ASSOCIATION OF AFRICAN UNIVERSITIES

14TH GENERAL CONFERENCE & 50TH ANNIVERSARY CELEBRATIONS OF THE AAU

SELECTED PAPERS

AAU@50: ACHIEVEMENTS, CHALLENGES AND PROSPECTS FOR SUSTAINABLE DEVELOPMENT IN AFRICA

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JUNE 5 -8, 2017 | ACCRA, GHANA

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P. O. Box AN 5744,
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ISBN: 978-9988-2-7268-5

PRINTED BY **OWL DESIGN SERVICES.**
+233 24 163 1555

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PREFACE

The Association of African Universities (AAU) held its 14th General Conference and marked its Golden Jubilee Celebrations on 4-8 June, 2017 in Accra, Ghana, under the theme **"AAU@50: Achievements, Challenges and Prospects for Sustainable Development in Africa".**

The General Conference is the highest decision-making body of the AAU. It is an assembly of representatives of all member institutions and is organized every four years in two parts - the Business and the Scientific/Thematic sessions.

The Business session: assesses the activities implemented by the AAU Secretariat over the previous four years against a background of the Core Programme of Activities and a budget approved at the previous Conference. It also approves the plan of activities and budget for the following strategic plan period. It elects the governing board members of the Association including the President and three (3) Vice - Presidents, from among the Vice - Chancellors, Presidents and Rectors of its member institutions.

The Scientific/Thematic Session: Every General Conference also hosts the Conference of Rectors, Vice Chancellors and Presidents (COREVIP) of African Universities which deliberates themes of relevance to higher education in Africa. The COREVIP is an assembly of the chief executive officers of member institutions or their representatives, which meets every two years with the purpose of examining collectively, themes identified as common concerns and priorities for the development of higher education in Africa.

COREVIP makes recommendations to AAU member Institutions, the Governing Board and the Secretariat. It also acts as a mid-term conference which takes stock of the implementation of the decisions of the General Conference, and makes recommendations for corrective measures if any.

The AAU's power as the voice of higher education in Africa was re-affirmed when the 14th General Conference attracted 500 participants from across the length and breadth of Africa, Europe, Americas, Asia and beyond. Participants at this important quadrennial event included Development Partners, Policy Makers, Vice Chancellors/Presidents/Rectors, Students and various stakeholders of African Higher Education Institutions.

Some high profile participants at the 14th General Conference and Golden Jubilee Celebration of the AAU included the President of the Republic of Ghana, His Excellency Nana Addo Dankwa Akufo-Addo; the Government of Gambia, represented by the Minister of Higher Education,Research, Science and Technology, Hon. Dr. Badara Joof; and the Government of Sudan, represented by the Minister for Higher Education and Scientific Research, Hon. Professor Eltigani Mustafa Mohamed Salih.

Key partner institutions such as the African Union Commission (AUC), Education Sub-Saharan Africa (ESSA), African Capacity Building Foundation (ACBF), African Development Bank (AfDB), European Commission (EC), European University Association (EUC), Association of Commonwealth Universities (ACU),UK Department for International Development (DfID), The European Union (EU) and several others were all well represented at this event.

The conference extensively deliberated the following five key higher education sub-themes: Promoting science, technology and innovation through higher education; Curriculum reform as key to graduate employability and entrepreneurship; The role of higher education in managing the environment; Higher education as a tool for promoting democratic governance; and Mobilising resources for higher education in Africa.

A total of 25 papers were presented by researchers, scholars and experts on the above subthemes. These were addressed over four days in 10 plenary sessions and two parallel sessions. Out of the 25 papers presented, 12 were considered as publishable after being peer reviewed and are contained in this publication.

The Association of African Universities expresses its gratitude to the authors, reviewers and all participants of the 14th General Conference. AAU further acknowledges the Government of Ghana and all our development partners for contributing immensely to the success of this event.

Professor Etienne E. Ehile
Secretary General
Association of African Universities

SELECTED **PAPERS**

PROMOTING SCIENCE, TECHNOLOGY AND INNOVATION THROUGH HIGHER EDUCATION

- Advancing Science, Technology and Innovation Through Postgraduate Research
- Building Scientific Capacity For High Quality BiomedicalResearch In Sub-saharan Africa
- Nigerian Solid Minerals Processing for Economic Sustainability and Development_How Far Thus Far

SUB-THEME 1

ADVANCING SCIENCE, TECHNOLOGY AND INNOVATION THROUGH POSTGRADUATE RESEARCH SUPERVISION: CHALLENGES AND PROSPECTS

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Abstract

The promotion of Science, Technology and Innovation (STI) is essential in today's complex and highly dynamic environment. This is because STI is the foundation and cornerstone of development worldwide. In Kenya, the achievement of Kenya's Vision 2030 is pegged on the advancement of STI. However, despite the formation of various organizations to steer the advancement in STI in Kenya, Technology Achievement Index (TAI) 2015 rates Kenya as marginalized (below 0.20) in technology enhancement. This indicates that technology diffusion and skill building in Kenya is still low. This therefore indicates that other approaches towards reinforcement of science, technology and innovation need to be explored.

This paper addresses the advancement of Science, Technology and Innovations in institutions of higher learning by focusing on research, its supervision and the role played by the Postgraduate Research Department at Kenya Methodist University in this enhancement. The findings and recommendations in the paper are based on views expressed during a focus group discussion session. On reinforcement of science, respondents indicated that the postgraduate research department made attempts to reinforce science by ensuring that student topics were critically scrutinized before students were allocated supervisors.

This ensured originality and new knowledge creation within specific disciplines. It was further indicated that officials from the postgraduate department attended oral presentation sessions. They assessed learner mastery of the topic and its critical analysis and synthesis. Respondents pointed out that technology was enhanced through establishment of online research forums such as WhatsApp groups. Respondents highlighted that the department emphasized on collaborative knowledge sharing forums and training of staff

on variety of technologies. Respondents pointed out that, the postgraduate department had various innovations such as supervisory support services, Research seminars, Collaborative research projects and Joint supervision programmes.

However, respondents indicated various challenges affecting the reinforcement of STI. This included supervisor absence, heavy workload/burnout experienced by supervisors, student/supervisor rigidity and payment based on student thesis completion. It was further highlighted that limited resources and a weak link between research and industry affected STI reinforcement. Respondents recommended a need for attitude change among students/supervisors towards STI and an increase of financial allocation to science and technology programmes. It was felt the University should prioritize STI particularly its application in research.

This paper contributes to an understanding of the role universities can play within their own institutions and within the subject areas, towards advancing science, technology and innovation.

Key words: Science, Technology, Innovation, Postgraduate Research Supervision, Supervisor intolerance

Introduction

Scientific advances, technological progress and innovations are essential components in socio- economic advancement worldwide. Any country's ability to create, distribute and exploit knowledge is a major source of competitive advantage. Various studies indicate that science, technology and innovation when used appropriately enhance overall performance in organizations. Nevertheless, to enhance STI, concerted efforts have to be made both at the national, local and individual levels.

In Kenya a lot of emphasis has been laid on the advancement of STI. The government has reiterated the key role played by Science, Technology and Innovation (STI) in wealth creation and building human capital required for transition to a knowledge driven economy. Vision 2030 proposes to intensify the application of STI to raise productivity and efficiency levels. Kenya has established STI institutions in its effort to develop and apply science and technology and address the country's development priorities. Nevertheless, despite this effort, Kenya is still ranked low in technological advancement. Technology Achievement Index (TAI) 2015 rates Kenya as marginalized (below 0.20) in technology enhancement, indicating that technology diffusion and skill building is still low.

This therefore raises questions on what needs to be done in order to improve Kenya's index in STI utilization. Institutions of higher learning can help address this challenge. This is because in many countries, these institutions are viewed as citadels of knowledge (Ahemba, 2016). The courses taught in these institutions such as research can be effectively utilized in the reinforcement of STI.

This paper therefore examines the extent to which universities, with a specific focus on Kenya Methodist University, have played a role in the advancement of Science, Technology and Innovation through postgraduate research supervision.

Research Supervision at the Postgraduate Level

In many institutions of higher learning, one course that is compulsory and can play a key role in the reinforcement of science, technology and innovation is research. Not only does research transverse in many disciplines making it a core area in knowledge transmission but it also encompasses many aspects of the scientific process. The similarity between science and research is vast in that, they both emphasize on knowledge creation, objectivity, testability, validity and reliability of the information gathered. Areas within the formal sciences, such as statistics and logic, are vital in research. Research like science lays emphasis on the formation of hypotheses and theories, both in discovering and describing phenomenon. In research the use of technology, particularly in data analysis, presentation and dissemination is highly applicable. In addition to this, learner innovativeness, inquisitiveness and critiques are encouraged. This similarity between science and research is a powerful tool that can be utilized in the enhancement of science, technology and innovation in institutions of higher learning.

Postgraduate research supervision is a form of apprenticeship undertaken under the supervision of senior faculty members. The focus of research supervision lies more with helping students to critically manage knowledge, identify and exploit existing knowledge and create new knowledge.

Although research displays positive attributes that are essential in the reinforcement of science, technology and innovation, research and specifically, its supervision has at times deterred this reinforcement. Dupre & Barling (2006) indicate that at times postgraduate research supervision has resulted in the curtailment of student innovation. Cases have been reported of supervisors hindering student independent thinking through sarcasm, intolerance, rigidity or unnecessary delays in responding. Allegations have been made that innovative students are at times viewed as irritants by their supervisors and cowed into silence (Kimani, 2014). This fizzles innovativeness. Some supervisor's incompatibility and uncomfortableness with changing technological innovations has at times affected student advancement in technology. This therefore implies that the quality of supervision may be a key determinant in the reinforcement of science, technology and innovation in institutions of higher learning.

Objective

The purpose of this paper is to examine to what extent science, technology and innovation has been advanced through postgraduate research supervision at the Kenya Methodist University.

Specifically the paper aims:
i) To identify mechanisms put in place by the Postgraduate Research Department to enhance STI at the research supervisory level.
ii) To determine ways in which research supervision at the postgraduate level can be effectively used to reinforce STI.
iii) To determine challenges affecting the reinforcement of STI and how they can be addressed

Method

This paper focused on the Postgraduate Research Department at Kenya Methodist University. This is because the department deals with research supervisory and any other duties linked with post graduate research at the University. It is also involved in monitoring and evaluation of the research supervision process. The department also addresses complaints and challenges affecting postgraduate students as pertain to research. A focus group discussion session was carried out involving eight staff members in the postgraduate department and five supervisors of postgraduate students who voluntarily participated in the discussion. This study was qualitative and employed a descriptive research design.

Discussion of Findings

Mechanisms put in place to enhance Science Technology and Innovation

Respondents indicated the following as mechanisms put in place by the postgraduate department in enhancing STI at the research supervisory level:

Enhancement of Science in Research Supervision

On mechanisms put in place to enhance science during research supervision, the responses were as follows:

Emphasis on Objectivity

Respondents indicated that research objectivity was highly emphasized by the postgraduate department. It was pointed out that in order to reinforce objectivity, the department ensured that all postgraduate research proposals adhered to a particular process. The proposal was first presented to panelists at the departmental level, who assessed its objectivity before it was presented in an open forum. After the open forum, an independent group reviewed the proposal to ensure that the indicated corrections had been made.

The final proposal was then forwarded to the Postgraduate Research Department, which after evaluation issued a letter of authorization for data collection. After data collection and analysis, the student presented the thesis to the department, then to an open forum. A successful thesis is then forwarded to external examiners.

Comments from external examiners are in-cooperated in the thesis before final submission to the postgraduate department. The department felt this rigorous process helped reinforce objectivity.

Systematic Process

Respondents indicated that the postgraduate department had a clearly structured and systematic process from topic identification to final thesis writing. The department ensured that during research supervision, supervisors/supervisees adhered to the set process. During oral presentations, the panelists expected students to adhere to these guidelines. This included the identification of the research problem, literature review, methodology, development of data collection instruments, data collection and analysis of data. The postgraduate department specified the period of time expected in proposal preparation, data collection and the handing in of the final research thesis.

Generation of New Knowledge

Respondents pointed out that the Postgraduate Research Department laid emphasis on the generation of new knowledge. Respondents highlighted that a lot of emphasis was put on establishing facts, solving new or existing problems and providing new ideas. To ensure effective knowledge creation, the titles selected were scrutinized by the department to ensure they were topical and would contribute to the body of knowledge in ones area of specialization. Respondents further indicated that to trigger continuous search for new knowledge, the Postgraduate Research Department frequently organized forums where professionals in different disciplines were invited to give talks and present findings. A case in point was a workshop organized by the department in February 2017.

Respondents indicated that to ensure a continuous search for new knowledge, the postgraduate department allocates students to supervisors in their area of specialization. This gives allowance for in-depth discussions. It was indicated that in collaboration with the library department, the postgraduate department keeps lecturers and students informed on current journal articles. This creates an awareness of current scientific studies. It was compulsory for postgraduate students to present an article in a referred journal before graduating. This enhanced continuous search for new knowledge.

Measurability

Respondents indicated that the postgraduate department was very keen on the reliability and validity of the data collection instruments, the methods of data analysis and the presentation of research findings. The department ensured that various workshops were held to improve on aspects of measurability.

Mechanisms of Enhancing Technology

Respondents pointed out various mechanisms that the Postgraduate Research Department had used to reinforce technology during supervision:

Emphasis on Electronic Communication

Respondents highlighted that most communication from the Postgraduate Research Department was through e-mails and phone calls. The department also encouraged supervisors and supervisees to communicate through phones and e-mails. A respondent pointed out that some postgraduate students' requested to record discussions during supervisor/supervisee interactions so that they could use them for reference. It was highlighted that the postgraduate department allowed researchers to use e-mails to disperse questionnaires if appropriate and effective. Respondents indicated that the use of e-mails and mobile phones had allowed greater interaction between postgraduate students and their supervisors.

Creation of Workstations

Respondents pointed out that the Postgraduate Research Department had specifically designated an area in the department with workstations where students and supervisors could surf the Internet with ease and speed. Students and supervisors were able to easily access e- journals and reputable documents. It was indicated that easy access to e-journals had created opportunities for new and diverse knowledge accessibility. Respondents indicated that due to the work stations, supervisors' contributions to journal articles were on the increase.

Digital Platform

Respondents pointed out that the Postgraduate Research Department had designated hours in a week where supervisors could visit the department and carry out online discussions with the supervisees, particularly those in far flung areas. The department had a follow up on the frequency of these interactions. It was indicated that video conferencing and use of Skype had enabled supervisors to listen to presentation and give recommendations to students in the diaspora and those unable to travel to the university during oral presentation. The Postgraduate Research Department has a portal where completed research studies and current scientific studies are posted. This had created easy access to current information. Online discussions have also been encouraged (WhatsApp groups). Supervisors are able to assess this platform and react to student queries.

Enhancement of Technical Skills

The discussants pointed out that the Postgraduate Research Department in collaboration with the Information, Communication and Technology (ICT) Department had come up with short term programmes aimed at enhancing technology skills among members of staff and students. Through the programmes, supervisors have been made aware of the comprehensive range of software that can support data collection, analysis and presentation such as the Statistical Package of Social Science (SPSS). Supervisors have also been taught how to make 'track changes' on student's research documents.

Plagiarism Detection

Respondents indicated that a major challenge previously encountered in research supervision was plagiarism. This challenge was addressed through short training programmes on

plagiarism detection by the ICT department and Library Department. Through this training, there has been a reduction in the number of students submitting plagiarized work. The purchase of the plagiarism detection software contributed immensely in the reinforcement of research ethics and quality research.

Advancing Innovation through Postgraduate Research Supervision

On enhancing innovations respondents indicated the following:

Supervisory support services
Respondents pointed out that the Postgraduate Research Department had established a supervisory support service that offered advice to supervisors who felt challenged in their research area, and particularly on the application of scientific rigor in research. Respondents indicated that supervisor rigidity had been minimized since the establishment of the support services.

Research Seminars Colloquiums
Discussants pointed out that the introduction of research seminars and colloquiums where students and lectures presented papers and held discussions had played a major role in the enhancement of scientific innovations and student creativity. These meetings triggered an urge among supervisors and supervisees to read and research more on selected research areas. This exchange of ideas has enriched the quality of presented papers and journal articles.

Collaborative Research Projects
Respondents indicated that the Postgraduate Research Department has frequently advocated for collaborative scientific research projects among departments and externally. This has enabled scholars to share experiences of best scientific practices across departments.

Student Exposure to STI Events
Respondents indicated that the Postgraduate Research Department has made concerted efforts to create awareness among supervisees and supervisors on any incoming events related to STI and encouraged them to participate. This includes the annual STI Congress in Kenya and visits to incubation centers.

Suggestions of other Mechanisms in Advancing STI

On any other mechanisms that respondents felt would advance STI further at the University respondents indicated that

Although the Postgraduate Research Department plays a major role in exposing students to STI Congress, there was need for the University to get more involved and increase funding. This would enable the Department to improve on technology and acquire modern equipment. The students are encouraged to be more innovative.

Respondents felt the Department had been very active in organizing interdisciplinary forums that place emphasis on science and technology. However, this can be improved inclusion of guest speakers from industries.

Respondents indicated that the short term training programmes facilitated by the Department had played a major role in enhancing STI. However, this training should be reinforced by inviting trainers from South Africa and Japan where technology is more advanced.

Research Supervision and Reinforcement of STI

Respondents indicated that supervisors were at the forefront in the emphasis of research objectivity, measurability and generation of new knowledge during supervision. They were also keen to ensure scientific rigor was adhered to in the final thesis.

Discussants indicated that supervisors have reinforced the application of technology by their insistence on student's use of technology in communication. Students have been referred to e-journals and encouraged to use of e-mails, phone calls, online discussions and digital platform.

