innovation's work in research on teaching and learning, and services provided. A major part of this work is their clickUP system (VLE) that innovatively integrates digital library resources with course materials.

**Source:**

Council on Higher Education (2008). Audit Report on the University of Pretoria: Report of the HEQC to the University of Pretoria

http://web.up.ac.za/sitefiles/file/6657/UP%20Audit%20FINAL%20to%20Christa%20North.pdf (Accessed on 4 May 2010)

This was corroborated by student's survey (Evidence 4) in the same project, showing the positive impact this VLE (project 3) had on learning experiences.

**Evidence 4**

From students' experience of using clickUP 2008 survey results:

*"Emerging evidence suggests that, when clickUP is used optimally, it enables independent and rich learning. This is important evidence about the impact of clickUP on student learning. Correctly used, the environment encourages networked and social learning, communication and interaction. Access to the library resources enables search. Furthermore, students arrive at lectures better prepared and happy to listen instead of taking notes. It is also apparent that the use has spins off in terms of increasing the computer and information literacy of students, thus contributing to their graduate attributes"* pg 36

**Sources:**

University of Pretoria (2008). Department for Education Innovation 2008 Annual Report, University of Pretoria

The presence of the human relationships factor also resulted in another kind of transformation in form of change of practice among stakeholders including students. In project 8 for instance, students engaged in the music digitization project saw how the other stakeholders collaborated and used their skills and technology to develop learners' digital collection. This changed their way of engaging with learning resources as seen in this

excerpt from one of them.

> *"...we [classmates] decided to start an e-journal where we would be keeping information on the things that we research about ... if you have journal it encourages interaction, ...You can actually have a discussion about what you are writing about which will in the end develop the knowledge...if institutions would have programs that would encourage the students to use digital technology, that is where the librarians would come in ... lets be honest the books that are in Makerere Library I wonder who will ever read them, the dissertations written by students ...in the end some people have researched the same things not knowing someone has done it. But if it was accessed on the net, if someone was searching to look for information on their topic, they would find that article ... if institutions were encouraged like we were encouraged in our class to do these things... if we worked together Uganda would be different and Makerere would not be the same. Because right now as we speak everyone has Internet on their phones, they are always on Facebook but you picture a period where you want information about someone's dissertation, you just type it on the phone and all your information comes out, how much greater would that be?"* (Student 7-UG)

Another example could be noticed in the way students following the PBL curriculum in project 10 started engaging with digital resources by holding weekly seminars to critically analyze journal articles obtained from the PBL digital information collection as seen below:

> *"...every Thursday we have journal clubs and that actually helps us a lot in looking for journals from the different available resources from the net... we learn how to critique work that has been done by others, maybe I want to look at the best management option in a person with X disease, so I go on PubMed for example, ... so you can get the latest article, sit down with my colleagues when I have made a powerpoint and critique, have they done the right thing, can it be used in a setting like ours, or is the drug the best in our setting? And if yes, maybe you could use that drug or we can say why don't we go ahead and do that study in our setting before we can adopt what other people have done."* (Student 6-UG)

The final example of this transformation could be seen in the way some of these projects increased visibility and interest in these digital resources locally and even internationally. This was particularly evident with the two institutional repositories (project 2 and 7). For example, in project 2, the 2010 webometric ranking of global institutional repositories ranked UPeTD (i.e. electronic theses and dissertation platform which was part of this South

African institutional repository) 95th out of 400 best institutional repositories worldwide in terms of content, size and visibility, as evidenced below. This was a good ranking considering that most Western repositories are included.

**Evidence 5:**

The UPeTD (i.e. electronic theses and dissertation platform) is rated 95 out of 400 best institutional repositories worldwide in terms of content, size and visibility, in the January 2010 Ranking of World Repositories.

***Source:***

Ranking Web of the World Repositories January 2010 http://repositories.webometrics.info/top400_rep_inst.asp?offset=50 (Accessed on 4 May 2010)

This is corroborated in the following informal feedback from the university community and alumni:

**Evidence 6:**

*"The UP OpenScholarship Programme (OpenUP), powered by Open Access, provides both students and researchers at the University of Pretoria a new dimension of the acquiring and spreading of knowledge which will entitle them to achieve greatness in their respective fields. The findings of which can be once again accessed by the next generation of researchers at UP, and elsewhere, thus feeding the cycles of turning information into knowledge, which makes this a truly great university, not only in an African context but globally."* (PhD student)

*"OA makes a lot of sense for us young people. This is how we think about information – available everywhere and at all times to be shared, used and to create new stuff."* (Undergraduate student)

*"I showed UPeTD to my new colleagues and student: they were challenged by the impressive format of UP PhD presentations and would like to learn from it."* (Alumnus)

*"This service proves that the Dept of Library Services at UP is dedicated to keeping in step with current technology, to the benefit of as many students as possible. Now I feel proud to call myself a Tuks alumnus again because of what my university can do for me."* (Alumnus)

*"I was asked to contribute to a journal after the editor saw my thesis on UPeTD."* (Alumnus)

***Source:***

University of Pretoria Open Access mandate: the first African open access institutional mandate story.

http://www.ais.up.ac.za/openup/docs/UPmandateAfrica.pdf (Accessed on 4 May 2010)

In the Ugandan case study, the institutional repository (project 7) and the College knowledge management system (project 9) which were both collaboratively developed

using DSpace application ranked highly in internal webometrics implying that their visibility had risen (see evidence 7 below).

**Evidence 7:**

- DSpace is rated the highest in an internal webometric carried out in the university in January 2010.
- College of Health Science rose from position 7 in internal webometric to position 4 since working with the Library.

***Source:***

How did your unit contribute to Makerere's January 2010 ranking? In Directory for ICT support blog

http://blogs.mak.ac.ug/dicts/2010/02/15/how-did-your-unit-contribute-to-makereres-january-2010-ranking/

(Accessed on 4 May 2010)

The last outcome indicator was project sustainability. As already highlighted, some of the stakeholders represented decision making systems. This was evident in project 11 where the Ministry of Health in Uganda was represented. This has been advantageous to the project's sustainability. As the project's life came to an end, the Ministry incorporated the solutions offered by the project in its strategies as noted below:

**Evidence 8:**

"The completion of the Uganda Health Information Network project does not in any way indicate its end. Health workers say they can't imagine going back to life without it," said Holly Ladd, AED Vice President and Director of the AED-Satellife Center.

The Ministry of Health is incorporating the UHIN solution into its formulation of a comprehensive strategy for a National Health Information System and the districts will continue using the system for health data gathering, reporting, and delivering vital medical information.

***Source:***

Nakkazi, E. 2010. Uganda to adopt electronic health records system. New Science Journalism

http://www.newsciencejournalism.net/index.php?news_articles/print/uganda_to_adopt_electronic_health_records_system/ (Accessed on 1 April, 2011)

## 6.5 IMPLICATION FOR THE HCI DESIGN PROCESS

Research findings presented in the preceding sections reveal interesting insights that are relevant to collaborative design processes for digital resources. Firstly, the presence of design champions supported collaboration of different multidisciplinary stakeholders within an institution. This all inclusive approach in having multidisciplinary stakeholders appears to agree with Cockton's (2009) meta-principle of inclusiveness in the design process. This is an important contribution not only in supporting a collaborative design process of digital resources but also in understanding how different disciplines can be brought to a joint participation within an institution. Multidisciplinary participation in academic institutions is a key topic of discussion within modern digital scholarship as observed by Shulman (2004). Secondly, the role of stakeholder collaboration, supported by national and institutional policies appeared to make a crucial contribution in the success of the design process within the projects reviewed. The following subsections discuss these two major contributions.

### 6.5.1 Design champions in the collaborative design process

The presence of a subset of multidisciplinary stakeholders (i.e. design champions) that appeared to champion and facilitate the design process in all the 'best practice' projects raises interesting insights for the collaborative design process of digital resources. On the surface level, their characteristics and roles appeared to mirror those detailed in previous literature about design champions (e.g. Department of Health, 2008; Design Council, 2010). These design champions also appeared to portray what Curley and Gremillion (1983) call personal effects in the support of the design process which were critical to the success of the collaboration. However, further analysis of this research identified that there

were two types of design champions who shared certain similarities but also some important differences in their approach to the design process and stakeholder involvement as noted below.

One category, the domain champions (DC), took a more traditional 'siloed' (see definition of terms in Section 1.5) approach that was driven by the goals and interests of a specific domain. As seen from the data presentation, these domain champions were initiators of projects and developed them on their own, only inviting the other stakeholders to join in at different stages. In order to get engagement, they used different ways such as enforcement and proactive marketing. The other category, the multidisciplinary champions (MC), was more inclusive of other multidisciplinary stakeholders right from the beginning of the projects and throughout the process. This in turn generated a more organic engagement where these stakeholders were motivated to participate.

This comparison of the two design champions brings out interesting insights that are relevant to modern digital scholarship which focuses on multidisciplinary participation in academia (Shulman, 2004). It also raises important questions particularly in the domain of digital libraries and how they are designed and deployed collaboratively with key stakeholders.

First, within this research the domain champions were only digital librarians. Although these librarians were actively seeking to engage stakeholders in the design process, it appears that the approach they were taking still allowed them to work in isolation for most of the design process. These "siloed" librarians were motivated and creative in their design and development of projects which apparently turned out to be very successful. However, they appeared not to have moved towards working in a multidisciplinary way as portrayed

by the multidisciplinary champions. The projects these DC were involved in are traditional library functions (institutional repositories and the digital library that utilized Web 2.0 resources). Might it be that the librarians were too comfortable working in ways that they know and enjoy and only brought in multidisciplinary participation when they were ready to engage others in their developments? Could a key point here be concepts of control and ownership within the design and development process? These projects utilized novel applications and applied them in interesting ways but it appears that the DC took a traditional approach to this process. The library retained primary ownership of the process and the system and utilized stakeholders to market and evaluate the systems. The MC on the other hand allowed ownership to be joint throughout the design process so that marketing was not required to ensure further engagement by the stakeholders.

Second, it is important to highlight that there were some digital librarians who were also identified as MC, i.e. in the PBL library project (project 10). How did they make this transition, when the other digital librarians did not? It is important to highlight here the importance of the project focus. PBL was noted as a new concept within the institution seeking to develop this system. In contrast, institutional repositories are traditionally library activities whose main function is to make scholarly resources more accessible. In this case, do digital librarians need to incorporate diverse pedagogical concepts as well as technologies into the design process? To incorporate radically alternative scholarship approaches to institutional repositories that are housed within a multitude of disciplinary domains might be a first step to advancing ideas that are different from what has traditionally been within the library domain. This could help move entrenched digital librarians into engaging with stakeholders in a multidisciplinary way similar to that found

among the MC.

Third, the research findings have shown that there is a diverse range of stakeholders within multidisciplinary projects, who were mainly facilitated by the MC. One important category is the policy makers who by the nature of their position influence the way projects are initiated and implemented. Some of these decision makers are donors as was identified in the Clinical mobile library in Uganda (project 11). Their policies influence the level of participation. For example, in this particular case they enforced a system that motivated the participation of all stakeholders, which ultimately resulted in a project that impacted greatly on health practice in the country. The presence of these decision makers also can have impact on sustainability of projects. In this same project, another category of decision makers were government ministry's representatives. This has led to the project being taken over by the ministry after the life of the projects has ended. With this in mind, might the "siloed" librarian be missing out on the value of multidisciplinary participation?

Finally this research suggests that it is important for librarians who, although effective and successful domain champions (DC), should consider engaging in design approaches that motivate stakeholder engagement throughout the design process. In taking this step, their own role as design champions could develop positively. Nardi and O'Day (1999) have carried out library studies and concluded that librarians can be keystone species in an information ecology analogy. They argue that librarians' various contributions are vital to the success of the library. Digital libraries provide exciting opportunities for information sharing and learning. They advocate an approach that encourages *"mutual adaptation, fostering new relationships between the technologies and the practices of librarians and people who are trying to find information"* p. 82. Hence the role of librarians as DC is

critical but for them to make a positive contribution to the success of collaborative design processes for digital resources, they should take on the collaborative approaches used by the MC.

The above issues are fundamental not only to successful design of a digital library but also to its implementation and uptake. There is a need to understand the role of design champions when planning digital library projects in order to comfortably participate in digital scholarship across academia and make a profound contribution in shaping its future direction.

The approach taken by the multidisciplinary champion in the design of educational digital libraries also appears to be useful in building bridges across multidisciplinary teams in teaching, learning and research, not only in African HE but perhaps also globally. They succeeded in bringing multidisciplinary stakeholders to collaborate in the design process. This can be considered as one way of breaking down traditional domain-based structures and encouraging borderless collaborations across different disciplines, thus making a useful contribution towards supporting digital scholarship. This research therefore suggests that the designs of educational digital libraries have a role to play in shaping modern scholarship, hence the way they are designed matters. The "siloed" domain approaches traditionally used by librarians appear to have no place in modern scholarship especially as it requires costly (both in time and resources) marketing of resources perceived to be owned by others, as was evident in this research.

### 6.5.2 Stakeholder collaboration and policies

The findings of this research show that the role of stakeholders collaborating and using their skills for mutual benefits was crucial in the design process. Their absence contributed towards poorly supported design processes in the projects. Social aspects of technology design and in particular the role of people involved in the design process is not a new thing. HCI researchers in the past have tried to define the role of various design process stakeholders in HCI research, as reviewed in Chapter 3. For example Zimmerman *et al.* (2007) have provided a model representing how the various HCI research interaction design process stakeholders interact among themselves within a design process. Nardi and O'Day (1999) have extensively described social technical relationships in their information ecology metaphor. The role of people within a particular context in technology designs has also been researched extensively in recent years. For example, Ramachandran *et al.* (2007)'s study of technology design in India and Uganda found out that people can make invaluable contributions in the early stages of design because they have social dynamic understandings of their contexts. Camara *et al.* (2010)'s study on design of rural-based e-learning mobile devices has been developed using knowledge obtained from working with users to design innovations that are suitable to their specific context needs. Some research has even focused on participatory design approaches with users. An example of this is a recent study by Kam *et al.* (2006) who used participatory design approaches with rural students in India to design education games.

One key difference between this current research and past studies highlighted above however is the relationship between the influence of these stakeholders and the influence of policies. Policies seemed intrinsically connected with how stakeholders collaborated and

contributed their skills towards effective design processes. As will be see in Chapter 7, where policies were weak as was the case with the Kenyan university digital library (project 5), collaboration failed and consequently stakeholders were not able to contribute their skills. Stakeholders in some of the projects researched were not just collaborating and interacting with the technology to produce a specific product as previous research has noted. Rather, they were being facilitated by existing national and institutional policies. Ultimately, this resulted in sustainable innovations that had the desired impact. Policies appeared to be crucial to the successful contribution of the human relationships factor which suggests that policy makers are indeed an important component of the stakeholders in the design process. In fact, these policies can be perceived as the keystone species referred to by Nardi and O'Day (1999), for the design process of context-based innovation which is the focus for this thesis. This role of policies in supporting stakeholder collaboration in design processes will be reviewed in more details in Chapter 7.

## 6.6 CHAPTER SUMMARY

This chapter sought to provide a detailed description of one of the key factors identified in Chapter 5. It has described the characteristics and the role of the *Human relationships factor* as a key component of the collaborative design process for digital resources. This factor comprised of multidisciplinary design stakeholders collaborating amongst themselves to utilize their skills relevant to the design process. A key subset of these stakeholders was identified, namely: design champions, who were of two categories: (i) multidisciplinary champions (MC) and (ii) domain champions (DC). Although they both facilitated engagement and collaboration among the stakeholders in the design process, their ways of engagement differed, producing different practical and affective outcomes

with the rest of the team. For example the MC engaged other stakeholders throughout the design process, while the DC took a 'siloed' approach where they used their domain expertise and only included other stakeholders as the design process progressed. This concept of design champions was particularly identified as making a significant contribution towards supporting multidisciplinary approaches advocated by digital scholarship.

The success of this human relationships factor depended on the support of national and institutional policies which facilitated the collaboration process to take place as well as the utilization of innovative technologies by stakeholders. The next chapter explores further how these institutional and national policies impacted on collaborative design processes in the identified digital library projects. It also presents findings about innovative technologies in the collaborative design process.

# Chapter 7: The role of innovative technologies and policies in the collaborative design process

This chapter is a continuation of the previous chapter. It presents and discusses the role of the *Innovative technologies factor* and the *Policies factor* in the collaborative design process within the projects reviewed in this research. The innovative technologies factor is a term used in this thesis to refer to modern technologies that supported the collaborative design process within the reviewed projects. It consisted of:

(i) universal (generic) technologies: these are applications meant for global consumption which means that they are not for any specific population but for as many users as possible (Ornella and Stephanie, 2006);

(ii) "flexible technologies": these are applications that were flexible and allowed these generic technologies to be customized to specific needs of the projects.

Policies factor included policies at a higher level comprising national and institutional policies.

Research findings established that the innovative technologies factor worked alongside the policies factor. As detailed in the preceding Chapter 6, these two factors (innovative technologies and policies) also supported the stakeholder collaboration and skills utilization (human relationships factor) which resulted in successful project outcomes.

These research findings are provided in detail in the subsequent sections. The innovative technologies factor is first presented by describing these technologies and their role in the collaborative design process. The nature of policies and their role in the design process is then presented. This is followed by a discussion on how these two factors impacted on the

project outcomes. These findings are then framed within the existing knowledge in a discussion that also highlights what this implies for HCI design.

## 7.1 THE ROLE OF INNOVATIVE TECHNOLOGIES IN THE DESIGN PROCESS

As mentioned above, this research identified presence of the innovative technologies factor in collaborative design processes for the identified 'best practice' digital library projects. Some of these technologies were generic (universal). Examples in the projects included web-based resources and mobile devices. Web-based resources were the digital library online databases of journals and other scholarly resources.

Mobile devices were used in two projects (the Kenyan Agricultural knowledge management system and the Ugandan clinical mobile digital library). Both projects were community based information systems that were developed in partnership with case study universities. The Agricultural knowledge management system (project 4) utilized a mobile resource kit comprising a Macbook laptop, solar charger, GPRS modem for access to the Internet, digital cameras, mobile phones and audio recorders. This kit was given to farmers to support them in gathering and contributing agricultural information to the information system in collaboration with other stakeholders.

> *"... farmers are provided with a digital camera, we also have another group with a laptop, they have mobile phones..."* (Academic 2-KEN)

The Clinical mobile digital library (project 11) was also designed around the use of mobile technologies (Personal digital assistants- PDA) as a delivery platform for data gathering and dissemination of the digital resources:

> *"...what we have are the PDAs and a wireless access point. These are the hardware. The other part of the network is the wireless cellular network."* (Project

Administrator -UG)

Further data analysis established that these technologies were introduced in the projects for the users (see Section 6.1) mainly to help in improving practice among them. For example in project 11, PDAs were introduced to help the rural clinicians collect health data on the ground as well as receive health information to support their clinical practice and professional development:

> *"It started off as a small project, brought in a few PDAs for the first time in Uganda and we wondered what we would use these PDAs for? Then we said that we would deploy them out there in the rural areas and use them to collect information and bring it back to the central level, then later we said no, probably we could keep those PDAs out there and beam information through the jacks, and also have information coming from that side."* (Academic 1-UG)

Additionally, it was noted that understanding these users and their needs for the technologies was crucial for the successful implementation of these technologies. For instance, project 4 carried out ethnographic studies of the farming communities at the onset of the project (see section 5.2.4.1). It was also noted during some of the design meetings attended by the researcher that this project used ethnographers who were of African origin (one of them being Kenyan from one of the communities' ethnicity). This aided these ethnographers to blend with the community in order to understand their technology expectations.

The other type of the innovative technologies factor was some applications which as mentioned in the introduction, had flexibility that enabled the universal technologies to be customized to the needs of the projects. The following subsection provides a detailed description of these technologies.

### 7.1.1 Flexible technologies in the design process

All projects appeared to be undergoing a customization process where stakeholders were collaborating to customize existing universal technologies to projects' needs (i.e. in solving problems identified in delivery of digital resources or in improving existing practice). Further data analysis identified that where this process was successful in terms of meeting user needs and sustainability within the project, there was also a presence of certain applications. Their absence resulted in unsustainable projects that failed to meet intended needs.

These applications were flexible and it is this flexibility that appeared to support the customization process. Because of this flexibility, they have been referred to as *'flexible technologies'* in this thesis. There were two examples, namely: (i) Open Source Software (DSpace) and (ii) Web 2.0 applications.

The following subsections provide an account of how these flexible technologies were applied in the design process to customize existing technologies. Additionally, a description of how their absence weakened the projects is provided.

#### *7.1.1.1 Flexible technologies: DSpace*

DSpace is an Open Source Software application that enables customization to take place. It also supports any form of digital content including text, images, moving images, mpegs and data sets[49]. This flexibility enables it to accommodate specific needs and requirements.

In this research, five projects were identified as utilizing DSpace application either to meet the broader institutional needs or to meet specific learners' needs. Those that met the

[49] http://www.dspace.org

institutional needs were the two institutional repositories (projects 2 and 7) and the College knowledge management system (project 9). These projects were tailored to meet the needs of the institutions using DSpace application. For example, both institutional repositories depended on academics and students, with no prior knowledge on content management, to be able to deposit their academic output on to the system. The flexibility in DSpace allowed them to do this.

> *"We have got the students doing it themselves now, and getting the materials and uploading them to the UPSpace. So they have a collection of architects they are working on, they get the stuff digitised and uploaded on to the UPSpace".* (Librarian 4-SA)

Because DSpace is Open Source Software, it supported the Open Access aspect of the institutional repositories which could be accessed without restrictions by anybody.

> *"...it is a project where we are compiling research output from the lecturers and students at Makerere University in to an online database [DSpace] that can be accessed even by the general public."* (Librarian 3-UG)

Those projects that were flexible to the learners' needs had been tailored to meet specific discipline needs of music and health students. These included (i) the Digitization of music collections (project 8) and the Problem Based Learning (PBL) digital resource support system (project 10) for music and health students respectively. DSpace was used to make the projects relevant to the learning needs of these students. For example the music project (project 8) required an application that had the capability for managing audio files which were necessary for the students' music analysis class. DSpace is flexible enough to handle such audio files and therefore was used to meet this need:

> *"...we are planning to put the audio files in the DSpace, because it has the capability of holding audio files."* (Librarian 4-UG)

Project 10 catered for a section of PBL students who were studying local communities through a program called Community Based Education and Service (COBES). Students depended on local knowledge to support this learning need and hence required access to a digital collection that integrated different local content. DSpace was used to organize this collection in the institutional repository and its success in meeting these learning needs could be seen in this comment from one librarian:

> *"...resources have been very helpful in supporting PBL. We have another one called COBES... when the lecturer gives them a topic... the first place to go to is the computer lab, because they know there are digital resources ..."* (Librarian 1 -UG)

### *7.1.1.2 Flexible technologies: Web 2.0*

Web 2.0 applications similarly create this flexibility and leverage collaboration between people where even non technical users can participate in systems' customization to perform specific tasks (see Gholami *et al.*, 2009; O'Reilly & Battelle, 2009). Web 2.0 applications in this research were used in project 1 to support the development of the digital library in the South Africa case study. Use of these applications had similar effects to those identified in the above projects that used DSpace to tailor resources to meet the intended user needs. Librarians in this project noticed a problem with their younger student population who were utilizing library resources less than expected. These are mainly the Netgen students who combine a number of technologies to achieve their learning goals (see Jones and Ramanau, 2009). Most of them are actively involved with social networking technologies such as Web 2.0 applications to acquire and share knowledge. Consequently, the library positioned itself to reach out to these students by using different Web 2.0 applications, i.e. facebook, blogs, U-tube, flickr, and integrating them into the digital resources. One librarian

commented:

> *"We felt that many of our library users are involved in all these web 2.0 applications, that's what they are using, they are using less and less the library databases, ... but they are googling, and they are using all these tools, and we said we have got to reach them. Take the library databases, the library articles, library tools to them by using these web 2.0 tools and that's what motivated us to do that."* (Librarian 1-SA)

This was confirmed in an interview with a different librarian:

> *"...because many of them are using facebook, so lets go and find them there, bring them back to the library without them necessarily knowing that they are coming back to the library, instead of them going away and they only using the Google scholar, we have put ourselves on the facebook ..."* (Librarian 3-SA)

They also developed an information literacy program adapted from a virtual game with a Web 2.0 context and piloted it among these students. This fitted well with the experiential and engaging learning style of these Netgen students defined by Skiba and Barton (2006). By using the game, students' interest was raised and this attracted them back to the library resources as shown in the following excerpt:

> *"...they did a pilot with a number of undergrad students at the main campus and at the medical library, they developed a game just at a pilot to train them in information literacy, and the students could play and while playing this game they could learn. ... That was very successful, we got very good feedback from the students ... the students were very very excited about this..."* (Librarian 1-SA)

The librarians also created blogs to engage directly with these users. For example, they encouraged students to post queries about their difficulties in doing assignments in the library blogs and put up notices in the library encouraging them to blog (see Figure 12 below):


**Figure 12: A blog's notice in the library (Source: Research fieldwork)**

### 7.1.2 Absence of flexible technologies in the design process

The research findings also established that absence of these flexible technologies could contribute to poor impact of innovation as well as the sustainability of projects. Kenya's educational library project (project 5) particularly highlighted a disconnection between technology innovation, user centeredness and sustainability of the digital resources developed. The system was designed around universal web-based resources of international databases and was intended to meet the needs of students and academics. However, this system avoided the use of flexible technologies to customize these resources to the needs of use. This in turn meant that the needs of individual departments and users were not always met. For example, academics and students needed personalized digital resources to support their teaching and learning needs, but were not using this generic library as it was not

meeting their needs:

> *"I do not use the resources here."* (Student –KEN)

In order to personalize their information needs, research findings established that these users were designing their own personal systems that fitted those needs. For example, academics created personal portals where they uploaded relevant digital resources to support students' needs:

> *"... A few lecturers out of their personal initiatives have their personal portals..."* (Students -KEN)

Another example is where some students wanted local information which they could share. As this was not provided for, they got together with their lecturer and created a website which used Web 2.0 applications (Facebook and blogs) to meet their need for customization of local information and knowledge sharing as confirmed during interviews with the lecturer:

> *"It is the students who came up with this idea and said "why don't we build our own site?" So we constructed our own site with these students who are actually agriculturists. .. It's called Try-African-Food."* (Academic 2 -KEN)

According to the students, developing such personalized portals enabled them to customize agricultural information they had obtained from their research so that others would benefit from it as well:

> *".... So we are making it a lot easier for people to access the same information ... repackaging to reach the clientele we want to reach. Lets take an example of our local food... this kind of food has some nutrition benefits, and you repackage this into various information i.e. how to cook it etc."* (Student -KEN)

This personalization happened without support of the library systems or the skills of the librarians. In this example, it is plausible that lack of flexible technologies in the project

to help meet the users' needs partly made that university library less usable. This situation was also encouraged by the lack of supportive national and institutional policies which also affected stakeholder collaboration and appropriate skills utilization (see Subsection 6.5.2 and 7.2.4). Although the institution had skilled librarians and academics, they were unable to collaborate and come to a joint understanding about the needs to be met by the system. The resultant situation was that users found their own ways of dealing with information sharing needs. However, these approaches often lacked wider university impact and were unsustainable due to limited resources (i.e. only a few individual students) to maintain them. For example, the student's website has since become deactivated. A possible explanation is that these students who were in their final year then have moved on and left no one to take up the portal maintenance.

## 7.2 THE ROLE OF POLICIES IN THE DESIGN PROCESS

Policies at national and institutional levels across the digital library projects reviewed appeared to play a very crucial role in the design process. The range of policies reviewed consisted of policy statements, directives, guidelines, rules and regulations, strategic plans and performance contracts. Their presence had a dramatic impact on the success and sustainability of the projects. To begin with, they motivated and supported people to initiate projects within the institutions. They were used to influence projects' funding. They also sustained the design process by supporting multidisciplinary stakeholders working collaboratively with the technology. However, where these policies were absent in the design process, innovative technologies failed to be properly implemented and supported within the projects, thus making these projects unsustainable. This also had negative impact on successful collaboration as multidisciplinary stakeholders failed to collaborate and use

their skills in the design process within the projects.

Further data analysis showed that the way these policies impacted on the design process differed across the three case studies at both national and institutional levels. On the one hand, there were policies that facilitated project inception and stakeholders' collaboration within the design process. On the other hand, there were those that provided enforcement. For instance, policies in the South African case study mainly provided enforcement while in the Ugandan case study they were facilitating the process. The Kenyan case study lacked any contribution from policies in the design process of the projects identified. As will be further explained, this variation seemed to suggest presence of important cultural differences across the countries in which case studies were located (see Subsection 7.2.1 and 7.4.2 below).

The following subsections present these research findings by first describing the nature of policies identified across all the projects. The specific roles of these policies in the collaborative design process are then presented followed by an illustration of where projects failed as a result of the absence of policies. These are summarized in Table 7 below:

**Table 7: Summary of policies and their impact across the three countries**

| Policies | South Africa | Kenya | Uganda |
|---|---|---|---|
| **National** | Republic of South Africa's White Paper on e-education | • Republic of Kenya ICT Policy<br>• Republic of Kenya Ministry of Education, Science and Technology Sessional Paper no.1 | • Republic of Uganda Universities and other Tertiary Institutions Act<br>• Republic of Uganda Health Sector Strategic Plan |
| **Role of policies** | Enforces initiation of projects and stakeholder collaboration | No policy support | Facilitates initiation of projects and stakeholder collaboration |
| **Institutional** | • University of Pretoria Strategic Plan 2007-2011<br>• University of Pretoria AIS (Library) Strategic Plan 2007-2010<br>• University of Pretoria Open Access Mandates<br>• Education Principles | • University Strategic Plan<br>• Library strategic plan<br>*(Kenyan university policies not referenced to anonymize identity)* | • Makerere University Library strategic plan 2007-2017<br>• Makerere University Research and Innovation Policy<br>• Makerere University Intellectual Property Management Policy<br>• Makerere University ICT Policy |
| **Role of policies** | Enforces initiation of projects and stakeholder collaboration | No policy support | Facilitates initiation of projects and stakeholder collaboration |

### 7.2.1 Nature of policies in the collaborative design process

Documentary analysis identified a range of different types of policies that impacted on the collaborative design process across the various digital library projects reviewed. These were policies at the national and institutional levels as well as those from external bodies such as funding agencies.