Respondents indicated that supervisors have been at the forefront of plagiarism detection and the emphasis on creativity and originality. Supervisors had played a major role in guiding students in the scientific innovations that are presented in national forums.

Challenges Affecting Reinforcement of STI and Solutions

On what they thought hindered the reinforcement of STI during research supervision and how these challenges could be addressed, the responses were as follows:

Supervisor absence

Respondents highlighted supervisor unavailability as a major challenge affecting reinforcement of STI. It was indicated that the most frequent complaint raised by students and recorded by the Postgraduate Research Department was supervisor absence. This affected student innovativeness as learners lacked guidance and critique. To address this, respondents felt the Department should specify the minimum consultation hours allocated to each supervisee. There should be a student log indicating the number of hours consulted.

Heavy Workload/Burnout

Respondents indicated that supervisor workload was a major challenge that hindered the reinforcement of STI. Respondents pointed out that supervision was not regarded as a teaching load in the University. Supervisors were expected to teach, carry out departmental responsibilities, attend meetings, conduct research and write journal articles. The quality of the supervised work was at times curtailed by the large number of students allocated to supervisors, and thus critical thinking and innovativeness was hindered. Respondents

indicated that due to high enrolment of postgraduate students, students were at times allocated supervisors outside their area of specialization. This hindered critical thinking. To address this, respondents felt supervision should be regarded as a workload and students should be allocated supervisors in their area of specialization. The Postgraduate Research Department should ensure realistic allocation of students for supervision.

Supervisor Rigidity

Respondents indicated that supervisor rigidity was a major challenge in the reinforcement of STI. Respondents stated that some supervisors had specific areas of interest and therefore insisted on supervisees focusing on these particular areas. It was indicated that despite the frequent training offered on reinforcement of STI, some supervisors insisted on supervising the way they had been supervised. To address this, the Postgraduate Research Department should hold frequent meeting with the supervisors to reinforce the importance of integrating STI in research supervision.

Supervisor Allowance

Respondents indicated that the linking of research supervisory payment to student's submission of the final research thesis had curtailed student innovation. It was indicated that some supervisors preferred students who did not embark on challenging studies as they would take a shorter period of time to complete research thesis. This resulted in more supervised students and more pay. To curtail this, the Postgraduate Research Department should indicate and reinforce the minimum time expected from the onset to completion of research thesis.

Conclusion

This paper highlights mechanisms put in place by the Postgraduate Research Department at the Kenyan Methodist University – Nairobi Campus to enhance STI. This includes provision of financial assistance geared towards the reinforcement of STI, facilitating student exposure to STI through annual events and offering technical assistance particularly in area related to STI. The Department came up with training programmes that enhance skills in technology. The collaborations between departments and universities in scientific and technological ventures created more awareness of the importance of STI.

Supervisors played an effective role in the enhancement of STI by insistence on research objectivity, measurability, originality, innovativeness and use of technology. However, respondents indicated that supervisor absence, heavy workload, rigidity and payment are some of the major challenges affecting the reinforcements of STI. It was suggested that these challenges could be addressed by ensuring close monitoring of supervision and continuous emphasis on STI. Supervisors should be allocated a manageable number of students.

Recommendations

Although the University offers training programmes that create awareness on the importance of science and technology, further improvement should be made on the curriculum scope to integrate science and technology.

Motivation should be key to embrace STI. This can be achieved through student/ supervisor exchange programmes, and facilitation of students/supervisors to attend science forums.

The University should maintain a specific proportion of its fund geared towards the sustenance and improvement of STI.

There needs for a practical and collaborative approach between the university and industries in the enhancement of STI. Supervisors should ensure student topics correlate with industry needs.

The University should provide an enabling environment for STI development. This includes ensuring supervisors have a reasonable workload to encourage learner innovativeness and creativity.

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BUILDING SCIENTIFIC CAPACITY FOR HIGH QUALITY BIOMEDICAL RESEARCH IN SUB-SAHARAN AFRICA

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Abstract

It is estimated that Africa needs to train one million new PhDs to keep pace with the world average of 800-1000 researchers per million population. The University of Ghana took advantage of recent donor-funded capacity-building schemes to establish a flagship biomedical research training programme known as the West African Centre for Cell Biology of Infectious Pathogens (WACCBIP). After initial funding from the World Bank's African Centres of Excellence Project in 2013, WACCBIP won additional funding from the Welcome Trust's DELTAS Africa initiative in 2015. The Centre has built capacity for high quality training of African scientists locally, from Masters, to Doctoral and Postdoctoral levels.

The training programmes have been endorsed by the American Society for Cell Biology and received Advanced International Accreditation from the Royal Society of Biology, UK. WACCBIP has also built an extensive network of collaborations locally, regionally, and internationally, which provides the intellectual and physical infrastructure for large-scale research investigations and implementation of new interventions across Africa. Experiences and challenges from the WACCBIP effort will be discussed as a model for building capacity and developing research collaborations between African institutions.

Introduction

A majority of African scientists who are actively involved in globally competitive research on the continent were trained abroad. Indeed these 'home-based' scientists represent a minority of the African scholars who returned home after their training overseas. 1 The

majority of them have remained outside the continent, mainly in Europe and the United States of America, but widely represented in many countries across the World. One of the major drivers of this type of brain-drain is the lack of adequate facilities and opportunities to conduct world class research on the continent. There is clear interest in returning home, but this enthusiasm is usually dampened by the fear of being stranded without funds or facilities to continue their research when they return to Africa. Africa's development partners have therefore, recognized the need to build the necessary capacity for training African scientists right here on the continent.

The World Bank's African Centres of Excellence project launched in 2013, and the Wellcome Trust/DFID led initiative known as Developing Excellence in Leadership, Training and Science (DELTAS) in Africa which began in 2015 are two of the largest science capacity building efforts on the continent in history.2,3 Having repositioned itself towards the goal of becoming a world class research-intensive University, the University of Ghana submitted bids to participate in both capacity-building projects, becoming the only institution to win grants from both the ACE and DELTAS projects. 2,4

About WACCBIP

The West African Centre for Cell Biology of Infectious Pathogens (WACCBIP) is one of the World Bank's African Centres of Excellence (ACE) and was established in 2014 led by faculty from the Department of Biochemistry, Cell and Molecular Biology (BCMB) and the Noguchi Memorial Institute for Medical Research (NMIMR), University of Ghana. The Centre was chosen by the World Bank as a Centre of Excellence for Cell Biology with a mandate to provide Masters, PhD training, and targeted short-courses in Cell & Molecular Biology, conduct applied research into biology and pathogenesis of tropical diseases, and increase research output and innovation by enhancing collaboration among biomedical scientists and industry/private sector leaders in the sub-region. In addition, WACCBIP is further supported by a Welcome Trust Developing Excellence in Leadership, Training and Science (DELTAS), Africa Initiative grant to strengthen its research, expand its regional network beyond West Africa, train postdoctoral fellows and provide additional PhD fellowships.

Mission and Objectives

The mission of the Centre is to improve diagnosis, prevention and control of infectious diseases in sub-Saharan Africa by providing advanced level training and research excellence on the cell and molecular biology of infectious pathogens.

The key objectives of the Centre are to:
a) Train high level health professionals and biomedical scientists on cell and molecular biology of infectious pathogens through MPhil, PhD and Post-doctoral programmes.
b) Serve as a core facility with state-of-the art biomedical laboratories to support infectious

diseases research in the sub-region.
c) Establish a Biomedical High Performance Computing Unit to provide cluster computing services to promote teaching, research, and dissemination of information among health professionals and academics in the sub-region.
d) Increase research output and innovation by serving as a focal point for enhancing collaboration among biomedical scientists and biotechnology companies in the sub-region.


Highly advanced training and research in the field of infectious pathogens sets the **WACCBIP** apart

Research Management and Administration

WACCBIP operates as an academic unit in the College of Basic and Applied Sciences, under the oversight of the Provost of the College and the Pro-Vice-Chancellor for Research, Innovation and Development. The Centre is led by the Director and Deputy Director, and assisted by the Centre's Management Committee composed of senior academics. The Management committee has sub-committees for Training and Research, responsible for implementing the teaching and research objectives at the Centre, Logistics for managing laboratory equipment and reagents, and Information Computing Technology (ICT) for managing ICT infrastructure and equipment. In addition, there is a Monitoring and Evaluation team whose head is a member of the Management committee.

The Centre also has an International Advisory Board comprising of international experts whose mandate is to provide sound and independent scientific advice on the scope of WACCBIP's scientific objectives, to guide and advice on the strategic planning and financial sustainability of the Centre, to evaluate the Centre's scientific and research outputs, and to assess WACCBIP's contribution to public health both nationally and internationally. The Board meets once a year and directly advise the WACCBIP Director on the Centre's scientific quality and strategic research. The WACCBIP Director is assisted by a Centre secretariat, with Project Manager, Administrator, M&E Officer, Accounts Officer, and ICT officer.

The University of Ghana's Office of Research, Innovation and Development (ORID) provides research administration and management services and other research support services to WACCBIP. ORID has the needed human resource capacity to support the implementation of projects at WACCBIP. The WACCBIP's accountant serves as the link

between the Centre and ORID for accountability and timely execution of financial transactions and reporting. The University of Ghana has in place financial regulations with ORID, putting into place systems and structures to ensure the proper management of project funds. ORID's financial management unit is led by a certified chartered accountant with considerable experience in management accounting, treasury and financial administrative services among others. Monitoring on the use of funds is further enhanced by the use of the Integrated Tertiary Software, which allows for easy tracking of expenditures against project budgets and preparation of financial statements to clients.

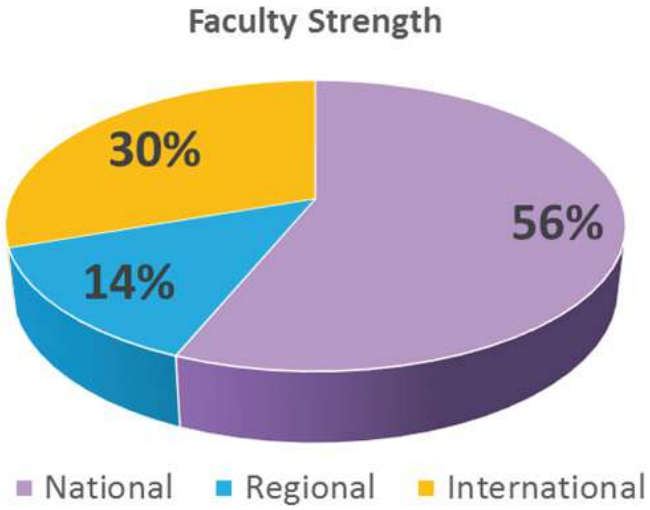
Training and Research

Training Activities

The Centre has built a coalition of faculty including, local, sub-regional and international biomedical scientists across the globe. A Curriculum Development Committee comprising faculty from this vast network of scientists was constituted to design specialized training programmes in Molecular Cell Biology of Infectious Diseases (MCBI) at the MPhil and PhD levels, as part of the World Bank ACE project. The MCBI programmes were accredited in 2014 by the Ghana National Accreditation Board and received International Advanced Accreditation from the Royal Society of Biology, UK in November 2016. These programmes are the first in Africa to receive such endorsement from the Royal Society, which is a testament to the quality of faculty and facilities that have been harnessed at WACCBIP within the short period (3.5 years) of its existence.

As part of the DELTAS project, and to complement the various research projects at the Centre that are focused on pathogen biology, the Curriculum Development Committee developed new PhD levels elective courses in Human Genetics (Molecular mechanisms of human genetic diseases) to catalyze new research in this area by providing students with a deeper understanding of the relationships and mechanisms that link genes to disease.

The WACCBIP faculty comprises local and international biomedical scientists from around the world



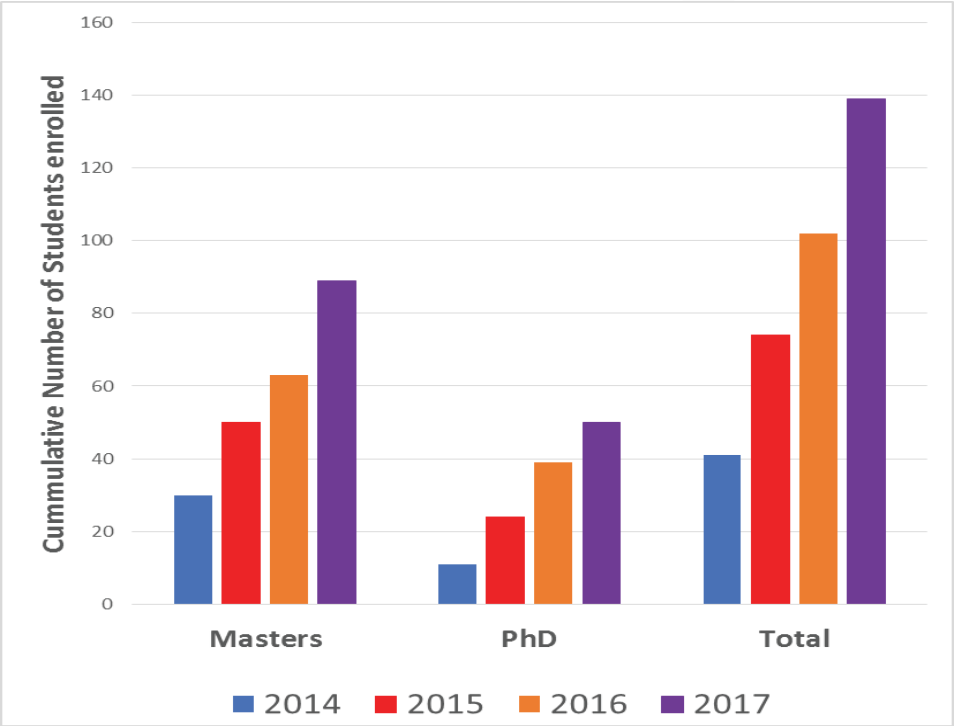
WACCBIP faculty strength

Training Programmes at the Centre include:

a) Short-term programmes (2-4 weeks long workshops/courses) targeting professionals in the health- care delivery sector, including physicians, pharmacists, and senior laboratory personnel, to improve their knowledge of disease pathogenesis and modern methods of diagnosis and treatment;
b) Medium-term programmes (3-6 month long research internships) for trainee biomedical scientists and hospital laboratory technologists, to provide experiential training on research design, specialized techniques, and team building skills; and
c) Long-term programmes (Masters, PhD and Post-doctoral), targeting career biomedical scientists in Universities and Health research institutions.

The Masters programme consists of one year course work at the University of Ghana (UG), plus one year research at UG or partner institution. For the PhD programme, students will do one year of course work at UG, followed by three years of research at UG or partner institution. The PhD programme also includes a six-month student visitor fellowship to spend time in an advanced research laboratory of collaborators in Europe or USA. The WACCBIP-DELTAS postdoctoral programme provides a three-year research fellowship at UG or African partner institution.

Additionally, a 1-year Graduate Internship programme was established under the DELTAS Africa initiative to train and mentor recent graduates as research assistants or research managers. Therefore, there is a complete pipeline of training from Graduate Interns through Masters and PhD programmes to postdoctoral programmes at the Centre. Since 2014, the Centre has recruited 89 Masters students, 50 PhD students, 11 Postdoctoral fellows, and 30 Graduate interns.



Student numbers at the Centre

	Male	Female	Total	% Regional
Postdoctoral fellows	7	4	11	63.64
PhD students	32	18	50	26.00
Masters students	54	35	89	10.11

Summary of enrollment

Student Recruitment and Supervision

Student recruitment is coordinated by the Graduate Students' Admissions and Examinations coordinator. Students are recruited through a thorough but fair selection process involving an entrance examination and interview to choose the best-qualified candidates with the greatest chance of success in graduate programmes. The Centre takes pride in the diversity of students based on both nationality and gender. Student supervision is coordinated by the programme Director and the Training and Research sub-committee. Students are guided to develop their research ideas with guidance from a faculty member based on their area of interest. Each Masters or PhD student is assigned a minimum of two local or regional supervisors, and at least one international supervisor.

Research

The research mission of WACCBIP is to conduct cutting edge research and innovation to guide development of new approaches to disease diagnosis, prevention, and control. The priority pathogens include protozoans causing diseases such as malaria and trypanosomiasis; Mycobacteria causing tuberculosis and Buruli ulcer; other bacteria causing gastro-intestinal and blood infections; and viruses, including HIV, rotaviruses, Influenza, and Dengue, as well as non-communicable diseases such as cancer, chronic kidney disease, sickle cell disease and diabetes. For each of the priority diseases/pathogens, research is organized into five themes: disease pathogenesis and immunity, pathogen genomics/bioinformatics, host genetics/genomics, host/pathogen interactions, molecular diagnosis, molecular epidemiology for surveillance, and target discovery for drug and vaccine development.

Partner Institutions

The Centre has an extensive network of partner institutions. Several faculties in each institution have committed to co-supervise trainees, host students in their labs through Student-visitor fellowships, serve on thesis advisory committees and serve as external reviewers for trainee research proposals and thesis reports. National partners include public health institutions such as the Navrongo Health Research Center, Kintampo Health Research Center, and LEKMA Community Hospital, Teshie; public universities including the Kwame Nkrumah University of Science and Technology, Kumasi, University of Development Studies, Tamale, and University of Health and Allied Sciences Ho; and a major private sector player, LaGray Chemical Company. Regional collaborators include Center Suisse de Recherche Scientifique, Cote d'Ivoire, Medical Research Council (MRC) unit, the Gambia, Malaria Research and Training Center, Mali, Centre National de Recherche et de Formation sur le Paludisme, Burkina Faso, Centre MURAZ Research Institute, Burkina Faso, Institute of Child Health, University of Ibadan, Nigeria, the Kenya Medical Research Institute, Kenya, and University of Cape Town, South Africa. Major international partners include, the American Society for Cell Biology, University of Pittsburgh, USA, University of New Mexico, USA, London School of Hygiene and Tropical Medicine, UK, University of Oxford, UK, University of Cambridge, UK, Wellcome Trust Sanger Institute, UK, MalariaGEN Consortium, UK and University of Copenhagen, Denmark.

Strengthening Research Facilities

In order to serve as a training and research hub with an organizational presence in the sub-region, WACCBIP has strengthened its research facilities by investing over $2,000,000.00 to procure lab equipment such as a Flow cytometer, Gel imager, Biosafety cabinets, Centrifuges as well as furniture, computers and vehicles. WACCBIP has also provided dedicated lecture rooms for Masters and PhD students, postdoctoral fellows' office and Bioinformatics laboratory with high-capacity desktop computers for analysis of

genomic data. To further improve teaching and learning environment at the Centre, a building annex is being constructed to provide additional seminar rooms, lecture rooms, offices, a Bioinformatics lab, a student resource center, and a cold room.

Flow Cytometer

Microscopes

Real Time PCR Machine

Biosafety Cabinet

Gel image

Centrifuge

Strengths, Challenges and Recommendations

A significant strength of the Centre is its regional collaboration with institutions across the sub-region. This has facilitated the sharing of resources, access to specialized equipment and the mobility of students and faculty across various partner institutions to study and conduct research. However, the Centre has encountered a number of challenges in its quest to serve as a hub for collaboration among scientists in the sub-region. High fees for non-Ghanaian students at the University of Ghana has restricted the enrollment of regional students into WACCBIP's graduate programmes. Therefore, while Ghanaian students are mostly partially sponsored, WACCBIP had to offer full scholarships to regional students to enable them to access the high-quality training offered at the Centre. One major challenge the Centre still faces is the bureaucratic and cumbersome procurement process associated with importing laboratory equipment, reagents and consumables for research. This is a common challenge facing scientists across West Africa. However, a new Government of Ghana directive which requires all import duties to be paid and reimbursed later has

compounded this issue. African Universities and research institutions should therefore work with governments to develop separate procurement and clearing procedures for scientific equipment and supplies.

Developing industry partnerships is another significant challenge for research and training institutions such as WACCBIP. This is because there are hardly any biotechnology companies or pharmaceutical industries in Ghana with research and development (R&D) units where research findings could be developed into new products. Such industrial units are also critical for bridging the gap between University education and industry needs, by proving opportunities for internships to graduate students. These interactions are essential for increasing the employability of the students that are being trained. With the increased numbers of PhD graduates expected to be produced through the investments of the World Bank ACE and Wellcome Trust/AESA DELTAS programmes, it is imperative that African economies are restructured appropriately to absorb this influx of high caliber scientists. African governments must provide incentives for industries to establish R&D units locally, instead of relying on international parent companies.

Industries should also commit to offering internship opportunities and scholarships to fund graduate students, who should undertake research projects that are directly responsive to the needs of the industries. Above all, governments in Africa must commit to ensuring the sustainability of Centres of Excellence such as WACCBIP, which are currently mostly donor funded, by making good on their commitment at the 2007 African Union summit5 to invest at least 1% of GDP into R&D. Universities in Africa should also modernize their institutional structures by facilitating cross-departmental graduate programmes and formalizing positions such as postdoctoral researchers who are the driving force behind research and innovation. Finally, there must be intensive public and community engagement to increase awareness about the crucial role of scientific research in economic development.

Conclusion

The progress made by WACCBIP in less than four years of its existence demonstrates how much impact adequate funding can make in transforming the science and research landscape in Africa. WACCBIP was established and led by African scientists, and its long-term success and impact would be a powerful symbol of how Africans can set the agenda for science on the continent. While there are positive signs that the Government of Ghana will move forward with plans to establish a Research Fund to support science, the major plan for sustainability is to continue to place WACCBIP in a strong position for competitive funding from donor agencies by demonstrating consistency in teaching and research excellence. With the increased visibility and credibility that is being gained through the ACE and DELTAS projects, the Centre is well-positioned to access additional funding for its training programmes. WACCBIP is also engaging corporate organizations to sponsor students and research at the Centre. The Centre has successfully synchronized two capacity-building projects to provide full training from graduate internships, through

Masters and PhD programmes to postdoctoral, thereby creating an environment for high quality training and development of research leaders. WACCBIP is training the next generation of biomedical scientists in modern techniques of molecular cell biology and equipping them with the skill-set for independent research in the peculiar research environment in Africa. This network of young scientists who would be bonded together through their training will continue to collaborate as independent scientists.

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NIGERIAN SOLID MINERALS PROCESSING FOR ECONOMIC SUSTAINABILITY AND DEVELOPMENT: HOW FAR THUS FAR?

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Abstract:

Nigeria is one of the richest countries in the world as far as solid minerals resources are concerned. Apparently, all the 36 Federating States including Abuja (Federal Capital Territory) are naturally endowed. Despite these abundant deposits and proven reserves of solid minerals across the country, their utilization and defined researches to meet the need of the local industries and other economic sectors has not been given serious attention. Nigeria is the largest economy in Africa but depends solely on its oil and gas for survival. With the present economic recession that essentially arose from sharp drop in crude oil price and outputs, the need to explore other sectors of the economy such as solid minerals development that can generate more income, provide jobs and serve as raw material for industrialization becomes paramount.

At present, over 44 different types of minerals identified in more than 500 locations in Nigeria are yet to be adequately explored. The Nigerian minerals and metals sector is a key sector crucial to the successful execution of Governments economic diversification strategy and the attainment of growth, wealth creation and poverty reduction goals. In the present context, the processing, extraction and beneficiation of some industrial minerals of

Nigerian origin such as sphalerite (ZnS), galena (PbS), chalcopyrite ($CuFeS_2$), malachite ($Cu_2CO_3(OH)_2$), ilmenite ($FeTiO_3$), rutile (TiO_2), calcite ($CaCO_3$), talc ($Mg_3(Si_2O_5)_2(OH)_2$ and kaolin ($Al_2Si_2O_5(OH)_4$) proposed for various industrial utilizations has been successfully enriched and examined at the Hydrometallurgy and Mineral Processing Research Unit of the University of Ilorin, Nigeria.

The treatment of these mineral ores were examined by hydrometallurgical route involving leaching, solvent extraction and precipitation methods as against the conventional reduction-roasting route involving high energy consumption coupled with environmental challenges. Using combination of the aforementioned unit operations, the process efficiency ranging from 90-98%, have been recorded for producing different industrial metal products and purified minerals prototypes suitable for application in galvanizing, automobile, paper, paints, textiles, cosmetics, rubber, plastics, refractory materials,chemical and agro-industries etc.

Also, the applicability of the developed method for the ore processing have been successfully used in the treatment of some spent secondary materials such as zinc-carbon batteries, automobile tyre wastes, electronic waste and waste eggshell for the recovery of valuable industrial metals and other useful products in the waste-to-wealth research initiatives for economic sustainability and development. Nigeria happens to be a good example of African countries with abundant, yet undeveloped mineral deposits that could improve the economic development and sustainability of Africa. Researches in these areas should therefore be encouraged at research centers and universities across the continent for proper laboratory to industrial product development for appropriate scale-up in boosting the economic growth and development of Africa.

Introduction

Nigeria is one of the endowed countries of the world, abundantly blessed with proven reserves of mineral resources. Solid mineral deposits of economic significance occur in different geologic segment of Nigeria and, each of the 36 Federating states has a fair share of the solid mineral inventory of the nation. There are over forty different types of minerals spread across the nation in diverse environments (Fig. 1). The various mineral resources are categorized into strategic groups as iron and iron-alloy metals, non-ferrous industrial metal, precious metals and industrial minerals. Of these minerals, seven strategic minerals including coal, bitumen, limestone, iron-ore, barite, gold and lead-zinc ores were identified by the Nigeria Ministry of Mines and Steel Development for aggressive reforms to encourage investment in the sector as mining is a significant driver of Nigeria industrialization and development before the oil boom [1]. With the present economic recession, mainly due to drop in crude oil prices and outputs, including the great desire to diversify Nigeria's economy, the need to explore the vast potential of Nigeria minerals and metal resources becomes paramount.

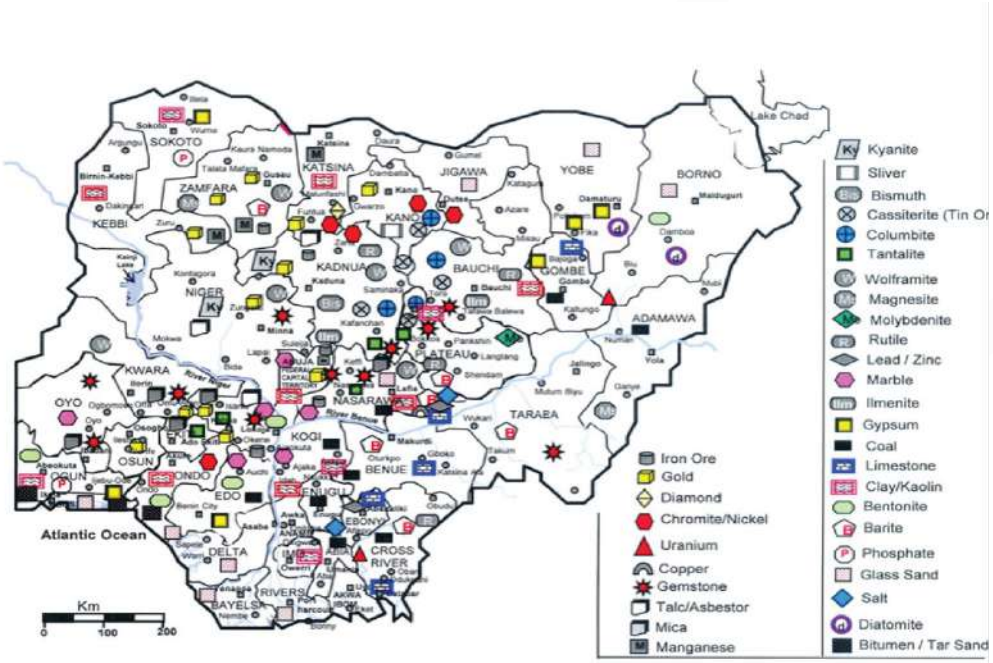

Figure 1: An overview of solid mineral resources distribution map of Nigeria [1]

Hydrometallurgical Treatments of Nigeria Solid Minerals

Hydrometallurgy is essentially concerned with methods whereby metals, metal salts or other metal compounds are produced by means of chemical reactions involving aqueous and organic solution. It normally operates in the temperature range of 25 to 250°C and at pressures of only a few kilopascals (vacuum) to as high as 5000kPa. Consequently, the late 1960s and early 1970s witnessed a great spurt in research and development of hydrometallurgical alternative to conventional pyro- metallurgical processes (involving high energy consumption with emission of obnoxious gases such as (SO_2) used to produce the bulk of non-ferrous metals in the world from high grade ores [2].

High grade ore resources in the world are declining and therefore increased attention is given to low and more complex ores which are difficult to treat with convention mineral processing methods as the concentrates produced are often not clean enough, and thus renders these ores difficult to commercialize [3,4]. As a result of global high metal demands, the hydrometallurgical route has been an alternative to pyro-metallurgical processes for sulphidic ores and concentrates for improved industrial utilizations [5,6].

However, the Nigeria-sourced minerals have high economic values and most companies in the country and other parts of the world depend largely on the importation of refined metals. Consequently, the use of locally sourced minerals for our industries would enable the country save a significant proportion of her hard-earned foreign currencies through petroleum exploration. At present, the hydrometallurgical processing or improvement on the quality of Nigerian minerals and secondary materials have not been seriously given much attention, at least to the best of our knowledge.

As the Federal Government of Nigeria is now addressing positively, the solid mineral sector, this submission would no doubt; contribute to Nigeria's economic growth and development and in the long-run secure the sustainable development in Africa [7]. Over a decade, tremendous efforts aiming at processing the Nigeria sourced mineral resources to meeting the needs of our local industries in laboratory scales have been established by the Hydrometallurgy and Mineral Processing Research Unit of the University of Ilorin, Nigeria. The applicability of the established and developed processes has also been extended to the treatments of some spent secondary materials for possible industrial applications. Some of the successful researches include the following:

From Solid Mineral Deposits

Sphalerite (ZnS)

Sphalerite (ZnS) is the major ore of zinc. Pure sphalerite exists in form of clear crystals and contains 67% zinc and 33% Sulphur [8]. It is generally associated with other metal sulphide minerals such as chalcopyrite ($CuFeS_2$), galena (PbS) and pyrite (FeS_2) and it is the principal source from which zinc is produced commercially [9]. Deposits of lead and zinc ores which are usually found as mixtures have long been known in Nigeria, but they have been mined in the past in a very small scale. The Nigerian lead-zinc field extends for about 560km within the Benue Trough of Nigeria. An estimated 10 million tonnes of zinc/lead veins are spread over eight states of Nigeria with proven reserves of 5 million tonnes [10]. In the commercial flow sheet for the production of zinc metal, the sphalerite concentrate is roasted, leached in sulfuric acid solution and electrolyzed and subsequently used as metallic coating to improve corrosion resistance of various types of steel [9, 11].

We have successfully explored leaching, solvent extraction, precipitation and cementation techniques in the purification and recovery of 95.48% of zinc from zinc loaded organic phase by Cyanex®272 in kerosene extractant. The stripped solution containing pure zinc was precipitated as zinc oxide (ZnO). The zinc oxide (97.3% purity) with melting point 1950±2 ºC is an important coating material for mild skin irritations, galvanizing, pigments and abrasions [12, 13]. The process flow chart summarizing the relevant analytical operations in the extraction-separation of zinc from other impurities in the hydrochloric acid leached sphalerite liquor is depicted in Fig. 2.

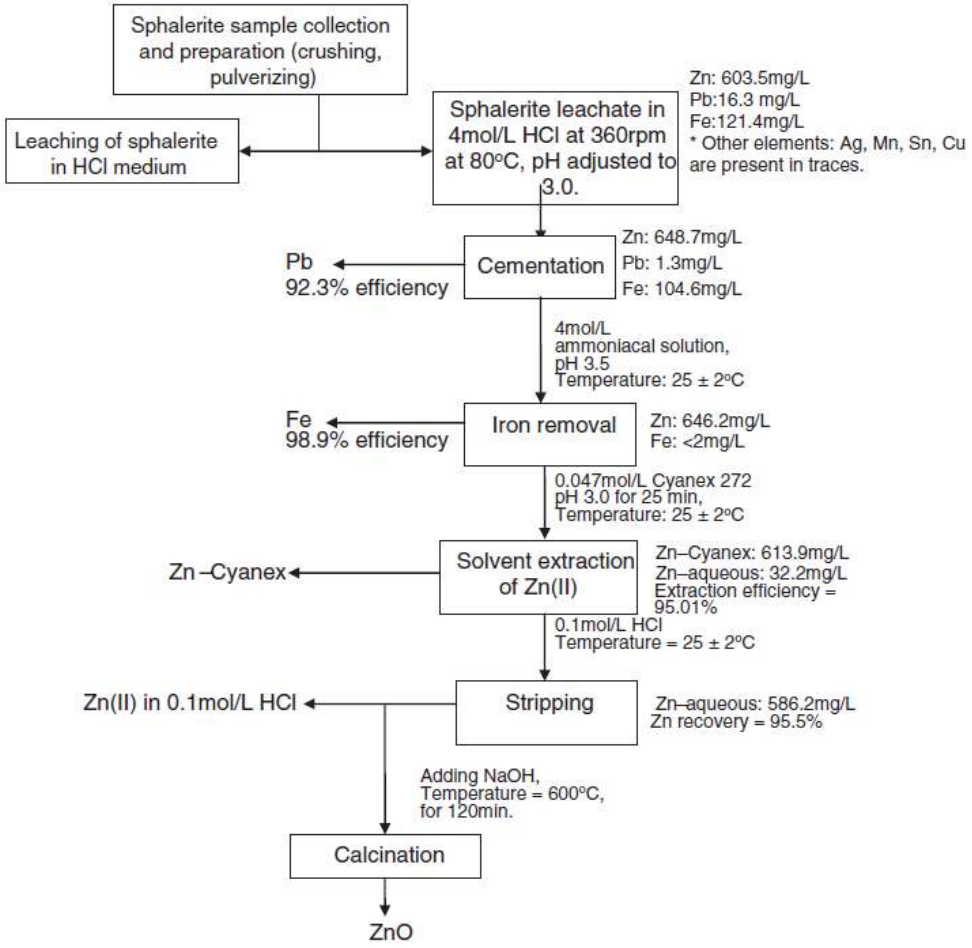

Fig. 2 Hydrometallurgical flow diagram for the recovery of Zn(II) extraction and production of pure ZnO from Abakaliki (Nigeria) Sphalerite ore [12].

Apart from the sphalerite treatment by chemical method, we have also explored the bio-hydrometallurgical approach in the treatment of sphalerite and galena ores using mixed culture of acidophilic bacteria. The use of micro-organisms in metal solubilization processes has attracted much attention in recent years. The leaching of metals using micro-organisms is very attractive because of its low cost and relatively few pollution problems compared with conventional hydrometallurgical processes [14, 15]. In this regard, bio-oxidation of Zn(II) and Pb(II) from Nigeria sphalerite and galena ore were achieved successfully at pH 2.1 and 2.7, respectively by mixed culture of acidophilic bacteria with recovery efficiencies of 92.0% Zn(II) and 89.0% Pb(II) recorded within five days. The rapid consumption of primary zinc resources and ever-increasing demand for zinc metal continue to stimulate worldwide investigations on alternative zinc resources for recovering zinc metal by bioleaching method [16].