### *(i) National policies*

These were policies at the national level impacting on the operations of the projects. In the South Africa case study for example, the country's Department of Education produced a National White paper on e-education (Republic of South Africa, 2004) that was identified as impacting on the technology use in teaching and learning at the university:

> *"The introduction of information and communication technologies (ICTs) in education represents an important part of Government's strategy to improve the quality of learning and teaching across the education and training system. The policy intention is to focus on learning and teaching for a new generation of young people who are growing up in a digital world and are comfortable with technology...." p. 19*

In the Ugandan case study, the Universities and Other Tertiary Institutions Act (Republic of Uganda, 2001) supports quality higher education, promotion of research and advancement of learning. Additionally, Uganda's health sector strategic plan (Republic of Uganda, 2009) was found to support one of the projects reviewed (project 11) by making a provision for the use of ICTs in the dissemination of health information:

> *"ICT mainstreaming/integration in healthcare delivery will facilitate the implementation of the National Health Policy and help in co-ordination of health information for planning and decision making, as well as effective sharing of the scarce resources for optimal health care delivery for all Ugandans."* p.67

As mentioned before, national-level policies in the Kenyan case study failed to provide support in the design process for educational digital resources. Educational related policies at national level showed a lack of connection with development of educational digital resources as well as the exploitation of ICT in supporting teaching and learning at the institutional level. For example, the Ministry of Education, Science and Technology Sessional Paper No. 1 (Republic of Kenya, 2005) is a recent key policy document which

defines the use of ICTs in addressing national educational challenges of the 21st century. Yet, it makes no mention of educational digital resources. The National ICT policy (Republic of Kenya, 2006) does attempt to make a connection by encouraging the use of ICTs in teaching and learning at the universities. However, there was no evidence that the university applied this policy explicitly in its operations as there was no relationship between the policy and the university strategic plans as was the case for the Ugandan and South African case studies.

***(ii) Institutional policies***

The second type of policies was at the institutional level. What is interesting to note here was the explicit relationship that existed between the national policies and these institutional ones. In the South Africa case study, the university's strategic plan[50] was identified as being implicitly influenced by the national White Paper by including use of ICT in teaching and learning (see Subsection 5.1.3). This in turn impacted on the departmental policies. For example, the library's strategic plan included the e-library strategy[51]; consisting of learning and e-learning facilitation and the open scholarship among other aspects. These supported the university's strategy to use technology in teaching and learning. This was then translated to individual staff performance contracts. For example, one of the librarians described how:

> *"...each information specialist as part of their performance contracting is expected of them to develop some of these tools, so that they can feed in to the plans, and they get evaluated on how they implemented these tools, and how successful it was etc."* (Librarian 1-SA)

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[50] University of Pretoria Strategic Plan 2007-2011
http://web.up.ac.za/default.asp?ipkCategoryID=2995&subid=2995&ipklookid=2
[51] University of Pretoria AIS Strategic Plan 2007-2010
http://www.library.up.ac.za/aboutus/doc/stratplan07_10.ppt

In order to support the open scholarship component of the library strategy, the Open Access Mandates[52] were developed by the library staff which enforced students and academics to deposit their research output in the institutional repository. These mandates cover the following aspects:

> *"To assist the University ... in providing open access to scholarly articles and conference papers resulting from research done at the University, and which are wholly or in part supported by public funding, staff and students are required to submit peer-reviewed postprints of their articles and published conference papers to UPSpace, the University's institutional repository...Each student should submit paper and electronic copies of his/her thesis/dissertation to the Postgraduate Office of the relevant faculty... Alternatively students may self-submit their theses/dissertations to the UPeTD system."*

Additionally, the Education Principles[53] developed by the department responsible for the E-learning design and development, supported the university's strategic plan by ensuring that all teaching practices used technology-based learning platforms (i.e. the VLE).

> *"All teaching practices, in both contact and distance, should use appropriate combinations of resources to support learning, such as ...technology-based learning platforms."*

This was reinforced by requiring the academics to use the VLE:

> *"I know that the university would like us to actually embrace [the VLE], as part of the policy."* (Academic 1-SA)

A similar scenario was identified in the Uganda case study. The university's strategic plan[54] was framed within the provisions of the national's Universities and Other Tertiary Institutions Act, 2001. This is set out explicitly at the beginning of the plan:

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[52] University of Pretoria Open Access Mandates http://www.library.up.ac.za/openup/mandates.htm

[53] University of Pretoria Education Principles http://web.up.ac.za/default.asp?ipkCategoryID=105&ipklookid=2

[54] Makerere University Strategic Plan 2008/09-2018/19 http://mak.ac.ug/documents/policy/STRATEGIC%20PLAN%20NEW.pdf

> *"The ...University Strategic Plan 2008/09-2018/19 is developed in the quest to provide quality higher education, promote research and advance learning as provided for in the Universities and Other Tertiary Institutions Act, 2001"*

This top-down effect was also felt at the departmental level. For instance, the university's strategic plan states explicitly that:

> *"The University Library services play a crucial role in providing support to the functions and intellectual development of the University. The cornerstone of the strategies in the current plan is anchored in ensuring a user-centred Library and Information Service and sustaining effective institutional linkages."*

In its strategic plan, the library acknowledges this role and frames its strategic objectives around it. This library strategy is in turn supported by other institutional policies which include the ICT policy[55] that has an e-learning component and explicit support for the library information systems. The Research and Innovations Policy[56] and Intellectual Property Policy[57], both support the implementation of the Open Access component in the library's strategic plan, which is one of the projects identified for this research (project 7).

Another relevant example of how this top-down effect was identified is in the implementation of the Problem Base Learning (PBL) digital library resources. The university's strategic plan defines learner centeredness as a refocus from teacher centred instruction to learner centred problem based learning. The College of Health Sciences implemented this focus by having a curriculum change with a focus on PBL.

The Kenyan case study lacked examples of institutional policy support within the identified projects, just as was the case with the national policies. For example, this could be seen in

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[55] Makerere University ICT Policy
http://mak.ac.ug/documents/policy/Makerere%20University%20ICT%20Policy%20(2005-2009).pdf

[56] Makerere University Research and Innovation Policy
http://sgs.mak.ac.ug/files/MAKERERE%20UNIVERSITY%20RESEARCH%20POLICY.pdf

[57] Makerere University Intellectual Property Management Policy
http://policies.mak.ac.ug/downloads/MAKERERE_UNIVERSITY_IPM_POLICY.pdf

the case of the university library that implemented a digital library service out of its own mandate with no support from institutional policies as pointed out by one librarian:

> *"It is [mandate to provide digital resources] through the strategic plan which we have designed ourselves, the library's strategic plan. The university does not care much because there is no time they have told us that you have to get digital resources. The mandate comes from the library, it is not a mandate from the university."* Librarian –KEN

***(iii) External policies***

The last type of policies identified in the research findings were externally generated policies. In particular, a project donor from one of the projects (project 11) introduced guidelines for use of a project management tool that ensured stakeholders worked together from the beginning of the project:

> *"...it was a requirement for us to use that approach [project management tool] in defining the project's key parameters such as impacts, outcomes, outputs, and activities..."* (Project administrator-UG)

This supported the collaborative design process of that project.

As mentioned in Section 7.2, the above description of policies reveals that they differed across the three case studies. For example, policies in the South African case study appeared to enforce the design process. This was evident for example through staff performance contracts which ultimately enforced the top-down effects of the policies, and the Open Access Mandates that enforced stakeholder participation. Policies in the Ugandan case study were somehow facilitating the collaborative design process. Though they appeared to lack the enforcing effects of the South African case study policies, they still enabled the collaborative design process to occur within the projects. The Kenyan case study lacked any policy support. Policies at the national level were not articulated at the

institutional level, and institutional policies failed to support collaborative design processes within the projects. As will be discussed in Subsection 7.4.2, this variation reveals some interesting findings about cultural variations across different African countries. This is an important contribution to HCI design processes especially when considered within the African context.

### 7.2.2 Policies supporting project initiation

The research findings established that policies supported initiation of the 'best practice' projects either through enforcement or facilitation. For example, the top-down effect of the national policies to institutional and departmental levels enforced the library in South Africa to use innovative technologies as seen below, and ultimately initiating projects such as project 1 and 2:

> *"...the university supports the government's Department of Education, and university in their strategic plans say that we are going this e-route, that helps the library because we support the e-strategy of the university plus what we do is that each staff member has performance contract brought in line with that strategy."* (Librarian 1-SA)

Similarly, initiation of e-learning VLE project 3 was enforced by the Education Principles:

> *"All teaching practices, in both contact and distance, should use appropriate combinations of resources to support learning, such as ...technology-based learning platforms."* Education Principles

In the Ugandan case study, some projects were also initiated through the facilitation of certain national and institutional policies. For example the PBL digital resources (project 10) resulted from a curriculum change in one of the colleges facilitated by the university's strategic plan. This curriculum led to the inception of a tailor-made digital library resource specially developed to support the PBL students. This included a digital collection

supported by a dedicated information intermediary and appropriate technology infrastructure as observed by a student:

> *"...we have quite a number [computers], we have personal laptops, they make us have access to the wireless, so am able to use Internet ..."* (Student 3-UG)

This was corroborated by an academic who described how the library had become well equipped with technology and hence facilitating increased access to information:

> *"Well, first of all in terms of accessibility, a few years ago they were inaccessible. We had very few computers, very few well trained staff to assist, and so you would not get the information at the time you wanted it. But I would say that since last year or so, the facility has improved in terms of more computers in the library, ... they are having their own Internet connection, wireless connection ..., so in a way the information accessibility is increasing, meaning that the student or member of staff have time to do these searches on their own."* (Academic 3-UG)

The information intermediary was used to facilitate the access and utilization of this PBL service:

> *"whenever researchers come here, we are able to satisfy their needs by giving them the relevant information they are looking for, either by getting the information on spot through assisting them from here or those who want to know how to use the major medical databases to research, they can ask you if you are able to teach them so that they can go and access them."* (Information intermediary-UG)

Another example was the design of a college knowledge management system which was initiated following a university's ICT taskforce aimed at creating visibility of university's knowledge. This facilitated academics and librarians to design a system of consolidating and managing knowledge in such a way that it could be accessed electronically.

> *"It was a collective directive initially because we realized the importance of ICT both in course development and across the college... Because the university is realizing more and more that it is a knowledge community."* (Academic 2 -UG)

Another way policies facilitated the initiation of projects was through influencing project

funding. This was apparent in the Uganda's clinical mobile digital library (project 11). The project's funding agency (IDRC) produced guidelines for use of a project management tool to influence collaboration process among stakeholder and this had obvious implication on continued project funding (see Subsection 7.2.1).

Lastly, policies facilitated project initiation by providing an environment where staff members were encouraged to innovate. For example, the library's e-library strategy in South Africa case study encouraged creativity among librarians who in turn were able to design projects that improved their service delivery. One librarian commented:

> *"The best part of this library is that you are allowed to do new things, and experiment and do research about new things, that to me is the best thing."* (Librarian 4-SA)

### 7.2.3 Policies supporting collaboration in the design process

Policies also supported stakeholders working collaboratively in the various projects. As already mentioned in Subsection 7.2.1, one way this happened was through enforcement. For example, librarians in South Africa case study were expected to participate in the development of the VLE (project 3) and seamlessly integrate digital resources. This was enforced by the library's Learning and eLearning Facilitation Strategy. One librarian commented:

> *"...we work very close with the lecturers in setting that up, we do that together with the education innovation department of the university, it's a three way engagement ...it is an official process."* (Librarian 4- SA)

Similarly, academics were expected to participate in the development of the VLE and were evaluated on the basis of how many modules they had uploaded onto the VLE.

> *"...one of the measurements that the university uses is the number of [VLE]*

> *modules that there are. So the deans are measured against those numbers...I know some heads of the departments that write it into the performance management agreement every year of the staff that they must have [VLE] modules."* (E-learning specialist-SA)

Another example where policies enforced collaboration was in the design of South African case study's institutional repository (project 2). Development of this repository depended on librarians working collaboratively with academics and students so that they could provide their research output. The domain champions used the Open Access Mandates to enforce this by making it compulsory for academics and students to deposit their academic output in the institutional repository and consequently collaborate with the librarians (see Subsections 6.3.3 and 7.2.1).

The other way policies supported stakeholder collaboration in the design process was through facilitation. This was mainly observed in the Ugandan case study projects. For example, the development of the clinical mobile library project (project 11) involved collaboration of different stakeholders in the university, ministry and with external collaborators. The project funder introduced guidelines through a project management tool that facilitated all stakeholders to be involved throughout the project development process.

> *"The [project management tool] is a participatory Planning, Monitoring and Evaluation methodology where the all stakeholders including the primary beneficiaries meet in a workshop environment together with the donor and implementers and agree on results and how they will be attained."* (Project administrator- UG)

This project was also indirectly supported by the university strategic plan which encouraged collaboration with the public and private sector institutions through a strategy of knowledge transfer and partnerships outside the university. The university strategic plan also recognized that the library is central to the operations of the university and in

supporting its strategic plan and institutional linkages. This encouraged and supported librarians to collaborate with other stakeholders in some of the projects. For example, they collaborated in the digitization of a music collection project where they used their expertise to design and implement the project. One librarian commented:

> *"We are supposed to support teaching and learning in the university and one of the university departments is the Music and Drama."* (Librarian 4-UG)

Another example was the development of the institutional repository where the library was expected to collaborate with university's research community to develop this portal. Besides the university's strategic plan empowering the library to take lead, other policies facilitated the collaboration process. For example, the Research and Innovation Policy and the Intellectual Property Management Policy facilitated the depositing of the university's research output including students' theses and dissertations with the library.

### 7.2.4 Policies absent in the design process

As noted in Subsection 5.2.3, projects in the Kenyan case study were not supported by policies. This case study therefore provides an example where lack of policies in the design process led to poorly supported and unsustainable educational digital resources. The projects reviewed focused on designing information systems collaboratively with the users. They also had adequate technological support. However, they operated within a national and institutional policy vacuum.

This was particularly evident in the development of university library digital resources. These being learning resources, it was expected that academics and librarians were collaborating to develop resources that were learner-centred. However, findings of this project revealed that the existing national and institutional policies failed to support the

collaboration between e-learning designers and digital library specialists in the design process. There was no link between the university's strategic plan and the national policies with regard to the development of these technologies. Further, this university strategic plan failed to provide adequate support for the design of technologies at the departmental level and so development of the digital library resources was left entirely to the library with no support from the institution. One librarian commented:

> *"The university does not care much because there is no time they have told us that you have to get digital resources. The mandate comes from the library; it is not a mandate from the university"* (Librarian –KEN)

This absence of policy support seemed to weaken the collaboration process between educational technology stakeholders. For example the e-learning people failed to see the role of integrating or using the library's digital resources and one commented:

> *"...we do not have a deliberate arrangement with the library"* (E-learning specialist-KEN)

Ultimately, the system developed was weak, lacked input from e-learning people and hence failed to meet the needs of the learners.

As already mentioned in Subsection 7.1.2, another effect was that this lack of policies impacted on the effective use of innovative technologies to support tailoring of the digital library system to meet the needs of the project. For example, users of the digital library resources (project 5) wanted to personalize these resources to fit their needs but there was no support for this. As a result, they tried to deal with their information needs by developing their own personalization approaches. These approaches lacked sustainability as they were purely on individual basis and not integrated within or supported by the

institution.

The agricultural knowledge management system (project 4) had strong collaboration component among stakeholders in the design process. However, because it lacked policy support, this affected its sustainability and it has come to an end since the project life has ended. This contrasts with clinical mobile library (project 11) in Uganda, which was also a community-based project but supported by policies as already established. Some of the stakeholders were also policy makers and one of them (from the Ministry of Health) has taken over the operation of the project ensuring its sustainability (see section 6.4).

## 7.3 THE CONTRIBUTION OF THE POLICIES AND INNOVATIVE TECHNOLOGIES TO THE PROJECT OUTCOMES

As already identified in preceding sections, policies were very crucial in supporting design processes within the projects. They supported project initiation and the use of innovative technologies especially flexible technologies to enable tailoring of projects according to users' needs. They also supported stakeholder collaboration. This led to successful project outcomes evidenced by the following indicators: (i) stakeholder engagement; (ii) transformation (in learner centred digital resources, changed practice among stakeholders, creation of projects' visibility); and (iii) project sustainability. Some of these outcome indicators which were specific to the human relationships factor have already been presented in Section 6.4. The following examples represent those outcome indicators that were directly linked to the role of policies and innovative technologies.

The first example was the way educational digital resources were transformed to become more learner-centred and appropriate as a result of existing digital resources having been tailored through the use of flexible technologies. This was evident for example in project 1

where the usage of digital library resources was increased as reflected in a library survey and students' feedback on the virtual game pilot as seen below:

**Evidence 9:**

1. The 2009 LibQual Survey indicates that out of 2264 undergraduate student respondents:

   81% find the library website an enabling tool for independent work

   80% commend the staff for their willingness to help

   80% find the electronic resources needed for their studies

   79% regard the library as a haven for study, learning and research

   ***Source:***

   University of Pretoria Library Services (2009). Contribution to UP Excellence 2009, University of Pretoria.

   http://www.library.up.ac.za/quality/docs/ContributionToUPExcellence2009.pdf

   (Accessed on 4 Mar 2010)

2. Users' feedback in the Virtual game pilot project:

   *"...the game was fun, modern, doable, informative and quite interesting!; ...It was not at all dull or anything, it rocked!; ...awesome idea of using the game instead of just a boring talk"*

   ***Source:***

   Van Wyk, J. (2009). UP Library Service's Web 2.0 Journey. Knowledge Management Practitioners Group of Pretoria Meeting. CSIR Knowledge Commons, Pretoria.

   http://www.up.ac.za/dspace/handle/2263/12792 (Accessed on 4 Mar 2010)

This was also corroborated by the commendation provided by the South Africa's HEQC as described in evidence 2 (see Section 6.4)

The second example of this transformation could be seen in changed practice among digital resources users. This was demonstrated in a number of ways. For example, in project 11, rural clinicians were able to provide better clinical services to their patients because they could now access relevant digital resources through their PDAs. This was supported by the

following evidence:

**Evidence 10:**

1. *"I remember someone saying during one of the field trips I made, that that drug database had been very useful to them because he was about to make a very big mistake in handling an HIV patient who also had TB but because he referred to that drug database he was able to see that a certain drug cannot be given to a patient with those two conditions"* (Proj. 11 Project administrator)

   ***Source:***

   Fieldwork: Interview with the project administrator

2. *"We have seen changes in practice, particularly around treatment for diarrhoea. We emphasize in the medical treatment alerts that we send to the handheld devices in the clinics that rehydration therapy is strongly recommended as a first course of action, particularly with kids. We have evidence that this is now used much more often as a first course of action in those clinics."* (Holly Ladd, Director of AED-Satellife, Pg 16)

   ***Source:***

   http://mobileactive.org/files/MobilizingSocialChange_full.pdf (Accessed on 4 May 2010)

3. *"UHIN has had very encouraging success by empowering health workers with appropriate technology that allows them to more effectively collect, share and access health information. The potential for the UHIN model to improve the efficiency and effectiveness of Ugandan health care, especially in remote areas, is enormous."* (Dr. Nelson Sewankambo Board Chair, Uganda Chartered HealthNet)

   **Source:**

   http://www.idrc.ca/en/ev-86353-201-1-DO_TOPIC.html(Accessed on 4 May 2010)

The impact this good practice had was not just felt among the rural clinicians but also with medical students (who were part of the PBL project 10). During the fieldwork, the researcher observed that these students moved with PDAs in their pockets whenever they did hospital ward visitation. These PDAs were loaded with digital reference materials which students could quickly consult before writing drug prescriptions. One student commented:

> *"...once in a while we use palmtops, ... when you want to make a quick reference of dosages, counteractions because sometimes you want to give two drugs but you want*

*to be sure and counteract the reaction of the other."* (Student 5-UG)

Another example of how innovative technologies led to changed practice was noted in project 8. Students' involvement in the digitization of music collection led them to start using software to record their music as they collected it during field trips. This ultimately avoided digitalization of newly recorded music as it was already digitized at source, hence simplifying the resources' design process:

> *"...they have access to software and they do the recording using their laptops."* (Librarian 4-UG)

The third example of transformation occurred in the creation of projects' visibility. The use of DSpace in the five projects noted earlier which were supported by policies and the stakeholders' collaboration and skills increased visibility of these projects. As described in Section 6.4, this was evidenced by project 2 being noted among top 500 international institutional repositories and comments from university community (evidence 5 and 6 respectively) and in the Uganda case study high rating of the institutional repository and college knowledge management projects in the internal webometrics (evidence 7).

Lastly, the presence of policies ensured sustainability of the projects as they became embedded into the operations of the institutions. Also, by including a policy maker (Ministry of Education) as a stakeholder, project 11 has now been taken up by the ministry, thus ensuring sustainability (see evidence 8, Section 6.4).

## 7.4 IMPLICATIONS FOR THE HCI DESIGN PROCESS

### 7.4.1 The role of innovative technologies in the collaborative design process

This research has identified existence of innovative technologies within the 'best practice'

projects, which supported collaborative design processes. They included universal technologies (i.e. web-based databases and mobile devices). There were also certain applications (referred to in this thesis as flexible technologies). These technologies had flexibility that enabled customization of existing universal technologies to meet specific institutional and subject discipline needs. They included Web 2.0 applications and DSpace Open Source Software. Multidisciplinary stakeholders who were facilitated by design champions, collaborated to use these technologies and were supported by national and institutional policies. This resulted in successful collaborative design processes. These findings have relevant contribution to HCI, especially within the topic of HCI for development (HCI4D). More specifically, they contribute towards our understanding of how design processes can be enhanced to become more context-relevant in order to meet the intended user needs.

To begin with, it is important to first understand strengths and weaknesses of universal technologies so that we can appreciate the important role the flexible technologies were playing in the collaborative design process. Universal technologies are premised on the fact that products, communications and built environment should not be for any specific population but for as many users as possible (Ornella and Stephanie, 2006). This has brought about unprecedented technological advancement in all areas including education. For example, as highlighted in Chapter 2, developments in digital libraries and open educational resources (OER) are helping overcome the challenge of accessing quality learning resources in African higher education. However, these universal technologies can be too broad and generic to cater for specific needs of a range of different users because they are standardized for universal usage. An example is use of web-based resources

designed to operate under broadband Internet. These become a challenge to use in bandwidth constrained environments (e.g. within the African context) (see Dray *et al.*, 2003; Brewer *et al.*, 2006; Sambasivan *et al.*, 2010; Wyche *et al.*, 2010). They would require customization in order to fit particular contexts. This has been a topic of interest within HCI4D (see Subsections 1.1.1 and 3.2.3).

The presence of flexible technologies (DSpace Open Source Software and Web 2.0 applications) in some of the projects researched seems to provide this customization. The flexibility identified in these technologies allowed existing universal technologies to be customized to make them relevant to the needs of the users. This was supported by national and institutional policies as well as multidisciplinary stakeholders who were facilitated by design champions to collaborate and apply their skills in this process. This in turn resulted in better innovation that was sustainable and had the desired impact (i.e. was user-centred, created projects' visibility and improved practice among stakeholders). It is this flexibility present in these technologies that was crucial in the customization process. Bardzell uses the concept of a 'quality of pluralism' to describe certain design artefacts which *"resist any single, totalizing or universal point of view"* [Bardzell, 2010, p.1305]. These flexible applications in the researched projects appear to have some resemblance with Bardzell's description. By being flexible enough to customize universal technologies, they dissolved the universality of the generic (universal) technologies.

These research findings present an approach which designers can use in situations that demand customization of universal technologies. This approach shows that you can start with existing universal technologies. Then customize them by using these flexible technologies, supported by national and institutional policies, and stakeholders

collaborating and using their skills in this process. The outcome of this process is customized innovation that is relevant to the needs of the context. This outcome can be said to be an improvement on initial technologies because they are more relevant to the needs of users, a fact supported by several authors (e.g. Smyth *et al.*, 2010; Wyche *et al.*, 2010).

Finally, the role of customization was provided primarily through Open Source Software (DSpace) and Web 2.0 applications (flexible technologies). The value of Open Source Software and Web 2.0 applications in creating flexibility for project design processes meant that these projects were able to be customized to contextual needs. However, this research did not identify appropriately if other applications that are not supported by the Open Source Software and the Web 2.0 application can also effectively present these flexibility features. For instance, can universal digital library systems provide this customization by simply allowing increased flexibility to enable developers and end-users to personalize these resources? Further research is needed to understand other approaches to customization of existing universal technologies (see Chapter 9).

### 7.4.2 The role of policies in the collaborative design process

National and institutional policies identified in this research appeared very crucial to the success of collaborative design processes of 'best practice' projects. As identified in Subsection 7.2.3, these policies initiated projects and influenced their funding. This happened through enforcement and facilitation approaches. Policies also enforced or facilitated multidisciplinary stakeholders collaborating and using their skills in the design process (Subsections 6.5.2 and 7.2.3). Design champions (i.e. domain champions) used policies to enforce engagement among various stakeholders within the design process. Policies also supported stakeholders to use flexible technologies to customize existing

universal technologies to meet specific needs. They influenced an environment that was conducive for technological creativity among stakeholders, which led to use of these flexible technologies.

As highlighted in Section 7.3, presence of these policies resulted in successful collaborative design processes which had positive project outcomes. This included project sustainability, visibility, stakeholder joint participation and user-centred resources. However, their absence resulted in projects that were unsustainable and failed to meet user needs. This was particularly evident in the Kenyan case study's university library digital resources project (Project 5). Lack of policies in this institution meant that qualified stakeholders failed to collaborate in the design process. Though they could use flexible technologies (DSpace and Web 2.0 applications) to customize existing technologies, they failed to do so. The library digital resources remained as they were, did not benefit from these flexible technologies, and hence users were left to sort out their own information usage needs. This also led to unsustainable projects (Subsection 7.2.4).

These findings extend our understanding of the role of policies in HCI design processes. As identified in Subsection 3.2.1.1, existing related literature (e.g. Bederson *et al.*, 2006; Winter, 2006; Inglesant and Sasse, 2007; Jaeger *et al.*, 2007; Lazar *et al.*, 2008; Shneiderman, 2010) tends to focus on the role of public policies. However, this research has revealed interesting findings about the important role of national and institutional policies in collaborative design processes for institutional technological innovations. They appeared to dictate project initiation and funding, and supported stakeholder collaborations, leading to well supported collaborative design processes and successful, sustainable projects. Their absence appeared to stifle the collaborative design process and weakened

technology innovations within an institution.

Research findings also showed that presence of policy makers amongst multidisciplinary stakeholders was very important in influencing application and impact of these policies. As highlighted in Subsection 6.3.2, multidisciplinary champions were able to identify this category of stakeholders and include them amongst other stakeholder. This particularly happened in the Uganda's clinical mobile library (project 11) where a funding agency (IDRC) was part of the stakeholders but had policy making role within the project; they introduced guidelines that encouraged stakeholder collaboration. In the same project, the Ministry of Health was also part of the stakeholders. They are policy makers and have taken on solutions provided by this project after it has come to an end, thus ensuring project sustainability.

These research findings have important implications for HCI. In order to have collaborative design processes, these findings suggest that HCI design researchers and practitioners should integrate national and institutional policies in the design process for institutional technologies. They should also include policy makers as a key component of multidisciplinary design stakeholders. Taking such approaches will support collaborative design processes for institutional technologies and ensure that these technologies are successful, sustainable and appropriate for the intended purposes.

The fact that the role of national and institutional policies in the design process differed from case study to case study is interesting and provides important insights when considering HCI design processes especially within the African context. As noted in Subsection 7.2.1, policies in the South African case study appeared to have an enforcing effect while those in the Ugandan one were facilitating. In Kenya, policies were absent in

the design process. This variation appears to suggest cultural differences across African countries, given that each case study represented a particular African country. It can be argued that the culture in South Africa relies more on enforcement where policies are designed and implemented to enforce certain functions whilst the Ugandan set up is more about persuasiveness. The Kenyan situation appears to have a weak policy structure that fails to offer positive impacts.

What does this variation tell us about Africa as a continent in relation to how different national cultures affect policy design and implementation and how this in turn can impact on HCI technological development? Could the enforcing situation in South Africa be linked to the historical development of this country, perhaps as a means of instilling a culture of accountability within the government to counteract the effects of the apartheid rule? Could this be the outcome of a state-driven linear notion of progressive policy formulation and implementation through the transformation process from the apartheid era as alluded to by Cloete (2002)? Are there cultural aspects of policy design and implementation that designers of HCI technologies especially those related to HCI for development (HCI4D) should be aware of? While policy design and implementation is not the focus of this thesis, these are interesting questions to bear in mind when thinking about HCI design processes in Africa. Although collaborative design processes in the South African and Ugandan case studies benefitted from these policies regardless of their apparent cultural differences, understanding this variation makes an interesting contribution into HCI design processes within Africa and broadly within the topic of HCI4D (see Chapter 9).

This variation further helps to confirm previous work which states that Africa is not homogeneous but has great diversity across different countries in terms of socio-economic,

cultural, political and technological contexts, as well as in institutional capacity, policy formulation and implementation (see Bateman, 2008; Visser, 2008).

## 7.5 CHAPTER SUMMARY

This chapter has continued with the discussion started in the previous Chapter 6, which focussed on one of the three factors identified in Chapter 5 (i.e. the *human relationships factor*). The chapter has presented and discussed the remaining two factors (i.e. the *innovative technologies factor* and the *policies factors*).