Galena (PbS)

Galena, the chief ore of lead and one of the most widely distributed metallic sulphides, occurs both in igneous and sedimentary rocks. It is commonly associated with other sulphide minerals such as sphalerite (ZnS), pyrite (FeS_2), chalcopyrite ($CuFeS_2$), and arsenopyrite (CuFeAsS). In Nigeria, large deposit of proven reserves exists in Ameka, Ameri, and Ishiagu near Abakaliki (Ebonyi State); at Benue and Zurak etc with proven reserves of up to 711,237 tonnes in Abakaliki, for example [17, 18].

The Abakaliki galena ore has been successfully characterized with detailed kinetic studies in different media aimed at establishing the extraction parameters for the lead recovery from the galena leachate have been derived [17, 19]. However, the intrinsic nature of chloride leach liquors resulting from the hydrometallurgical treatments of sulphide ores is rather complex. These solutions usually contain relatively high concentrations of basic metals as well as small amounts of other rare metals as impurities that must be purified prior to define uses. Hence, the purification of these impurities could be achieved through solvent extraction technique for example [19, 20], using the established dissolution kinetic parameters [18], solvent extraction of Pb(II) and Zn(II) from a Nigerian galena leach liquor by tributy- phosphate and bis (2,4,4-trimethylpentyl). Phosphinic acid was investigated for the recovery of 95% extraction efficiencies of both Pb (II) and Zn(II) from the galena leach liquor at optimal conditions.

Clay Minerals

Clay minerals such as talc and kaolin are the most important industrial minerals with diverse industrial applications, depending largely on the physical and morphological properties of the mineral [21]. Kaolin deposits are widespread throughout Nigeria. Almost every state has at least one known deposits of kaolin, with about 300 million proven reserves [22]. Considering the vast deposit of kaolin and its diverse industrial utilization, the development of a low-cost purification process by oxalic acid leaching from Egbeda kaolin deposit was investigated. From the results, it was confirmed that oxalic acid was effective in the treatment and removal of iron impurities from the ore. The product has improved whiteness recommended for use in paper-filling, paper-coating, paint filler, plastic filler and suitable for ceramic products [23].

Report of the Vision 2020 National Technical Working Group on Minerals & Metals Development, 2016 showed that Nigeria kaolin annual national demand is 250,000 tons and present annual production at 25,000 tons. To bridge the gap, the industrial alumina production was successfully achieved through combination of acid leaching, calcination and precipitation techniques in our laboratory, where 96.7% process efficiency was achieved. The product with melting point of 2925°C (Fig. 3) was obtained and would find application as filler in plastic and ceramic industries, coagulant in water treatment and for metallurgical uses in aluminium plant [24]. Also, alum production from Nigeria indigenous kaolin at laboratory scale was achieved through acid leaching technique [25].

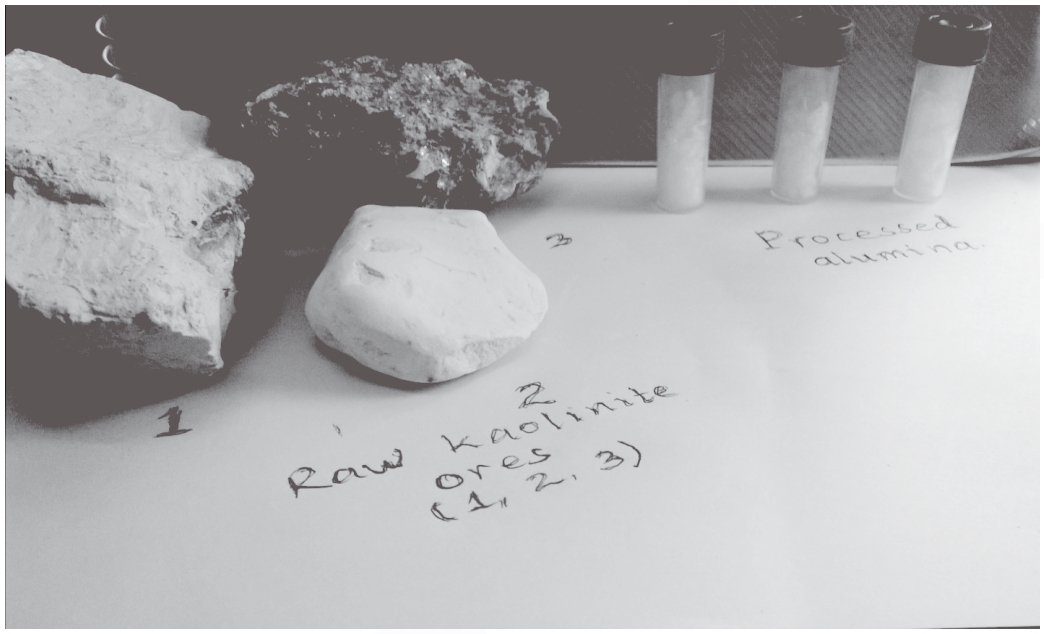

Fig. 3 Raw kaolinite ores from different sources and processed industrial alumina

Talc ore from Isanlu area of Kogi State, Nigeria was purified using hydrochloric acid leaching. The process was reported to 90.4% efficient and product purity in the iron content reduced from 3.75% to 0.36%. Based on the purity tests, increased surface area and porous nature of the product has potential usage in paper, paints, ceramics and rubber industries [26].

Chalcopyrite and other Copper Ores

Chalcopyrite ($CuFeS_2$), the most common mixed and low grades copper bearing mineral with significant proven reserves occur in Bauchi and Nassarawa States [27]. Due to increasing world consumption and demand for copper, such low grade ore are widely exploited [28]. The result of the investigated chalcopyrite dissolution recorded 91.33% efficiency [29, 30]. The treatment of the leach solution containing copper and other metal ions was accordingly purified by dithizone in kerosene extractant. The extraction and purification was successfully achieved by first removing iron and manganese impurities at pH 3.58 and 4.25 respectively to obtain 98.3% copper efficiency from the loaded organic phase. The pure copper solution was later beneficiated as copper oxide, an important compound useful as p-type semiconductor, in pigment and ceramics production.

Also, malachite from Sabon-gari was processed hydrometallurgically for production of high grade copper sulphate pentahydrate crystal ($CuSO_4.5H_2O$) and the process recorded 98% efficiency [31].

Manganese Ore

Pyrolusite (MnO2) is an important manganese ore used extensively for the manufacture of ferromanganese of various alloys such as manganese, bronze, cells and fine chemicals. The ore is usually mined as oxide ore converted to ferromanganese or silicomanganese in a blast furnace or electric arc involving high energy consumption and release of obnoxious pollutant to the environment [32]. Hence, the development of a low cost, effective route for manganese extraction and its beneficiation from Kaoje pyrolusite ore by hydrometallurgical route was investigated. The method achieved an extraction and beneficiation efficiencies of 95.5% and 98.4% pure manganese and its oxide, respectively [33].

Calcite Ore

Hydroxyapatite (HAp), a major constituent of hard tissue and human bone is one of the most versatile materials used for implantation purpose due to its similarity to natural bone material. It is extensively used for a variety of biomedical, orthopedic and dentistry applications [34-36]. Therefore, the preparation of HAp was carried out using a Nigerian calcite ore and diammonium hydrogen phosphate as the calcium and phosphorous source respectively by hydrothermal method in our laboratory. At optimal conditions, HAp crystal with Ca/P molar ratio of 1.66 close to the stoichiometric ratio of 1.67 required for biomedical application was obtained [37]. The clinical test for possible biomedical remediation in orthopedic medicine is ongoing at the University of Ilorin Teaching Hospital (UITH), Ilorin – Nigeria.

From Secondary Materials

Metals, including zinc are primarily produced from mineral ores such as sphalerites, oxide and carbonate. However, resulting from the concurrent increase in demand for metals and the gradual depletion of these un-renewable sources, attention had been directed to the recovery of metals from secondary sources to contribute to the "waste-to-wealth" initiatives of the Federal Government of Nigeria. Recycling from metal wastes are growing rapidly in the country since cost of safe disposal of hazardous materials is quite high compared with amount of waste produced and the limited storage capacity.

In the aforementioned, the potential of solvent extraction using Cyanex®272 for the recovery of zinc from spent zinc-carbon batteries after a prior leaching in hydrochloric acid has been successfully carried out. An extraction yield of 94.23% was quantitatively achieved by 0.032 mol/L Cyanex 272 extractant [20]. In the same vein, combination of leaching, solvent extraction and precipitation were used in the treatments of spent motorcycle batteries [38]; mobile phone waste [39] spent automobile tyres [40] and metallic component in discarded cell phone [41] examined to obtain recovery efficiencies of 86.9%, 92.4%, 94.1% and 96.3% respectively. The recycling of these products have minimized waste disposal problem, a major concern to the environment in terms of their heavy metals contents.

Also, industrially suitable hydroxyapatite (HAp) powder was successfully produced from waste egg-shell using low temperature treatment. The results, after detailed characterization gave Ca/P stoichiometric ratios from 1.69 – 1.65 at optimal conditions affirmed the product suitability for biomedical and non-medical applications [42], etc.

Conclusion

The findings of the reported studies underline the importance of adoption of hydrometallurgical mineral processing for social economic development and sustainability in Africa countries, as it will ensure significant harnessing of the abundant mineral resources. Hence, hydrometallurgical method can be successfully used to replace other mineral processing methods that are generally costlier with higher energy consumption and potential environmental hazards. With abundant deposits of viable industrial minerals in Nigeria, the country still depends largely on external sources of refined products for its industries.

Thus, the various products emanating from our research efforts when exploited and utilized would on the long term result to economic empowerment, job creation and technological advancement of the nation's economic growth and development. Therefore, further development and collaborations in these areas of research can be successfully undertaken at the Mineral Processing and Hydrometallurgical Research Unit of University of Ilorin, Nigeria.

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CURRICULUM REFORM AS KEY TO GRADUATE EMPLOYABILITY AND ENTREPRENEURSHIP

- Effect of curriculum review on job aspiration of undergraduatesof agriculture
- Agriculture embedded in science, engineering and (ict)_the missing key to graduate employability in africa
- Re-focussing the moi university bachelor of education curriculum on employability_ a holistic triad model
- Vocational education and training curriculum responsiveness in the context of economic implosion - the case of zimbabwe
- Enhancing teaching quality in higher education for better student outcomes:"a case study of the university of rwanda"

SUB-THEME 2

EFFECT OF CURRICULUM REVIEW ON JOB ASPIRATION OF UNDERGRADUATES OF AGRICULTURE IN KWARA STATE, NIGERIA

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Abstract

The study investigated whether the inclusion of Farm Practical Training (FPT) in undergraduate curriculum of agriculture significantly influenced job aspiration of students, using the results of empirical evidence from University of Ilorin and Kwara State University, Nigeria. One hundred and twenty final year students who recently completed the FPT were selected from the two Universities through multi-stage sampling. Data were collected with a structured questionnaire, summarized using appropriate descriptive statistics, while binary logistic regression model was used for inferential deduction. Many (69.8%) of the students aspired for agriculture/farming related job, while 12% aspired to work in agro-allied industries.

Problems associated with the FPT included, inadequate funding and non-functional and inadequate materials. Results of the binary logistic regression (Wald statistic = 0.021; p-value of 0.885) indicated FPT did not empirically affect students' job aspiration. It was thus concluded that FPT did not significantly influence students' job aspiration. Overhauling of the practical component of the FPT in order to enhance practical and entrepreneurial skill acquisition that can enhance graduate employability is recommended. Also, universities offering degrees in agriculture should be committed to adequate funding and acquisition of functional and requisite materials needed for the programme. Lastly, encouraging students to contribute funds and skills to jointly engage in agro-enterprises during the FPT is also recommended to complement the inadequateness of facilities provided for FPT implementation.

Key words: FPT; farming, agro-allied, funding, entrepreneurial skill, graduate employability

Introduction

The Agricultural sector, especially in developing countries, has been identified as an area with lots of opportunities for university graduates in terms of self-employment as entrepreneurs, as well as direct employment by other stakeholders (Mugisha and Nkwasibwe, 2014). Unfortunately, the youth see very limited opportunities in Agriculture; it is viewed as a non-viable income source and employment of last resort and many consider becoming a farmer as condemning oneself to subsistence and poverty, Muir-Leresche (2013). For instance, Okorley (2001) in a study conducted in Ghana and cited in Oloruntoba (2008) reported that only 20% of students indicated a definite willingness to pursue agribusiness as self-employment venture, due to poor practicals delivered by the curriculum. Also, undergraduate students seldom pick Agriculture as their first choice course of study, an indication of their aversion for studying and consequently practising it. They often pick Agriculture as second or third choice or accept admission offer as last resort to gain admission into the university (Yusuf, 2005; Zinnah et al., 2013; Ayanda et al., 2013).

The significance of practical exposure in Agriculture can never be overemphasized. It affords learners the opportunity to put theoretical learning in classrooms into practice thereby improving their competence and employability after graduation. This may be referred to as competency-based training or experiential learning. Activities such as field attachment and field visits were reported as vital in agricultural training internship that linked the agricultural training institutions to private sector (Mugisha and Nkwasibwe, 2014). However, while practical experience has been widely accepted as an integral part of Medical and Engineering degree programmes, it is not often part of the curriculum in Agriculture, and where it is, it is often viewed negatively by students as manual labour and by faculty and administrators as being too expensive Muir-Leresche (2013).

A number of universities provide opportunities for their students (e.g. Swaziland, Costa Rica, and Nigeria) or upon graduation (e.g. Botswana) to undergo internships. An example of practical experience and an active and well established student entrepreneurial project programme is that of EARTH (Escuela de Agricultura de la Region Tropical Humeda) University in Costa Rica, which provides practical opportunities throughout the degree for students' internships within the surrounding rural community, establishment of student projects as well as internships with private companies and civil society organizations as part of its curriculum (Juma, 2012; cited in Muir-Leresche, 2013).

Also, The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) (promotes much closer integration between universities and communities and supports projects that help to transform knowledge into usable innovations in rural areas. It then provides, through the Field Attachment Program Award, (FAPA) (an opportunity for students to go back to the communities after completing their theses to work with a local agency to encourage uptake. These internships also provide the students with windows to identify community needs and gaps for entrepreneurial projects Muir-Leresche (2013).

Many educational institutions in Sub-saharan Africa are limited by a lack of instructional capacity to develop and deliver relevant up to date competency based training Mercer et al. (2011). Okorley (2001), cited in Oloruntoba (2008), submitted that heads of agricultural faculties opined that the curriculum for teaching Agriculture in Ghana were not adequate to address training needs for self-employment in agribusiness. Also, much recently, findings of a study carried out on assessment of tertiary Agricultural education by Zinnah et al. (2013) in Ghana revealed that curriculum of the institution were mainly theoretical, lacking off campus,… and employers generally concurred that existing curriculum and courses were not producing graduates responsive to end-users needs.

In Tanzania, Mercer et al. (2011) emphasized need to focus on small basic entrepreneurship within the agribusiness sector in order to enhance graduate employability. In Nigeria, a report of a recent survey by Phillip Consulting, a recruitment firm, on education and employability recommended a realignment of curriculum of educational institutions, especially at the tertiary level to make it more relevant to the needs and status of the Nigerian society (Phillips Consulting, 2014).

In the realization of the foregoing, the National Universities Commission (NUC) had since 1981 introduced a Farm Practical Training (FPT) programme in the undergraduate Agriculture curriculum. The training, according to the NUC, should be for a duration of 12 months of which not less than 80% should be devoted to practical training on a farm and related industries (NUC, 2007).

The new curriculum makes FPT mandatory for Agriculture undergraduates in the fourth year of the five-year degree programme leading to the award of B. Agric. Degree. The Bachelors of Agriculture programme had hitherto been for four years but is now five years after inclusion of FPT in the Agriculture degree programme curriculum. The FPT aims to complement theoretical classroom teaching with experiential learning, improve the technical know-how of the nation's university graduates of agriculture and enhance youth retention in agriculture (Ayanda et al., 2013; Oloruntoba, 2008).

Despite the inclusion of the FPT in the curriculum of undergraduate Agriculture degree programme, Oloruntoba (2008) noted there was poor vocational competence and near-zero practical skills in Agriculture, which according to the author, had earlier necessitated a roundtable conference of Deans of Agriculture universities on practical training in 2006. It thus became necessary to investigate whether inclusion of the FPT in curriculum of agriculture impacted on students' willingness to practice the profession upon graduation as an employee or employer of labour.

Objective of the Study

The main objective of the study was to investigate whether inclusion of Farm Practical Training (FPT) in undergraduate curriculum of Agriculture significantly influenced job aspiration of undergraduate students in Kwara State, Nigeria.

Specific Objectives were to:
i. Identify students preferred courses of study;
ii. Determine students' perception of adequacy of the FPT on influencing their job aspiration;
iii. Determine students' job aspiration after completion of the FPT;
iv. Empirically investigate the effect of FPT on students' job aspiration.

Methodology

The study was conducted in Kwara State, Nigeria. A multi-stage sampling procedure was used to select respondents for the study. First was purposive selection of University of Ilorin (UNILORIN) and Kwara State University (KWASU), being the only Federal and State Universities in the State, respectively, that offer agriculture as a field of study. At second stage, all 61 final year agricultural students from KWASU were purposively selected, while 30% of all final agricultural students (213 in all) in UNILORIN were randomly selected giving 64 students. Thus, a total of 125 students were sampled for the study. However, only 120 questionnaires duly filled and returned were used for data analysis. A validated, structured questionnaire was used for data collection, which took place in December, 2016. Data collected were summarized using descriptive statistic such as frequency counts and percentage, mean and standard deviation.

Variables including sex, preferred course of study and job aspiration were measured at nominal level, while 'age' was measured at ratio level. 'Students perception about adequacy of the FPT on influencing their job aspiration' was measured on a 5-point Likert Type Scale with options 'strongly agreed,' 'agreed,' 'undecided,' 'disagreed' and 'strongly disagreed' scored 5, 4, 3, 2 and 1 respectively, for positively worded statements, and vice-versa for negatively worded statements. A total score was obtained by adding response score of each respondent per statement together. Then using mean plus or minus standard error, respondents were categorized into three groups; namely, 'those who perceived the FPT as adequate in influencing their job aspiration,' 'those who perceived it not so' and 'those indifferent.' Binomial logistic regression was used to establish the impact of FPT on students' job aspiration. Job aspiration was the response (i.e. dependent) variable and classified as 'agriculture/farming related' = 1, and 'non-agriculture related' = 0. On the other hand, 'attitude towards FPT' represented the independent variable in the regression model.

Results and Discussion

Students' Personal Characteristics

Results in Table 1 show that slightly above half (56.7%) of the students were males. The result tends to indicate that more male students were admitted to study agriculture. While this submission concurs with the findings of Oloruntoba (2008) where male majority were reported to be studying agriculture, it is in contrast with that of Ayanda et al. (2013) who

reported more female students studying agriculture in their study in Kwara State. With these contrasting findings, it may not be convincing to conclude that gender composition of agricultural students in higher institution tilt in favor of either gender. The mean age of the student was 23.51 years with a standard deviation of 2.37. The results indicate that the students, although young, had passed adolescent stage. This implies that the students are matured enough to make decision on their own which agrees with the submission of Ajayi et al. (2008) and Ayanda et al. (2013).

Table 1: Socioeconomic Characteristics of Students

Variable/Institution	Total (n=120)
Gender	
Male	68 (56.7)
Female	52 (43.3)
Age (years)	
Mean	23.51
Std. dev.	2.39

Source: Data analysis, 2017

Students Preferred Course and Reason for Decision to Remain in Agriculture

Results in Table 2 show that 40% amongst the students indicated preference to study Agriculture. This was followed by Science which 38.3% indicated preference for. Few (less than 10% each) indicated preference for Engineering, Pharmacy and Medicine. The results show that Agriculture and other Science related disciplines ranked highest amongst course of study students desired. The finding is in contrast to submission of Okorley (2001), Ajayi et al. (2008), Ayanda et al. (2013) where most students did not pick Agriculture ab initio but indicated preference for 'prestigious courses' like Medicine and Pharmacy. This may be attributed to two reasons. Firstly, increasing effort of the Government in recent past emphasising and encouraging Agriculture may have subtly influenced students' career choice. Secondly, the seemingly prestigious courses might be losing credibility now, even as most graduates of these courses face serious difficulty in getting placement for their one-year post graduation internship, with future job prospects ever becoming bleaker.

Results in Table 2 show that 31.7% of the students decided to remain in Agriculture because they considered it prestigious profession. Another 25.0% indicated agriculture as a profession had always been their personal ambition. Also, 16.7% indicated they stayed on in Agriculture because they believed it offers a lot of entrepreneurial opportunities. While few (13.3%) got into Agriculture because that was the last opportunity they had to gain admission into the University, very few (5.0%) indicated parental influences as reason behind their decision. These results indicate students' decision to study Agriculture was not due to much external influence, rather they willfully decided to stay on studying Agriculture for the reasons mentioned.

Table 2: Students' Preferred Course of Study and Reason for Decision to Remain in Agriculture

Variable/Institution	Total (n=120)
Preferred course of Study	
Agriculture	48 (40.0)
Science	46 (38.3)
Medicine	6 (5.0)
Engineering	8 (6.7)
Pharmacy	6 (5.0)
Others	6 (5.0)
Reasons for decision to remain in agriculture	
It is prestigious	38 (31.7)
My personal ambition	30 (25.0)
Those who studied agriculture are well to do in the society	10 (8.3)
Last available opportunity to gain admission	6 (13.3)
Parental influence	6 (5.0)
It offers lot of entrepreneurial opportunities	20 (16.7)

Source: Data analysis, 2017

Students' Perception about Adequacy of FPT on Influencing their Job Aspiration

Results in Fig. 1 show that majority (96.7%) perceived the Bachelors of Agriculture programme as incomplete without the FPT component. In the same vein, majority (93.3%) supported the position that FPT programme enabled them have a change of mind about the job they had always aspired before the training. This could mean that, those amongst them who might have been aspiring for white collar jobs have now decided to have their own farm business as a result of the training. While a large percentage of the students (77.5%) disagreed with the opinion that skills acquired during the FPT is not sufficient to make students establish their own farm after graduation, quite a number (20.8%) indicated otherwise. This may imply that students did not all gain sufficient skills from the training. However, with as much as above three-quarter of the students holding this opinion is credible enough to posit that students had learnt necessary and sufficient skills to enable them start up on their own agricultural enterprises after finishing in school. This is corroborated by further results wherein majority (97.5%) held the view that FPT imparted on students enough entrepreneurial skills necessary to enable them manage a farm on their own in future.

Results in Fig. 2 further show that majority (93.4% and 97.5%) did not concur with the position that FPT was a mere waste of financial resources and mere waste of time, respectively. Similarly, majority (90.8%) did not opine that the programme should be scrapped. These results could mean that students believed no amount of money committed by their institution is a waste and, as well regarded the FPT worthwhile and necessary. The results further show that more than half of the students (54.2%) were of the opinion that the training did not afford students the opportunity to practice what they learnt in the classroom. This indicates that a large proportion, close to half, didn't hold that the training afforded them the opportunity to exemplify classroom learning. This could be due to the inability of the students to link theory with practical knowledge or that some of the lessons taught were not covered during the FPT. The finding underscores the need to harmonize the curriculum such that theoretical learning in the classroom is reinforced by experiential learning taken place during the FPT.

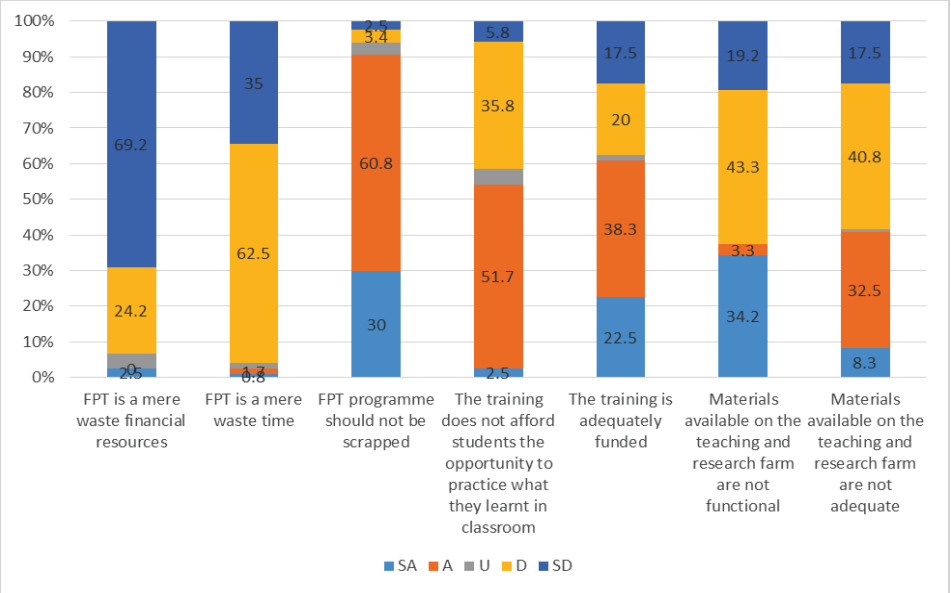
Fig. 1: Percentage Distribution of Students' Perception of Adequacy of FPT on influencing their Job Aspiration

Source: Data analysis, 2017

Less than two-third (60.8%) supported the position that the training was adequately funded (see fig. 2). Also, about one-third (34.2%) agreed that materials available on the teaching and research farm were not functional while quite a number (40.8%) held that the materials were not adequate. The results were an indication of inadequate funding of the FPT, non-functional and inadequate materials available for the FPT. All these have negative implications for the successful implementation of the FPT programme, especially on skills acquisition necessary to enhance students' employability upon graduation and retention within the agricultural sector.

There is therefore the need for the following: A future curriculum review by the NUC to mandate universities offering degrees in Agriculture to allocate certain proportion of their budget to funding of the FPT, particularly for acquisition of functional and requisite materials needed for the programme becomes necessary to address the situation. Also, students should be encouraged to contribute funds and skills to jointly engage in agro-enterprises during the FPT so as to complement the inadequateness of facilities provided by the universities. This will inculcate in the students the merit of social and capital formation through partnering.

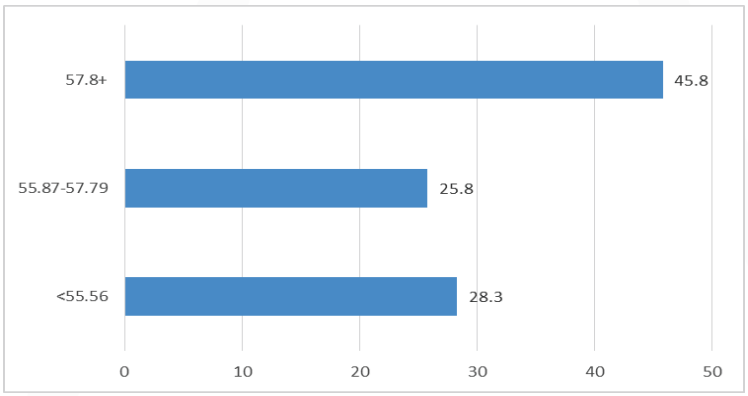
Fig. 2: Percentage Distribution of Students Based on Attitudes Toward FPT (cont'd)



Source: Data analysis, 2017

Results in Figure 3 show that less than half (45.8%) of the students perceived the FPT as adequate in influencing their job aspiration, whereas, an ample proportion of students (28.3% unfavorable and 25.8% indifferent) did not consider the FPT as adequate in influencing their job aspiration. This may not be unconnected to issues of inadequate funding of the FPT, non-functional and inadequate materials associated with the FPT. There is therefore the need for the universities to provide adequate funding and more functional and adequate materials required for students' experiential learning during the FPT, as earlier on alluded to. Also, the roles of students in addressing the situation were discussed above.

Fig. 3: Percentage Distribution of Students based on Perception about Adequacy of FPT in Influencing their Job Aspiration

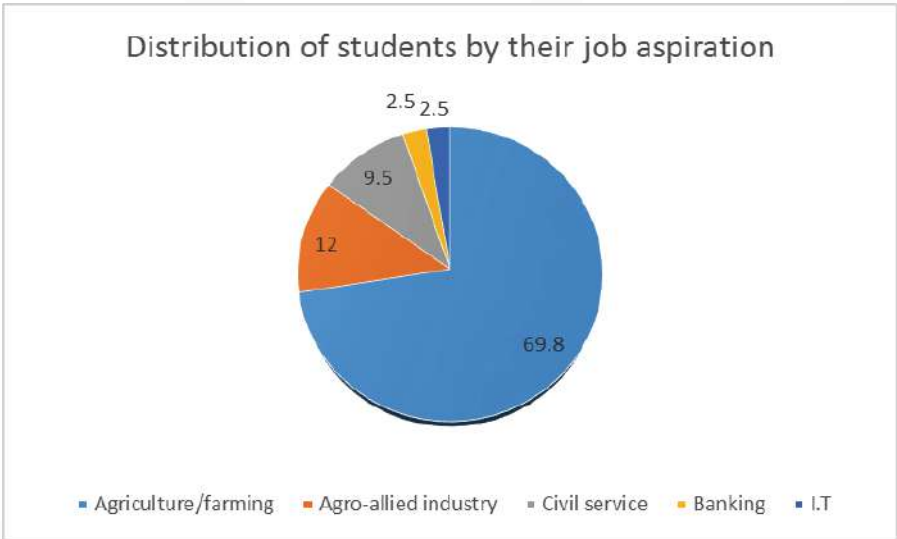


Source: Data analysis, 2017

Students' job aspiration after completion of the FPT

Results in Figure 4 show that majority (69.8%) aspired to work in the field of Agriculture/-farming. Another 12% aspired to work in agro-allied industry. Few others opted to work in the civil service (9.5%), banking industry (2.5%) and Information Technology sector (2.5%). The results indicated that majority (81.8%) aspired to engage in agriculture and related profession after graduation. However, whether this was direct influence of their participation in the FPT, empirical finding from the binomial logisitic regression below would tell.

Fig. 4: Distribution of Students by their Job Aspiration



Source: Data analysis, 2017

Result of Binomial Logistic Regression

Results of binary logistic regression gave Wald statistic value of 0.021 with p-value of 0.885. Also, Cox and Shell R2 value obtained was 0.00. These results indicated that FPT was not a useful parameter to the model, meaning it was not a significant determinant of job aspiration. The findings thus reveal that, although majority of the students aspired to work in agriculture and agro-allied industry, yet, this may not be attributable to the effect of FPT as established by the regression analysis. As much as inclusion of the FPT in Agriculture curriculum is a step in the right direction, the above finding underscores need for overhauling of the practical component of the FPT in order to ensure it enhances practical and entrepreneurial skill acquisition of students becomes necessary.

Conclusion and Recommendation

It was concluded that while students regarded the FPT as vital to experiential learning and therefore its inclusion into the agriculture curriculum relevant, the FPT did not significantly

influence student's job aspiration. Also, there were problems of inadequate funding, non-functional and inadequate materials associated with the FPT. Complete overhauling of the practical component of the FPT by ensuring it enhances practical and entrepreneurial skill acquisition of students is recommended to enhance graduate employability. Also, universities offering degrees in Agriculture should be more committed to adequate funding and acquisition of functional and requisite materials needed for the programme. It is also recommended that students should be encouraged to contribute funds and skills for jointly engaging in agro-enterprises during the FPT. This is to complement the inadequateness of facilities provided for FPT implementation with a view to enhancing agricultural graduate employability and retention in the agricultural sector.

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AGRICULTURE EMBEDDED IN SCIENCE, ENGINEERING AND INFORMATION AND COMMUNICATION TECHNOLOGY (ICT): THE MISSING KEY TO GRADUATE EMPLOYABILITY IN AFRICA

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Abstract

This paper examines how agriculture can be made more attractive, especially using the creativity of students of science, engineering and Information and Communication Technology (ICT) to boost agriculture in Africa. About half of the graduates produced in African universities are unemployed after graduation due to many factors. However, according to records, the agricultural industry employs the most, and it is one of the most promising industries that can help to reduce the unemployment rate and generate more revenue in Africa. Unfortunately, this field is not attractive to most graduates, because the curriculum used in our educational system is no more encouraging active farming or tools to improve farming. Rather, the sector is seen as a sector for rural, uneducated dwellers. This is because fewer resources are in place to encourage research and development of the agriculture industry.

This paper argues that the research work carried out majorly in our universities does not give priority to the development of the agricultural sector, despite this sector having the potential of employing more graduates. In looking for the missing key to employment opportunities in Africa, this paper explores the concept of employability by showing how most of the graduates of Science, Engineering and ICT are unemployable especially by the 'booming' information and technology industry hence; they are better-off acquiring employability skills needed to promote agriculture. Therefore, this paper advocates for the inclusion of employability skills in agriculture into the curriculum of these subjects. This paper also shows how the 'African' Science and Engineering curriculum is leaving behind a major skill gap and how it does not allow for much flexibility. Some of the on-going works

to improve the field of Agriculture using Science, Engineering and ICT are also explained while examining how our universities research and developmental focus on agriculture can be improved.

Introduction

Employability is a notion that refers to acquiring some specific skills or knowledge needed by an employer [1, 2]. Employability skills have been defined as: "A set of achievements, understandings and personal attributes that make individuals more likely to gain employment and to be successful in their chosen occupations" [3]. Employability is not simply getting a job, it is the ability to retain a job, have job mobility and security [4]. It is therefore the responsibility of both the student and the educational system to provide students with employability skills, especially at the higher education level. This is because higher education, more especially at the university level is meant to serve as the getaway to employment. On a wider view, a nation or region can reduce its unemployment rate when most of it citizens who require employment have the employable skills for the industry where the jobs are available. In Africa, almost 50% of the 10 million graduates produced in the over 668 African universities are unemployed after their university education [5]. It is also a known widely that Africa has the highest unemployment rate globally, at 12.1 per cent in 2015 for North Africa, 40% in Kenya, 17.8 in Botswana,13.3 in Zambia, 6.6% in Nigeria and 3.6% in Ghana [6]. On the average, unemployment rate stood at 8.1, 7.6, 7.3, 7.4, 7.5, and 7.5 for 2000-2007, 2008-2013, 2014, 2015, 2016 and 2017 respectively [7]. The African youth unemployment rate is stood at 48% in 2015 and 50% in 2016 [6].

The rest of this paper is as follows: Section II explains the problem with graduate employability in Africa. Section III explains how and why the other booming industries cannot employ more Africans like the agriculture sector. Section IV explains the on-going efforts to use Science, Engineering and ICT to boost Agriculture, while the conclusions are provided in the last section.