The research findings have revealed that the innovative technologies factor consisted of universal technologies and flexible technologies. Flexible technologies included two types of applications that had flexibility features (i.e. DSpace Open Source Software and Web 2.0 applications). This flexibility allowed customization of existing universal technologies in order to meet intended needs. The research has suggested that there is need to understand this flexibility and establish if other technologies can also allow this kind of flexibility.

The role of the policy factor was found to be very crucial to successful collaborative design processes. Research findings established that this factor consisted of national policies and institutional policies which supported project initiation and stakeholder collaboration (alluded to in the previous chapter). The presence of these policies led to successful collaborative design process and positive project outcomes while their absence led to stifled design processes with weak and unsustainable projects.

The chapter has also highlighted an interesting aspect suggesting certain cultural differences across the three countries researched. The role of policies across the three case studies was different. It appeared like South Africa has a culture that is enforcing while

the Uganda's approach is persuasiveness. Kenya appears to be weak in policies. This variation reinforces existing literature that confirms the heterogeneity of the African continent, but also makes interesting contribution to the HCI4D body of knowledge.

These findings of the innovative technologies factor and policies factor, along with the human relationships factor (Chapter 6), are central towards providing guidance for the collaborative design process for learner-centred educational digital resources in African higher education. These three factors offer a means of providing a collaborative design process that can lead to sustainable and learner-centred resources where all key stakeholders are supported in the design process.

The research has ultimately developed a grounded theory about the relevant factors necessary for 'good practice' in educational digital library design processes. All the three factors (i.e. human relationships factor, innovative technologies factor and policies factor) are important for collaborative design process of effective and sustainable educational digital resources in African HE. If one of them is missing, then the collaborative design process is weaker, and this can lead to unsustainable digital resources that are not user-centred similar to what was identified in the Kenyan case study project 5.

The next chapter has used these factors to suggest a collaborative design process model (the Collaborative Educational Resource Design process model – CERD) that can be used to provide guidance to designers of educational digital resources.

# Chapter 8: The CERD process model in an African HE Context

The overarching aim of this thesis was to provide guidance on how learning designers and digital library designers can be supported to collaborate in the design process to enable them to create learner-centred educational digital resources in African higher education. Consequently, an empirical investigation has been carried out seeking to answer two research questions:

- *What are the existing factors that can be used to support a collaborative design process for educational digital resources in African higher education?*

- *What are the characteristics of these factors and the roles they play in the collaborative design process?*

The findings of this investigation have been used to develop the Collaborative Educational Resources Design (CERD) process model which can act as guidance for collaborative design process to designers of educational digital resources in African HE. The model has been developed from a multidisciplinary perspective and eventually being reviewed by multidiscipline experts (see Section 8.4).

This chapter presents the CERD process model. It first provides a rationale for the model's development, detailing its purpose and intended users. It then details the steps followed to develop the model, followed by a detailed description of the model. Model reviews completed by experts from different domains and a discussion on how the issues raised have been dealt within the thesis are then presented. The chapter ends with a description of the different ways in which the model can be applied using a set of guidelines, and a

diagrammatical representation of the CERD process model.

## 8.1 THE RATIONALE FOR THE CERD PROCESS MODEL

The CERD process model presented in this chapter has been developed within African HE context. This model has been inductively developed by identifying factors present in design processes for 11 'best practice' digital library projects. These projects were identified from case studies located in three African countries (see Chapters 4, 5, 6 and 7).

Development of this model was motivated by a design chasm often present between designers of digital libraries and designers of learning programs (educational digital resources stakeholders) with reference to African HE (see Chapter 1). These stakeholders work in 'silos' and fail to collaborate and share their different expertise. This usually results in design of educational digital resources that fail to exploit the expertise and technological advancements currently taking place in the fields of information sciences and e-learning. Ultimately, this lack of connection between these stakeholders often leads to educational digital resources being developed which are not always aligned to learners' needs. This design chasm can be reduced by designing these resources collaboratively with the educational digital resources stakeholders. However, review of related studies suggests existence of a knowledge gap in how to design collaboratively with these stakeholders in the African HE context (Chapter 3).

The purpose of this CERD process model is therefore to provide design process guidance for designing educational digital resources together with key stakeholders (e.g. digital library designers, librarians, academics, e-learning technologists, and students) within African HE context.

## 8.2 THE DEVELOPMENT PROCESS

The development of the CERD process model can be considered a design process in itself. Although empirically developed within a multidisciplinary research perspective (see Chapter 4), the development of this model borrowed some principles that are applied in HCI technology designs, as described below.

In the first instance, the CERD model is descriptive in nature. MacKenzie (2003) has provided a distinction between two types of models: descriptive and predictive. He defines descriptive models as those suitable for qualitative studies because they provide a framework for discussing a problem or situation, as compared to predictive models which are used for hypothetical testing. Watkins (2007) further elaborates that hypothetical testing approach is suitable where much is known about a phenomenon in question. In this case, very little prior knowledge existed on the process of designing educational digital libraries collaboratively with other stakeholders particularly in African Higher Education (see Chapters 3).

Secondly, a participatory design approach was applied to identify design process factors where this was pragmatically possible. According to Schneiderman and Plaisant (2010), participatory design is a HCI approach that provides direct involvement of users in the collaborative design of things and technologies they use. This research benefitted from one of the digital library projects that was being developed following this method. In this project, it was possible to participate in some of the design process meetings and make observation of the nature of participation stakeholders were involved in (see Subsection 4.2.4.2).

Another HCI design influence on the development of the CERD process model was the way it was developed iteratively. Several HCI authors (e.g. Dix *et al.*, 1998; Brandt, 2006; Bellamy *et al.*, 2007; Watkins, 2007) agree that the process of designing HCI technologies is iterative and subject to refinement at every stage of development. The final product is open and flexible to allow for future emerging knowledge (Khoo, 2001; Hummels and Frens, 2009). Although this CERD process model is not really a HCI technology in that sense, it was developed iteratively through three key stages as illustrated in Figure 13 below.

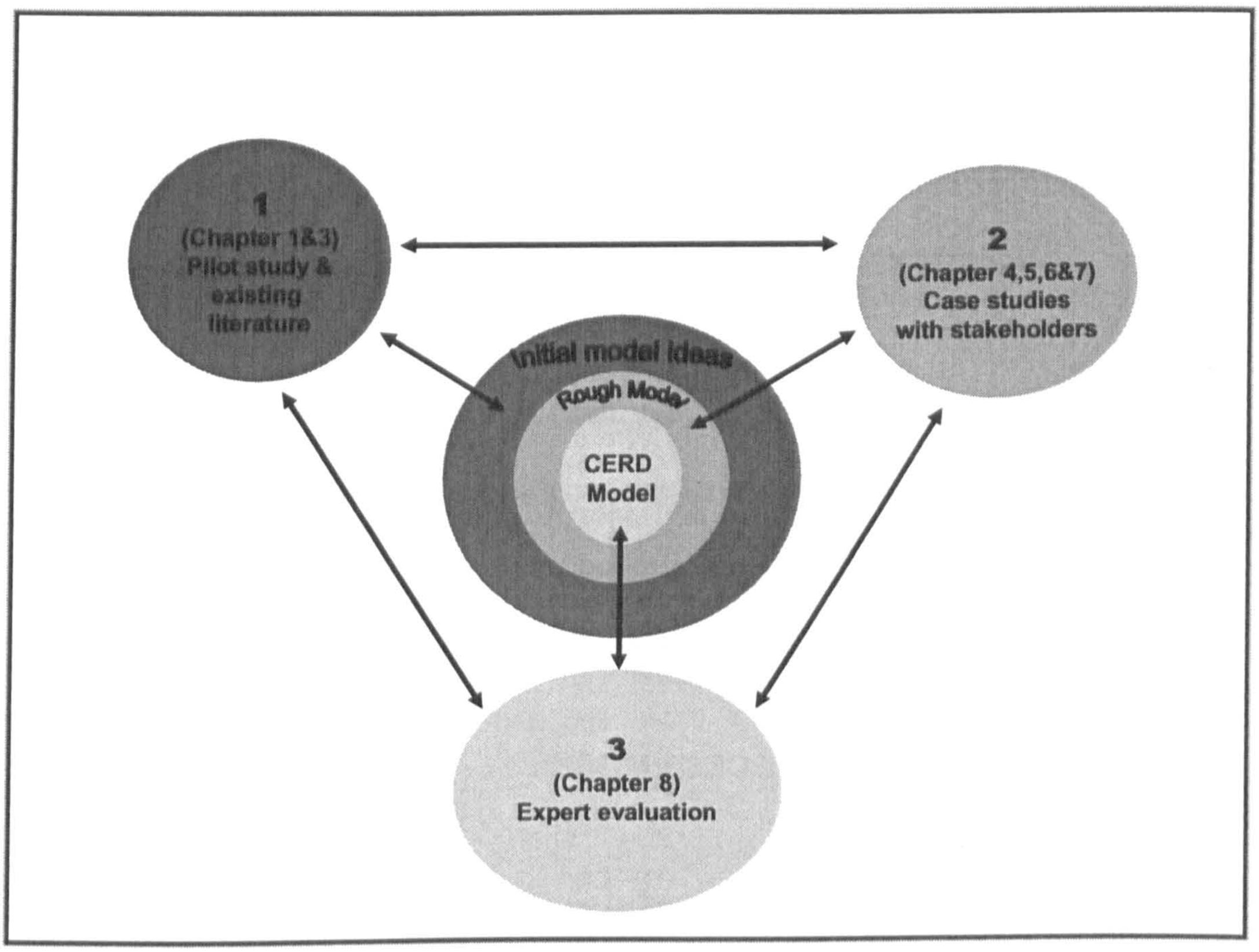



**Figure 13: CERD process model development process**

The first stage happened way before any empirical work was started. It was first of all necessary to review existing literature in the area of digital library designs to establish if

any such work existed (see Chapter 3). This first stage also considered the findings of two pilot studies, one of which was later developed as one of the case studies that constituted part of the empirical investigation (see Subsection 4.2.1). Both the findings of these pilot studies and the review of literature provided initial ideas and invaluable direction for the model development.

The second stage constituted an in-depth investigation of three case studies in African HE institutions (see Chapters 4, 5, 6 and 7) which reviewed 11 digital library projects. This stage identified factors that were used to produce a rough model, through an iterative process that reviewed the evidence from stage 1 and expanded data collection. For instance, it was essential to revisit one of the pilot studies and conduct further in-depth investigation, and that is how it became one of the three case studies. To support this stage, some grounded theory aspects were employed in which findings of all the three case studies were iteratively compared against each other and where necessarily, documentary evidence used to support any major claims (see Subsection 4.2.5). In addition, existing related literature was later reviewed in light of emerging findings. The rough model was then subjected to expert review (stage 3) in order to produce a more refined model (see Chapter 8.4). The end product is open and flexible as it can be modified and developed further in future research.

## 8.3 THE CERD PROCESS MODEL

### 8.3.1 Introduction

The research findings (see Chapters 6 and 7) showed that the CERD process model represents a collaborative design process which can start with the project initiation stage leading to project development stage (detailed in Subsection 8.3.2). These two stages feed

into project outcomes which can happen either after the development stage or during each of the stages. The outcomes can be seen in form of the following three indicators of successful projects (described in details in Section 6.4 and 7.3):

- Stakeholder Engagement ***(SE)***
- Sustainability ***(S)***
- Transformation ***(T)***

The two stages are made up of the three factors identified in the research findings:

(i) Human relationships factor

(ii) Policies factor

(iii) Innovative technologies factor

These factors can have different characteristics at each stage, influencing how they contribute to specific outcome indicators. Additionally, these factors can interact with each other within a particular stage. Finally, like most design processes which are iterative by nature, the outcome has potential to feed back to the initiation stage for project improvement or initiation of new projects. Below is a detailed description of the three factors:

(i) Human relationships factor: This is made up of stakeholders collaborating and providing their skills in the design process. Stakeholders comprise of:

a. Multidisciplinary stakeholders representing different discipline domains and professions i.e. academics and students from different disciplines, e-learning

technologists, librarians and related information professionals, design experts, policy makers (e.g. government bodies and funding agencies/project donors), project administrators and the general public.

b. Design champions whose main role is to facilitate stakeholder engagement and collaboration within the design process. There are two different types of these design champions: the multidisciplinary champions (MC) and the domain champions (DC). They both differ in their characteristics and approaches. For example, the DC are mainly driven by the goals of the domains they represent. They use their domain knowledge in the early stage of the design process and only engage other stakeholders in the later stage of the design process. On the contrary, the multidisciplinary design champions identify other multidisciplinary stakeholders and their relevant skills and engage them throughout the design process. They facilitate and coordinate collaboration among these stakeholders; are able to motivate joint ownership of the project; and usually have a vision for the project beyond the design process.

(ii) Policies factor: These are a range of policies that can be national or institutional. Examples include strategic plans, guidelines, policy statements, directives and mandates. At the national level, they can include national policy statements, national strategic plans, white papers and directives. At the institutional level, they can comprise strategic plans (with staff performance contracts to enforce implementation), directives, principles, mandates (e.g. the Open Access mandates), function-specific policies such as research policies, intellectual property related policies and ICT policies. Additionally, there are external policy directives such as

those provided by funding agencies.

(iii) Innovative technologies factor: In the projects reviewed, these innovative technologies have been classified into the following two categories:

a. Universal technologies i.e. web-based applications and mobile devices;

b. Technologies that have flexibility features (referred to in this model as 'flexible technologies'). These flexible technologies support customization of existing universal technologies to enable them meet context needs. They include the Open Source Software (DSpace) and the Web 2.0 applications.

### 8.3.2 The CERD process model detailed

All the three factors described above make up the initiation and development stages of the CERD model and contribute to the project outcome. They also interact with each other within the stages. The research findings showed that at each stage, these factors can have certain characteristics depending on the nature of the project. In the following sub-sections, factors in each of the two stages are detailed, showing how they contribute to the outcomes and how factors interact with each other.

#### *8.3.2.1 Project initiation stage*

Project initiation according to the research findings is the first stage in the design process. The projects reviewed identified that all the three factors (human relationships factor, policies factor and innovative technologies factor) can initiate projects and contribute towards the projects' outcome. Below is a description of how these three factors can initiate projects using illustrations from examples of the projects reviewed in this thesis, and how

they interact with each other and contribute to project outcome[58].

### (i) Human relationships factor

Projects can be started through initiating stakeholder engagement. Stakeholders are facilitated to collaborate and contribute towards project start-up (Table 8).

**Table 8: Human relationships factor and related outcome indicators at the initiation stage**

| INITIATION STAGE : HUMAN RELATIONSHIPS FACTOR | | |
|---|---|---|
| **Factor characteristics** | Initiating collaboration by:<br>• identifying design stakeholders<br>• engaging them collaboratively | *Example:*<br>The multidisciplinary design champion in the Clinical mobile digital library (Project 11) identified and immediately engaged multidisciplinary stakeholders, representing designers, policy makers (government departments, donors) and users. The aim was to utilize mobile devices (innovative technologies) to rural clinicians. This was supported by policies |
| **Issue** | Domain design champions may not support stakeholder engagement at this initiation stage | |
| **Interaction with other factors** | **Policies factor** | **Innovative technologies factor** |
| | Stakeholders particularly policy makers can enforce other stakeholders' collaboration by insisting that policies favouring collaboration are followed right from the start of the project and throughout the process | Stakeholder collaboration at this stage utilizing innovative technologies in the design process |
| **Contribution to project outcome** | **Stakeholder engagement** | **Sustainability** |
| | • Joint participation in system development<br>• Stakeholder ownership of project outcome | • Policy makers among stakeholders can influence project continuity<br>• Multidisciplinary champion's ability to see beyond project life allows for sustainability |

[58] These projects are detailed in Chapter 5 (Subsections 5.1.4; 5.2.4 and 5.3.4). This model description should be read hand in hand with these sections.

In this thesis, multidisciplinary champions were identified as playing a key role in this initiation stage. They initiated projects collaboratively with other design stakeholders. For this to happen, they had first to identify these stakeholders and then engage them in the process so that they could collaborate among themselves. This all-inclusive approach has some far-reaching positive effect that can impact on collaboration building as well as on project outcomes. For example, some stakeholders can have policy making responsibilities and therefore have the potential to contribute towards decisions such as those related to how people collaborate. They can also contribute towards project sustainability and continuity. In this research, these multidisciplinary design champions were not only initiating projects but were also identifying diverse multidisciplinary stakeholders (some of who could influence the direction of the project). They were initiating collaboration among these stakeholders to participate in this early stage of the process. Domain champions were identified as less important in establishing stakeholder collaborations at this stage in comparison to the multidisciplinary champions. This is because their role was only to initiate projects on their own initially without the collaboration of other design stakeholders, who they identified and incorporated only at the later stage of the development process.

At this initiation stage, this human relationships factor can also interact with the other factors (i.e. policies factor and innovative technologies factor). For example, as already mentioned, some of the stakeholders were policy makers who had an influence in enforcing stakeholders' collaboration right from the beginning of the project and throughout the process. At the same time, the objective of forming collaboration at this stage was so that stakeholders could engage with each other by utilizing innovative technologies.

This factor and associated activities ultimately contribute to the project outcome. Specifically, it can lead to stakeholder engagement and ownership, and project sustainability. In the projects reviewed, stakeholder engagement was demonstrated by joint participation of key stakeholders as they collaborated in the design process. This in turn created joint ownership of the projects. Project sustainability can be ensured when policy makers who have influence on project continuity are included. For example, ***Project 11*** has been taken up by the Ministry of Health (stakeholder) for further development and implementation after the project period has ended. Additionally, these multidisciplinary champions are able to see beyond the current project and therefore plan for continuity.

**(ii) Policies factor:**

Different policies can play an important role of motivating project initiation. For example in this research, they influenced or enforced project initiation and they influenced funding of project start up (Table 9).

**Table 9: Policies factor and related outcome indicators at the initiation stage**

| **INITIATION STAGE : POLICIES FACTOR** | | |
|---|---|---|
| **Factor characteristics** | Can motivate project initiation by:<br>• facilitating and enforcing project initiation<br>• influencing funding for project initiation | *Example*:<br>Project 1 was supported by national and institutional focus on use of technologies in education. Policies encouraged staff to innovate and apply innovative technologies (Web 2.0) to improve service |
| **Interaction with other factors** | **Human relationships factor** | **Innovative technologies factor** |
| | Policies can provide an environment that encourages staff creativity leading to innovation | Policies can influence application of innovative technologies through directing funding for technology-led initiatives |
| **Contribution to Outcome** | **Sustainability** | |
| | Can lead to mainstreaming projects within an institution by embedding them in the institution's operations. | |

*a. Policies facilitating and enforcing project initiation*

Policies can be used to facilitate the initiation of projects by providing an environment that supports innovation to happen. For example, a policy on curriculum change (i.e. based on Problem Based Learning - PBL) framed within the innovative use of technology can influence initiation of a digital resources project to specifically cater for this curriculum's needs. In this research, ***Project 10*** was initiated to support students following PBL curriculum.

Policies can also have an enforcing effect that enables project initiation to take place. For instance, a national policy that enforces the use of innovative technologies in teaching and learning can be implemented at the university level through institutional and departmental strategic plans. This can then lead to initiation of certain innovative projects such as digital libraries. For example ***Project 1*** in the South Africa case study was mainly initiated as a result of a national White Paper on the use of innovative technologies in teaching and learning being taken up by the institution's strategic plan. This was then incorporated in the library's strategic plan which led to the initiation of this project.

*b. Policies influencing project funding*

Policies can motivate project initiation by influencing national and institutional focus and spending. For example, an institution can have a focus on the use of innovative technologies in teaching and learning and thus introduce policies (e.g. strategic plans) that support this focus. This can mean that projects being funded by the institution at that particular point have to be in line with the use of innovative technologies. Project

funding agencies can also influence where they want their financial aid to go and how it is going to be spent, thus introducing policies that enforce this objective.

Policies can also interact with the human relationships factor and the innovative technologies factor. For example, policies at the initiation stage can support stakeholders to innovate by providing an environment that facilitates staff creativity as was identified in ***Project 1***. At the same time, policies' role in enabling project initiation and project funding indirectly influences the application of innovative technologies because they are providing a supportive environment for this application to happen.

The policies factor at this initiation stage contributes to the project outcome primarily by ensuring project sustainability through mainstreaming of projects within the institution. Projects become part and parcel of the institution's operations as policies help to embed them within the institution, hence ensuring their sustainability.

### (iii) Innovative technologies factor

The projects investigated in this research showed that innovative technologies can lead to project initiation especially where there is a need to use these technologies to produce some form of transformation (Table 10). This can be in solving existing problems within the institutions such as those related with usage of resources or institutional knowledge management. It can also be in improving existing practice.

**Table 10: Innovative technologies factor and related outcome indicators at the initiation stage**

| INITIATION STAGE : INNOVATIVE TECHNOLOGIES FACTOR | | |
|---|---|---|
| **Factor characteristics** | Innovative technologies can provide innovative ways of solving problems and changing practice | *Example*:<br>Project 1 was based on the use of Web 2.0 to solve library usage problems among younger library users |
| **Interaction with other factor(s)** | **Human relationships factor** | |
| | Innovative technologies can influence the choice of stakeholders | *Example:*<br>Stakeholders in Project 4 were primarily chosen on the basis of their contribution to the innovative technologies (mobile devices for building agricultural knowledge system) |
| **Contribution to Outcome** | **Transformation** | |
| | Innovative technologies can lead to transformation in the project in form of improved practice or in problem solving within the project. | |

*a. Solving problems*

Availability of innovative technologies can trigger people's interest to use them for solving problems. For example, Web 2.0 applications were used in ***Project 1*** to overcome the problem of younger library users not using digital library resources effectively. Because these users were interested in social networking, using technologies that support social networking (e.g. Web 2.0) to make library resources more accessible to them was a way of dealing with this problem.

*b. Improving practice*

Projects can be initiated using innovative technologies in order to improve existing practice i.e. in creating better ways of working, e.g. mobile technologies in developing countries are being used for outreach services in places not connected by the Internet. This leads to creation of innovative projects that result in improved

practice. For example in ***Project 11***, Personal Digital Assistants (PDA) were used to deliver a digital library to clinicians in rural areas not connected by the Internet. This gave clinicians access to medical information which they used to improve practice.

In this research, the level of interaction of the innovative technologies factor with the other factors was very minimal at this stage and it only appeared to happen with the human relationships factor and not with the policies factor. For example the choice of participating stakeholders to some extent was determined by the type of innovative technologies being used and what they were intended for. In other words, where the innovative technologies were leading the initiation of a technology project, this determined the kind of stakeholders to include in the design process. This was evident in ***Project 4*** where mobile devices were used for two farming communities to develop an agricultural knowledge management system. The choice of stakeholders included researchers who had expertise in dealing with mobile devices and customising them for rural communities, and farmers who could contribute farming knowledge to the system.

The contribution of this innovative technologies factor at the initiation stage towards project outcomes is that it can lead to a transformation in form of problem solving or improvement of existing practice.

### *8.3.2.2 Project development stage*

**(i) Human relationships factor**

The human relationships factor plays a crucial role at the project development stage particularly through the multidisciplinary and domain champions (Table 11).

**Table 11: Human relationships factor and related outcome indicators at the development stage**

<table>
<tr><th colspan="4">DEVELOPMENT STAGE : HUMAN RELATIONSHIPS FACTOR</th></tr>
<tr><td>Factor characteristics</td><td colspan="3">• Design champions (both multidisciplinary and Domain) identifying skills among stakeholders and encouraging their utilization in the design process.<br>• Multidisciplinary champions facilitating, coordinating and motivating organic engagement among the collaborating stakeholders</td><td><u>Example:</u><br>Multidisciplinary design champion in Project 6 identified that the librarian who was among the stakeholders provided her domain knowledge in digital resources for the benefit of the other stakeholders. This design champion managed to maintain engagement among the stakeholders</td></tr>
<tr><td>Issue</td><td colspan="4">Domain champions use other sources of motivation i.e. marketing and institutional reinforcement to keep stakeholders engaged in the design process. This is problematic as it is time consuming and takes away project ownership</td></tr>
<tr><td rowspan="4">Interaction with other factors</td><td colspan="2">Policies</td><td colspan="2">Innovative technologies</td></tr>
<tr><td colspan="2">Stakeholders (Design champions and policy makers) can introduce policies that will ensure collaboration takes place among stakeholders</td><td colspan="2">Stakeholders using their domain skills and expertise to implement innovative technologies in the design process</td></tr>
<tr><td rowspan="2">Contribution to outcome</td><td>Stakeholder engagement</td><td>Sustainability</td><td>Transformation</td></tr>
<tr><td>• Shared participation in system development among stakeholders<br>• Stakeholder ownership of project outcomes</td><td>Policies initiated by design champions can ensure projects are mainstreamed within institutions</td><td>Stakeholders using domain skills on innovative technologies can lead to transformation in the form of changed practice</td></tr>
</table>

However, this research identified that the multidisciplinary champions used more collaborative approaches with other stakeholders than the domain champions. They can champion the design process by (a) identifying relevant skills among the stakeholders and encouraging their utilization in the design process and (b) ensuring that stakeholders engage in the design process.

*a. Skills identification and utilization*

The design champions can identify relevant skills and expertise among the diverse group of design stakeholders identified in the initiation stage. These can be domain-related expertise such as digitization and knowledge management from experts like librarians. These skills and expertise can also be based on the users' system needs or expectations used to identify system requirements. They are also able to encourage the application of these skills and expertise for specific purposes in the development stage to gain mutual benefit. However, there is a difference between the approaches taken by the two types of design champions. While the multidisciplinary champions identify the expertise of the other stakeholders and encourage utilization for mutual benefit, the domain champions tend to use their domain skills and only involve other stakeholders later in the design process.

*b. Facilitating collaboration*

It is important that different stakeholders remain engaged through the development process so that they are able to participate effectively and contribute their specific skills and knowledge for mutual benefit in the design process. This means that they must be facilitated to collaborate. How they collaborate must also be coordinated.

The research shows that the multidisciplinary champions have the ability to facilitate and coordinate stakeholder collaboration. Their approach encourages organic engagement where the stakeholders do not require outside motivation to participate. In contrast, domain design champions have to motivate this stakeholder engagement by using methods such marketing and institutional reinforcement through policies.

The human relationships factor at this development stage can interact with other factors (i.e. policies factor and innovative technologies factor). For example, design champions (especially domain champions) are capable of implementing policies (e.g. the Open Access Mandates) that ensure stakeholders collaborate in the design process. Policy makers like funding agencies (part of design stakeholders) can also introduce policies that ensure stakeholder collaboration. These stakeholders and design champions can also use their domain expertise on the application of innovative technologies in the system development process. For example, librarians can use their knowledge management and digitization skills to work with content management systems like DSpace in order to develop institutional repositories.

These human relationships factor activities at the development stage can contribute towards project outcomes in three ways. Firstly, collaboration leads to stakeholder engagement that results in joint participation of people from the learning side (e.g. academics and students) and those from the information side (e.g. librarians). This is what happened with the development of institutional repositories (***Projects 2*** and ***7***) where digital librarians, academics and students jointly participated in the development of resources in these institutional repositories. A shared participation can in turn cause project ownership among the participating stakeholders. Secondly, policies initiated by the domain champions can enable projects to be mainstreamed within the operations of the institutions and hence ensure their sustainability. Lastly, stakeholders working with some of the innovative technologies can bring about transformation such as in improvement of service delivery and change of practice.

**(ii) Policies factor**

At this development stage, the main role played by the policies factor is through influencing and supporting collaboration of stakeholders in the design process. This can happen through facilitation and enforcement (Table 12).

**Table 12: Policies factor and related outcome indicators at the development stage**

| **DEVELOPMENT STAGE : POLICIES** | | |
|---|---|---|
| **Factor characteristics** | Influencing stakeholder collaboration through facilitation and enforcement | *Example:*<br>Stakeholder collaboration in the two institutional repositories (Projects 2 and 7) was supported by various policies which either facilitated or enforced stakeholders' engagement. These policies included the Open Access Mandates, Intellectual Property rights and research policies |
| **Issues** | None | |
| **Interaction with other factor(s)** | **Human relationships factor** | |
| | Policies are enforcing and facilitating collaboration of stakeholders | |
| **Contribution to outcome** | **Stakeholder engagement** | **Sustainability** |
| | • Shared participation in system development among stakeholders<br>• Stakeholder ownership of project outcomes | Mainstreaming projects within institution |

*a. Policies facilitating collaboration*

Policies can facilitate collaboration i.e. by explicitly encouraging inter-departmental collaborations. For example, a library can be empowered to work with any academic department if the university strategic plan recognizes the central part played by the library in supporting all academic functions. An example is in ***Project 6*** where librarians were happy to collaborate because the university strategic plan stated that

the library should sustain institutional linkages.

*b. Policies enforcing collaboration*

Policies can also enforce collaboration among key stakeholders. In ***Projects 2*** and ***7,*** policies such as the Open Access Mandates, Intellectual Property Rights policies and research policies were used to ensure that stakeholders collaborated with librarians in the development of institutional repositories.

Externally motivated policies such as those imposed by funding agencies can also have an enforcing effect on collaboration. For example, in this research, financial support to implement ***Project 11*** came from one of the stakeholders (IDRC), a funding agency that insisted on the use of a certain project management tool. This tool ensured effective involvement and participation of all stakeholders.

There is minimal interaction of this factor with the other factors and this only appears with the human relationships factor, i.e. through policies facilitating and enforcing collaboration among stakeholders. This research did not highlight any direct interaction with the innovative technologies at this development stage.

The main contribution to the project outcome this policies factor is making is in stakeholder engagement. By supporting stakeholder collaboration, a joint participation of these stakeholders in the design process can occur. This in turn can result in stakeholders owning the project. Some policies also ensure that projects are mainstreamed in the institution hence contributing towards project sustainability.

### (iii) Innovative technologies factor

The most important role innovative technologies play in the development stage is tailoring of the projects systems to meet the needs of users (Table 13).

**Table 13: Innovative technologies factor and related outcome indicators at the development stage**

| DEVELOPMENT STAGE : INNOVATIVE TECHNOLOGIES | | |
|---|---|---|
| **Factor characteristics** | Flexible technologies (DSpace Open Source Software and Web 2.0 applications) allow existing generic technologies to be tailored for fit intended use | *Example*:<br>The digitization of music collection (Project 8) was based on digitization technology, digitized files were organized using DSpace which accommodates different formats, i.e. digital music files and this made the resources more appropriate to users. |
| **Issues** | None | |
| **Interaction with other factors** | None | |
| **Contribution to Outcome** | **Transformation** | |
| | Results end-user centeredness and creates visibility of project system | |

This research has shown that tailoring of project systems can be effected by using certain technology applications that manifest flexibility features. These applications work on existing generic technologies (e.g. web-based resources and mobile devices) to customize them for the intended use. Such applications can include the Open Source Software such as DSpace (in ***Project 2*** and *7*) which allows customization of different formats of digital content to suit specific needs and requirements of an organisation. Web 2.0 applications (in ***Project 1***) can also be used to create this tailoring of existing innovations to meet systems needs. Such technologies are flexible enough to allow some level of usage by stakeholders regardless of their expertise and technical abilities.

Innovative technologies seem not to have any direct interaction with the other factors at this development stage. There are also no issues identified.

The main contribution these flexible technologies have on the project outcome is bringing a transformation by enabling tailoring of technologies in order to make them meet the intended need. For example, DSpace and Web 2.0 applications in this research transformed the way digital resources were delivered to users. Resources became more user-centred. They also created visibility of projects systems when they became more popular among the users.

## 8.4 EXPERT REVIEWS OF THE CERD PROCESS MODEL

In order to establish the relevance of the CERD process model as a guidance tool, it was submitted for expert evaluation. Since the model itself has been developed within a multidisciplinary perspective, it was important to get views from experts representing relevant disciplines. A total of six experts (see Table 14) were identified. One of them had been a research participant and potential model user. This therefore introduced room for a validity check (respondent validation) on the model against researcher's subjectivity, which according to some HCI researchers (e.g. Adams *et al.*, 2008) can be dealt with through professional counterparts' scrutiny (see Subsection 4.2.5.2).

These experts were provided with a detailed account of the model (see Appendix 9) and asked to provide their critical review of the model particularly in (but not limited to) the following areas:

(i) Completeness

- Overall presentation

- Conceptual coherence

(ii) Versatility for interpretation by different disciplines

(iii) Usefulness

- Applicability at
  - regional level
  - global level

**Table 14: Model's multidisciplinary model reviewers**

| NAME | BACKGROUND |
|---|---|
| Prof. Steve Garner | Professor of Design |
| Dr. Richard Butterworth | HCI expert (in digital library) |
| Dr Buhle Mbambo-Thata | University librarian in African HE |
| Diana Rosenberg | Information science academic in African HE (retired) |
| Prof. Christine Borgman | Professor of Information Science |
| Unnamed reviewer [59] | Research participant (potential model user) |

*(**NB:** some of the excerpts provided below do not bear the identity of the reviewers in order to anonymize to protect their privacy).*

From the reviews of all the six reviewers, the CERD model was generally viewed as relevant. Some reviewers also found it "*fascinating*" and "*interesting*". However, it was interesting to note that their views varied across the represented disciplines. The following is a breakdown of these reviews, categorized into two parts. The first part highlights expert reviews of the model's strong points and the second part covers highlighted model limitations and a critical reflection of these reviews.

[59] Identity concealed to respect participant's privacy in accordance to ethical guidelines followed in this research

### 8.4.1 Model's strong points

***(i) Completeness***

One expert commented that the model had been successful in integrating two important design features. First, the inbuilt iteration of the model's development process supported generation and testing of proposals.

> *"...given that the various projects represent real-world problems it's vital that the development process is presented as iterative. Sometimes the only way one might reveal the nature of a problem is through generating proposals and testing these. Your model is successful in this respect."*

The second design feature is the thinking skills of champions, which according to this expert is something that is well supported in the management literature. This thinking skills idea is characterized by flexibility and agility which are relevant in bringing about collaboration in situations of conflict and in overcoming stakeholder conflict that can happen in design.

Two other experts found the model well presented, written and structured, for example:

> *"The overall presentation looks good and was easily understandable and I could follow the discussion quite easily. Your discussions flowed well from one concept to another and the meaning of the concepts came out clearly."*

They also commented on the detailed and clear description of the projects within the model.

***(ii) Versatility for interpretation by different disciplines***

One expert found versatility inbuilt in the model because of different disciplines coverage. In other words, the multidisciplinary nature taken in developing the model meant that it could be applicable to those disciplines involved.

Another expert with a librarian's perspective thought that other disciplines such as IT and education would be able to interpret and apply it to their disciplines:

> *"This model will be useful not only for librarians, but also for the field of Education, IT, and other academic disciplines that wish to design educational digital resources for their disciplines."*

***(iii) Usefulness at institutional and national levels***

Three experts agreed that the model was useful. For example one of them thought that the model was not only useful at the local institutional level but that it:

> *"...could also be useful at national level to help governments in setting up successful workable programmes for designing and sustaining national educational digital resources".*

Another thought that it could be usefulness for conceptualizing collaboration within academic institutions.

***(v) Usefulness at regional and global levels***

Two experts considered that even though the model was built for Africa and was thus useful at this level, lessons learnt and model abstractions could as well be applicable at a global level.

### 8.4.2 Model's limitations

This section discusses certain limitations identified in the model. Some of them arose from the expert reviewers' constructive feedback. These are outlined below:

***(i) Issues with presentation***

- The order in which the boxed descriptions of projects were presented in the summary

was found to be confusing as they were not systematically placed where the projects were mentioned in the text, e.g.:

> *"...in Table 8.2, Project 1 is used as the example. Yet the boxed description of Project 1 does not come until two pages later under (b). I think it should come soon after it is mentioned (otherwise the reader is left thinking that maybe the example in the Table should read Project 10!)."*

and

> *"...but why are they numbered differently to their order of presentation? When you start talking about project 11, I worry that I've missed 10."*

- One reviewer suggested that the presentation of the schema should be circular in order to depict dynamic interactions.

***(ii) Inadequate information about the model***

- This was highlighted as an issue by a number of reviewers who felt that it limited their ability to fully comprehend certain aspects of the model as noted below:

> *"Because the findings are presented at a high level of abstraction its sometimes difficult to keep a grasp on the points being made. If it was me writing I would make a point, and then immediately follow it with a concrete example of the point in action."*

- Two reviewers wondered about the nature of the model, whether it had been developed by the researcher or it was adopted as noted in the following excerpts:

> *"What I could not find was information on the CERD Model? Is that your creation or was it adopted? Perhaps you talk about it in earlier chapters. I could not find information on the CERD Model?"*

and

> *"...am not sure the status of the CERD model; some Googling suggests that its a model that you've devised based on your work, rather than being a*

*model already existing in the literature that you're refining or applying to an African HE context."*

- Absence of theoretical underpinning of the model was also raised:

*"I was concerned by the theoretical underpinnings of the model?...Maybe you have covered them in an earlier chapter."*

Another reviewer wondered if other existing models had been reviewed to establish the need for this model. He was also concerned about the presence of unsubstantiated assertions without references which made it difficult to tell which ones of these assertions were novel and which ones were from the literature.

***(iii) Similarities with Everett Roger's diffusion of innovation model***

One reviewer commented that the model looked much like the diffusion theory developed by Everett Rogers and suggested that the CERD process model should be compared to this model.

***(iv) Absence of Africa-specific characteristics in the model***

There was a concern that the model lacked African-specific characteristics. Two reviewers highlighted the need to make the African aspect distinct. Their view was that the issues highlighted were not specific to Africa and they occur in other environments. Another reviewer had a contradictory suggestion that other international examples should be added to confirm if the model can be applicable to contexts outside Africa.

***(v) Process versus Outcomes***

The development of the model included specification of outcomes which were highlighted as outcome indicators. These outcome indicators were derived from specific examples

of evidence obtained from the research findings. The outcomes are important for providing a measure of effectiveness of the collaborative design process. However, the way some of the outcome indicators have been defined in this thesis is problematic as they can appear to represent a process rather than an outcome. For example, the outcome indicator 'stakeholder engagement' presents 'stakeholder participation'. Participation is an outcome in itself according within the Scandinavian design perspective, but to some other HCI design experts, participation can be seen as a process. While it was necessary to provide for such an outcome that reflects stakeholder engagement in light of stakeholder collaboration focus of this thesis, it is important to acknowledge that defining the outcome indicator as such introduces as risk of misinterpretation.

#### *8.3.2.1 Reflections on the model's limitations*

The above critical comments concerning the model's limitations have provided useful reflections for future improvement of the model as well as areas for further research. Firstly, they have shown that there is need to put the model into context. Most of the issues raised have been covered extensively elsewhere in the thesis, as the model itself is embedded within the thesis. However, it was presented to the reviewers as a stand alone model, outside the thesis with the intention of making it concise and easy to review. This unfortunately meant that it ended up lacking some details necessary to provide the context.

Secondly, this critique seems to suggest an interesting aspect about multidisciplinary differences in how certain concepts are interpreted. The reviewers represented different disciplines. While there was consensus in most of the limitations, there were also some differences. For example, the suggestion that the CERD process model was similar to

Roger's diffusion of innovation theory appears like it was a disciplinary issue as the CERD model is not about dissemination, rather it is a design process model. A reviewer with an information management perspective would be more inclined to perceive the model in light of dissemination because the field of information management is more concerned with dissemination than with design aspects.

These two points raise an important consideration for dissemination of the model. They seem to suggest the importance of placing the model within some appropriate context when disseminating it. Equally important is the need to pay attention to the subject discipline of the intended audience when disseminating it in order to frame it accordingly and avoid potential for misconception.

Going forward, the critique about the absence of Africa-specific characteristics in the model suggests that there is need for further investigation to test the model in non-African contexts. This is discussed in further details in Subsection 9.6.4.

## 8.5 THE CERD PROCESS MODEL APPLICATION

As highlighted in Section 8.1, users of the CERD process model are African HE educational digital resources stakeholders consisting of information designers (digital librarians), learning designers (academics and e-learning specialists) and education decision makers at national and institutional levels. Their need is for a guidance tool to support them in the process of collaborating to design effective and sustainable educational digital resources. This guidance tool should support them respectively as follows:

(i) Information designers (e.g. digital library designers and digital librarians) can use the tool to collaborate with other related stakeholders (e.g. academics and e-learning

specialists) to develop digital library resources that effectively support learning objectives of students;

(ii) Learning designers can use the tool to collaborate with information professionals to develop learning resources that effectively integrate relevant digital library resources to support students learning objectives;

(iii) Education decision makers at national and institutional levels can use the guidance tool in order to understand how to support design of effective learner-focused educational digital resources.

In order to make this model applicable, a number of guidelines have been developed as guidance documentation. These guidelines can be applied at different points in the design process. For example, they provide what one needs to consider at the beginning of the project, showing how the different design process factors (labelled **(a), (b), (c)**) can be applied, and the resultant outcomes. These guidelines are first represented in Figure 14.

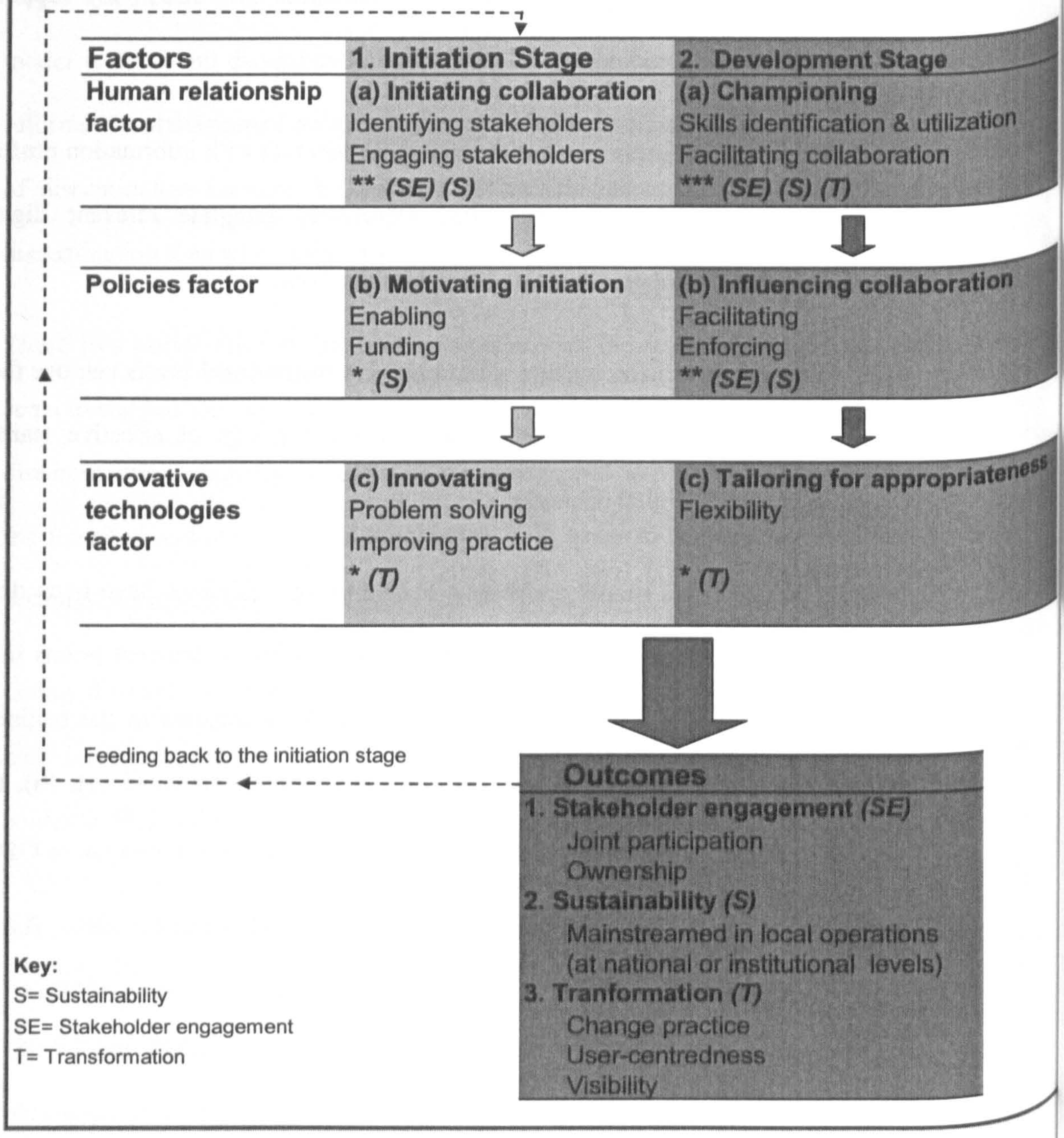



**Figure 14: The CERD process model in an African HE context**

## The CERD process guidelines

***1. At the beginning of the digital resources design project:***

(a) Incorporate design champions in order to initiate collaboration among different design stakeholders.

*Expected outcome:* Both multidisciplinary champions and domain champions will ensure that there is joint participation of the key stakeholders (stakeholder engagement). However,

- multidisciplinary design champions will ensure the right mix of multidisciplinary design stakeholders is identified and will in turn lead to project ownership and sustainability.

- domain champions will not guarantee project ownership among stakeholders which can effect project sustainability. To get buy in, this may call for marketing which will require resources.

(b) Identify national policies that support use of technology in teaching and learning and incorporate them at the institutional level as strategic plans, mandates, etc, in order to influence and support digital resources project start-up. This will create an enabling environment for stakeholders to become creative and innovative in initiating digital resources projects. This will also influence start-up of projects by having a focus on which projects to fund.

*Expected outcome:* this will lead to projects being mainstreamed into the operations of the institutions, ultimately ensuring project sustainability until it has fulfilled its purpose.

(c) Use innovative technologies especially those that have flexibility features (Open Source Software and Web 2.0) in order to support initiation of digital resource projects that are aimed at solving problems within existing information systems or improving their performance.

These innovative technologies will influence the choice of stakeholders to include depending on their skills and ability to use these technologies.

*Expected outcome:* this will lead to transformation in form of improved or changed practice caused by the designed digital resources. Innovative technologies will help solve existing problems.

2. ***At the project development stage:***

(a) Identify design champions (both domain and multidisciplinary) in order to ensure that the relevant stakeholder skills required for the development of the projects are identified and utilized appropriately.

Multidisciplinary champions will particularly ensure sustained stakeholder collaboration in the design process because of their ability to facilitate, coordinate and motivate organic engagement among collaborating stakeholders.

Domain champions will also facilitate engagement among collaborating stakeholders. However, they will need to use different methods to encourage this engagement among stakeholders, i.e. marketing and use of institutional reinforcement such as enforcing policies. This can require additional resources which should be planned for.

*Expected outcome:* this will ensure that there is joint participation of the key stakeholders (stakeholder engagement) which will result in project ownership. It may also result in sustainable resources and improved practice.

(b) Identify national and institutional policies that facilitate or enforce collaboration so as to support stakeholders collaborating in the design process.

*Expected outcome:*

i. This will ensure that there is joint participation of the key stakeholders (stakeholder engagement) leading to project ownership.

ii. This will lead to projects being mainstreamed into the operations of the institutions, ultimately leading to project sustainability until it has fulfilled its purpose.

(c) Use innovative technologies especially those that have flexibility features (Open Source Software and Web 2.0) in order to support tailoring of existing systems to make them fit the intended purpose i.e. design of learner-centred resources.

*Expected outcome:*

i. This will ensure that resources designed meet the needs of the intended users, i.e. they are learner centred.

ii. Resources produced could lead to changed or improved practice as they inform users on new ways to perform their tasks.

iii. Use of innovative technologies will also create visibility of the resources being designed among intended or potential users.

# Chapter 9: Conclusion

The effectiveness of educational digital resources depends greatly on key stakeholders (designers of digital libraries and designers of learning programs) collaborating in the development, access and usage of these resources (see Bunker and Zick, 1999; Littlejohn *et al.*, 2006; Lankes *et al.*, 2007). Yet as this research has highlighted, these stakeholders do not always work together in the process of designing them (see OCLC, 2003). This often results in the design of educational digital resources that do not effectively meet learners' needs. This is a situation experienced in African higher education (HE) which faces historical challenges of access to quality education (see Chapter 2). Hence availability of effective and learner-centred educational digital resources is of enormous contribution to this sector.

This thesis set out to understand how these stakeholders can be assisted to work collaboratively in the process of designing these educational digital resources. The existing theoretical literature in this field, especially in reference to the African HE context, is inconclusive on approaches that offer guidance to stakeholders to collaborate in the design process for these resources. To address this gap, the research reported in this thesis sought to answer two research questions (see Section 1.2):

- *What are the existing factors that can be used to support a collaborative design process for educational digital resources in African higher education?*

- *What are the characteristics of these factors and the roles they play in the collaborative design process?*

The main aim of the thesis was to come up with guidance that could be used by key

stakeholders in the collaborative design process for educational digital resources within the African HE context. Consequently, an empirical investigation was carried out on existing design processes for 11 'best practice' digital library projects in three case studies of African universities (located in Kenya, Uganda and South Africa). 'Best practice' was determined by a set of criteria that considered presence of innovative technologies, policies and collaboration activities between information and learning design professionals (see Subsection 4.2.2). This revealed important findings which offer insights into HCI collaborative design processes in Africa, as well as the wider global context. These findings have been used to develop a descriptive collaborative design process model that can offer design process guidance. This chapter brings together these research findings and highlights their contribution and implications for the HCI design processes generally, and then what this means for HCI design processes in Africa. It then provides thesis reflections in relation to research limitations, lessons learnt from the methodological approach followed and suggestions for further research.

## 9.1 THE ROLE OF THE POLICY FACTOR

Policies at national and institutional levels were found to have a crucial role within the collaborative design process. These policies supported project initiation and stakeholder collaboration. Beside these policies playing an important role in the design process, research findings identified that their presence and how they influenced the design process differed across the three case studies.

In the first instance, the South African case study and the Ugandan one were well supported by policies at national and institutional levels. There was also a relationship between the national and institutional policies where the national ones were reflected at the institutional

level. Their impact could be seen in the way they supported collaboration of stakeholders and the application of innovative technologies in the design process. This resulted in multidisciplinary stakeholder joint participation in the resource development. The projects were sustainable and the use of innovative technologies enabled digital resources to be user-centred and visible to the users. They also were found to improve practice among stakeholders.

Conversely, policies in the Kenyan case study failed to support the digital library projects as it happened in the other two case studies. Policies at the national level were not reflected at the institutional level. There were no policies to support multidisciplinary collaboration within the university (especially between library staff and academics) or the use of innovative technologies to support intended use. This affected the ability of educational digital resources to meet the users' needs. Users were forced to look for unsustainable approaches to meet their needs. Ultimately, the collaborative design process especially in one project (project 5) was weak and projects in this case study were unsustainable.

The way these policies supported the collaborative design process differed across case studies. This was particularly evident in the Ugandan and the South African case studies. The Uganda case study was found to have policies that had facilitating effects while in the South African case study, they were mainly enforcing. Although these two approaches had similar outcomes, they uncovered some cultural differences at the country level (see Section 9.4).

### 9.1.1 Implications for HCI design processes

This thesis has exposed a vital part played by national and institutional policies in influencing successful collaborations between learning programs and digital libraries. It has further showed that these policies are vital for a successful collaborative design process for educational digital resources in African higher education. All examples of successful collaborations across the case studies had these policies as a key driver. Where policies were absent, the collaboration design process was weak and projects were unsustainable. This extends our understanding of the role of policies in HCI design. Previous studies (e.g. Winter, 2006; Jaeger *et al.*, 2007; Inglesant and Sasse, 2007; Shneiderman, 2009) reviewed in this thesis have focussed only on the role of public policy within HCI design. However, this research has revealed that these national and institutional policies can support or stifle technology innovations within institutions, and more specifically, their collaboration design processes.

Due to this important influence that national and institutional policies appear to have on HCI design processes, this thesis suggests that policy makers who make these policies are critical within the collaborative design process. Indeed some the multidisciplinary stakeholders identified in this research were policy makers. These policy makers could be government ministries such as those concerned with education and technology, university administrators and development partners working to support technology use in teaching and learning.

This idea of policy makers as stakeholders is an important contribution that extends our understanding of existing related models. Zimmerman *et al.* (2007) for example have considered a HCI research model for interaction design process showing a detailed

interaction process of different stakeholders as they contribute towards the interaction design process. These stakeholders represent engineers who are responsible for the technologies; anthropologists who produce the field data; and behavioural scientists who produce models and theories. The interaction designers seem to take on the role of a gatekeeper, clearing the different kinds of design knowledge these groups of people produce and feeding them to the HCI practice community.

In reflecting on Zimmerman and colleagues' model in relation to the findings of this thesis, it can be argued that policymakers (plus the policies they produce) should be considered as an additional category of stakeholders. The model by Zimmerman and his colleagues did not include policy makers, yet their importance in collaborative design processes makes such interaction design processes incomplete without their contribution. As established in this thesis's research, these policy makers are seen as affecting all other design stakeholders and their respective contribution, driving the processes and impacting on the success of design processes. Despite there being strong human relationships consisting of users (academics, librarians, students, etc) and technologists with their technologies, the design process in this research was stifled where there were no policies in the mix.

In view of these findings, the role of the interaction designer as a gate keeper who clears all the design knowledge from the other stakeholders before it feeds to practice, appears incomplete without taking into account policies and policy makers at all levels (i.e. national and institutional). Indeed, this important role of gate-keeping seems to be continually taken onboard by policy makers because without their policies, the design process can be stifled. Hence, a way out is to have policy makers included as an important stakeholder in the model. The interaction designers should incorporate these policies developed by the policy

makers in the design process and provide feedback into the policy making process as it happens with the other stakeholders. This will ensure that the impact of those policies can support other developments and make the policies themselves more appropriate. Figure 15 illustrates this additional component (shown in dotted lines on the left) within the interaction design process model, depicting the policies they produce and how they should feedback into the policy making process.

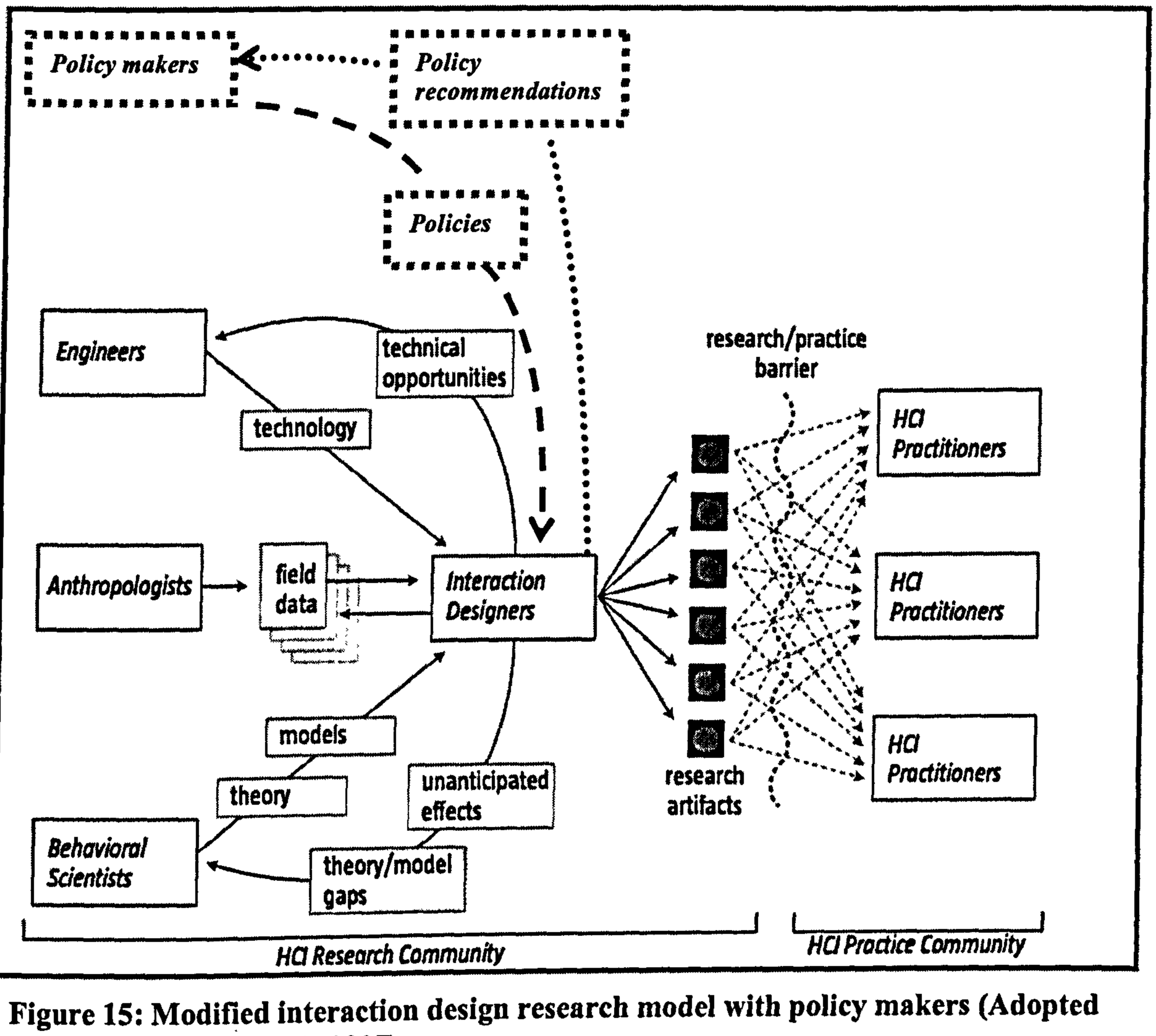



**Figure 15: Modified interaction design research model with policy makers (Adopted from Zimmerman *et al.*, 2007)**

This interpretation of Zimmerman and colleagues' model has important implications for designers of digital library systems. As evident from this research, institutional and national policies support or stifle design processes and hence influence the gate keeping roles of designers. With this in mind, developers of educational digital libraries can no longer carry on being passive observers in the policy arena but must be active participants.

At the same, it is important to recognize that constraining policies could also have a similar impact to a policy void. It is not just sufficient having policies as they can either be supportive or inhibitive. Policies can also be framed either at an appropriate or inappropriate level. A national policy or strategy may have increased impact (especially if it is accompanied by national funding) but it may be completely inappropriate for specific contextual needs. Context specific policies drawn up by policy makers may be completely impractical according to technical capabilities or unclear about how these advances will be sustained. Ultimately policies need to be clear in their supportive design role especially in relation to sustainability issues. In view of this, certain key implications for designers of institutional technologies, and more specifically, educational digital resources within African higher education, emerge:

i. developers of these technologies must actively be involved by first being aware of what national and institutional policies are around them and how they affect the design process. For example, they must ask themselves questions such as: what policies exist and where are they coming from? Are these policies facilitating or hindering the success of design processes? Are they linked to the sustainability of designed innovations?

ii. they must incorporate these policy considerations into the design process for their

system development. As has already been noted, some of these policies are only facilitative documents whilst others contain enforcement to encourage change. Within other fields, privacy and security policies are increasingly impacting on how systems are designed and what functions are likely to breach these policies. Often departmental strategic guidance documents are clearly evident but national and international policies are unclear. Developers of these systems should become aware of the impact these local policies have in order to make their systems contextually relevant. Moreover, they must incorporate them in their design work lest they fall foul by designing unsustainable systems;

iii. they must contribute to the policy making process. This can be done at two levels. The first level can be in form of direct or indirect feedback into the policy making mechanism, i.e. indicating what can be done to improve immediate design work. Incorporating policy makers as co-designers (stakeholders) enhances this policy contribution. The second level is contributing to the wider policy making community. For example, designers can ensure that appropriate policies exist to support their work. This means that they must work very closely with policy makers to develop these documents. Schneiderman (2010) reviews how this can be developed within a public participation forum. However, as findings of these research show, the repercussions of policies stretch far beyond what public policies can support. It is therefore imperative that those involved in digital library design projects understand which organizations have influence and can effect change in policy making mechanisms. Then, they must engage in the policy development process;

iv. Policy makers affecting educational technologies in the HE institutions in Africa must to become aware of the impact their policies (at national and institutional levels) can have on effective educational technology design and use.