Agriculture and Graduate Employability

Agriculture is the world's largest provider of jobs, employing over 1.2 billion people throughout the world [6]. This constitutes about 40% of the global workforce [8]. In Africa, the figure is higher. It can be seen from Fig. 1 that on the average, over 65% of employed Africans are employed by the agricultural sector. This percentage of farmers is one of the highest among all regions of the world. According to Bhorat et. al. in [7] half of the entire employment growth recorded between 1999 and 2009 in the sub-Saharan Africa occurred in Agriculture. In fact, in some African countries, over 75% of its population are employed by the agricultural sector. This is because Africa is blessed with enormous arable land and other natural resources needed for Agriculture [9]. However, this sector is struggling to attract graduates, youth and women.

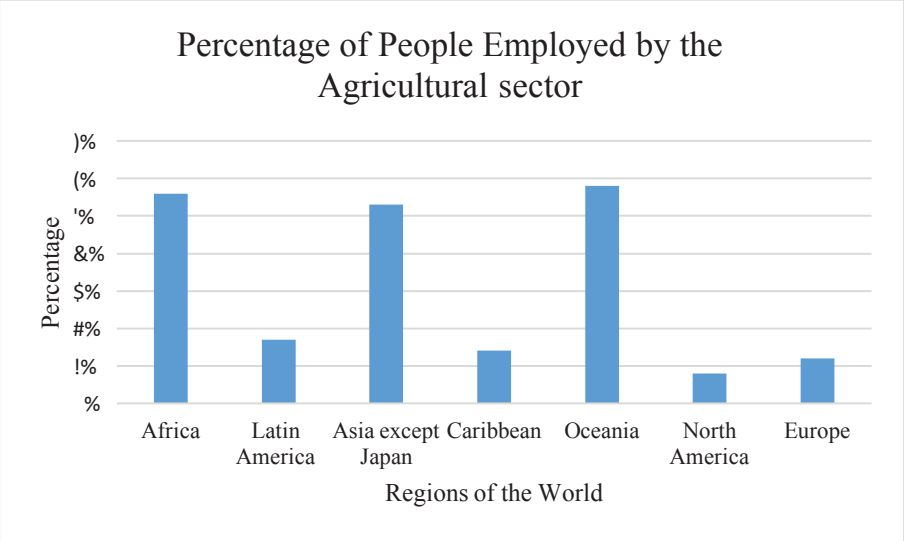

Figure 1: Percentage Employed by the Agricultural Sector

According to Tortora in [10], farmers in Africa are 57% more likely to be male because the traditional farming system which is more common, entails physical strength. According to the same report, farmers in Africa are more likely to be older when compared to others who are not farmers, with the average age of farmers being 40 years, compared to 34 years for those in other sectors. Therefore, there is a need for our curriculum to encourage graduates and even women to go into this industry. This can be done by providing incentive to females who are ready to work in this industry. The sector is also struggling because the focus of our Science and Engineering education is not developing the skills necessary in the agriculture sector, rather we focus on developing areas where no jobs are available as shown in the next section.

Therefore, there is a need for a change in curriculum. Education is supposed to provide a broad overview to students, but more emphasis should be made for the development of the skills where jobs are available. At the moment, our Science and Engineering education model focuses on solving problems of the large IT and Engineering companies. However, research has shown that these companies are only employing very few Africans, because of a number of reason [11]. Therefore, the Agriculture industry requires bright minds that can transform the sector using technology. This is because research in [9, 12] shows that the agricultural sector has the necessary potential to employ Africans and also has the potential to be a means of adding value and improving the living standard of Africans.

At the moment, despite the huge percentage of farmers in Africa, Agriculture contributes just about 15% of its GDP [13]. In fact, the capital agricultural productivity of Africa has relatively remained stagnant over the past 40 years. This is because subsistence farming, by majorly unskilled farmers is the most popular mode of farming in Africa. Jayne et.al and

Wambugu et al [14, 15] identified government policy, lack of technological and innovative approach, lack of research and development and deemphasising Agriculture in the main curriculum as some of the barriers facing commercial agriculture in Africa. However, this paper focuses on how more emphasises on Agriculture in our curriculum and research output can help to reduce the unemployment rate in Africa.

There is a need to actively encourage employability skills needed to make the agricultural sector more lucrative and attractive in Africa such as, effective human relations; giving directions and guidance to others; keeping up to date with technological changes/innovations working independently; supervising skills; making effective business presentation; adapting to change; coordinating skills; innovative skills; creativity skills; adapting to changes and visioning that deal with defining and solving problems, while analysing information and making decisions. These skills should be taught to students by a special unit of the University.

Agriculture, Science, Engineering and ICT in African Graduates

Being in suitable employment would lead to living an improved and quality lifestyle, leading to the social-economic development of a nation. Therefore, there is a need to give priority to areas that have the potential for employment opportunities. Around the world, and in recent years, Science, Engineering and ICT related fields are the main driving force [16]. These fields are quite popular among students in most universities in Africa. It accounts for about 30% of our graduating student's yearly [6]. These fields have not been properly tapped into, especially when designing curriculum and when carrying out research work. The inclusion of agriculture inclined research in fields like Science, Engineering and ICT in Asia and Latin America has transformed agricultural practice leading to the "green revolution" however, this has not occurred in Africa[13]. [13, 17] argued that international research on high-yields crops do not focus on Africans foods and the agro-ecological system. Therefore, this has to be done by indigenous researchers.

Furthermore, agriculture has been the main employer of labour, yet our universities are not focusing or using the necessary skills, especially in the field of Science and ICT to develop this industry. For example, in terms of full-fledged universities dedicated to agriculture in Africa, Nigeria has the most in sub-Saharan Africa, there are well over 100 universities in Nigeria, but only three are dedicated to agriculture, Ghana, Kenya, Tanzania Somalia and Ethiopia have only one of such universities, while most of the other sub-Saharan African countries have none at all. Establishing more of these types of specialised universities would help African graduates to appreciate Agriculture more, while developing the necessary curriculum. This is because a lot of African graduates do not appreciate the potential in Agriculture rather it is seen as an industry for non-graduates. At the moment, just about 20% of farmers have a formal nine -year education [10]. Therefore, most African graduates are seeking for employment in multinational companies, because they pay the most. [18] showed that 100% foreign-owned firms pay higher wages in most African countries. How-

ever, research shows that these companies are only employing few Africans. For example, the telecommunication industry is presently booming in Africa according to [19]. Despite the success of the telecommunication industry, Ericson has jobs for only 2,164 in Africa, constituting less than 2% of their workforce. Microsoft currently has 1.2% of its employees as American/African blacks [20].

In 2015, Facebook hired 1,216 employees, only 36 were Africans taking the percentage of Africans employed by Facebook to 1.5% [21]. Out of the combined employees of Twitter, Facebook and Google of 41,000, only 758, less than 2% were blacks. Furthermore, despite the best efforts to improve our Engineering skills, when Kenya wanted to construct a standard gauge rail in 2014, 87 Chinese were brought in because of lack of indigenous skills. This is same in Nigeria, Tanzania, Rwanda, and most other African countries [22]. This shows that the problem is not mainly a bias towards the countries where the owners of the earlier mentioned companies are from. Most Africans graduates in Engineering and related fields who hope to work in these types of companies end up spending more time gaining the employability skills needed by these companies rather than those needed to help transform the agricultural industry.

Unfortunately, based on the available figures, most of the time they do not get the job. There are few reasons for this: One is that our university graduates in these fields cannot compete with their counterparts in other parts of the world because of our curriculum, lack of equipment among other factors. According to Daily Mail report in [23], only 1% of the total workforce in Google as at 2015 are blacks compared to 35% Asians and 59 % whites. This is despite the efforts made by Google to employ more blacks. The simple reason given by Google was that Africans interviewed are not demonstrating the necessary skills in terms of knowledge gained from education when compared to non-Africans. This shows that sometimes even when these companies want to employ Africans, our curriculum and employability skills are not allowing us to compete with whites and Asians. However, rather than having to compete with the developed world why not modify our curriculum to encourage agriculture.

In addition, for the agricultural industry to develop and be more attractive to young graduates, Science, Engineering and ICT must be used in developing the industry. The African Science, Engineering and ICT curriculum should be made more productive by introducing some critical restructuring such as embedding Agriculture technology into the main stream curriculum of most Science, Engineering and ICT courses. For example, telecommunication engineers or electrical engineers should be encouraged to carry out research on how to use their fields to make the agricultural industry a better one, so that graduates can make a smoother transition into the available (agricultural) workforce in Africa. The power of telecommunications can also be used to train millions of farmers who are remote from educational institutions. Satellite communication via the use of geographical information systems can also be used for planning. Students in these fields can also be encouraged to carry out projects that would contribute to the development of agriculture while universities

encourage these with a research grant. This is necessary because agriculture has the greatest potential to lift the African continent out of poverty, create employment and alleviate hunger.

Current Efforts

The African education system that would support Agriculture needs some rapid, innovative accelerated progress, especially to teaching, learning and research. This cannot be accomplished by the business-as-usual approach. This section shall examine some of the on-going work and the challenges while also proposing some solutions.

The curriculum change would be effective in reducing unemployment in Africa. The curriculum should encourage Agriculture such that Science, Engineering and ICT students would adapt their work to support Agriculture. This changed is also necessary because there are efforts on the part of a number of governments in Africa to the Agricultural industry. As a result of a fall in the price of crude oil among other reasons, different African governments have begun to encourage Agriculture, especially among youths. This is beginning to yield some fruits. For example, in Kenya, there are efforts to empower young graduates to become job creators through agribusiness using ICT as a platform for connecting farmers to an inspiring solution.

The web platform, http://graduatefarmer.co.ke/ provides a lot of support to young graduates who are interested in Agriculture. M-Farm is another Kenya-based software solution and agribusiness company providing tools for young graduates with the goal of using IT to develop agriculture in East Africa. In Nigeria, Co-Agri, a non-profit organisation has been training college graduates about Agriculture and how different fields of study can influence it. The aim is to allow these students to think about how they can develop Agriculture through whatever course they eventually study in the university. More widely in Africa, Yfarm is seeking to encourage the establishing of at least 10,000 youth-led farm and agribusinesses by 2020.

University Students Spending more Time Working on farms:

In the majority of African universities, the curriculum of Agriculture students is not tailored to working on farms like the way medical students are trained to work in hospitals. This is majorly because of the separation between the research institutes and the universities [24]. Agriculture research institutes majorly under the Ministry of Agriculture carry out research, while the university under the Ministry of Education majorly does teaching, with the aim of producing peer-reviewed publications. However, the Nigerian Federal Ministry of Communications and the Nigeria Communication Commission are presently working on converting the Digital Bridge Institute (DBI) in Nigeria into a full fledge university managed by the ministry of communication. Therefore, the promotion of the staff working in the proposed institution would not mainly be on peer-reviewed publications. This change

would require a lot of effort and change in regulation to scale through. However, this has generated a lot of excitement among those of us in the field of telecommunication. In the past few months, the trial collaboration with DBI has created an entrepreneurial mind-set among those of us working on the trial, while encouraging successful knowledge transfer. This approach can also be applied to redesign a new curriculum for the agricultural research institutes, especially given the fact there are over 40 research institutes for Agriculture in Africa.

Telecommunication Research Focusing on Agriculture

Telecommunication is an essential part of ICT. The Department of Telecommunication Science, at the University of Ilorin, formed a research and development group to formulate research and help develop employability skills in students to help solve the local problem. The aim is to use the power of telecommunications as a tool in developing the agricultural industry and improve healthcare delivery system in Africa. Our aim is to target the low-level subsistence farmers, small, micro and medium agro-enterprises by making sure that our students use their skills to help develop this sector. The immediate aim is also to help develop rural telecommunication that would help the rural dwellers to communicate and access some facilities needed to improve on their farming. This is because farming activities are mostly in the rural areas and our research has shown that telecommunication infrastructure is less likely to be available in the rural areas.

This is because telecommunication companies do not find the rural areas profitable. Our aim is to develop a system that at the simplest level, it would help the farmers to communicate with their neighbours or discuss problems or activities around the farm. This technology would also allow access to the internet. This research group is currently at the infant stage, and no prototype has been developed so far as funding is a major challenge. However, 6 out of 30 students who graduated last year are currently working in the agricultural sector. It is still in the early stages, but the model is working. Some similar efforts are currently revolutionising the agricultural sector in Africa. Such as:

Precise Fertiliser Applicator: This is a device that allows the release of just the right amount of fertilizer into the ground. An engineer in Zambia developed it.

Cropster: This is an initiative that helps to support sustainable agriculture by helping farmers with vital information, while ensuring data transparency.

These initiatives were developed to solve the problems facing agriculture in Africa. Hence, there is a need to reform our curriculum to encourage more of such initiatives.

Recommendations and Conclusions

This paper recommends the following:

• There is a need to reform our current curriculum to encourage African graduates to go into Agriculture such that Science, Engineering and ICT research are tailored towards solving problems in the Agriculture industry, while also encouraging the participation of women.
• The African graduate should look more towards the direction of Agriculture when seeking employment.
• The model adopted by University of Ilorin should be encouraged more in African Universities.

This paper has shown that a large percentage of employed Africans are employed in the agricultural sector and this sector has the potential to employ a lot more Africans. However, there is a need to make sure that most of our Science, ICT and technological innovations are promoting agriculture while seeking for curriculum change. There is also the need to allow for the development of employability skills needed by the agricultural industry if Africans want to benefit from the booming telecommunication industry. Therefore, a curriculum change to include employability skills in Agriculture is proposed as presently done by the communication research group at the University of Ilorin. This is because this sector has the potential to employ more Africans and it is the missing key to reducing unemployment rate in Africa. This paper also showed that on-going efforts could help reposition the agricultural industry to reduce the number of unemployed graduates in Africa.

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RE-FOCUSSING THE MOI UNIVERSITY BACHELOR OF EDUCATION CURRICULUM ON EMPLOYABILITY:
A HOLISTIC TRIAD MODEL

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Abstract

The School of Education at Moi University produces averagely one thousand five hundred (1500) Bachelor of Education (B.Ed) graduates annually. Since its inception, the B.Ed curriculum has focused on producing teachers who will be employed primarily by Kenya's Teachers Service Commission (TSC). All curriculum review efforts in the history of the School of Education have been largely informed by this desire to produce graduates who fit into the traditional TSC employee profile. However, new and emerging realities, both in Kenya's education sector and in other sectors, especially the global shift from employment to employability, necessitate a review of the traditional focus of the B.Ed curriculum. These realities include the fact that TSC and the education sector as a whole no longer has the capacity to immediately employ all the B.Ed graduates of Moi University.

This means that thousands of B.Ed graduates either remain unemployed for indeterminate periods, or seek and secure employment in occupations other than the teaching for which they were trained. The occupational competencies in these "other" jobs are often not in tandem with the traditional focus of the B.Ed curriculum. Moreover, another emerging reality is that even TSC itself is progressively redefining its employee profile. There is a noticeable shift from employment to employability at TSC which requires B.Ed graduates to be equipped with competencies beyond the narrow classroom-teacher profile.

The B.Ed curriculum at Moi University is reviewed comprehensively after every four years. The next curriculum review cycle was in 2017. As the School of Education gears toward this process, context and circumstances impel us to shift focus from offering a curriculum that molds a TSC employee to offering a curriculum that enhances the employability of our graduate. The main curriculum review task for the School of Education is to determine how to engender employability in the B.Ed curriculum. To this end, this paper presents a Holistic

Triad Model for curriculum design and delivery. This Model identifies three overlapping platforms upon which graduate employability is enhanced. These are the intellectual platform, the training platform, and the development platform.

Introduction

It is thirty years since the Dearing Report thrust employability into the limelight of higher education discourse in the United Kingdom and beyond. Since then, employability has morphed from being a debate to an agenda. The definitions and descriptions of employability and its importance for the individual, the academy, the work-place, the economy, and humanity at large are well documented (Dearing, 1987; Gokulsing, 2013; Harvey, 2000; Nyandusi, 2013; Poku, 2013). The employability agenda has been and is being increasingly pushed by employers and policy makers in education. However, higher education institutions, which should drive the employability agenda, seem to be lagging behind the wave, and have been criticized for being 'irrelevant' and 'unresponsive' to the new realities of the world of work (Amimo, 2012; Harvey, 2000; Nyandusi, 2013; Pachauri & Yadar, 2014).

The School of Education (SOE) at Moi University, Kenya, is the second oldest and one of the biggest graduate teacher education institutions in the country. From such a lofty perch in the higher education terrain in Kenya, the School of Education invariably takes it fair share of the criticisms of irrelevance and unresponsiveness leveled against universities in Kenya. Beyond acknowledging and even debating these criticisms, the SOE has decided to change the narrative and adorn the tag of curriculum relevance and responsiveness. This paper outlines the curriculum shift that the SOE is undertaking.

The School of Education at Moi University

The SOE is the biggest school in Moi University. Its express mandate is to train effective teachers for schools and tertiary institutions. It currently has an enrolment of over 10,000 undergraduate students spread over eight campuses. Every year the school graduates over 1500 students. At undergraduate level, the school offers a Bachelor of Education (B.Ed) degree with seven specializations as follows:

B.Ed (Arts)
B.Ed (Science)
B.Ed (Early Childhood Care and Education)
B.Ed (Primary Education)
B.Ed (Special Needs Education)
B.Ed (Guidance and Counseling)
B.Ed (Technology Education)

The rationale behind the B.Ed programme is to produce a teacher who is well grounded and knowledgeable in both content and pedagogical skills required for effective teaching, while the purpose of the programme is to equip teachers with the necessary skills and knowledge that will enable them effectively conduct the instructional process at a specified level of learning.

Since its inception in 1987, the B.Ed curriculum has focused on producing teachers who will be employed primarily by Kenya's Teachers Service Commission (TSC). All curriculum review efforts in the history of the School of Education have been largely informed by this desire to produce graduates who fit into the traditional TSC employee profile. However, new and emerging realities, both in Kenya's education sector and in other sectors, especially the global shift from employment to employability, necessitate a review of the traditional focus of the B.Ed curriculum.