## 9.2 THE ROLE OF THE HUMAN RELATIONSHIPS FACTOR

The human relationships factor in this research comprised of multidisciplinary stakeholders collaborating and using their skills in the design process for educational digital resources. They represented different disciplines and professions that went beyond the mainstream university academic establishment to include other communities, funding agencies and a government department.

The findings also established that among the multidisciplinary stakeholders was a subset of design champions who played an important role of identifying the different stakeholders and the skills they brought to the design process. They also facilitated stakeholder engagement within the process. These champions were further divided into multidisciplinary champions (MC) and domain champions (DC). The distinction between the two was their different approaches to engaging the stakeholders. The MC were more engaging throughout the process, generating an organic motivation for participation among the stakeholders. The DC used 'siloed' approaches according to their domain goals and interests and only engaged with other stakeholders in later stages of the design process. They had to use other means of motivation such as enforcement to get stakeholders engaged. However, their ability to identify and bring in different stakeholders in the design process is important as their ability to identify a range of multidisciplinary stakeholders contributed positively towards project outcomes. All stakeholders were facilitated into a

joint participation in the development of digital resources.

### 9.2.1 Implications for HCI design processes

The identified design champions (MC and DC) are important to the collaborative design processes and also in supporting emerging educational technologies, specifically in the area of modern digital scholarship. This is an emerging concept that is moving academia away from the traditional domain structured way of operation to more collaborative approaches that promote multidisciplinary teams working together (Shulman, 2004). The collaborative approaches taken by these design champions can be a way of bridging the different disciplines within academia, and hence support digital scholarship. But there are two implications to this proposition:

i. Although the two types of design champions were found to support multidisciplinary stakeholder collaboration, the DC were less engaging compared to their MC counterparts. While the MC were able to pull together and motivate engagement of different multidisciplinary design stakeholders throughout the process, the DC took a more 'siloed' approach to engagement and only brought in other stakeholders at later stages. The result was that the MC generated a more organic engagement among stakeholders while the DC had to use enforcement approaches to encourage participation. One thing that stood out about the DC was that they were all digital librarians. Their 'siloed' approach would appear to weaken their contribution when it comes to digital scholarship. Yet, in their information ecology analogy, Nardi and O'Day (1999) equate librarians to 'keystone species' because of their various contributions which are vital to the success of libraries. The information ecology

metaphor is used to represent a system of people, practices, values and technologies in a particular local environment where the emphasis is on human activities served by the technology rather than on the technology itself. The 'keystone species' in this ecology are certain skilled people whose presence is crucial to the survival of the information ecology as they support the effective use of technology.

This implies that if these librarians are to retain their place as 'keystone species' within information ecology and make a substantive contribution towards digital scholarship, they have to embrace the approaches taken by their MC counterparts. This research identified that this is possible if the DC would incorporate radical pedagogical approaches to their traditional library domain functions. This was evident in one project where the MC happened to be the only digital librarian among other MC identified i.e. the Practice Based Learning (PBL) library project. PBL is an approach that is quite different from the traditional digital library tasks such as institutional repositories. It is a resource-based approach that forces learners to depend on resources, hence integrating pedagogy with digital resources. In view of this, the DC (digital librarians) need to incorporate diverse pedagogical and technological concepts in their processes. Taking such a shift will enable them to adequately support the concept of digital scholarship as well as contribute effectively towards collaborative design processes for educational digital resources.

ii. The policymakers found to be critical stakeholders in HCI design process (see Subsection 9.1.1) were mainly identified by the MC who were able to locate different stakeholders and their contribution to the design process. By taking a 'siloed' approach, the DC were missing important contribution from such stakeholders. This implies that

in order for them to be effective, they need to embrace more inclusive approaches that bring different multidisciplinary stakeholders on board as it happened with the approaches taken by the MC.

## 9.3 THE ROLE OF THE INNOVATIVE TECHNOLOGIES FACTOR

Innovative technologies were found to be an important factor in the collaborative design process. This was made up of universal technologies such as web-based databases of journals and other scholarly information resources as well as mobile devices. Additionally, there were certain applications referred in this thesis as *'flexible technologies'* because of their flexibility. These two applications included the Open Source Software (DSpace) and the Web 2.0 applications.

The flexible technologies were able to customize existing universal technologies to fit the intended use. This led to digital library projects being user-centred. They also resulted in projects that were visible to users and digital resources that enabled improved practice among stakeholders. Conversely, their absence led to poorly supported and unsustainable digital library projects.

### 9.3.1 Implications for HCI design processes

The concept of flexible technologies (DSpace Open Source Software and Web 2.0) identified in this research offers useful contributions particularly to the field of HCI4D. The flexibility feature inherent in these technologies enabled customization of existing universal technologies to context needs. Together with the human relationships factor and the policies factor, they resulted in successful collaborative design processes for digital library projects that were user-centred, visible to users and sustainable. Stakeholders using

these technologies were able to improve their practice. This is an important consideration for universal technologies i.e. digital library resources which are mostly produced for universal usage but require to be customization to make then appropriate for contexts such as Africa that has its own unique needs.

The flexibility effects resulted in improved innovation as highlighted in the previous paragraph. This suggests that these flexible technologies can help leapfrog technology innovation. Buxton (2008; 2009) has discussed this extensively in his notion of the 'long nose of innovation'. He argues that the bulk of innovation takes a long period of time. To illustrate just how long the process of innovation can take, he presents two examples (a) the mouse which took 30 years from first inception in 1965 to 1995 when it became ubiquitous with the release of Windows 95; and (b) the present multi-touch screens first discovered by researchers in the early 1980s. He likens this process to the long and laborious process of gold prospecting, mining, refining and goldsmith before we can claim gold bars. It is this 'augmentation and refinement' process of the innovation idea that appeared to be happening in the design process of the projects reviewed in this research. Most of the projects reviewed already utilized existing universal technologies. However it is the additional flexible technologies that supported the customization of the innovation.

Buxton's interest in the above illustration is in seeing the 'long nose' reduced and considers those who can shorten it by 10% -20% as having made as great contribution to the innovation as those with the initial idea. It can be argued that the flexibility features of the flexible technologies in the first instance helps in reducing this long nose of innovation. But this nose can be further shortened by adding the support of the policies factor and the human relationships factor which ensure appropriate impact and sustainability of the

customized innovation.

## 9.4 IMPLICATION FOR AFRICAN TECHNOLOGY DESIGN PROCESSES

This thesis set out to find a solution for African technology development in relation to collaborative design processes of educational digital resources. As highlighted in the introductory chapters (Chapter 1 and 2), this is a continent with great potential to exploit technology for expanding access to quality education. The African higher education is coming out of a historical state of crisis that left this sector very underdeveloped. There were no sufficient financial resources to support teaching, learning and research activities including associated facilities such as libraries. Enrolment figures shot up while infrastructural development stagnated, leading to overstretching of existing limited resources. Expansion of access to quality educational opportunities and learning resources is of great relevance to this context. Emergence of modern technology in the form of e-learning and educational digital resources could not have come at a better time than this.

The research carried out in this thesis has established that there is a general appreciation of technology use in education. In all the three countries researched, there is eagerness to embrace e-learning approaches. There are also digital libraries being developed and implemented. However, development of these technologies and how they are implemented is being done differently with varying results as was established in the findings of this research (see Chapter 5). This has impacts on the effectiveness of educational digital resources that are eventually developed. This differentiation was particularly evident from the policies factor in collaborative design processes. Policies in South Africa were enforcing, those in Uganda were facilitating, while those in Kenya provided no support.

The above differentiation uncovers a whole issue to do with culture that must be borne in mind when it comes to understanding design processes within the HCI4D domain. The South African situation appeared to have an enforcing culture in the way policies were implemented while that in Uganda was facilitating. Could the situation in South Africa be linked to its historical development through the apartheid rule? While the focus of this thesis is how design processes are implemented and not about cultural differences or how policies are developed and implemented across different African countries, these cultural insights cannot be ignored. Both South African and Ugandan case studies benefitted regardless of these apparent cultural differences but the Ugandan one ended up having more examples of good practice projects. The Kenyan case study obviously had weak examples of 'best practice' projects. Is the policy situation in this country also impacted upon by the culture? Does it have something to do with the historical colonial rule in some way or is it simply a flaw in the way policies are developed and implemented? These are important questions that require further investigation (see Subsection 9.6.3).

## 9.5 PRACTICAL IMPLICATION: A GUIDANCE TOOL

This thesis set out primarily to provide guidance to designers of educational digital resources which would support them in the collaborative design process when designing these resources. The identified design process factors have been used to provide this sort of guidance, in the form of a collaborative design process model called the Collaborative Educational Resource Design (CERD) process model. This CERD process model is a descriptive model that has been generated systematically through an empirical process. African universities in three separate African countries were systematically investigated to understand how collaborations between the learning and information parties occurred. This

makes the model an African model, as it relates to the actual experiences within this context and hence is relevant for supporting educational digital resources designers in African HE.

In order to make this model applicable as a collaborative design process guidance tool, a set of guidelines have been developed out of the model. These guidelines are detailed in Section 8.5.

## 9.6 REFLECTIONS

The overarching aim of this thesis was to develop guidance for the collaborative design process of educational digital resources in African HE. In order to achieve this aim, two research questions guided the investigation process, namely: (i) *What are the existing factors that can be used to support a collaborative design process for educational digital resources in African higher education?*, and (ii) *What are the characteristics of these factors and the roles they play in the collaborative design process?*

This section provides a reflection of these two research questions and how they came to be understood in the course the research. It further makes a reflection on an alternative methodological approach learnt in the course of the research, and identifies research limitations and further research areas.

### 9.6.1 Reflection on the research questions

The first research question focused on identifying design process factors from existing best practice digital library projects. By studying such projects, it was possible to single out design process factors that made them stand out as best practice projects. However, identifying these factors was not enough as it was necessary to further understand what made them support the projects successfully. Hence, the second research question aided

in understanding the characteristics of these factors and the role they were playing in making these projects stand out as best practice. Taking this approach in turn provided a greater understanding of the design process factors necessary to support a design process guidance tool than if the research only focused on the first research question. More specifically, studying these two research questions together helped develop a grounded theory about the educational digital library design process that highlights the fact that all the three identified collaborative design process factors (i.e. human relationships factor, innovative technologies factor and policies factor) are necessary. Absence of any one of them weakens the collaborative design process which can lead to unsustainable digital resources that are not user-focused.

Additionally, the second research question helped uncover invaluable insights necessary to the study of HCI4D. All the three identified factors had unique characteristics and roles. For example, different levels of policies were identified as having specific roles that supported the collaborative design process. The role of these policies differed across the three different countries in which research case studies were located, further revealing the importance of considering different cultural contexts. Similarly, the innovative technologies factor revealed that there were certain technologies that provided the flexibility necessary to make existing universal technologies context-specific, thus contributing to sustainability and relevance of the digital library projects. The human relations factor showed that it was not just stakeholders working collaboratively, but there were design champions who played an important role of facilitating this collaboration.

In summary, this research benefitted greatly from adding the second research question because it helped to uncover further details concerning the identified design process factors

from the first research question.

### 9.6.2 An alternative methodological approach for HCI research?

Although developing different methodological approaches was not the focus of this thesis, the process followed in developing the research methodological approach revealed a different and useful alternative to other HCI research approaches. The multidisciplinary nature of this thesis forced the methodological development to analyze the research norms guiding educational and HCI investigations. This resulted in a richer research approach that benefitted from the strength of these two domains (see Subsection 4.1.1.1). In taking this approach, it was possible to step back and review a considerable number of relevant projects at their different stages of development whilst allowing a rigorous in-depth investigation. This was an important deviation from the conventional HCI research (e.g. Participatory Design approach) which is carried out as the design process is happening. This approach resulted in a broader perspective of design processes across the different stages of development in all the 11 projects. This aided in understanding of concepts that had previously been only vaguely conceptualized (i.e. the nature and role of policies in design processes). The value of this broad and diversified methodological approach could be useful for other HCI research projects.

### 9.6.3 Research limitations

This thesis encountered low level limitations of a pragmatic nature, but also identified some high level issues that require to be highlighted. Pragmatically, the research was faced with an issue related to the availability of student participants. In the South African case study, the semester was drawing to the end and students were busy preparing to go for their teaching practice. Their lecturer kindly arranged for meetings with the students on the final

day when she was having a briefing meeting with them. However the time available was limited and only a few students were available to participate. Nevertheless, those interviewed provided useful responses. In the Ugandan case study, participating students were Masters medical students who are required to spend time with patients in the hospital wards. Accessing these students proved very difficult and the researcher had to follow some of them in the wards and conduct interviews on the hospital corridors. This inadvertently provided useful observational data on how they were using PDA (innovative technologies) to improve practice.

The other issue related to financial and time constraints limiting the number of days the researcher could spend at a particular case study. This meant that it was not possible to make face-to-face follow up of interviews and observations in situations that required further information or clarification. This was resolved by contacting the participants through email or telephone for such clarifications.

At a higher level, there is the issue of the extent to which this thesis can be generalized for the whole of the African continent. In the first instance, this thesis was framed within the Sub-Saharan region (see definition of terms in Section 1.5). This region does not include the northern part of Africa which has different cultural and social systems. Secondly, the research focused only on three countries which cannot be used to represent the whole of Africa that is so diverse socio-culturally, politically and technologically. Further research is required in order to enhance generalizability of these findings (see the subsequent Subsection 9.6.3).

### 9.6.4 Recommendation for future research

The research findings have identified the following six areas where there is potential for further investigation:

- This research identified that the role of flexible technologies was provided, in most of the projects reviewed, through Open Source Software and Web 2.0 approaches. The value of these approaches in creating flexibility is that the projects were able to meet contextual needs. However, this research did not identify appropriately if other applications that are not supported by either the Open Source Software or the Web 2.0 can also effectively present these flexibility features. For example, can universal digital library systems provide this flexibility by simply allowing increased flexibility to enable developers and end-users to personalize these resources? Further research in this area is suggested.

- This thesis has revealed some interesting cultural differences across the African countries studied. These cultural issues are linked with the role of policies and how they impacted on the collaborative design processes. However, neither policy nor culture was the main topic of investigation for this thesis. This means that the extent to which they were studied was limited. These interesting links with the collaborative design processes for Africa's innovative technologies require further investigation. This would help to understand clearly the potential impact different African cultures can have on the collaborative design process for African technological innovation development.

- Expert reviewers for the CERD process model raised issues about the African component of this model. On one hand, they were concerned that there was nothing in

the findings that made them Africa specific. On the other hand, they felt that the model needed to include other examples outside Africa to test its general applicability. These concerns point to the need to extend this research beyond Africa. This would respond to these concerns in two ways. First, including a context that is outside Africa would aid in identifying aspects of the findings that are Africa specific and those that are generic. Secondly, this would automatically provide an opportunity to test the model's applicability in other contexts.

- This research was based in three African countries, yet Africa is a very broad and diverse continent in terms of culture, technology, economy and policies. This means that these findings are only illustrative and can therefore not be generalized for this continent. The findings plus the CERD process model produced by this thesis need to be tested in other regions of the African continent in order to increase its generalizability for the continent.

- This research was based on educational technologies. The factors identified as pertinent in supporting collaborative design processes are not necessarily unique to educational technologies but could apply to design of technologies for other sectors such as transport or health. This could make an important contribution to design domains including HCI. It would therefore be crucial that the CERD process model is tested in other domain areas in order to establish whether there are commonalities with the way they have affected the educational technology reported here. For example, do policies have a similar effect to the design process for health technologies the way they impact the design process for educational digital resources? This can aid in determining the extent to which these findings can be generalized for other design processes.

- This research was based on a set of criteria guided by findings of pilot studies carried out in two individual universities. It is possible that other factors might be useful in supporting collaborative design processes of such institutional technologies which go beyond what was included in the criteria. This means that the CERD process model is open to further investigation to establish if other factors can be added to make it more inclusive. This is already provided for in the iterative approach taken in the development of the model (see Section 8.2).

## 9.7 SUMMARY

The chapter has provided a synthesis of the main research findings that have been identified to answer the thesis research questions and meet its overarching aim of providing guidance for collaborative design processes. It has detailed implications for each of the factors for HCI design processes for digital resources and then narrowed down to what they mean for HCI design processes of these resources in Africa. This has uncovered certain cultural considerations that cannot be ignored when it comes to HCI design processes in the African context. It also highlighted potential contribution made by design champions towards supporting digital scholarship but this implies that the approaches taken by the domain champions would need to be similar to those by the multidisciplinary champions. The flexible technologies have been identified as having potential for leapfrogging technology innovations because of their ability to customize exiting innovations to intended needs and hence improving them (i.e. existing technologies). This chapter has concluded by making reflections on a lesson learnt from a methodological perspective, observed limitations and areas that require further research.

# References


Abdullah, A. & Zainab, A. N. (2008) The digital library as an enterprise: the Zachman approach. *The Electronic Library,* 26, 446-467.

Adams, A. (2000) Users' perceptions of privacy in multimedia communications. *Psychology.* London, University College London.

Adams, A. & Blandford, A. (2002) Digital libraries in academia: challenges and changes. *ICADL'02, Digital Libraries: people, Knowledge and Technology.* Heidelberg: Springer.

Adams, A. & Cox, A. L. (2008) Questionnaires, in-depth interviews and focus groups. In Cairns, P. A. & Cox, A. L. (Eds.) *Research Methods for Human Computer Interaction.* Cambridge, Cambridge University Press.

Adams, A., Lunt, P. & Cairns, P. (2008) A qualitative approach to HCI research. In Cairns, P. A. & Cox, A. L. (Eds.) *Research Methods for Human Computer Interaction.* Cambridge, Cambridge University Press.

Ajegbomogun, F. O. (2007) Impediments to harnessing scholarly electronic journals on the Internet in developing countries: A Nigerian university case study. *Library Hi Tech News*, 27-32.

Allen, E. & Seaman, J. (2006) Making the grade: online education in the United States. The Sloan Consortium.

Alsos, O. A. & Dahl, Y. (2008) Toward a best practice for laboratory-based usability evaluations of mobile ICT for hospitals. *Proceedings of the 5th Nordic Conference on Human-Computer Interaction: Building Bridges.* Lund, Sweden, ACM.

Anunobi, C. V. & Ezeani, I. M. (2011) Digital library deployment in a university: challenges and prospects. *Library Hi Tech,* 29.

Appleton, L. (2006) Perceptions of electronic library resources in further education. *The Electronic Library,* 24, 619-634.

Asperin, A. E. & Castillo, A. (2010) Developing a best practice guide for increasing high school student participation and satisfaction in the national school lunch program. *Journal of Child Nutrition & Management,* 34.

AAU (2000) Technical experts meeting on the use and application of information and communication technologies in higher education institutions in Africa. Association of African Universities.

AVU (2004) African Tertiary Institutions Connectivity Survey (ACTIS) report (2004). African Virtual University.

Bardzell, S. (2010) Feminist HCI: taking stock and outlining an agenda for design. Proc.

CHI 2010. Atlanta, Georgia, USA, ACM.

Bassey, M. (1999) *Case study research in education,* Buckingham, Open University Press.

Bateman, P. (2008) Revisiting the challenges for higher education in sub-Saharan Africa: the role of Open Educational Resources Movement. Nairobi, OER Africa -an initiative of SAIDE.

Bederson, B. B., Lazar, J., Johnson, J., Hochheiser, H. & Karat, C. M. (2006) Workshop on SIGCHI Public Policy. ACM Press. *CHI 2006.* Montreal, Quebec, Canada.

Beecher, V. & Paquet, V. (2005) Survey instrument for the universal design of consumer products. *Applied Ergonomics,* 36, 363-372.

Bellamy, R. K. E., Kellogg, W. A., Richards, J., Thomas, J., Rosenbaum, R., Brezin, J., Erickson, T. & Swart, C. (2007) Common & particular needs: a challenge to participatory design. *Proceedings of the CHI 2007, April 28-May 3, 2007, San Jose, California, USA, 1697-1702.*

Bentley, F. R., Kames, J., Ahmed, R., Zivin, R. S. & Schwendimann, L. (2010) Contacts 3.0: bringing together research and design teams to reinvent the phonebook. *Proceedings of the 28th of the International Conference Extended Abstracts on Human Factors in Computing Systems.* Atlanta, Georgia, USA, ACM.

Blandford, A., Adams, A. & Furniss, D. (2009) Understanding the Situated Use of Healthcare Technologies. In *Proceedings of CHI workshop 'Evaluating new interactions in healthcare'.*

Blandford, A., Adams, A., Attfield, S., Buchanan, G., Gow, J., Makri, S., Rimmer, J. & Warwick, C. (2008) The PRET A Rapporter framework: evaluating digital libraries from the perspective of information work. *Information Processing and Management* 44, 4-21.

Blaxter, L., Hughes, C. & Tight, M. (2006) *How to research,* Berkshire, Open University Press.

Bloom, D., Canning, D. & Chan, K. (2006) Higher education and economic development in Africa. Washington, DC, The World Bank (Human Development Sector, Africa Region).

Bond, M. & Beale, R. (2009) What makes a good game?: using reviews to inform design. *Proceedings of the 23rd British HCI Group Annual Conference on People and Computers: Celebrating People and Technology.* Cambridge, United Kingdom, British Computer Society.

Borgman, C., L., Gilliland-Swetland, A. J., Leazer, G. L., Mayer, R., Gwynn, D., Gazan, R. & Mautone, P. (2000) Evaluating digital libraries for teaching and learning in undergraduate education: a case study of the Alexandria Digital Earth Prototype (ADEPT). *Library Trends, Special Issue on Assessing and Evaluating Library*

*Services,* 49, 228-250.

Brandt, E. (2006) Designing exploratory design games: a framework for participation in participatory design? In *Proceedings of Participatory Design Conference, Aug. 2006, Trento, Italy, 57-66.*

Brewer, A., Ding, W., Hahn, K. & Komlodi, A. (1996) The role of intermediary services in emerging digital libraries. In *Proceedings of DL'96.* Bethusda. , ACM Press.

Brewer, E., Demmer, M., Ho, M., R.J.Honicky, Pal, J., Plauche, M. & Surana, S. (2006) The challenge of technologies for developing regions. *Pervasive computing,* 15-23.

Britten, N. (1995) Qualitative interviews in medical research. *British Medical Journal, 311* (6999), 251-3.

Bryman, A. (2008) *Social Research Methods,* Oxford, Oxford University Press.

Bunker, G. & Zick, G. (1999) Collaboration as a key to digital library development. *D-Lib Magazine,* 5.

Buxton, B. (2008) the long nose of innovation. *Business Week, January 2, 2008.*

Buxton, B. (2009) The mad dash toward touch technology. *Business Week, October 21, 2009.*

Cairns, P. & Cox, A. L. (Eds.) (2008) *Research methods for Human-Computer Interaction,* Cambridge, Cambridge University Press.

Camara, S., Shrestha, S., Abdelnour-Nocera, J. & Moore, J. (2010) Village eLearning: An offline mobile solution to rural communities' knowledge requirement. *HCI 2010.*

Carroll, John M. (2011). Human Computer Interaction (HCI). In: Soegaard, Mads and Dam, Rikke Friis (eds.), *Encyclopedia of Human-Computer Interaction.* Available online at http://www.interaction-design.org/encyclopedia/human_computer_interaction_hci.html. (Accessed 25 July, 2011)

Carroll, J. M., Dourish, P., Friedman, B., Kurosu, M., Olson, G. M. & Sutcliffe, A. (2006) Institutionalizing HCI: what do i-Schools offer? *CHI '06 Extended Abstracts on Human Factors in Computing Systems.* Montreal, Québec, Canada, ACM.

Cassel, L., Giersch, S. & Recker, M. (2008) Educational digital libraries on the verge: introduction to the special issue. *International Journal of Digital Libraries,* 9, 1-2.

Champeny, L., Borgman, C. L., Leazer, G. H., Gilliland-Swetland, A. J., Millwood, K. A., D'avolio, L., Finley, J. R. & Smart, L. J. (2004) Developing a digital learning environment: an evaluation of design and implementation processes. *JCDL.* Tucson, Arizona, USA, ACM.

Charmaz, K. (2004) Grounded theory. In Lewis-Beck, M. S., Bryman, A. & Liao, T. F.

(Eds.) *The Sage encyclopedia of social science research methods.* London, Sage Publications.

Charmaz, K. (2005) Grounded theory in the 21st century. In Denzin, N. K. & Lincoln, Y. S. (Eds.) *The Sage handbook of qualitative research.* 3rd ed. London, Sage Publishers.

Chege, Kevin (2010) Impact of Undersea Capacity in East Africa. Available from: http://www.nanog.org/meetings/nanog50/presentations/Tuesday/NANOG50.Talk53.KevinChege-KENETPresentation.pdf (Accessed 22 July, 2011)

Choi, B., Lee, I. & Kim, J. (2005) A qualitative cross-national study of cultural influences on mobile data service design. *CHI 2005.* Portland, Oregon, USA.

Christianakis, M. (2010) Collaborative Research and Teacher Education. *Issues in Teacher Education,* 19, 109-125.

Cloete, N. (2002) Policy expectations. In Cloete, N., Fehnel, R., Maassen, P., Moja, T., Perold, H. & Gibbon, T. (Eds.) *Transformation in higher education: global pressures and local realities in South Africa.* Johannesburg, Centre for Higher Education Transformation.

Cockton, G. (2009) Getting there: six meta-principles and interaction design. *Proceedings of the 27th International Conference on Human Factors in Computing Systems.* Boston, MA, USA.

Coffield, F. & Edward, S. (2009) Rolling out 'good', 'best' and 'excellent' practice. What next? Perfect practice? *British Educational Research Journal,* 35, 371-390.

Conole, Grainne and Weller, Martin (2008) Using learning design as a framework for supporting the design and reuse of OER. *Journal of Interactive Media in Education,* 5

Crawford, W. (2005) Policy, Technology, and the Digital Corpus *Library Technology Reports,* 41, 41-48.

Curley, K. F. & Gremillion, L. L. (1983) The role of the champion in DSS implementation. *Information & Management,* 6, 203-209.

Damsma, P., Norgaard, J. & Jones, R. (2005) Best practices in an online community for blind, partly sighted and fully sighted children. *Proceedings of the 17th Australia conference on Computer-Human Interaction: Citizens Online: Considerations for Today and the Future.* Canberra, Australia, Computer-Human Interaction Special Interest Group (CHISIG) of Australia.

Dantec, C. A. L. & Edwards, W. K. (2010) Across boundaries of influence and accountability: the multiple scales of public sector information systems. *Proceedings of the 28th International Conference on Human Factors in Computing Systems.* Atlanta, Georgia, USA, ACM.

Davis, L. D., M. (2001) Collaborative design with use case scenarios. *In Proceedings of the*

*1st ACM/IEEE-CS Joint Conference on Digital libraries,* June 24-28, 2001, pp.146-147. Roanoke, VA, USA.

de la Chica, S., Ahmad, F., Gu, Q., Okoye, I., Maull, K., Sumner, T. & Butcher, K. R. (2009) A personalized learning environment. In *Proceedings of the 9th ACM/IEEE-CS joint conference on Digital libraries.* Austin, TX, USA, ACM.

Department of Health. 2008. NHS Design Champions. Available from: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_085991.pdf (Accessed 22 July, 2011)

Denzin, N. K. & Lincoln, Y. S. (2005) *The Sage handbook of qualitative research.* In London, Sage Publications.

Design Council. 2010. Leadership. Available from: http://www.designcouncil.org.uk/about-design/Managing-Design/Managing-in-design/Leadership/(Accessed 22 July, 2011)

Dix, A., Finlay, J., Abowd, G. & Beale, R. (1998) *Human-Computer Interaction*, London, Prentice Hall Europe.

Dong, A. & Agogino, A. (2001) Designing principles for the information architecture of a SMET education digital library. *JCDL'01,* . Roanoke, VA, USA, , ACM Press.

Downs, R. R. & Chen, R. S. (2004) Cooperative Design, Development, and Management of Interdisciplinary Data to Support the Global Environmental Change Research Community. *Science & Technology Libraries,* 23, 5 - 19.

Dray, S. M., Siegel, D. A. & Kotze, P. (2003) Indra's net: HCI in the developing world. *Interactions*, 28-37.

Druin, A., Bederson, B., Rose, A and Weeks, A. (2009) From New Zealand to Mongolia: Co-Designing and Deploying a Digital Library for the World's Children. *Children, Youth and Environments*, 19, (1) 34-57.

Duncker, E. (2002) Cross-cultural usability of the library metaphor. *2nd ACM/IEEE-CS Joint Conference on Digital Libraries.*

Edwards, A. & Kinti, I. (2009) Working Relationally at Organisational Boundaries: negotiating expertise and identity. In Daniels, H., Edwards, A., Engeström, Y. & Ludvigsen, S. (Eds.) *Activity Theory in Practice: promoting learning across boundaries and agencies.* London, Routledge.

Eger, N., Ball, L. J., Stevens, R. & Dodd, J. (2007) Cueing retrospective verbal reports in usability testing through eye-movement replay. *Proceedings of the 21st British HCI Group Annual Conference on People and Computers: HCI...but not as we know it - Volume 1.* University of Lancaster, United Kingdom, British Computer Society.

Falconer, J. (2011) Knowledge as cheating: A metaphorical analysis of the concept of 'best

practice'. *Systems Research & Behavioral Science,* 28, 170-180.

Fallman, D. (2011) The new good: exploring the potential of philosophy of technology to contribute to human-computer interaction. *Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems.* Vancouver, BC, Canada, ACM.

Farrell, G. & Shafika, I. (2007) Survey of ICT and Education in Africa: a summary report, based on 53 Country Surveys. Washington, DC, infoDev/World Bank.

Freebody, P. (2003) *Qualitative research in education: Interactive and practice,* London, Sage Publications.

Flechais, I. & Sasse, M. A. (2009) Stakeholder involvement, motivation, responsibility, communication: How to design usable security in e-Science. *International Journal of Human Computer Studies,* 67, 281-296.

Furniss, D. (2008) *Beyond Problem Identification: Valuing methods in a 'system of usability practice'.* Unpublished PhD. Thesis, London, University College of London.

Furniss, D., Blandford, A. & Curzon, P. (2011) Confessions from a grounded theory PhD: experiences and lessons learnt. In *Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems.* Vancouver, BC, Canada, ACM.

Gakio, K., Chimwaza, G. & Nyareza, S. (2007) African Tertiary Institutions Connectivity Survey (ATICS): 2006 Report. IDRC, Canada.

Gakusi, A.-E. (2010) African Education Challenges and Policy Responses: Evaluation of the Effectiveness of the African Development Bank's Assistance. *African Development Review,* 22, 208-264.

Gerring, J. (2007) *Case study research: principles and practices,* Cambridge, Cambridge University Press.

Gholami, B., Kaviani, F., Zabihi, E., (2009) Web 2.0, a Boost in IT Infrastructure Flexibility and Team Collaboration, *ICCEE, vol. 1,* 153-157.

Gil, N. M., Hine, N. A. & Arnott, J. L. (2008) Stakeholder involvement in the design and development of a domestic well-being indicator system. In *Proceedings of the 10th International ACM SIGACCESS Conference on Computers and Accessibility.* Halifax, Nova Scotia, Canada

Gillham, B. (2000) *Case study research methods,* London, Continuum.

Gray, V. (2006) The un-wired continent: Africa's mobile success story, ITU.

Grierson, H., Wodehouse, A., Breslin, C., Ion, W., Nicol, D. & Juster, N. (2008) An evaluation study of a digital library of ideas: Workflow model and classroom use.

*International Journal of Digital Library,* 9, 29-39.

Guan, Z., Lee, S., Cuddihy, E. & Ramey, J. (2006) The validity of the stimulated retrospective think-aloud method as measured by eye tracking. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.* Montreal, Québec, Canada, ACM.

Gubrium, J. F. & Holstein, J. A. (2002) From the individual interview to the interview society. In Gubrium, J. F. & Holstein, J. A. (Eds.) *Handbook of interview research: context & method.* Thousand Oaks, CA, Sage.

Hammersley, M. & Atkinson, P. (2007) *Ethnography,* London, Routledge.

Hanna, N. (2008) Why a holistic e-development framework? *Information Technologies and International Development,* 4, 1-7.

Harle, J. (2010) Growing knowledge: Access to research in east and southern African universities. The Association of Commonwealth Universities/ARCADIA.

Hartley, D. (2007) Use and users of digital resources: a survey explored scholars' attitudes about educational technology environments in the humanities. *Educause Quarterly,* 4, 12-20.

Hummels, C. & Frens, J. (2009) The reflective transformative design process. *CHI 2009.* Boston, Massachusetts, USA, April 4-9, 2009, 2655-2658.

Hunter, J., Khan, I., Gerber, A. (2008) HarvANA - Harvesting Community Tags to Enrich Collection Metadata. *In Proceedings of the 8th ACM/IEEE-CS Joint Conference on Digital libraries, June 15-20, 2008.* Pittsburgh, PA, pp. 147-156.

Hwabamungu, B. & Williams, Q. (2010) m-Health adoption and sustainability prognosis from a care givers' and patients' perspective. In *Proceedings of the 2010 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists.* Bela Bela, South Africa, ACM.

Iluyemi, A. (2008) Mobile information access for community-based health workers in developing countries. In Needham, G. & Ally, M. (Eds.) *M-Libraries: Libraries on the move to provide virtual access.* London, Facet Publishing.

Inglesant, P. & Sasse, M. A. (2007) Usability is the best policy: public policy and the lived experience of transport systems in London. *Proceedings of the 21st British HCI Group Annual Conference on People and Computers: HCI...but not as we know it - Volume 1.* University of Lancaster, United Kingdom, British Computer Society.

Innocenti, P., Vullo , G. & Ross, S. (2010) Towards a digital library policy and quality interoperability framework: the DL.org project. *New Review of Information Networking,* 15, 29-53.

Issroff, K. & Scanlon, E. (2002) Educational technology: the influence of theory. *JIME,* 6.

Jaeger, P. T., Shneiderman, B. & Fleischmann, K. R. (2007) Community response grids: e-government, social networks, and effective emergency management. *Telecommunications Policy,* 31, 592-604.

John, B. E. & Packer, H. (1995) Learning and using the cognitive walkthrough method: a case study approach. *Proceedings of the SIGCHI Conference on Human factors in Computing Systems, p.429-436, May 07-11, 1995*, Denver, Colorado, United States.

Jones, Chris and Ramanau, Ruslan (2009) The Net Generation enters university: What are the implications for Technology Enhanced Learning? *In: M-2009: Proceedings of the 23rd ICDE World Conference on Open Learning and Distance Education including the 2009 EADTU Annual Conference,* Maastricht, NL.

Kam, M., Ramachandran, D., Raghavan, A., Chiu, J., Sahni, U. & Canny, J. (2006) Practical considerations for participatory design with rural school children in underdeveloped regions: early reflections from the field. *IDC'06.* Tampere, Finland, ACM Press.

Kanyengo, C. W. (2009) Managing digital information resources in Africa: Preserving the integrity of scholarship. *The International Information & Library Review,* 41, 34-43.

Karapanos, E., Martens, J.-B. & Hassenzahl, M. (2010) On the retrospective assessment of users' experiences over time: memory or actuality? *Proceedings of the 28th of the International Conference Extended Abstracts on Human Factors in Computing Systems.* Atlanta, Georgia, USA, ACM.

Kavulya, J. M. (2007) Digital libraries and development in Sub-Saharan Africa. *The Electronic Library,* 25, 299-315.

Kebede, G. (2004) The information needs of end-users of Sub-Saharan Africa in the digital information environment. *The International Information & Library Review,* 36, 273-279.

Khan, A., Blevis, E. & Busse, D. (2011) CHI 2011 sustainability community invited SIG: framework & agenda. *Proceedings of the 2011 Annual Conference Extended Abstracts on Human Factors in Computing Systems.* Vancouver, BC, Canada, ACM.

Khoo, M. (2001) Community design of DLESE's collections review policy: a technological frames analysis. *JCDL'01, June 24-28, 2001, Roanoke, Virginia, USA, 157-164.*

Kiguli-Malwadde, E., Kijjambu, S., Kiguli, A., Galukande, M., Mwanika, A., Luboga, S. & Sewankambo, N. (2006) Problem based learning, curriculum development and change process at faculty of Medicine, Makerere University, Uganda. *African Health Sciences,* 6, 127-130.

Kinengyere, A. A. (2007) The effect of information literacy on the utilization of electronic information resources in selected academic and research institutions in Uganda. *The*

*Electronic Library,* 25, 328-341.

Kiondo, E. (2008) Monitoring and evaluation of electronic resource usage: a case study of the University of Dar es Salaam Library, Tanzania. In Rosenberg, D. (Ed.) *Evaluating electronic resource programs and provision: case studies from Africa and Asia.* Oxford, International Network for the Availability of Scientific Publications (INASP).

Komladi, A., Caidi, N. & Wheeler, K. (2004) Cross-Cultural Usability Of Digital Libraries. In Chen, Z., Chen, H., Miao, Q., Fu, Y., Fox, E. & Lim, E. P. (Eds.) *7th International Conference on Asian Digital Libraries, ICADL 2004.* Shanghai, China, December 13-17, 2004, Springerlink.

Lam, E. (2011) Sharing Best Practices in Barbados and Trinidad and Tobago: Patterns of Policy Implementation and Resistance. *Compare: A Journal of Comparative and International Education,* 41, 25-41.

Lankes, D. R., Silverstein, J. Nicholson (2007) Participatory Networks: the library as conversation. American Libraries Association's Office for Information Technology Policy.

Law, D. (2004) Content and services issues for digital libraries. In Andrews, J. & Law, D. (Eds.) *Digital libraries: policy, planning and practice.* Aldershot, Hunts, Ashgate Publishing Limited.

Lazar, J., Hochheiser, H., Johnson, J., Karat, C.-M. & Bederson, B. B. (2008) CHI policy issues around the world. *CHI 2008.* Florence, Italy, ACM Press.

Lebeau, Y. (2008) Universities and social transformation in sub-Saharan Africa: global rhetoric and local contradictions. *Compare,* 38, 139-153.

Lesk, M. (2005) *Understanding digital libraries,* San Francisco, CA, Morgan Kaufmann.

Lippincott, J. K. (2005) Net generation students and libraries. In Oblinger, D. G. & Oblinger, J. L. (Eds.) *Educating the Net Generation.* EDUCAUSE.

Littlejohn, A., Cook, J., Sclater, N., Currier, S. & Davis, H. (2006) Managing educational resources. In Conole, G. & Oliver, M. (Eds.) *Contemporary perspectives in e-learning research.* London, Routledge.

Lund, B., Hammond, T., Flack, M., And Hannay, T. (2005) Social Bookmarking Tools (II): A Case Study- Connotea. *D-Lib Magazine,* 11.

Lustria, M. L. A., Kazmer, M. M., Glueckauf, R. L., Hawkins, R. P., Randeree, E., Rosario, I. B., Mclaughlin, C. & Redmond, S. (2010). Participatory design of a health informatics system for rural health practitioners and disadvantaged women. *Journal of the American Society for Information Science and Technology,* 61, 2243-2255.

Mackenzie, I. S. (2003) Motor behaviour models for Human-Computer Interface. In Carroll, J. M. (Ed.) *HCI Models, Theories and frameworks: towards a*

*multidisciplinary science.* London, Morgan Kaufmann Publishers.

Manda, P. A. (2008) Access to electronic library resources and services in academic and research institutions in Tanzania. In Rosenberg, D. (Ed.) *Evaluating electronic resource programs and provision: case studies from Africa and Asia.* Oxford, International Network for the Availability of Scientific Publications (INASP).

Marchionini, G., Plaisant, C. & Komladi, A. (2003) The people in digital libraries: Multifaceted approaches to assessing needs and impact. In Bishop, A. P., House, N. A. V. & Buttenfield, B. P. (Eds.) *Digital Library Use: Social practice in design and evaluation.* London, The MIT Press.

Materu, P. (2007) *Higher Education Quality Assurance in Sub-Saharan Africa: Status, Challenges, Opportunities and Promising Practices.* Washington, DC, World Bank.

Maxwell, J. A. (2005) *Qualitative research design: an interactive approach,* London, Sage Publications.

Mazrui, A. A. (2003) Towards Re-Africanizing African Universities: Who Killed intellectualism in the Post Colonial Era? *Alternatives: Turkish Journal of International Relations,* 2, 135-163.

Mbambo-Thata, B. (2007) Overview and context of the library's digitization. In Mbambo-Thata, B. (Ed.) *Building a digital library at the University of Zimbabwe.* Oxford, International Network for the Availability of Scientific Publications (INASP).

Mbambo-Thata, B. (2008) Libraries and mobile phones in Southern Africa: possible implications at the University of South Africa. In Needham, G. & Ally, M. (Eds.) *M-Libraries: Libraries on the move to provide virtual access.* London, Facet Publishing.

Mccrickard, D. S., C.M.Chewar & Somervell, J. (2004) Design, science, and engineering topics? Teaching HCI with a unified method. *SIGCSE '04, March 3-7, 2004, Norfolk, Virginia, USA.*

Mcgowan, P. J. (2005) Coups and Conflict in West Africa, 1955-2004. *Armed Forces & Society,* 32, 5-23.

Medhi, I., Ratan, A. & Toyama, K. (2009) Mobile-Banking Adoption and Usage by Low-Literate, Low-Income Users in the Developing World. *Proceedings of the 3rd International Conference on Internationalization, Design and Global Development: Held as Part of HCI International 2009.* San Diego, CA, Springer-Verlag.

Merriam, S. B. (1998) *Qualitative research and case study applications in education,* San Francisco, Jossey-Bass Publishers.

Mia, J. & Nesta, F. (2006) Marketing library services to the Net Generation. *Library Management,* 27, 411-422.

Mills, Jane, Bonner, Ann, and Francis, Karen (2006) The development of constructivist

grounded theory. *International Journal of Qualitative Methods*, 5 (1). pp. 25-35.

Morris, S., Morris, A. & Barnard, K. (2004) Digital trail libraries. *In Proceedings of the 4th ACM/IEEE-CS Joint Conference on Digital Libraries. pp. 63-71.*

Muller, M. J. (2008) Participatory design: the third space in HCI. In Andrew Sears, J. A. J. (Ed.) *Human-computer interaction handbook: fundamentals, evolving technologies, and emerging applications.* 2 ed. London, Lawrence Erlbaum Associates.

Muswazi, P. (2000) Digital library and information services in Southern Africa. *Information Development,* 16, 75-82.

Mutula, S. M. (2004) IT diffusion in Sub-Saharan Africa: implications for developing and managing digital libraries. *New Library World,* 105, 281-289.

Mutula, S. M. (2007) Paradigms shifts in information environment: prospects and challenges African libraries. *Library Hi Tech,* 25, 396-408.

Mwanza-Simwami, D., McAndrew, P. & Madiba, M. (2008) Fostering Open Educational Practices in Cross-Cultural Contexts. In Cunningham, P. C. A. M. (Ed.) *IST-Africa 2008 Conference Proceedings,* IIMC International Information Management Corporation.

Nakkazi, E. (2010) Uganda to adopt electronic health records system. *New Science Journalism.*

Nardi, N. A. & O'day, V. L. (1999) *Information ecologies: using technology with heart,* Cambridge, MIT.

Nettamo, E., Nirhamo, M. & Hakkila, J. (2006) A cross-cultural study of mobile music-retrieval, management and consumption. *OZCHI.* Sydney, Australia.

Newell, A. F., Dickinson, A., Smith, M. J. & Gregor, P. (2006) Designing a portal for older users: A case study of an industrial/academic collaboration. *Journal ACM Transactions on Computer-Human Interaction,* 13, 347-375.

Ng'ambi, Dick; Njenga, Kennedy (2006) Use of personal digital assistants (PDAs) in clinical education / practice: literature review. *A joint project between the Education Development Unit (EDU) and the Centre for Educational Technology*, University of Cape Town.

Ngimwa, P. (2010) *OER readiness in Africa*. In Dyson, Janet (Ed.), Blurb.com

Ngimwa, P. (2008) An African experience in providing a digital library service: the African Virtual University (AVU) example. In Brophy, P., Craven, J. & Markland, M. (Eds.) *Libraries Without Walls 7: Exploring 'anywhere, anytime' delivery of library services.* London, Facet Publishing.

Nkosi, D. S. (2008) Establishing an institutional repository. *Conference on Electronic*

*Publishing and Dissemination,* Dakar, Senegal, 6-7 October, 2008.

Noor, Khairul Baharein Mohd (2008) Case study: a strategic research methodology. *American Journal of Applied Sciences,* 5, 11

Obura, F. (2010) Wrong priorities, policies hinder e-learning. *The Standard (online edition).* Nairobi, The Standard Group Limited.

OCLC (2003) Libraries and the enhancement of e-learning. Dublin, Ohio, Online Computer Library Center.

Oketch, M. O. (2003) The Growth of Private University Education in Kenya: The Promise and Challenge. *Peabody Journal of Education* 78, 18-40.

Okumu, T. (2009) Back and forth, challenges in designing of elearning system in Makerere University. *4th International Conference on ICT for Development and Training.* Le Meridien President, Dakar, Senegal, May, 29th, 2009.

O'Reilly, T. and Battelle, J. (2009) Web Squared: Web 2.0 Five Years On. Special report. Available from: http://gossgrove.com/sites/default/files/web2009_websquared-whitepaper.pdf (Accessed 17 August, 2011)

Ormerod, T. C., Mariani, J., Morley, N. J., Rodden, T., Crabtree, A., Mathrick, J., Hitch, G. & Lewis, K. (2004) Mixing research methods in HCI: Ethnography meets experimentation in image browser design. In Bastide, R., Palanque, P. & Roth, J. (Eds.) *Joint Working Conferences EHCI-DSVIS 2004 Hamburg,* Germany, July 11-13, 2004. Springer.

Ornella, P. & Stephanie, B. (2006) Universal design for mobile phones: a case study. *CHI 2006.* Montreal, Quebec, Canada.

Pade, C. I., Mallinson, B. & Sewry, D. (2006) An exploration of the categories associated with ICT project sustainability in rural areas of developing countries: a case study of the Dwesa project. *Proceedings of the 2006 annual research conference of the South African institute of computer scientists and information technologists on IT research in developing countries.* Somerset West, South Africa, South African Institute for Computer Scientists and Information Technologists.

Patton, M. Q. (2002) *Qualitative research & evaluation methods,* London, Sage Publications.

Phipps, K., Sangudi, G. & Woolway, S. (2003) What works: Healthnet Uganda's Evolution From NGO To Sustainable Enterprise.

Preece, J., Rogers, Y. & Sharp, H. (2002) *Interaction Design: beyond human-computing interaction*, John Wiley & Sons.

Puri, S. K., Byrne, E., Nhampossa, J. L. & Quraishi, Z. B. (2004) Contextuality of participation in IS design: a developing country perspective. *Proceedings of the eighth conference on Participatory design: Artful integration: interweaving media,*

*materials and practices - Volume 1.* Toronto, Ontario, Canada, ACM.

Ramachandran, D., Kam, M., Chiu, J., Canny, J. & Frankel, J. L. (2007) Social dynamics of early stage co-design in developing regions. *CHI 2007.* San Jose, California, USA, ACM Press.

Republic of Kenya (2005) Ministry of Education Science and Technology Sessional paper no.1 of 2005 on a policy framework for education, training and research. Nairobi, Republic of Kenya.

Republic of Kenya (2006) National Information Communications Technology (ICT) Policy, Nairobi, Ministry of Information & Communications.

Republic of South Africa (2004) White Paper of e-education: transforming learning and teaching through ICT. In Department of Education (Ed.). Pretoria, Government Printer.

Republic of Uganda (2001) Universities and other tertiary institutions Act, 2001. In The Parliament of the Republic of Uganda (Ed.). Kampala.

Republic of Uganda (2009) Health Sector Strategic Plan II 2005/06 - 2009/2010. In Ministry of Health (Ed.). Kampala.

Rieger, O. Y. (2008) Opening Up Institutional Repositories: Social Construction of Innovation in Scholarly Communication *Scholarly Communication Journal of Electronic Publishing,* 11.

Robbins, I. P. (2009) "Best Practices": What's The Point? *Clinical Law Review,* 16, 321-333.

Rodriguez, S., Wan, Y. & Learning Point, A. (2010) Connecting Research about Access to Higher Education to Practice. An Introductory Guide for Educators.

Rogers, E. M. (2003) *Diffusion of innovations*, London, Free Press.

Rosenberg, D. (2006) Towards the digital library in Africa. *The Electronic Library,* 24, 28-293.

Rubin, H. J. & Rubin, I. S. (2005) *Qualitative Interviewing: The art of hearing data,* London, Sage Publications.

Rubin, R. E. (2000) *Foundations of library and information science,* New York, Neuman-Schuman Publishers.

Sambasivan, N., Cutrell, E., Toyama, K. & Nardi, B. (2010) Intermediated technology use in developing communities. *CHI 2010.* Atlanta, Georgia, USA.

Sawyerr, A. (2004) Challenges Facing African Universities: Selected Issues. *African Studies Review,* 47, 1-59.

Seale, C. (1999) *The quality of qualitative research,* London, Sage Publications.

Sellen, A., Rogers, Y., Harper, R. & Rodden, T. (2009) Reflecting human values in the digital age. *Commun. ACM,* 52, 58-66.

Shneiderman, B. (2009) A National Initiative for Technology-Mediated Social Participation (Technology, Society & Public Policy).

Shneiderman, B. (2010) Getting serious about social media: strategies for increasing civic participation. *HCI 2010.*

Shneiderman, B. and Plaisant, C., (2010) *Designing the User Interface: Strategies for Effective Human-Computer Interaction,* London, Addison-Wesley.

Shulman, L. S. (2004) *Teaching as community property: essays on higher education.* Jossey-Bass, San Francisco.

Silverman, D. (2000) *Doing qualitative research: a practical handbook,* London, Sage Publications.

Skiba, D. J. & Barton, A. J. (2006) Adapting your teaching to accommodate the Net Generation of learners. Online Journal of Issues in Nursing, 11, 15-15.

Smalley, P. & Herman, J. (2005) Creating a system to share user experience best practices at eBay. *CHI '05 Extended Abstracts on Human Factors in Computing Systems.* Portland, OR, USA, ACM.

Smith, C. (2006) Multiple cultures, multiple intelligences: Applying cognitive theory to usability of digital libraries. *Libri,* 56, 227-238.

Smyth, T. N., Kumar, S., Medhi, I. & Toyama, K. (2010) Where there's a will there's a way: mobile media sharing in urban India. *Proceedings of the 28th International Conference on Human Factors in Computing Systems.* Atlanta, Georgia, USA, ACM.

Spoerri, A. (2002) Souvenir: flexible note-taking tool to pinpoint and share media in digital libraries. *In Proceedings of the 2nd ACM/IEEE-CS Joint Conference on Digital Libraries. July 14-18, 2002,.* Portland, OR, USA. pp. 383.

Stake, R. E. (2005) Qualitative case studies. In Denzin, N. K. & Lincoln, Y. S. (Eds.) *The Sage handbook of qualitative research.* London, Sage Publications.

Steiner, R., Tirivayi, N., Jensen, M. & Gakio, K. (2004) *Africa tertiary institution connectivity survey (ACTIS) report.* World Bank Institute.

Strauss, A. & Corbin, J. (1990) *Basics of Qualitative Research: grounded theory procedures and techniques,* London, Sage Publications.

Straw, J. B. (2009) Digital partners: Collaborating to build digital resources. In Deyrup, M.

M. (Ed.) *Digital scholarship.* London, Routledge.

Suber, P. (2004) Guide to the Open Access Movement.

Sumner, T., Khoo, M., Recker, M. & Marlino, M. (2003) Understanding educator perceptions of "quality" in digital libraries. *Proceedings of the 3rd ACM/IEEE-CS Joint Conference on Digital Libraries.* Houston, Texas, IEEE Computer Society.

Sumner, T. and Team, C. (2010) Customizing science instruction with educational digital libraries. *Proceedings of the 10th Annual Joint Conference on Digital libraries.* Gold Coast, Queensland, Australia, ACM.

Tatum, C. 2009. Champions for integrated design solutions. In *Proceedings of LEAD* 2009.

Teferra, D. and Altbach, P. G. (2004) African Higher Education: Challenges for the 21st Century. *Higher Education,* 47, 21-50.

The Commission for Africa (2005). Our Common Interest: report of the Commission for Africa, UK.

The Commission on Growth and Development Report (2008), Washington, DC. The World Bank

Theng, Y. L., Mohd-Nasir, M., Buchanan, G., Fields, B., Thimbleby, H. & Cassidy, N. (2001) Dynamic digital libraries for children. *JCDL'01.* Roanoke, Virginia, USA.

Theng, Y. L., Mohd-Nasir, N., Thimbleby, H., Buchanan, G. & Jones, M. (2000) Designing a digital library with and for children. *In the Proceedings of the ACM International Conference on Digital Libraries.*

Torjman, S. (2005) What is policy? Ottawa, Canada, The Caledon Institute of Social Policy.

Tusubira, F. F., Mulira, N. K., Kahiigi, E. K. & Kivunike, F. N. (2008) *Transforming institutions through information and communication technology: the Makerere University Experience.* Kampala, Makerere University.

UCL (2008) Information behaviour of the researcher of the future. *A CIBER briefing paper.*

UN Department of Public Information (2007) *Africa and the Millennium Development Goals: 2007 Update.* Paris: United Nations.

Unesco Institute for Statistics (2008). Available from: http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=167 (Accessed 17 April 2008).

University of Pretoria (2009) *UP in a nutshell.* Pretoria, University of Pretoria.

University of Pretoria (2008) *Department for education innovation Annual report,* University of Pretoria.

Van der WALT, W. (2005) Electronic theses and dissertations: defining the objectives and secondary challenges. *International Network for the Availability of Scientific Publications (INASP) Newsletter.*

Van Wyk, J. (2009) UP Library Service's Web 2.0 Journey. *Knowledge Management Practitioners Group of Pretoria Meeting.* CSIR Knowledge Commons, Pretoria, 14 October, 2009.

Visser, H. (2008) Listen to the Urgent Sound of Drums: Major Challenges in African Higher Education. *New Directions For Institutional Research,* Assessment Supplement 65-77.

Vredenburg, K., Mao, J., Smith, P. W., Carey, T. (2002) A survey of user-centred design practice. *In Proceedings of SIGCHI conference. ACM Press pp471- 478.*

Walker, K. (2009) The mobile resource kit. *ICT Update, 51.*

Watkins, J. (2007) Social media, participatory design and cultural engagement. *Proceedings of the OzCHI 2007, 28-30 Nov. 2007, Adelaide, Australia, 161-166.*

Winter, J. S. (2006) Public involvement in technology policy: focus on the pervasive computing environment. *SIGCAS Computers and Society,* 36, 49-57.

Witten, I., Loots, M., Trujillo, M. & Bainbridge, D. (2001) The promise of digital libraries in developing countries. *Communications of the ACM,* 44.

Witten, I. H. & Bainbridge, D. (2007) A retrospective look at Greenstone: lessons from the first decade. *Proceedings of the 7th ACM/IEEE-CS Joint Conference on Digital Libraries.* Vancouver, BC, Canada, ACM.

Wolfenden, F. (2008a) Harnessing OERs, mobiles and other technologies for teacher education in Africa: the TESSA and DEEP projects. In Needham, G. & Ally, M. (Eds.) *M-Libraries: Libraries on the move to provide virtual access.* London, Facet Publishing.

Wolfenden, F. (2008b) The TESSA OER Experience: building sustainable models of production and user implementation. *JIME,* 1-14.

Wong and Blandford (2003) Field research in HCI: A case study. Paper presented at the *CHINZ '03 Conference of the ACM Special Interest Group on Computer-Human Interaction,* New Zealand Chapter, Dunedin, New Zealand.

World Bank (2010) *Financing higher education in Africa.* Washington DC, The World Bank.

Wyche, S. P., Smyth, T. N., Chetty, M., Aoki, P. M. & Grinter, R. E. (2010) Deliberate interactions: characterizing technology use in Nairobi, Kenya. *CHI 2010.* Atlanta, Georgia, USA.

Yin, R. (2003) *Case study research: design and methods,* London, Sage publications.

Zimmerman, J., Forlizzi, J. & Evenson, S. (2007) Research through design as a method for interaction design research in HCI. *CHI 2007.* San Jose, California, USA, ACM Press.

# Appendices

## APPENDIX 1: CASE STUDY SELECTION CRITERIA

### 1. Introduction

The main aim of the study is to create the link between digital library resources (library) and educational resources (e-learning). One way to do this is to have a collaborative design process in developing digital libraries by bringing in end users (i.e. academics and students) to design with the librarians and technical designers. This springs up from a study conducted in a Kenyan university as a pilot for the current study. This pilot study showed that the university library and the eLearning do not connect with each other, but tend to work in isolation. However, there was a pocket of innovation at the same university that presented an interesting design process model which brought end users and designers of information together. This is the VeSeL project that is using mobile devices (a technical innovation) to advance lifelong learning among farming communities. A closer analysis of the policy framework at the national and institutional level within this context revealed that there is a policy void in regards to the development of digital libraries. However, the university library is interested in developing this resource but it seems to be doing it with no institutional and national guidelines or support. This might partially explain why there seems to be this disconnect between the library and the learning sides.

Out of the above background, criteria for other case studies have been developed which include:

1. Pockets of innovation (i.e. library, technical, and eLearning) across
    - The university
    - Lifelong learning project (that has an e-learning component and digital resources component)
2. Policy framework

### 2. Pockets of innovation

At the Kenya university, the development of the digital library resources is the traditional way that is passive, static and not user centered. Meanwhile, the users were keen to use digital resources for their learning process and created their own resources while not differentiating between educational content and library content. However, at the same university and among the same students and academics interviewed, there was the VeSeL project. This is a community lifelong learning project that combines technical innovation (mobile technology) and e-learning innovation to create a knowledge management system for agricultural information (a form of a digital library). End users (farmers) co-create the content and at the same time participate in designing requirements for the system (digital library). The approach fits well with what the students and academics were expressing, i.e. users using technology to design and develop library-type resources that fit their learning needs. This is a model that seems to work and thus further investigations are necessary. Therefore studying similar projects as additional case studies would provide useful comparison data for the current study.

Uganda Health Information Network (UHIN) and Teacher Education in Sub-Saharan Africa (TESSA) projects in Makerere University are good examples and have similar approaches to the VeSeL project. Both projects have a lifelong learning component. UHIN aims at delivering continuing education to clinicians serving in rural Uganda while TESSA supports teachers in sub-Saharan Africa. UHIN is using mobile technology (PDA) as an innovation to support the dissemination of this content and makes use of library resources among others. TESSA is using e-learning innovation (OER). These two projects are operating within universities that have libraries and also e-learning programmes. Both projects have a collaborative approach where the end users are also content creators and therefore have a stake in defining/designing requirements for content development. They therefore fit into the criteria for a case study that can be used to compare with the pilot study findings.