These realities include the fact that TSC and the education sector as a whole no longer have the capacity to immediately employ all the B.Ed graduates of Moi University. This means that thousands of B.Ed graduates either remain unemployed for indeterminate periods, or they seek and secure employment in occupations other than the teaching for which they were prepared. The occupational competencies in these "other" jobs are often not in tandem with the traditional focus of the B.Ed curriculum. Moreover, another emerging reality is that even TSC itself is progressively redefining its employee profile. There is a noticeable shift from employment to employability at TSC which requires B.Ed graduates to be equipped with competencies beyond the narrow classroom-teacher profile.

The B.Ed curriculum at Moi University is reviewed comprehensively after every four years. In the last curriculum review in 2014, there was a noticeable shift toward a broader spectrum of courses offered by the school. The current core courses of the B.Ed programme, which cut across all the specializations, are a blend of foundational knowledge in education, including general pedagogical skills, and general knowledge and skills for personal, social, and professional development.

The Moi University School of Education Bachelor of Education Curriculum (2014) core courses are listed in Table 1 below:

Table 1: **Bachelor of Education Core courses**

Professional Education Courses	General Knowledge and Employability Related Courses
Principles and practices of teaching and learning Introduction to learners with special needs Philosophy of education	Character education and integrity Computers and management of information in education Quantitative techniques in education

General educational psychology
General methods of teaching
Curriculum development
History of education
Human growth and development
Educational media and resources
Educational guidance and counseling
Educational planning
Educational measurement and evaluation
Research project
Sociology of education
Comparative education
Economics of education
Teaching practice
Communication Skills in education

It is now four years since the 2014 curriculum was initiated and implemented, and the School of Education has therefore geared itself toward a curriculum review process for the new cycle which begins in 2018. From the very outset of this review process, context and circumstances impel the SOE to shift focus from offering a curriculum that only molds a TSC employee to offering a curriculum that enhances the employability of our graduate. Employability is characterized by academic, occupational/vocational, personal, and social attributes, skills and competencies. While each occupation normally has clearly defined 'job-specific' competencies, employability embraces and transcends these competencies.

The discourse on employability centers on what has been variously called 'generic skills,' or 'soft skills,' or 'employability skills,' or 'transferable skills.' This paper adopts the 'generic skills' concept. Generic skills include: Personal grooming (cleanliness and neatness), punctuality and time management skills, respect for authority, oral communication skills, computer literacy/ICT skills, honesty and integrity, commitment to work, written communication skills, ability to work in a team, responsibility and accountability, ability to work with minimum supervision, specialized/professional/vocational (job-specific) skills, adaptability, willingness and ability to learn continuously, leadership, ability to think and solve problems, creativity and innovativeness, and self-drive. These skills fall in four broad skill domains; the personal domain; the social domain; the intellectual domain; and the productive domain. The new curriculum review imperative for the School is to determine how to engender employability in the B.Ed curriculum. There are three main reasons for taking this direction.

Rationale for Refocusing the B.Ed Degree on Employability

The first compelling reason for re-focusing the B.Ed curriculum on employability is the realization that the default employer and regulator of teachers in Kenya, the Teachers'

Service Commission (TSC) has also adopted the employability agenda. Recent circulars from the TSC to schools Management Boards, especially TSC Circulars no. 10 and no. 13 of 2016, indicate that 'communication ability,' 'special talents,' and 'willingness to participate in co-curricular activities and other duties assigned by the head are part of the criteria for the selection and recruitment of teachers. These criteria are indicative of the TSC's espousal of some of the key generic skills that define employability. The SOE is therefore obliged to produce candidates who will satisfy these criteria.

The second compelling reason for re-focusing the B.Ed curriculum on employability is the fact that for over two decades now, the TSC and the education sector in Kenya as a whole no longer have the capacity to immediately employ all the B.Ed graduates of Moi University and other universities. This means that thousands of B.Ed graduates either remain unemployed for indeterminate periods, or they seek and secure employment in occupations other than the teaching for which they were trained.

The occupational competencies in these "other" jobs are often not in tandem with the traditional focus of the B.Ed curriculum. Though there is no documented graduate tracking data for the B.Ed graduates of Moi University SOE, it is common knowledge that our graduates seek and find jobs in occupations as disparate as the National Police Service, the financial services sector especially, banking and insurance, various non-governmental organizations, and in county governments. Within this expanded career space, the SOE is expected to produce graduates with employability skills to help them to secure employment in these alternative occupations. Quite a number of the B.Ed graduates also take the self-employment path. The same employability skills would be useful for them.

The third compelling reason for re-focusing the B.Ed curriculum on employability is the acknowledgement that the employability agenda is the new benchmark in determining curriculum relevance. While the focus has been on the relevance of university curricula to employability, there is the argument, and it is gaining momentum, that the employability agenda must of necessity be part of the earlier levels of education (Hassan, Maharoff & Abiddin, 2014; Nyandusi, 2001; Pachauri & Yadar, 2014). If the curricula at primary, secondary and other tertiary education school levels should engender employability in learners, it follows that the teachers at these levels should be well equipped to deliver such curricula. As a teacher education curriculum, the B.Ed of Moi University occupies a vantage position of cascading employability to these curriculum levels.

The curriculum shift we envisage is therefore actualized at two levels: one, the enhancement of our graduates' employability, whether in the teaching profession or in alternative occupations, and, two, enabling our graduates, teachers, to enhance the employability of their learners whether in primary schools, secondary schools, or other tertiary institutions. This shift is achievable through a comprehensive curriculum framework, the Holistic Triad Model.

The Holistic Triad Model for re-focusing the B.Ed curriculum on employability

The current curriculum model of the B.Ed programme in Moi University is based on a concurrent approach with two platforms - the subject content platform and the pedagogical knowledge and skills platform. In the subject content platform, B.Ed students are required to select and study two teaching subjects, while in the pedagogical knowledge and skills platform, the students study all the core courses listed above, plus specific teaching methods courses in their content specializations. This model has worked well to produce teachers, but in the current and emerging dispensation, it is too narrow and limiting.

The B.Ed curriculum review cycle for 2018 therefore espouses a broader framework. This is the Holistic Triad model. This model has three salient features: one, three overlapping platforms: the intellectual platform, the training platform, and the development platform; two, a concurrent approach, where all the three platforms are engaged at the same time; and, three, a holistic philosophy encompassing and pervading the three platforms.
The holistic philosophy upon which this model is premised is a response to sustained criticism of the current model of teacher education. Kafu (2006), for instance, criticizes the current teacher education curriculum and points a way forward.

… teacher education curriculum has remained narrow and rigid in nature. It emphasizes the training rather than preparation of teachers. There has been no attempt to make it responsive to the emerging trends in the society in general and education in particular. Consequently, it has continued to produce conservative/traditional school teachers who are perverse [sic] to change, less creative and innovative, and unable to manage modern instructional and non-instructional situations. Consequently, the teacher education curriculum should be designed to address the new demands of the society and those of the teaching profession. That is, the new curriculum should produce a pragmatic and creative teacher with the capacity and ability to efficiently overcome the challenges of education in this century (Kafu, 2006, p.11)

This is essentially a call for holistic education, where there are multiple paths of learning, and the entire enterprise of learning is responsive to diversity and change (Miller, 2000). The Holistic Triad Model presented here has three overlapping paths or platforms of learning: the intellectual platform, the training platform, and the development platform. In each of these platforms, the twin processes of content selection and content delivery are flexible, interactive and responsive to both internal and external feedback. Further, the three platforms continuously interact with each other. The point at which they intersect, portrayed in Fig. 1 below as a deep shaded triangle in the middle of the diagram, is the holistic juncture. It is at the holistic juncture that the four key dimensions of schooling converge.

These are: the personal dimension, **the intellectual dimension, the social dimension, and the productive dimension.**

Fig. 1: The Holistic Triad Model

The Intellectual Platform

The intellectual platform mainly focuses on the intellectual domain. It entails the academic and intellectual pursuit of a broad spectrum of knowledge. This knowledge includes 'general knowledge' and specific content area mastery or 'disciplinary knowledge.' It is on the teaching platform that learning and thinking skills are developed. This platform constitutes all the core non-pedagogical and general knowledge courses which are meant to develop in the student a broad awareness, appreciation and understanding of current affairs and enhance their personal, social, and intellectual competencies. The platform also includes the content of the teaching subjects. Every student is required to have a combination of two teaching subjects drawn from one of three categories: Arts (including languages), Sciences, or Technology. Table 2 below shows the focus of the intellectual platform, the delivery approaches, the instructional methods, and the assessment and evaluation procedures.

Table 2: The Intellectual platform

Platform Focus (Desired Outcomes)	Delivery Approaches	Instructional methods	Assessment and evaluation procedures
Demonstrable information and knowledge processing ability (This includes searching for knowledge, analyzing it, synthesizing it, and evaluating it, and the ability apply and/or transfer	Expository; Heuristic	Lecture; Question and Answer; Research and presentation; Group Discussion;	Written Progressive Assessment examinations; Graded Research/Term papers; Graded Individual

knowledge in disparate contexts); Demonstrable mastery of teaching subjects content; Demonstrable awareness of current and emerging affairs both locally and globally; Demonstrable willingness to learn		Teacher demonstration; Class debates	and group presentations; Graded Individual and group projects

The Training Platform

The training platform deals mainly with the productive domain. It has an occupational focus. For B.Ed, it entails mastery of pedagogical skills through teaching-methods courses, and student teaching-practice. For the new curriculum, this platform will involve a reconceptualization of pedagogical mastery from 'the telling teacher' to 'the letting teacher.' This is to be achieved through a re-engineering of the course delivery approaches: From expository teaching to experiential learning (Mwaka, Nabwire, and Musamas, 2014). The shift will also entail a redesigning of the practical/work experience component from teaching practice, where the emphasis is merely on classroom teaching, to school experience, which includes but transcends classroom teaching and focuses on the school as a complex work-place. Table 3 shows the salient features of this platform.

Table 3: The Training Platform

Platform Focus (Desired Outcomes)	**Delivery Approaches**	**Instructional methods**	**Assessment and Evaluation Procedures**
Demonstrable pedagogical competence; Demonstrable mastery and application of foundational concepts and principles in education (including Educational Psychology, Philosophy of Education, Sociology of Education, History of Education, Curriculum Studies,	Largely Heuristic (Experiential); Expository where and when absolutely necessary	Demonstration; Research and presentations; Simulation; Role play; Question and Answer; Group Discussion; Micro-teaching;	Graded research/term papers; Observation reports; Micro-teaching assessment; Assessed simulation; School experience assessment

Educational management, Educational Policy and the Politics of Education, Educational Technology, and emerging issues in education); Demonstrable effective communication skills	Largely Heuristic (Experiential); Expository where and when absolutely necessary	Non-participant observation of actual school activities; Supervised school experience	(including school experience journals and reports)

The Development Platform

The development platform is the least considered in the current curriculum. This platform focuses mostly on developing and nurturing the personal and social skills of the student. This is mainly achieved through non-formal curriculum (co-curriculum) and informal curriculum (hidden curriculum) initiatives and activities. However, this platform overlaps both teaching and training, making it arguably the most influential of the three platforms in enhancing graduate employability. In the current curriculum, this platform is taken for granted. In the new curriculum, the development platform ought to be deliberate and intentional. Because it is not a formal aspect of the curriculum, it does not fit into structured parameters such as the ones in Tables 2 and 3above. Table 4 below shows the envisaged significant features of the development platform.

Table 4: The Development Platform

Platform Focus (desired outcomes)	**Relevant Activities/Experiences**
Demonstrable time consciousness; Demonstrable leadership and decision making abilities; Demonstrable team spirit and relationship intelligence; Demonstrable problem solving skills; Demonstrable adaptability to diverse contexts; Demonstrable creativity and innovation; Demonstrable initiative and self-drive;	Timelines that require strict adherence (for example school teaching timetable and university almanac); Required membership and attested participation in identified interest groups, clubs, societies or associations, including participation in sporting activities; Productive participation in

Demonstrable commitment to tasks; Demonstrable honesty and integrity	collaborative activities and projects; Adaptability challenges (such as placement of learners in unfamiliar settings for a given period); Creativity and innovation contests for both individuals and groups

Conclusion

The Holistic Triad Model is envisioned as the answer to the embedment of employability in the Moi University Bachelor of Education curriculum. It is a comprehensive initiative that aims at developing in learners the knowledge, skills, dispositions, and competencies that would ensure that they secure employment and thrive in the workplace. While this Model has been developed for and adopted by the Moi University School of Education, it can be adapted for use in other contexts.

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VOCATIONAL EDUCATION AND TRAINING CURRICULUM RESPONSIVENESS IN THE CONTEXT OF ECONOMIC IMPLOSION

-THE CASE OF ZIMBABWE

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Abstract

With ever increasing focus from policy makers on the role of vocational education to address critical socio-economic challenges, this study set out to investigate vocational education curriculum responsiveness in the context of challenges due to the economic crisis in Zimbabwe. The researchers sought to fill the knowledge gap created by the absence of such a study in post 2000 Zimbabwe. The study used a comparative case study research design and focused on two rural vocational training centres in Masvingo province. Purposive sampling was done in recruitment of study participants.

Data was collected using semi-structured interviews with Ministry officials, principals of the two training centres, lecturers as well as focus group interviews for students. The study revealed that the economic crisis in Zimbabwe had affected both government and non-government vocational training cent res in several ways, affecting labour market responsiveness. The economic decline means that Vocational Training Centres (VTCs) are not able to do their jobs because of the shortage of funds.

This does not only mean the lack of expertise, lack of equipment and inability to be responsive, but also that there are no placements and few jobs. In light of these challenges vocational training centres have responded innovatively by focusing on skills for new farmers in Agriculture and community development contrary to the idea that Vocational Education Training (VET) should have a narrow focus on the labour market. The implications of this

study are that we could argue for more funding etc., but that is unrealistic – perhaps the more creative route would be for VET to be responsive to non-market issues such as community development and the informal economy, given that the formal economy is weak.

Key words: Vocational Education and Training, Economic Crisis, Curriculum responsiveness

Introduction

The relationship between the provision of Vocational Education and Training (VET) and economic development has regained the attention of policy makers internationally over the past few years (McGrath, Akoojee, Gewer, & Roberts, 2006). International agencies and funders, as well as national governments are increasingly turning to Technical and Vocational Education and Training (TVET) as a key strategy for addressing a range of social and political concerns, including but not limited to growing youth unemployment, stagnating economic growth, addressing gender inequality and addressing environmental concerns (UNESCO, 2016, 6). Technical and Vocational Education and Training is increasingly viewed as a solution for a range of national problems, and while it has not eclipsed basic education and higher education within development discourses, it is firmly on the education policy agenda after an extended hiatus.

Zimbabwe is a good example of a country that has made significant investments in general education and VET provision since the attainment of political independence in 1980, particularly during the first decade, and is widely recognised for the quality of its graduates. Post 1990, the country has had successive economic crises that affected all sectors of the Zimbabwean society, including education (Bennell et al., 1999;Kanyenze, Kondo, Chitambira, & Martens, 2011; Nyazema, 2010; Nziramasanga, 1999).

While the case of Zimbabwe is extreme, it is not isolated and the precarious nature of global economics places all developing and many developed countries at risk of economic crisis. Zimbabwe thus presents an interesting case of a developing country with a strong educational system which has faced serious economic and wider socio-political challenges, and presents lessons and possible outcomes for other countries. This paper is therefore concerned with the following question: How is the VET curriculum responding to the economic crisis in Zimbabwe with the new focus on TVET within national and international policy discourses?

Background

The policy discourse on TVET has recently seen significant shifts. At a global level, Sustainable Development Goal Number 4 (SDG4) on Quality Education, part of the United Nations Agenda 2030, seeks to ensure inclusive and equitable education and promote lifelong

learning opportunities for all (Doyle & Stiglitz, 2014; UNDP, 2016). Furthermore the motivation for this Goal includes arguments that education enables people to break cycles of poverty, reduces inequalities and provides access to 'better jobs and better lives' (UNDP 2016). Unlike the previous Millennium Development Goals, SDG4 makes an explicit commitment to equal access to affordable and quality TVET for all, and specifically seeks to "substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship" (UNDP, 2016, 7).

In light of the adoption of the SDG4, and the end of the Education for All (EFA) campaign which focused on schooling, UNESCO recently adopted a specific Technical Vocational Education and Training (TVET) strategy from 2016 to 2021(UNESCO, 2016). The new TVET strategy aims to reflect the current social, economic, and environmental landscape which includes changes in technology, the labour market and skills patterns (UNESCO, 2016). The strategy prioritises transformation of the TVET sector to maximise its potential to respond to these developments in the world economy. "In view of these changes there is a renewed sense of urgency and a need for the TVET to adapt, respond and transform itself to be relevant and valuable"(UNESCO, 2016, p. 5). The Strategy focuses on the following six key areas: Access to TVET, Quality of TVET provision, TVET Governance, Private sector involvement, TVET Institutions, and Funding.

In much the same vein, the African Union (AU) recently adopted the Continental Education Strategy for Africa (CESA 2016-2025) as the framework for a transformative education and training system in Africa. The strategy makes an explicit appeal to African countries to adopt policies that align with the CESA, including expanding technical and vocational education and training (TVET) opportunities at both secondary and tertiary levels and strengthening linkages between the world of work and education and training systems. The CESA follows an earlier 2014 AU resolution that adopted a continental TVET strategy, calling on member states to i) enhance support and investment for TVET as it is fundamental for skill development for the youth, to promote employability and entrepreneurship through innovation; and ii) to align their national TVET strategies to the AU continental TVET strategy for effectiveness.