In regards to library innovation, the university of Pretoria library has adopted a variety of technologies that aim at making the connection with the learning end of the university. These include DSpace (a form of repository for learning and research resources), Patron 2.0 (inviting end users to be content generators), web 2.0 (going out to where the end users are), and having the library resources embedded in the university's VLE. This kind of innovation adoption provides a good comparison to what was happening in Kenya and would therefore form a good case study.

## 3. Policy framework

The situation in Kenya shows that the library is operating outside an enabling policy framework, and so is the VeSeL project. The Kenyan policy framework in relation to libraries and more specifically digital libraries at the national and institutional shows that the development of libraries and particularly digital libraries is not adequately supported (see the analysis in Appendix 4). At the national level they are highlighting the role of the libraries but not with regards to the role of digital library. At the institutional level, there is a mention of the role of library in supporting an enabling education environment (i.e. Ominde Report) but with no emphasis on digital library. However, the library does acknowledge and support the role of digital library.

This inadequate policy framework can be used to support the findings of the pilot study that the library is working in isolation and not making the connection with the learning side of the university. The national and institutional policy makers are not providing guidelines or standards in relation to provision of digital resources and how this fits with the learning process. Meanwhile the library is developing its own standards without really being accountable to those above or even their end users. In this sense, it appears like nobody really cares if they do it or not. They are not getting any recognition and are not being evaluated or audited with regards to whether or not they do it. They just do it themselves because they think it would be a nice thing to do. However, they are not making an emphasis on how this service relates to learning, learning is on one end and library on the other, and the two are not making any connections. In the meantime, students and their lecturers are interested in making this connection as per the study findings. They are interested in digital resources, are searching them and devising ways of managing them and even creating their own resources. They are also not making the difference between library resources and education resources but consider them as educational resources. It was interesting to see that there was the VeSeL project which was however operated devoid of a

policy framework, and hence unlike UHIN, failed to connect to the library.

Drawing a comparison with other scenarios that have enabling policy frameworks would be useful. The University of Pretoria library is excellent (see AIS Strategic Plan 2007-2010). It is adequately supported by institutional and library policy frameworks that are very specific and supportive of digital resources for learning purpose. UHIN project in Uganda operates with a good national ICT policy that supports health information dissemination (Kintu, 2006).

**References**

1. AIS Strategic Plan 2007-2010, University of Pretoria, http://www.library.up.ac.za/aboutus/doc/stratplan07_10.ppt (Accessed on 31 July 2009)
2. Kintu, Frederick (2006) Bridging the North –South Divide through Scholarly Communication in Africa, Council for the Development of Social Science Research in Africa (CODESRIA) http://www.codesria.org/Links/conferences/electronic_publishing06/papers/Frederick_Kintu.pdf (Accessed 30 July 2009)
3. Republic of Kenya (1964) Kenya Education Report Part 1. Nairobi, Republic of Kenya (The Ominde Report 1).

## Suggested criteria for selecting Case studies

| | Kenya | | Uganda | | South Africa | |
|---|---|---|---|---|---|---|
| **Criteria** | ***University (anonymized)*** | ***Life long learning projects*** | ***University (Makerere)*** | ***Life long learning projects*** | ***University (Pretoria)*** | ***Life long learning projects*** |
| **Library innovation** | - | - | ? | √ | √<br>i.e. UPSpace, web 2.0 applications, Patron 2.0 | ? |
| **Technical innovation** | - | √<br>Mobile technology | ? | √<br>Mobile technology | √ | ? |
| **eLearning innovation** | √ limited | √<br>(VeSeL) | √ | √<br>UHIN<br>TESSA | √ | √<br>TESSA |
| **Policy framework** | Limited at national level<br>No institutional policy for DL<br>Depart policy support DL | - | ? | √<br>A national ICT policy support for health information | √<br>University strategic plan supports digital resources in the library for the support of learning<br>Exhaustive strategies that support digital resources and their integration to learning process | ? |

## APPENDIX 2: LIST OF INTERVIEW PARTICIPANTS

Participants listed in their specific roles (identified by codes in order to anonymize and protect their identity), according to individual case studies.

| Case study | Participant (identified by codes) | Occupation | No. |
|---|---|---|---|
| South Africa | Academic 1-SA | Academic –Education | 12 |
| | Academic 2-SA | Academic/ PhD student Education | |
| | Academic 3-SA | Academic –Education | |
| | Academic 4-SA | Academic –Education | |
| | Librarian 1 –SA | Librarian | |
| | Librarian 2 –SA | Librarian | |
| | Librarian 3 –SA | Librarian | |
| | Librarian 4 –SA | Librarian | |
| | Student 1 – SA | Masters student – Education | |
| | Student 2 – SA | Bachelors student – Education | |
| | Student 3 – SA | Bachelors student – Education | |
| | E-learning specialist –SA | E-learning specialist | |
| Kenya | Academic 1–KEN | Academic – Computer science | 5 |
| | Academic 2 –KEN | Academic – Agriculture | |
| | Librarian –KEN | Librarian | |
| | E-learning specialist –KEN | E-learning coordinator/ICT Director | |
| | Student – KEN | Masters student – Agriculture | |
| Uganda | Academic 1-UG | Academic – Medicine | 21 |
| | Academic 2-UG | Academic – Medicine | |
| | Academic 3-UG | Academic – Medicine | |
| | Academic 4-UG | Academic/PhD student - Medicine | |
| | Academic 5 -UG | Academic – Music | |
| | Academic 6 –UG | Academic – Music | |
| | Librarian 1 –UG | Librarian | |
| | Librarian 2 –UG | Librarian | |
| | Librarian 3 –UG | Librarian | |
| | Librarian 4 –UG | Librarian | |
| | Librarian 5 –UG | Librarian | |
| | Information intermediary -UG | IT Lab/library Assistant | |
| | Student 1-UG | Masters student – Medicine | |
| | Student 2-UG | Masters student – Medicine | |
| | Student 3-UG | Masters student – Medicine | |
| | Student 4-UG | Masters student – Medicine | |
| | Student 5-UG | Masters student – Medicine | |
| | Student 6-UG | Masters student – Medicine | |
| | Student 7 –UG | Masters student – Music | |
| | E-learning specialist –UG | E-learning coordinator | |
| | Project administrator- UG | Project Manager –UHIN | |
| **Total** | | | **38** |

## APPENDIX 3: SEMI-STRUCTURED INTERVIEW SCHEDULE

**Interviews for academics**

### A. General background information

1. What programs/courses do you teach?
2. For how long have you been doing this?

   *Probe:*

   - *Check status: i.e. Professor/senior lecturer/lecturer?*
   - *Check out if there is a research component and how much this takes compared to teaching*
3. Can you describe your experience with any ICT equipment that you have used or are familiar with?
4. What do you know about digital libraries generally?

### B. Perceptions and usage of digital resources

1. What is your concept of digital resources?

   Probe:

   - *Library resources?*
   - *Educational resources?*
2. In what ways do **you** personally use these resources?
3. How do **you** go about finding and accessing them?

   *Probe:*

   - *Through the Internet?*
   - *In the library?*
   - *Any other medium/channel?*

### C. Collaboration & design issues

i. What is your perception of the way the resources are made available/presented to you?
ii. How do you see the library personnel engaging with you in regard to these?

*Probe:*

- *Development and design process?*
- *Recommendations for suitable resources (for own or learning purpose)?*

*(Look out for anything to do with learning design)*

iii. What is your perception of this engagement?
iv. How do you engage with the library personnel?

*Probe:*

- *For design of the courses.*
- *Using the resources to recommend references to the students.*
- *In designing the resources.*

v. Do you see yourself involved or engaged enough in the decisions taken by the library in relation to the nature of the resources and the way they are presented to you?

a. If yes, describe how you are engaged.
b. If no, would you like to be involved?
   i. If yes, how would you like to be engaged?
   ii. If no, please explain.

**D. Library digital resources and the learning design process (in case it is not covered above)**

1. How do you use digital resources in the light of learning design process?

   Probe:

   i. If they mention the link between digital resource and educational resources, probe when they use these resources?
   ii. If they say this does not relate to education, probe why?
   iii. Check out for ownership, cultural issues
2. How do you see the library personnel engaging with you in regards to resources you require for learning design process or purposes?
3. Overall, how do you think the technological innovations in the library support or hinder your usage of library resources for the teaching and learning purposes?

**E. Students engagement with resources and library**

1. How do you see your students engaging with digital resources?
2. How do they use them?
3. For what purpose?
4. Do they use the library resources?
5. How do you see the students playing any role in the way the resources are designed to support their learning process?

*Probe:*

- *Do you involve them?*
- *Are they independently getting involved or designing their own resources?*

**A. Policies**

1. What is your participation in the educational policy making or implementation processes, (at international, regional, institutional, departmental)?

   *Probe*

- *Look out for policies in technology use in education*

2. What policies have you participated in either their development or implementation processes?
3. How do they link up with the library operations?

*Probe*

- *Look out for those that relate to digital resources*

4. In your view, do you think they facilitate or hinder the operations of the library's support for the learning process?

**B. To be asked to participants in University of Pretoria**

1. Do you use UPSpace?
    a. If yes, what do you use it for?
    b. What is your impression of it?
2. If no, what are your reasons for not using it?
3. Do you participate in Patron 2.0?
    a. If yes, what is your participation?
    b. What is your impression of it?
4. If not, what are your reasons for not using it?

**C. Projects**

1. Do you have any projects or plans for projects that use digital resources?
    a. If yes, elaborate and explain the motivation.
2. Do you know the TESSA project?
3. Have you participated in it?
    a. If yes, what was your participation?
    b. What is your perception of this participation?

**D. To be asked to participants at the University of Makerere**

1. Do you know of UHIN project?
2. Have you participated in it?
    a. If yes, what was your participation?

**E. Round up and debrief**

1. Is there anything else we have not covered that you would like to tell me?

**Interviews for librarians**

**A. General background information**

1. Would you like to tell me about your role and responsibilities in the library?
2. For how long have you been doing this work at this university?

3. Can you describe your experience with any ICT equipment you have used or are familiar with?
4. What do you know about the role of digital resources in this library?

   *(look out for any mention of learning process)*

**B. Perceptions of library digital resources and educational resources**

1. What is your concept of digital resources?

   *(if mention of learning design process, jump to que 3)*
2. What is your concept of digital resources for learning design process?
3. What part do you see the library playing in the learning design process?

   *Probe:*

   i. *If they mention the link between library digital resources and educational resources, probe **when** these resources are integrated in the learning process*
   ii. *If they say this does not relate to education, probe why?*
   iii. *Check out for **ownership, cultural issues***
4. In what ways does the library use digital resources to support the learning process?
5. In your opinion, do you think digital resources in this library are utilized optimally by students and academics?
6. Are there future plans to change or improve the current operations of the library in relation to the delivery of digital resources in supporting the learning process?
   a. If yes, describe these plans and the motivation
7. Overall, how do you think the technological innovations in the library support or hinder your usage of library resources for the teaching and learning purposes?

**C. Collaboration and design issues**

1. How do you see the academics engaging with you in regards to resources they require for learning design process or purpose?
2. How do you involve them in the resource design process?
3. How do you involve them when you are designing new services?
4. Do they involve you in the design of their academic programs?
   a. If yes, how?
   b. If no, please explain.
5. What is your perception of this engagement?

**D. Students' engagement with resources and library**

1. How do you see your students engaging with digital resources?
2. How do they use library digital resources?
3. For what purpose?

4. How do you see these students playing any role in the way the resources are designed for their learning process?

   *Probe:*

   - *Do you involve them?*
   - *Are they independently getting involved or designing their own resources?*

**E. Projects**

1. Do you have any projects or plans for projects that use digital resources?
2. If yes, elaborate and explain the motivation.
3. Do you know the TESSA project?
4. Have you participated in it?
   a. If yes, what was your involvement?

**F. To be asked participants at Makerere university**

1. Have you heard of the UHIN project?
2. Have you participated in it?
3. If yes, what was your participation?
4. What is your perception of this participation?
5. If you know about it and have not been involved, do you think you should have been involved, explain.

**G. To be asked participants at university of Pretoria**

1. What was the motivation behind embracing technology to enhance the delivery of library resources?
2. To what extent was the end users (academic staff and students) involved in the design of these services?
3. If they were not involved, please explain the reasons for them not being involved?
4. How has this initiative been received by the end users (academic and students)?

**H. Policies**

1. What is your participation in educational policy making or implementation processes (at international, national, institutional or departmental level)?

   *Probe*

   - *Look out for policies in technology use in education*
2. What policies have you participated in either their development or implementation processes?
3. How do they link up with the library operations?

   *Probe*

- *Look out for those that relate to digital resources*

4. In your view, do you think they facilitate or hinder the operations of the library's support for the learning process?
5. What else would you like to see in terms of policies that support the development of digital resources

## I. Round up and debrief

Is there anything else we have not covered that you would like to tell?

**Students**

## A. General background information

1. What degree program are you taking?
2. For how long have you been doing it?
3. Can you describe your experience with any ICT equipment you have used or are familiar with?
4. Is there anything you would like to tell me about digital libraries generally?

## B. Perceptions of digital resources

1. What is your concept of digital resources?

*Probe:*

- *Give examples of the ones you are aware of.*
- *Look out for differentiation between educational digital resources and library digital resources*

2. In what ways do you use these digital resources?

*Probe:*

- *Use of Internet search engines like Google*
- *User-generated content*
- *As directed by academics or librarians?*

3. How do you access them?
4. Where do you access them from?

*Probe:*

- *From the library, from Internet?*

5. What is your motivation for using them?

*Probe:*

- *Do you use it for academic or personal purposes?*
- *Do you use it upon lecturer's recommendation? Librarian's recommendation? Peer?*

6. Overall, how do you think the technological innovations in the library support or hinder your usage of library resources for the teaching and learning purposes?
7. How do you use digital resources in the light of learning process? **(if it would not have mentioned above)**

*Probe:*

- *If they mention the link between digital resource and educational resources, probe **when** they use these resources?*
- *If they say this does not relate to education, probe why?*
- *Check out for **ownership, cultural issues***

**C. Collaboration and design issues**

1. What part do you see the library playing in your learning process?
2. In what ways does the library use digital resources to support your learning process?
3. How do you see the library personnel engaging with you in regards to resources you require for learning process or purposes?
4. Do you consider yourself being involved in deciding how the library digital resources are presented to you?
   a. If yes, how do you get involved?
   b. What is your perception of this involvement?
5. If no, what do you think are the reasons?
6. In your opinion, do you think it would be a good thing or not, to be involved? Please explain.
7. What is your perception of the way you interact with the library personnel in learning process?
8. What role do your lecturers play in your usage of digital resources for learning purpose?

**D. Round up and debrief**

Is there anything else we have not covered that you would like to tell?

**Project staff for UHIN & TESSA projects**

**A. General information**

1. Could you please tell me what your current role is?
2. Please tell me what you know about this project.
3. What is your involvement in this project?
4. Can you tell me how you got to be involved?

**B. End users involvement in the design process**

1. I am trying to understand about your project. Who do you see as the end users of your projects?

2. How do they participate in the design and implementation of this project
3. Can you please describe how you have gone about involving them?

   *Probe*

   - *In the design requirements*
   - *In suggesting the nature of the content*
4. Why did you consider involving them?
5. In your assessment, do you think they have participated as much as you would have liked them to?
   a). If yes, please explain how.
   b). If no, please explain why you think so.
   c). What do you conceive of this kind of involvement?
6. What value do you think they (end users) hold for the digital resources?
7. How do you see them using these resources?

## C. Library involvement

1. Has the library been involved in this project?
2. If yes, why and how did they get to be involved?
   a. What is their involvement?
   b. What is your perception of this involvement?
3. If no, please explain why they have not been involved.

## D. Policies

1. What is your participation in the educational policy making or implementation processes (at international, national, institutional or departmental)?

   *Probe*

   *Look out for technology use in education*
2. What policies have you participated in either their development or implementation processes?
3. How do they link up with the operations of this project?
4. In your view, do you think they facilitate or hinder the operations of the project?
5. What else would you like to see in terms of policies that support the development of digital resources in this project?

## E. Round up and debrief

1. Is there anything else we have not covered that you would like to tell me?

## APPENDIX 4: A PRINT-OUT SAMPLE NVIVO CODES

# Tree Nodes

| Name | Sources | References | Created D |
|---|---|---|---|
| academics use of digital resources | 0 | 0 | 05/02/2( |
| Application of web2 tools | 1 | 1 | 05/02/2( |
| concepts of digital resources | 0 | 0 | 05/02/2( |
| Design issues | 0 | 0 | 05/02/2( |
| Elearning and digital resources | 0 | 0 | 05/02/2( |
| Engagement in Digital resources | 1 | 1 | 05/02/2( |
| a tripartite engagement | 2 | 3 | 06/02/20 |
| academics and librarians | 8 | 10 | 05/02/20 |
| academics helping students acc | 14 | 29 | 05/02/20 |
| academics not encouraging their | 2 | 2 | 05/02/20 |
| engagement through surveys | 1 | 1 | 16/02/20 |
| engagement with elearning expe | 1 | 1 | 06/02/20 |
| good engagement necessary | 2 | 3 | 15/02/20 |
| hindrances for engagement | 0 | 0 | 06/02/20 |
| incentive through recognition | 1 | 1 | 20/02/20 |
| Librarians engaging students | 4 | 5 | 05/02/20 |
| librarians initiative | 2 | 6 | 07/02/20 |
| official arrangement | 0 | 0 | 06/02/20 |
| recognition of library's importanc | 1 | 1 | 19/02/20 |
| TESSA engagement in design th | 1 | 2 | 05/02/20 |
| use of publicity activities | 1 | 1 | 20/02/20 |
| use of web2 to engage with user | 2 | 3 | 06/02/20 |
| impediments to adoption of ICTs and | 1 | 2 | 05/02/2( |
| Innovation | 3 | 3 | 05/02/2( |
| nature of digital resources used | 0 | 0 | 05/02/2( |
| Ownership | 1 | 1 | 06/02/2( |
| Ownership (2) | 1 | 1 | 15/02/2( |
| Policies in digital resources | 12 | 15 | 05/02/2( |
| students engagement with resources | 2 | 2 | 09/02/2( |
| information skills | 2 | 2 | 09/02/20 |
| netgen students | 2 | 2 | 15/02/20 |
| pedagogy influence | 5 | 8 | 15/02/20 |
| preference for web not books | 1 | 1 | 15/02/20 |
| to keep up todate | 1 | 1 | 09/02/20 |
| use for academic work | 6 | 7 | 09/02/20 |
| use internet resoruces | 6 | 9 | 09/02/20 |
| use library e-resources | 2 | 3 | 09/02/20 |
| use of ICTs in teaching and learning | 2 | 2 | 05/02/2( |

## APPENDIX 5: A SAMPLE OF THE ANALYSIS PROCESS

| Catalyst Element | CERD factors | | | | Results/outcome | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***Human factor*** | ***Innovative technology*** | ***Policy*** | ***Relationship*** | ***Innovative transformation process*** | ***Nature of the process*** | ***Direct impact*** | ***Indirect impact*** | ***Ranking of qualifiers of a design process ingredients*** |
| E-learning facilitation | ✓ | ✗ | ✓ | E-learning technologists and librarians (Human factors) are the main driver while policies exist to provide an enabling environment for e-learning and DL integration into e-learning<br><br>***Human factors impacting on policies*** | E-learning facilitation provided by e-learning experts and proactive librarians, and policies transformed the way academics and librarians work by bringing them to work together in applying DL in the learning process. This was by academics and librarians becoming aware of how they could support each other in integrating DL resources in the learning design process and working together to achieve this goal. | Academics, librarians and e-learning technologists collaborate to produce an innovative way of embedding DL resources within the VLE (UP).<br><br>***Innovation through collaboration*** | DL resources that support learning objectives integrated within the Virtual Learning Environment (VLE) causing a positive learning experience.<br><br>***Evidence1:***<br>UP's Education Innovation user surveys<br><br>***Evidence2:***<br>Higher Education Quality Committee (HEQC) of the SA Council on Higher Education (CHE)'s commendations | None | No of evidence=**2**<br><br>Application of innovative technologies= **low**<br><br>Presence of quality=**v. high (evidence 1 &2)**<br><br>Scalability=**high?**<br><br>Sustainability=**high?**<br><br>Learner-centred=**high (evidence 1)** |

NB: This is an excerpt from a larger table which was a stage in the analysis process that developed an emerging metaphor of the 'catalyst element' in the process of developing the CERD process model.

## APPENDIX 6: THE OPEN UNIVERSITY HUMAN PARTICIPANTS AND MATERIALS ETHICS COMMITTEE (HPMEC) APPROVAL LETTER

The Open University

**MEMORANDUM**

**HUMAN PARTICIPANTS AND MATERIALS ETHICS COMMITTEE**

| | | | |
|---|---|---|---|
| **FROM:** | John Oates, Chair, HPMEC | **Email:** | **j.m.oates@open.ac.uk** |
| | | **TEL:** | 52395 |
| **To:** | Pauline Ngimwa, research student | | |
| | | **DATE:** | 26 August 2009 |
| **CC:** | | | |
| | | **Ref:** | **HPMEC/09/#619/1** |
| **SUBJECT:** | **Ethics application:** Collaborative design of educational digital libraries for African Higher Education | | |

This memorandum is to confirm that the research protocol for the above-named research project, as submitted on 29th July 2009, is approved by the Open University Human Participants and Materials Ethical Committee, subject to satisfactory responses to the following recommendations:

1. Amend the second sentence of the participant information form to say that 'all personally identifiable data that you provide will be kept confidential, only used in an anonymised form, and destroyed after the project is completed';

2. Clarify that a person who withdraws from the research (either during the interview, or subsequently) can ask for any data already collected to be destroyed, up to the point when it is incorporated into the analysis;

3. Remove the request for name and address from people who choose not to participate.

So that the completion of ethics approval can proceed, please respond regarding these points.

At the conclusion of your project, by the date that you stated in your application, the Committee would like to receive a summary report on the progress of this project, any ethical issues that have arisen and how they have been dealt with.

John Oates

Chair, OU HPMEC

# APPENDIX 7: PARTICIPANTS' INFORMATION SHEETS



**Title of Project: COLLABORATIVE DESIGN OF EDUCATIONAL DIGITAL RESOURCES FOR AFRICAN HIGHER EDUCATION**

This project seeks to investigate how educational digital resources support learning in African Higher Education. The aim is to develop a digital resources design process model that brings together key stakeholders (including users, information professionals and designers) in designing digital resources. This model can be used to support designers of educational resources in designing learner-focused digital resources.

This is an invitation to you to participate in the project, and to let you know what this would involve. The project will be carried out by a research student registered at the Open University of UK.

**What would happen if you join the study?**

If you agree to join the study, you will be requested to sign a consent form. Then the researcher will arrange to carry out an interview at a time convenient to you, on campus. The interview will last about 30 minutes to one hour and it will be audio-recorded for ease of data recording. The researcher may take notes. You are free to decline the use of audio recording if you are not comfortable with it.

Your participation will be on voluntary basis and you can change your mind and stop at any time. Your decision will be respected and this will not affect your job studies or marks.

**How will the information collected be used and handled?**

The researcher will follow certain research guidelines throughout the research project including handling of data collected. These include the Open University data protection Code of Conduct, the Open University Research Ethical Guidelines and the British Education Research Association Ethical Guidelines.

The Data Protection Code of Conduct provides advice on how to treat personal and other types of information you provide about yourself. This is to protect the information against loss, theft, destruction or authorized access.
In order to ensure confidentiality, your identity will be anonymised after the interview such that your opinions cannot be personally identified. Information

about you will be kept confidential and your real name will not be included in the final report or any published work. The information you provide may be used for educational or research purposes, including publication.

**Are there benefits from taking part?**

There are no direct benefits to you for taking part; however this study has potential to improve educational technology use particularly digital resources in Africa's institutions of higher learning. The findings of this study can be made available to you upon request.

**Who can be contacted in case of any queries?**

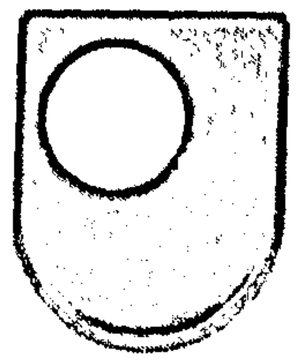
You can contact the researcher directly using the contact details provided below:

Ms. Pauline Ngimwa
Institute of Educational Technology
The Open University
Walton Hall
Milton Keynes
MK7 6AA
Email: p.g.ngimwa@open.ac.uk

You may also contact the principal supervisor whose contact details appear below in case you wish to talk with someone else about this research:

Dr Anne Adams
Institute of Educational Technology
The Open University
Walton Hall
Milton Keynes
MK7 6AA
E-Mail: a.adams@open.ac.uk

## APPENDIX 8: CONSENT FORM





### Participant Consent Form

**Title of Project: COLLABORATIVE DESIGN OF EDUCATIONAL DIGITAL RESOURCES FOR AFRICAN HIGHER EDUCATION**

This is a request for your consent to participate in the above project. Please note that all personally identifiable data that you provide will be kept confidential, only used in an anonymised form, and destroyed after the project is completed'

The results of any Open University research project involving people that constitute personal data are covered under the Data Protection Act. This project will ensure such results obtained will be kept secure and not released to any third party.

Please indicate your willingness or otherwise to take part in this research project by ticking the appropriate box and completing the details below. At any time in the course of the research (either during the interview, or subsequently) you will be free to withdraw, and you can ask for any data already collected to be destroyed, up to the point when it is incorporated into the analysis. Your participation or non participation will not affect you negatively in anyway.

☐ I am willing to take part in this research, and I give my permission for the data collected to be used in an **anonymous** format in any written reports, presentations and inclusion in published papers relating to this study. My written consent will be sought separately if I am to be identified in any of the above.

**Or**

☐ I am **not** willing to take part in this research (you do not have to complete the details below).

**Name:**.....

**Affiliation:** .....

**Signed:**.....

**Date:**.....

# APPENDIX 9: SUMMARY OF THE CERD PROCESS MODEL PRESENTED TO EXPERTS

## The CERD Model in an African HE Context

The Collaborative Educational Resources Design process (CERD) model described here has been developed within African HE context. This has been inductively developed from studying design processes in the development of selected best practice examples of digital library projects in three case studies of African universities. This CERD model provides design process guidance for designing educational digital resources collaboratively with key stakeholders (e.g. digital library designers, librarians, academics, e-learning technologists, students) within this context. Development of this model was motivated by the presence of a design chasm which often exists between designers of digital libraries and designers of learning programs with reference to African HE. This often results in educational digital resources that fail to exploit the benefits and expertise from technological advancements in the field of information sciences and the broader educational technologies. Ultimately, such resources often end up not being designed along the needs of students and are also mostly unsustainable. This design chasm can be reduced by designing these resources collaboratively with the stakeholders. However, review of related studies suggests existence of a knowledge gap in how to design collaboratively with these stakeholders in African HE context. Thus, the CERD model is intended to provide support to these key stakeholders when designing collaboratively learner centred and sustainable digital resources.

The research findings have shown that this CERD model (Figure 8.1) presents a collaborative design process that can start with the project initiation stage leading to project development stage. These two stages feed into project outcome which can happen either after the development stage or during each of the stages. The outcome has three indicators namely:

- Stakeholder Engagement ***(SE)***
- Sustainability ***(S)***
- Transformation ***(T)***

The two stages are made up of three factors namely:

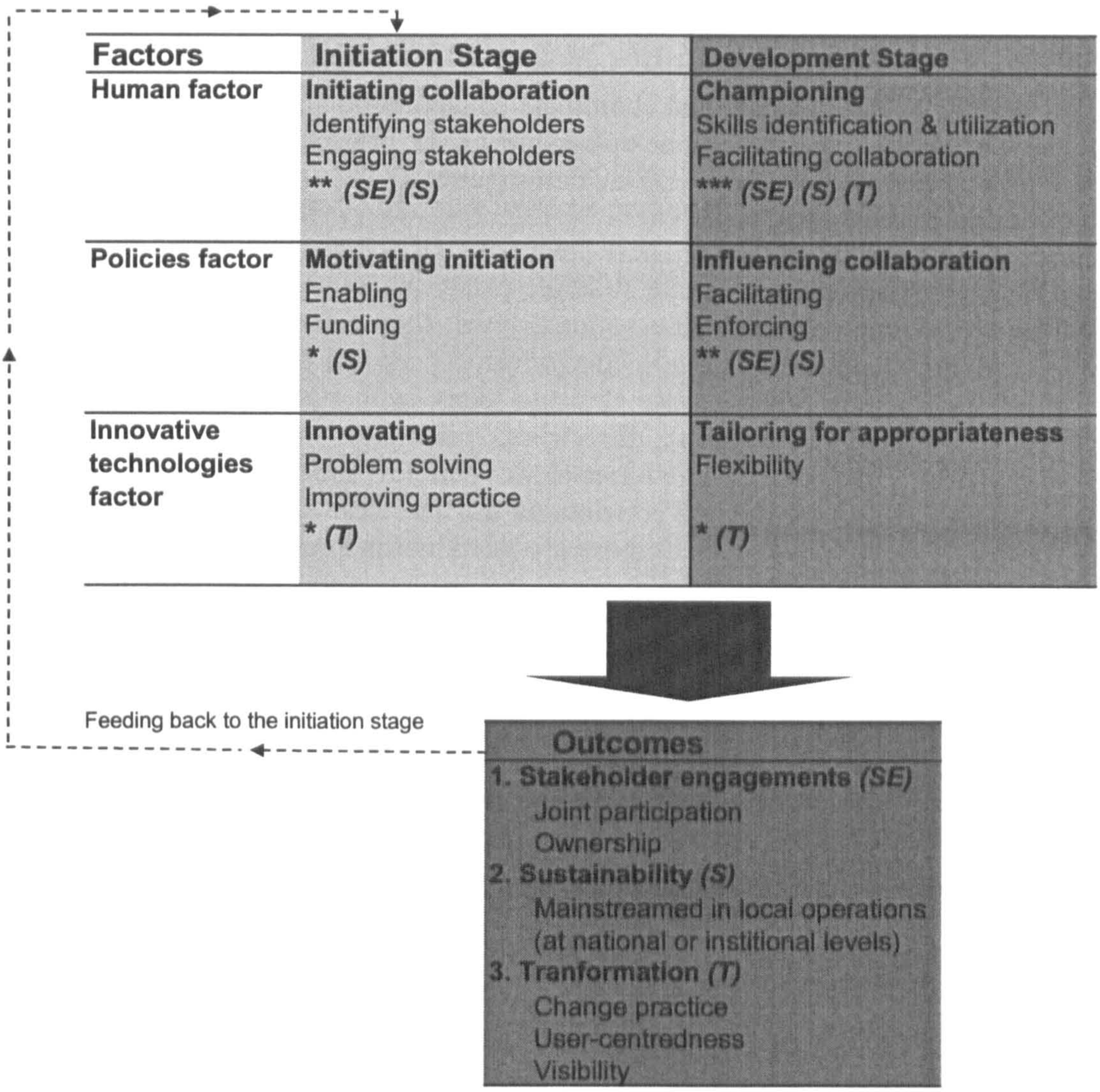
(iv) Human factor

(v) Policies factor

(vi) Innovative technologies factor

These factors can have different characteristics at each stage, influencing how they contribute to specific outcome indicators (as detailed in section 8.1). This means that one factor can be more important than the others at a particular stage as depicted by the star-rating in the model diagram. Additionally, these factors can interact with each other within a particular stage. Finally, like most design processes which are iterative by nature, the outcome has potential to feed back to the initiation stage for project improvement or initiation of new projects.

**Figure 8.1: The CERD model in an African HE context**




Below is a detailed description of the three factors:

(i) Human factor: This is made up of stakeholders collaborating and providing their skills in the design process. Stakeholders comprise of:

c. Design participants representing different discipline domains and professions i.e. academics and students from different disciplines, e-learning technologists, librarians and related information professionals, design experts, policy makers (e.g. government bodies and funding agencies/project donors[60]), project administrators and the general public.

d. Design champions whose main role is to facilitate stakeholder engagement and collaboration within the design process. There are two different types of these design champions: the multidisciplinary design champions and the domain design champions. They both differ in their characteristics and approaches. For example, the domain stakeholders are mainly driven by the goals of the domains they represent. They use their domain knowledge in the

[60] These have been used in this thesis to represent development organisations that work mainly in Africa with a development agenda and they sponsor certain projects according to this agenda. This can for example be use of ICT to improve health or education.

early stage of the design process and only engage other stakeholders in the later stage of the design process. On the contrary, the multidisciplinary design champions identify other multidisciplinary stakeholders and their relevant skills and engage them throughout the design process. They facilitate and coordinate collaboration among these stakeholders; are able to motivate joint ownership of the project; and usually have a vision for the project beyond the design process.

(ii) Policies factor: These are a range of policies that can be national or institutional. Examples include strategic plans, guidelines, policy statements, directives and mandates. At the national level, they can include national policy statements, national strategic plans, white papers and directives. At the institutional level, they can comprise strategic plans (with staff performance contracts to enforce implementation), directives, principles, mandates (e.g. the Open Access mandates), function-specific policies such as research policies, intellectual property related policies and ICT policies. Additionally, there are external policy directives such as those provided by funding agencies.

(iii) Innovative technologies factor: These are usually technology applications that are new and bring about improvement. Bell (2007)[61] gives examples of such technologies as Web 2.0 and mobile devices. In the projects reviewed, these innovative technologies have been classified into the following three categories:

c. Universal or generic technologies i.e. web-based applications;

d. Specific technologies such as mobile technologies and digitization technologies;

e. Technologies that have flexibility features (referred to in this model as 'flexible technologies'). These flexible technologies support contextualization of existing universal and specific technologies to enable them meet context needs and include the Open Source Software (DSpace) and the Web 2.0 applications.

**The CERD Model detailed**

All the three factors described above make up the initiation and development stages of the CERD model and contribute to the project outcome. They also interact with each other within the stages. The research findings showed that at each stage, these factors can have certain characteristics depending on the nature of the project. In the following sub-sections, factors in each of the two stages are detailed, showing how they contribute to the outcomes. It also details how these factors interact with each other.

***Project initiation stage***

Project initiation according to the research findings is the first stage in the design process. The projects reviewed identified that all the three factors (Human factor, Policies factor and Innovative technologies factor) can initiate projects and contribute

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[61] BELL, S. J. (2007) Book forward. IN Courtney, N. (Ed.) Library 2.0 and beyond: innovative technologies and tomorrow's user. Westport, Conn., Libraries Unlimited

towards the projects' outcome. Below is a description of how these three factors can initiate projects using illustrations from examples of the projects reviewed in this thesis, and how they interact with each other and contribute to project outcome.

- **Human factor**

Projects can be started through initiating stakeholder engagement. Stakeholders are facilitated to collaborate and contribute towards project start-up (Table 8.1).

**Table 8.1: Human factor and related outcome indicators at the initiation stage**

<table>
<tr><th colspan="3">INITIATION STAGE : HUMAN FACTOR</th></tr>
<tr><td>Factor characteristics</td><td>Initiating collaboration by:<ul><li>identifying design stakeholders</li><li>engaging them collaboratively</li></ul></td><td>Example:<br>The multidisciplinary design champion in the Clinical mobile digital library (Project 11) identified and immediately engaged multidisciplinary stakeholders, representing designers, policy makers (government departments, donors) and users. The aim was to utilize mobile devices (innovative technologies) to rural clinicians. This was supported by policies.</td></tr>
<tr><td>Issue</td><td colspan="2">Domain design champions may not support stakeholder engagement at this initiation stage</td></tr>
<tr><td rowspan="2">Interaction with other factors</td><td>Policies factor</td><td>Innovative technologies factor</td></tr>
<tr><td>Stakeholders particularly policy makers can enforce other stakeholders' collaboration by insisting that policies favouring collaboration are followed right from the start of the project and throughout the process</td><td>Stakeholder collaboration at this stage by utilizing innovative technologies in the design process</td></tr>
<tr><td rowspan="2">Contribution to project outcome</td><td>Stakeholder engagement</td><td>Sustainability</td></tr>
<tr><td><ul><li>Joint participation in system development</li><li>Stakeholder ownership of project outcome</li></ul></td><td><ul><li>Identified policy makers among stakeholders can influence project continuity</li><li>Multidisciplinary design champion's ability to see beyond project life allows for future implementation and planning.</li></ul></td></tr>
</table>

In this thesis, multidisciplinary design champions were identified as playing a key role in this initiation stage. They initiated projects collaboratively with other design stakeholders. For this to happen, they had first to identify these stakeholders and then

engage them in the process so that they could collaborate among themselves. This all-inclusive approach has some far-reaching positive effect that can impact on the collaboration building as well as on project outcome. For example, some of these stakeholders can have policy making responsibilities and therefore have the potential to contribute towards decisions such as those related to how people collaborate as well as towards project sustainability and continuity. In this research, these multidisciplinary design champions were not only initiating projects but were also identifying diverse multidisciplinary stakeholders (some of who could influence the direction of the project). They were initiating collaboration among these stakeholders to participate in this early stage of the process. Domain design champions were identified as less important in establishing stakeholder collaborations at this stage in comparison to the multidisciplinary champions. This is because their role was only to initiate projects on their own initially without the collaboration of other design stakeholders, who they identified and incorporated only at the later stage of the development process.

At this initiation stage, this Human factor can also interact with the other factors (i.e. Policies factor and Innovative technologies factor). For example, as already mentioned, some of the stakeholders were policy makers (e.g. donors) who had an influence in enforcing stakeholders' collaboration right from the beginning of the project and throughout the process. At the same time, the objective of forming collaboration at this stage was so that stakeholders could engage with each other by utilizing innovative technologies. However, Human factor has the strongest contribution in shaping this initiation stage compared to these other two factors.

This factor and associated activities ultimately contribute to the project ***Outcome.*** Specifically, it can lead to stakeholder engagement and ownership. It can also lead to project sustainability. In the projects reviewed, stakeholder engagement was demonstrated by joint participation of key stakeholders as they collaborated in the design process, which in turn created joint ownership of the projects' outcome. Project sustainability can be ensured when policy makers who have influence on project continuity are included. For example, ***Project 11*** in the research has been taken up by the Ministry of Health (stakeholder) for further development and implementation after the project period has ended. Additionally, these multidisciplinary champions are able to see beyond the current project and therefore plan for project continuity.

**Project 11: Clinical mobile digital library**

*This mobile library was developed by a health community-based project called Uganda Health Information Network (UHIN) to deliver a health information system using mobile devices (personal digital assistant (PDA)) to clinicians in rural Uganda. This was housed at the Uganda case study university's College of Health Sciences. The project was a joint partnership of a number of organisations, namely: AED-SATELLIFE, Uganda Chartered HealthNet (UCH), Faculty of Medicine of Makerere University (including academics and library professionals), International Development Research Centre, Canada (IDRC), and District Health Services in five districts. These stakeholders had specific roles in the development process. For example, the clinicians and Ministry of Health were the system users and provided system requirements. The university provided information resources and advice; the funding agency (IDRC) provided financial support and project tools, and the project staff provided technical expertise such as customizing the PDA to fit end user requirements and also coordinated all the stakeholders' activities. There was a supportive national (Ministry of Health) and institutional policy framework. The sponsor also introduced a project management tool that enforced stakeholder engagement throughout the process. The*

*outcome was noticeable improved practice among the clinicians as they now had access to required information resources to carry out their practice. Furthermore, this project has been taken up by the Ministry of Health ensuring sustainability and continuity.*

- **Policies factor:**

Different policies can play an important role of motivating project initiation. For example in this research, they enabled project initiation to take place and they influenced funding of project start up (Table 8.2).

**Table 8.2: Policies factor and related outcome indicators at the initiation stage**

| **INITIATION STAGE : POLICIES FACTOR** | | |
|---|---|---|
| **Factor characteristics** | Can motivate project initiation by:<br>• providing an enabling environment<br>• influencing funding for project initiation | *Example*:<br>Project 1 was supported by national and institutional focus on the use of technologies in teaching and learning. Policies encouraged staff to innovate and apply innovative technologies (Web 2.0) to improve service delivery |
| **Interaction with other factors** | **Human factors** | **Innovative technologies** |
| | Policies can provide an environment that encourages staff creativity leading to innovation | Policies can influence the application of innovative technologies |
| **Contribution to Outcome** | **Sustainability** | |
| | Can lead to mainstreaming projects within an institution by embedding them in the institution's operations. | |

*A. Policies enabling project initiation*

Policies can facilitate the initiation of projects by providing an environment that supports innovation to happen. For example, a policy on curriculum change (i.e. introduction of Problem Based Learning (PBL)) framed within innovative use of technology can influence initiation of a digital resources project to specifically cater for this curriculum's needs. In this research, ***Project 10*** was initiated to support students following PBL curriculum.

**Project 10: Problem Based Learning (PBL) digital resource support system**

*This project was specially developed to support students in the Uganda case study's College of Health Sciences following PBL system, a tutorial based form of instruction methodology that is student-centred rather than teacher-centred and encourages students' participation. It helps students to develop problem solving and life long learning skills. To support their problem solving, they use library resources, mainly digital resources because of their variety and currency. They draw assistance from an information professional and in the process develop information skills such as ability to search, retrieve and evaluate appropriate information resources. PBL in this university*

*has an extension of what is called Community Based Education and Service (COBE), where students study communities, and hence local information stored in the university's institutional repository is very relevant. In order to support these students, a digital collection of health related resources including institutional repository was redesigned for this program's specific needs. The stakeholders (librarians, academics and students) collaborated where librarians provided appropriate resources, enabling technology infrastructure (a networked computer laboratory, laptop connection points and hotspots for wireless Internet connection) and devised a system of supporting the information inquiry through an intermediary. Students engaged intensely with digital library resources and relied heavily on the support mechanism provided by the information intermediary and the technical infrastructure in the computer laboratory. Academics also tapped into this support mechanism as they too had to consult the digital resources in order to support the PBL/COBE methodology. This created a joint participation of academics, library staff and students in the provision and use of the digital resources to fulfil this pedagogical need.*

Policies can also have an enforcing effect that enables project initiation to take place. For example, a national policy that enforces the use of innovative technologies in teaching and learning can be implemented at the university level through institutional and departmental strategic plans. This can then lead to initiation of certain innovative projects such as digital libraries. For example ***Project 1*** in the South Africa case study was mainly initiated as a result of a national White Paper on the use of innovative technologies in teaching and learning being taken up by the institution's strategic plan. This was then incorporated in the library's strategic plan which led to the initiation of this project.

*B. Policies influencing project funding*

Policies can motivate project initiation by influencing national and institutional focus and spending. For example, an institution can have a focus on the use of innovative technologies in teaching and learning and thus introduce policies (e.g. strategic plans) that support this focus. This can mean that projects being funded by the institution at that particular point have to be in line with the use of innovative technologies. Project funding agencies can also influence where they want their financial aid to go and how it is going to be spent, thus introducing policies that enforce this objective.

Policies can also interact with the Human factor and the Innovative technologies factor. For example, policies at the initiation stage can support stakeholders to innovate by providing an environment that facilitates staff creativity as was identified in ***Project 1***. At the same time, policies' role in enabling project initiation and project funding indirectly influences the application of innovative technologies because they are providing a supportive environment for this application to happen.

**Project 1: Digital library supported by Web 2.0 applications**

*This project focused on tailoring existing designs (based on web-based online resources) to make them fit the needs of the library system. It involved the use of innovative technologies (i.e. Web 2.0 resources including a virtual game) as part of the implementation of an e-information strategy spearheaded by the library in South Africa*

*case study. This use of innovative technologies was intended to help the library reach out to their younger users who were using the library resources less, but were very active in the virtual world space. Librarians designed digital resources around these innovative applications, i.e. by creating library catalogue widgets and encouraging users to link them to their Facebook pages. They invited stakeholders (students) to provide input and test an information literacy program designed around a virtual game which turned out to be appealing to these students. There was a supportive policy framework from national level (White paper on ICT use in teaching and learning) down to institutional strategic plans. This led to a better quality of digital library service within the institution. Staff members also felt supported to innovate and invent new ways of improving service using technology. The outcome was a service that was student-centred as was reflected by user surveys and commendations from the national quality assurance body.*

The Policy factor at this initiation stage contributes to the project ***Outcome*** primarily by ensuring project sustainability through mainstreaming of projects within the institution. Projects become part and parcel of the institution's operations as policies help to embed them within the institution, hence ensuring their sustainability.

- **Innovative technologies factor**

The projects investigated in this research showed that Innovative technologies can lead to project initiation especially where there is need to use these technologies to produce some form of transformation (Table 8.3). This can be in solving existing problems within the institutions such as those related with usage of resources or institutional knowledge management. It can also be in improving existing practice.

**Table 8.3: Innovative technologies factor and related outcome indicators at the initiation stage**

| **INITIATION STAGE : INNOVATIVE TECHNOLOGIES FACTOR** | | |
|---|---|---|
| **Factor characteristics** | Can provide innovative ways of solving problems and changing practice | *Example*:<br>Project 1 was based on the use of Web 2.0 to solve library usage problems among younger library users |
| **Interaction with other factors** | **Human factors** | |
| | Innovative technologies can influence the choice of stakeholders | *Example:*<br>Stakeholders in Project 4 were primarily chosen on the basis of their contribution to the innovative technologies (mobile devices for building agricultural knowledge system) |
| **Contribution to Outcome** | **Transformation** | |
| | Innovative technologies can lead to transformation in the project in form of improved practice or in problem solving within the project. | |

*A. Solving problems*

Availability of innovative technologies can trigger people's interest to use them for solving problems. For example, Web 2.0 applications were used in ***Project 1*** to overcome the problem of younger library users not using digital library resources effectively. Because these users were interested in social networking, using technologies that support social networking (e.g. Web 2.0) to make library resources more accessible to them was a way of dealing with this problem.

*B. Improving practice*

Projects can be initiated using innovative technologies in order to improve existing practice i.e. in creating better ways of working. For example, mobile technologies in developing countries are being exploited for outreach services in places not connected by the Internet and among oral communities whose literacy levels are too low to allow reading and writing. This leads to creation of innovative projects that result in improved practice. For example in ***Project 11***, Personal Digital Assistants (PDAs) were used to deliver a digital library to clinicians in rural areas not connected by Internet. This gave the clinicians access to medical information which they used to improve their clinical practice.

In this research, the level of interaction of the Innovative technologies factor with the other factors was very minimal at this stage and it only appeared to happen with the Human factor and not with the Policy factor. For example the choice of participating stakeholders to some extent was determined by the type of innovative technologies being used and what they were intended for. In other words, where the innovative technologies were leading the initiation of a technology project, this determined the kind of stakeholders to include in the design process. This was evident in ***Project 4*** where mobile devices were used for two farming communities to develop an agricultural knowledge management system. The choice of stakeholders included researchers who had expertise in dealing with mobile devices and customising them for rural communities, and farmers who could contribute farming knowledge to the system.

The contribution of this Innovative technologies factor at the initiation stage towards project ***Outcome*** is that can lead to a transformation in form of problem solving or improvement of existing practice.

**Project 4: Community-based agricultural knowledge management system**

*This is a research project called VeSeL (Village e-Science for Life) funded by the UK's Engineering and Physical Sciences Research Council. It involved researchers developing an agricultural knowledge management system for rural farming communities in Kenya using mobile technologies. The team consisted of UK researchers and technical experts working with local experts at the case study university and two farming communities. The project was designed from scratch using participatory design method. The communities were involved right from the onset where a mutual understanding (between all stakeholders) of each other's contexts and needs was established. Mobile resource kits comprising of a Macbook laptop, solar charger, GPRS modem for access to the Internet, digital cameras and audio recorders were deployed to the communities to support information access and information capture, publishing and dissemination. Farmers were encouraged to collect and post data from their farms as a simple blog posting. These bits of information were later linked to an online Knowledge Management System (KMS), a kind of a Content Management System*

*which has the basics of a digital library infrastructure. This project thus presented a joint participation of stakeholders in the design process.*

***Project development stage***

- **Human factor**

Human factor play a crucial role at the project development stage particularly through the multidisciplinary design champions and domain design champions (Table 8.4).

**Table 8.4: Human factor and related outcome indicators at the development stage**

<table>
<tr><th colspan="4">DEVELOPMENT STAGE : HUMAN FACTOR</th></tr>
<tr><td rowspan="2">Factor characteristics</td><td colspan="2">• Design champions (both multidisciplinary and Domain) identifying skills among stakeholders and encouraging their utilization in the design process.<br>• Multidisciplinary design champions facilitating, coordinating and motivating organic engagement among the collaborating stakeholders</td><td>Example:<br><br>Multidisciplinary design champion in Project 6 identified that the librarian who was among the stakeholders could delivery her domain knowledge in digital resources for the benefit of the other stakeholders. This design champion managed to maintain engagement among the stakeholders</td></tr>
<tr><td>Issue</td><td colspan="3">Domain design champions use other sources of motivation i.e. marketing and institutional reinforcement to keep stakeholders engaged in the design process</td></tr>
<tr><td rowspan="2">Interaction with other factors</td><td colspan="2">Policies</td><td>Innovative technologies</td></tr>
<tr><td colspan="2">Stakeholders (Design champions and policy makers) can introduce policies that will ensure collaboration takes place among stakeholders</td><td>Stakeholders using their domain skills and expertise to implement innovative technologies in the design process</td></tr>
<tr><td rowspan="2">Contribution to outcome</td><td>Stakeholder engagement</td><td>Sustainability</td><td>Transformation</td></tr>
<tr><td>• shared participation in system development among stakeholders<br>• stakeholder ownership of project outcomes</td><td>Policies initiated by design champions can ensure projects are mainstreamed within institutions</td><td>Stakeholders using domain skills on innovative technologies can lead to transformation in form of changed practice</td></tr>
</table>

However, this research found that the multidisciplinary design champions played a more important part than the domain design champions. They championed the design process by (a) identifying relevant skills among the stakeholders and encouraging their utilization for mutual benefit in the design process, and (b) ensuring that stakeholders remained engaged in the collaboration process.

*A. Skills identification and utilization*

The multidisciplinary design champions can identify relevant skills and expertise among the diverse group of design stakeholders identified in the initiation stage. These can be domain-related expertise such as digitization and knowledge management from experts like librarians. These skills and expertise can also be based on the user systems' needs or expectations used to identify system requirements. They are also able to encourage the application of these skills and expertise for specific purposes in the development stage to gain mutual benefit.

*B. Facilitating collaboration*

It is important that the different stakeholders remain engaged through the development process so that they are able to participate effectively and contribute their specific skills and knowledge for mutual benefit in the design process. This means that they must be facilitated to collaborate. How they collaborate must also be coordinated.

The research shows that the multidisciplinary design champions have the ability to facilitate and coordinate stakeholder collaboration. Their approach encourages organic engagement where the stakeholders do not require outside motivation to participate. In contrast, domain design champions have to motivate this stakeholder engagement by using methods such marketing and institutional reinforcement through policies.

The Human factor at this development stage can interact with other factors (Policies factor and Innovative technologies factor). For example, design champions (especially domain design champions) are capable of implementing policies (e.g. the Open Access Mandates) that ensure stakeholders collaborate in the design process. Policy makers like donors (part of design stakeholders) can also introduce policies that ensure stakeholder collaboration. These stakeholders and design champions can also use their domain expertise on the application of innovative technologies in the system development process. For example, librarians can use their knowledge management and digitization skills to work content management systems like DSpace in order to develop institutional repositories.

These Human factor activities at the development stage can contribute towards project ***outcome*** in three ways. Firstly, collaboration leads to stakeholder engagement that results in joint participation of people from the learning side (e.g. academics and students) and those from the resources side (e.g. librarians) as it happened with the development of institutional repositories (***Projects 2*** and *7*). This shared participation can in turn cause project ownership among the participating stakeholders. Secondly, policies initiated by the Domain design champions can enable projects to be mainstreamed within the operations of the institutions and hence ensuring their sustainability. Lastly, stakeholders working with some of the innovative technologies

can bring about transformation such as in improvement of service delivery and change of practice.

- **Policies factor**

At this development stage, the main role played by the policies factor is influencing and supporting collaboration of the stakeholders in the design process. This can happen through facilitation and enforcement (Table 8.5).

**Table 8.5: Policies factor and related outcome indicators at the development stage**

<table>
<tr><th colspan="3">DEVELOPMENT STAGE : POLICIES</th></tr>
<tr><td>Factor characteristics</td><td>Influencing stakeholder collaboration through facilitation and enforcement</td><td><u>Example</u>:<br><br>Stakeholder collaboration in the two institutional repositories (Projects 2 and 7) was supported by the presence of various policies which either facilitated or enforced stakeholders to get involved. These policies included the Open Access Mandates, Intellectual Property rights policy, research policies</td></tr>
<tr><td rowspan="2">Interaction with other factors</td><td colspan="2">Human factor</td></tr>
<tr><td colspan="2">Policies are enforcing and facilitating collaboration of stakeholders</td></tr>
<tr><td rowspan="2">Contribution to outcome</td><td>Stakeholder engagement</td><td>Sustainability</td></tr>
<tr><td>• Shared participation in system development among stakeholders<br>• Stakeholder ownership of project outcomes</td><td>Mainstreaming projects within institution</td></tr>
</table>

*A. Policies facilitating collaboration*

Policies can facilitate collaboration i.e. by explicitly encouraging inter-departmental collaborations. For example, a library can be empowered to work with any academic department if the university strategic plan recognizes the central part played by the library in supporting all academic functions. An example is in ***Project 6*** where librarians were happy to collaborate because the university strategic plan stated that the library should sustain institutional linkages.

**Project 6: E-learning initiative**

*E-learning project in the Uganda case study focused on developing information pathways for stakeholders (academics, e-learning specialists and librarians) to appropriately develop and use a learning management system containing learner centred resources that combined e-learning content and appropriate digital library resources. The e-learning specialist facilitated other stakeholders (academics and librarians) to collaborate in designing the information resources interaction within this*

*system. One way this happened was through workshop sessions where the e-learning specialist led some training sessions. These were targeted at interested academics who would then lead e-learning integration into the academic programs throughout the university. Participants were drawn from all faculties and attendance was on voluntary basis. Librarians were invited to co-facilitate where they would talk about how digital library resources can be used to support the e-learning content. This facilitation was supported by the policy framework within the university, i.e. the university strategic plan stated that the library should sustain effective institutional linkages. The outcome was a joint participation of key stakeholders as they designed processes for the design of an integrated learning management system.*

### *B. Policies enforcing collaboration*

Policies can also be used to enforce collaboration by making it compulsory for key stakeholders to collaborate. In ***Projects 2*** and *7,* policies such as the Open Access Mandates, Intellectual Property Rights policies and research policies were used to ensure that stakeholders collaborated with librarians in the development of institutional repositories.

Externally motivated policies such as those imposed by funding agencies can also have an enforcing effect on collaboration. For example, in this research, financial support to implement ***Project 11*** came from one of the stakeholders (IDRC), a funding agency that insisted on the use of a certain project management tool. This tool ensured involvement and participation of all stakeholders.

There is minimal interaction of this factor with the other factors and this only appears with the Human factor, i.e. through policies facilitating and enforcing collaboration among stakeholders. This research did not highlight any direct interaction with the innovative technologies at this development stage.

The main contribution to the project ***Outcome*** this policies factor is making is in stakeholder engagement. By supporting stakeholder collaboration, a joint participation of these stakeholders in the design process can occur. This in turn can result in stakeholders owning the project. Some policies also ensure that projects are mainstreamed in the institution hence contributing towards project sustainability.

**Project 2: Institutional repository**

*This was an initiative of the South Africa case study's library carried out within the Open Scholarship component of the library's e-information strategy as part of the Open Access movement. It involved archiving of research papers in what they refer to as the OpenUP and archiving of theses and dissertations referred to as the UPeTD. These open access resources constitute the institutional repositories of the university..The OpenUP is hosted in the UPSpace (customised DSpace), and the UPeTD runs on ETD-db Open Source Software from Virginia Tech. Librarians designed the systems and invited other stakeholders (academics and students) to contribute their research output, theses and dissertations which were uploaded into these institutional repositories. This was supported by the Open Access Mandates developed by the library which made it mandatory for academics and students to deposit their output in these repositories. Ultimately, the academics and students became co-creators of the digital collections with the librarians who facilitated the process by introducing DSpace application and ETD-db (innovative technologies) and promoting their usage among the university*

*community. The outcome was resources customised to meet the needs of the institution, hence popular among the university community. This raised its visibility as evidenced by both repositories ranking among the top 100 best institutional repositories according to the global Webometrics rating.*

**Project 7: Institutional repository**

*This was developed by the library in the Uganda case study to host the institution's academic and research output (e.g. research papers, theses and dissertations, teaching and learning resources such as music files) in order to increase their accessibility for the wider university community. Like the one South African institutional repository, this system was part of the Open Access movement and also developed by the librarian using the DSpace open software. They invited the academics and students as stakeholders to populate the system using their academic output. The librarians were very active in encouraging academics and their students to contribute these resources. This process is supported by a policy framework. The outcome was a shared participation as librarians, academics and students became collaborators in the creation of OA digital collection that was supported by innovative technology (DSpace open source) and policies. It also raised visibility of these resources as the institutional repository rated highly in the internal university webometric rating.*

- **Innovative technologies factor**

The most important role innovative technologies play in the development stage is tailoring of the projects systems to meet the needs of users (Table 8.6).

**Table 8.6: Innovative technologies factor and related outcome indicators at the development stage**

| **DEVELOPMENT STAGE : INNOVATIVE TECHNOLOGIES** | | |
|---|---|---|
| **Factor characteristics** | Flexible technologies (DSpace Open Source Software and Web 2.0 applications) allow existing generic and specific innovation to be tailored for fit intended use | *Example*:<br>The digitization of music collection (Project 8) was based on the digitization technology but digitized files were organized using DSpace which accommodates different formats including digital music files and these made the resources more appropriate to users. |
| **Contribution to Outcome** | **Transformation** | |
| | Results end-user centeredness and creates visibility of project system | |

This research has shown that tailoring of project systems can be effected by using certain technology applications that manifest flexibility features. These applications work on existing generic (e.g. web-based resources) and specific (e.g. mobile devices)

technologies to customize them for the intended use. Such applications can include the Open Source Software such as DSpace (in ***Project 2*** and *7*) which allows customization of different formats of digital content to suit specific needs and requirements of an organisation. Web 2.0 applications (in ***Project 1***) can also be used to create this tailoring of existing innovations to meet systems needs. Such technologies are flexible enough to allow some level of utilization by stakeholders regardless of their expertise and technical abilities.

Innovative technologies seem not to have any direct interaction with the other factors at this development stage.

The main contribution these flexible technologies have on the project ***outcome*** is bringing a transformation by enabling tailoring of technologies in order to make them meet the intended need. For example, DSpace and Web 2.0 applications in this research transformed the way digital resources were delivered to users. Resources became more user-centred. They also created visibility of projects systems where they became more popular among the users.

**Project 8: Digitization of music collection**

*The Uganda case study university's Department of Music, Dance and Drama was involved in a music digitization project to develop a digitized music collection for learning and preservation purposes for the general public use. This was collaboratively designed and developed by library digitization experts and music academics. Each of these stakeholders had different skill sets and roles which they engaged throughout the design process. The library experts provided specialized skills in digitization and organization of digitized music files while academics provided music descriptions for Metadata development. Digitized files were hosted in the Institutional repository (DSpace). Additionally, the librarians also worked with the students and taught them how to digitize their own files as part of their learning process. This project was supported by a supportive policy framework within the university which facilitated interdepartmental partnerships. The collaboration between the stakeholders resulted in a form of shared participation between academics, students and librarians in the usage of technologies (DSpace and digitization) to design a digitized music collection. This ultimately resulted in a learner-centred resource collection that supported the learning needs of music students.*