At a national level, Zimbabwe, has adopted the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIMASSET) 2013- 2018 (Ministry of Finance and Economic Development 2013) as a strategic plan document to drive the sustainable socio-economic development of Zimbabwe from 2013 to 2018. The strategy is anchored on the pillars of indigenisation, empowerment and employment creation. The ZIMASSET blueprint focuses on four clusters as engines for development which are: the Food Security cluster, Social Services and Poverty Eradication cluster, Infrastructure and Utilities cluster and the Value Addition and Beneficiation cluster (Ministry of Finance and Economic Development 2013, p. 10). Education, inclusive of TVET, is seen as critical for the success of the Social Services and Poverty Eradication cluster.

While the policy discourse is unambiguous about the benefits of TVET to development, the research literature paints a more complex picture. At a conceptual level there is discussion on the very purpose of TVET and how it should be conceptualised within wider debates about how development is defined (McGrath, 2012, 198). Most studies on TVET in African countries have tended to focus on the contribution of vocational education to national development, the link between skills and the job market, employability, productivity and generally the challenges faced in provision and policy implementation (Zengeya, 2007, 74; Bennell, 1999, 294; Gwembire, 2013, 303; Kasambira, 1987, 301; Oketch, 2007, 61 }. In the Zimbabwean case, VET's focus on labour market responsiveness has not been viable because of the economic crisis which has affected funding for both government and private training centres. Lack of funding also affects the availability of equipment and training facilities, human resources, placement work integrated learning and linkages between training centres and industry.

Methodology

The study was a pilot of a bigger project covering all the vocational training centres in Zimbabwe, and a comparative case study of two vocational training centres; College A which was Government run and College B, a non-governmental run training centre in Masvingo province of Zimbabwe. Currently there are forty two government VTCs in the country (Ministry of Youth, 2014, 535). The exact number of private and NGO training centres is difficult to establish but these are much more than those run by the government. The selections of the two centres by no means represent all of the VTCs in Zimbabwe.

Twenty four purposively selected participants took part in the study as follows: two Ministry Officials, four employer representatives; two principals, one from each centre; eight lecturers (four from each College) and eight students (four from each College). Data was collected from the rest using semi-structured interviews except for the eight students who participated in a focus group discussion. In addition to these, six key informant interviews were held with the District Administrators, Councillors and Chiefs in the respective areas where the institutions are located. Data was analysed using thematic analysis (Braun and Clark 2006; p.79). Though the study was done at only two vocational training centres in Zimbabwe, and had a small sample size, it indicates how the issue of VET curriculum is being innovatively addressed in the study sites. The findings cannot be generalised, but can indicate alternative directions for vocational curriculum in economic crisis.

Results and Discussions

The economic crisis in Zimbabwe has caused several challenges in the provision of vocational education and training in rural areas in Zimbabwe. The most obvious level at which the crisis has impacted the two VTCs was at the level of funding, which in turn has affected infrastructure and equipment and human resources. However, the case study reveals that

the two VTCs under study Zimbabwe have responded innovatively to these challenges, by responding to the need for community development through a focus on the needs of new farmers. Some of the challenges which affected labour market responsiveness are briefly presented in the next section, followed by the innovative response by the training centres under study.

In light of the above challenges in the provision of VET focusing on the labour market, there has been a deliberate shift especially by NGO providers towards non-labour market issues. In this case, VET has become a tool for community development as revealed by the case study.

Alternative Directions: Vocational Education and Training for Community Development

There are growing debates in academic literature about the broader role of vocational education in human development (McGrath 2012). Our data supports this broad approach in so far as the study revealed that vocational training still has an important role to play in community development. Both the government and NGO centre have been responsive to non-labour market issues, what differs is the extent of responsiveness which is less pronounced in the government centre due to financial constraints.

This is possible through the capacity building that has been done by the NGO VTC which responds to the needs of the locals of the communities in which they operate. The Principal of the NGO centre said:

In the past year alone we trained more than four thousand community members in agriculture, brick moulding, building, carpentry, small livestock production, fisheries, small dam construction and gulley reclamation. Most of these participants were new farmers under the Fast Track Land Reform Programme FTLRP.

The participation of new farmers in vocational training is a new and interesting development that was confirmed at both training centres. This has shown that VET curriculum is capable of responding to national imperatives such as land reform. The Principal of the government training centre noted that:

From the time the FTLRP was implemented in the year 2000, we have managed to train over ten thousand agriculture extension officers with the support of the Ministry of Agriculture and other NGOs such as Plan International in Zimbabwe. This was done in order to respond to the increased demand for extension services in the country after a sudden jump in households resettled which was in excess of one hundred thousand.

Key informants in the community also confirmed that the centre has made significant contributions not only through the training, but also through the projects they went on to implement using the skills acquired. Councillors and Chiefs concurred that their district has

seen significant improvements in overall development as a result of the activities of the centre. One councilor argued that:

In my ward, graduates from the Centre have managed to construct two small dams with support from the centre as well as manage nutritional gardens which were started around the dams. We also have many other projects running concurrently such as small livestock. These have enabled many households to have food on the table and also earn an income from selling farm produce.

In support of entrepreneurship among new farmers, the NGO centre has trained most of its participants in agro-processing, including peanut butter processing, honey processing and vegetable packaging for the market. The following pictures show VET graduates processing peanut butter for the market.

Figure 1: Peanut Butter processing at the NGO training centre

Figure 2: Processed peanut butter for the market

For graduates of the small livestock component in the agriculture section apart from the skills they get on animal husbandry, they are given capital in the form of goats which they raise and pass on to other graduates. This has improved the livelihoods of the graduates including food security as well as the ability to earn income from selling the livestock. The following picture shows some goats being raised by VET graduates.

The success of these community development projects anchored on VET is attributed to a number of factors including, flexibility of the NGO centre, its collaboration with local stakeholders inclusive of local chiefs and villagers and its ability to be responsive to the needs of locals, and the changes in the economy.

The Principal of the NGO Centre indicated that in view of the current challenges the VET sector in Zimbabwe faces due to an underperforming economy, there was a need to shift the focus from exclusive labour market responsiveness to responding to the need for community development imperatives. Already the NGO training centre has shown a commitment to responding towards community development, meanwhile most government training centres still focus on developing skills for employment. The NGO Centre is community-based not just by virtue of its physical location but all other aspects including, governance, curriculum development, the implementation of programmes and recruitment of facilitators and participants who are the students in VET.

The community development focus of the NGO Centre is further strengthened by the involvement of the community in the process of curriculum development from needs assessment, community-based facilitation of training (which is flexible) and assessment of training. The majority of participants from the NGO Centre were united in their appreciation of the Centre for making significant contributions in poverty alleviation through skills development in their community. This has been highlighted in previous studies which brought to the fore the poverty reduction in communities (King & McGrath 2002; McGrath 2002).

In addition, while we reported on the frustration of many students, there were some that indicated that their source of comfort was that they could start their own small enterprises upon completion of the programmes if they get capital. This points to another strand of

development in TVET, namely, supporting entrepreneurship, which is often articulated as a goal but not clearly embedded in the curriculum (DeJaeghere & Baxter 2014).

Conclusions

The economic crisis in Zimbabwe has compromised VET provision in both VTCs under study by affecting their capacity to produce personnel for the labour market that has been reduced. To that end curriculum responsiveness to the labour market has been compromised at the two institutions. However, the two VTCs under study have responded in innovative ways, by focusing on responsiveness to non-labour market issues such as community development and entrepreneurship.

The NGO Centre has shown the practical ways in which vocational education curriculum can be made more responsive even in times of economic crisis. The NGO training centre over the past five years has been more responsive to non-market issues, training new farmers in nutritional and herbal gardens, animal husbandry, beekeeping, aquaculture and agro-processing in these areas. The training centre managed to train over four thousand community members in the past five years. This shows the impact that its programmes have had in community development. In line with responsiveness to economic crisis, VTCs should also be flexible in their programming.

The findings from the study have a number of implications for the provision of VET in contexts such as Masvingo province. At one level one must argue for greater investment and improvement of the quality of what is on offer. The Government should open posts for qualified lecturers in VET centres that are currently frozen and also improve the working conditions for staff so as to lure more qualified personnel to the rural training centres as has been revealed in the government centre under study. There is need for partnerships between vocational training centres and employers on their representatives in order for effective collaboration in terms of highlighting the labour demands of employers to the training centres in order to improve employability of graduates.

However, a simplistic assumption that increased focus on VET, which underpins most policy, was that it will improve employability and economic development. It however does not acknowledge the embedded nature of VET institutions within particular economies. Institutions such as VTCs cannot create the work opportunities for their students regardless of how good the quality of the education system. There is thus a critical need to rethink reforming the vocational training system to focus on a wider understanding of work, including domestic labour, the informal economy and community development, rather that the narrow focus on the formal labour market. The VTCs are part of the social system and constrained by it, but if a broader view of development and the economy are adopted,then they can play a wider and more transformative role than current policy ascribes to them.

Recommendations

The findings from the study have a number of implications in the provision of VET in resource constrained settings. There is need to rethink reforming the vocational education curriculum in crisis times to focus on community development rather than the narrow focus on the labour market. The study has shown that this is achievable.
The case study has shown the practicality of reforming the VET curriculum to focus on Agriculture; equipping new farmers who came into being due to the Fast Track Land Reform Programme (FTLRP) with practical skills.

Rural VTCs should emphasise the aspect of flexibility of delivery. This has yielded results, especially at the NGO Centre, which does most of their training off campus at places and times determined by the participants. This ensures that training does not disrupt the normal functioning of communities.

There is a need for VTCs to further incubate the business ideas of their graduates and continue to offer technical support to enhance the sustainability of these enterprises. In the case of graduates of Agriculture for example, there is need to set up agro-processing units to enhance value addition which is a key issue under the ZIMASSET blueprint.

VET centres in developing countries ought to respond to the emergence of alternative forms of livelihoods including, the emergence of artisanal mining on the African continent for example in countries such as Zimbabwe, Sierra- Leone and Ghana. Participants in artisanal mining are mostly youth who need technical and business management skills in order to enhance the sustainability of their ventures.

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PAPER V

ENHANCING TEACHING QUALITY IN HIGHER EDUCATION FOR BETTER STUDENT OUTCOMES:
"A CASE STUDY OF THE UNIVERSITY OF RWANDA"

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Abstract

Background: Teaching is a complex and demanding activity that requires the use of professional judgment as well as specific knowledge and technical skills. Teacher quality is the most important factor in student achievement. Quality teaching in higher education is substantial for student learning outcomes. However, quality teaching requires that higher education establishments make certain that the education they provide meets the needs of students and of employers.

Objective: To assess teaching quality and associated factors at the University of Rwanda.
Methods: A mixed methods approach incorporating futures methodology was adopted for the study. The population was undergraduate and postgraduate students at the University of Rwanda. Students on half of the campuses were sampled. Paper-based questionnaires were used to collect quantitative data, and key informant interviews were conducted with academic administrators at the University. Univariate, chi square test and multivariate analyses (binary logistic regression) were computed. ANOVA statistics were used at an alpha level of 5% to check for significance. Thematic analysis was done for qualitative information collected through interviews.

Results: The quality of teaching inputs was at 58%, teaching process quality at 74%, and output quality at 83% among the sampled campuses of the University of Rwanda. The overall quality of teaching in the University of Rwanda stands at 71.8%.

Three input quality parameters had a significant influence on the quality of teaching in the University. Having to a great extent academic staff in the campus who provide adequate training to students was related to higher likelihood of having high quality teaching (OR = 1), while having student centered teaching was related to having 1.3 times higher likelihood of having high teaching quality (OR = 3.601, CI = 1.881 - 6.891).

At process level, campuses where the student-teacher relationships was ranked highly were twice more likely to have high quality teaching (OR = 2.116, CI = 1.191 – 3.762), there was 1.5 times higher likelihood of having high quality teaching in campuses where academic staff presented their materials using digital methods (OR = 9.557, CI = .922 - 2.712). At campuses where the academic staff went an extra mile as mentors, there were twice more likely to have high quality teaching (OR = 2.357, CI = 1.236 – 4.494). There was a significant variation in teaching quality by campus (p = 0.04, F = 8.470). Busogo, Rukara (100%) and Nyarugenge campus were the highest quality of teaching (100%) amongst the seven campuses sampled.

Conclusion: This paper sought to collect the evidence for change in learning and teaching. It provides a baseline for evaluation. The level of teaching quality is fairly high at the University, however, the input quality dimension is still average. Both the input and process quality parameters are associated with the quality of teaching in equal measure, and the quality of teaching varies by campus of the University. More work needs to be done to find credible ways to encourage feedback from students, as well as to process such feedback. Again, more work needs to be done to reform the approach to application in practice of knowledge and theory. Greater investment in, and reliance on, electronic resources for learning, teaching and assessment; and more investment is needed in bandwidth.

Key words: Teaching quality; Higher Education; Student outcomes; University of Rwanda.

Introduction

Not many topics in education have caught as much consideration from policymakers and experts as the association between teaching quality and student accomplishment. Studies have demonstrated that quality teaching matters in learning (Rivkin et al., 2000; Rowan et al., 2002; McCaffrey, 2003). Teaching quality has been reliably distinguished as the most essential school-based aspect in student accomplishment /achievement (Ibid). In addition, various reviews, both hypothetical and experimental, have concentrated on quality in higher education as multi-dimensional in terms of institutional inputs, outputs and process (Johnes and Taylor, 1990, Biggs, 1993; West et al., 2000; Chua, 2004). The input dimension of quality in this case concerns the context of the university (in the form of students, faculty,

support staff and infrastructure), the process dimension concerns the teaching and learning activities and the output is concerned with the results of the teaching /education procedure (e.g. instructive pick up, maintenance and employability) (Biggs, 1993; West et al., 2000; Chua, 2004; Sahney et al., 2004).

Higher education assumes a fundamental part in the public arena by creating new information, transmitting it to students and cultivating development and innovation. Quality teaching in higher education matters for student learning. In any case, encouraging quality required that there are foundations to guarantee that the teaching and training offer meets the desires of students and the prerequisites of managers and employers, both today and for the future (Hénard and Roseveare, 2012). The government of Rwanda has made critical accomplishments to enhance the number of students acquiring education from both primary and tertiary levels. The University of Rwanda, a higher education institution formed in 2013 through the merger of Rwanda's previously independent public institutions of higher education, the largest of which was the National University of Rwanda (Koenig, 2014). The University's head office is in Kigali (Official Gazette of the Republic of Rwanda, 2013). The University of Rwanda is organized into six subject-based colleges (UR Statement and Concept, 2015): including the College of Arts and Social Sciences, College of Agriculture, Animal Sciences and Veterinary Medicine, College of Business and Economics, College of Education, College of Medicine and Health Sciences, and; the College of Science and Technology. The University has a total of 14 campuses (University of Rwanda Statistics Office, 2015): spread all over the country. They include Gikondo Campus, Remera Campus, Nyarugenge Campus, Huye Campus (Butare), Busogo Campus, Rubirizi Campus, Nyamishaba Campus, Nyagatare Campus, Rusizi Campus, Kicukiro Campus, Musanze Campus, Rukara Campus, Byumba Campus and Kibungo Campus.

In 2015 the University of Rwanda (UR) had 30,445 students, of whom 28,875 were undergraduates and 1,570 postgraduates. 99.4 per cent of UR students are Rwandan nationals and the University employs 1,450 academics and about 810 support and administrative staff.

However, regardless of the significant progress towards ensuring quality in learning and tireless efforts to promote higher education responsiveness to labour market needs, the most important challenge of Rwandan higher education is handling graduates who are not adequate to serve the economy's needs (Mbabazi, 2013). Noticeable skill gaps exist between the present graduates' competences and the competences required to meet the aspirations of Vision 2020, and only a minority of the graduates can work in jobs that are directly related to their level of education or specific training. Furthermore, many graduates lack the competence and lifelong learning skills needed to be successful in the workforce and do not have the skills that fit the employers' needs (MINEDUC, 2010; Human Resource Development Agency-HIDA, 2009). This alone is symbolic of a subjective quality of teaching in the tertiary institutions of Rwanda.

Yet, according to a report by International Youth Foundation (2011), employability skills remain the key determinant for a decent job regardless of the sector targeted or positions held, including entry-level positions. Rwandan graduates increasingly face high competition from the other member countries of the East African Community. The overarching challenge is to ensure effective teaching quality.

Vision 2020 is Rwanda's long-term development plan that seeks to fundamentally transform Rwanda into a middle-income country by 2020. It sets out quite ambitious arrangements and plans to make a universally aggressive, dynamic economy, upheld by a gainful and gifted workforce. There is a developing consciousness of the significance of education in the advancement of a learning-based economy/society (Pârgaru, 2009). There is a shift in focus from the natural resources as the basis for development to human resources as central to the economic success of nations (Pârgaru, 2009). However, these human resources have to work at their best potential to perpetuate quality output in the form of teaching in a major tertiary institution like UR. However, no study has been done in the University to assess the quality of teaching and the factors associated with it. It was therefore imperative that a study be done to establish the quality of teaching apparent in UR and further still ascertain any significant influences on the quality of teaching. Specifically, the study aims at assessing: (1) The quality of teaching in terms of inputs, process and output at the University of Rwanda, (2) To determine the inputs and process attributes associated with the quality of teaching and finally (3) To determine the variations in quality of teaching within the colleges and campuses affiliated to the University of Rwanda. The study intends to address the following research questions:

1. What is the quality of teaching in terms of input, process and output at the University of Rwanda?
2. What are the input attributes associated with the quality of teaching at the University of Rwanda?
3. What are the process attributes associated with the quality of teaching at the University of Rwanda?
4. Are there variations in teaching quality across colleges/campuses affiliated with the University of Rwanda?

Conceptual Framework

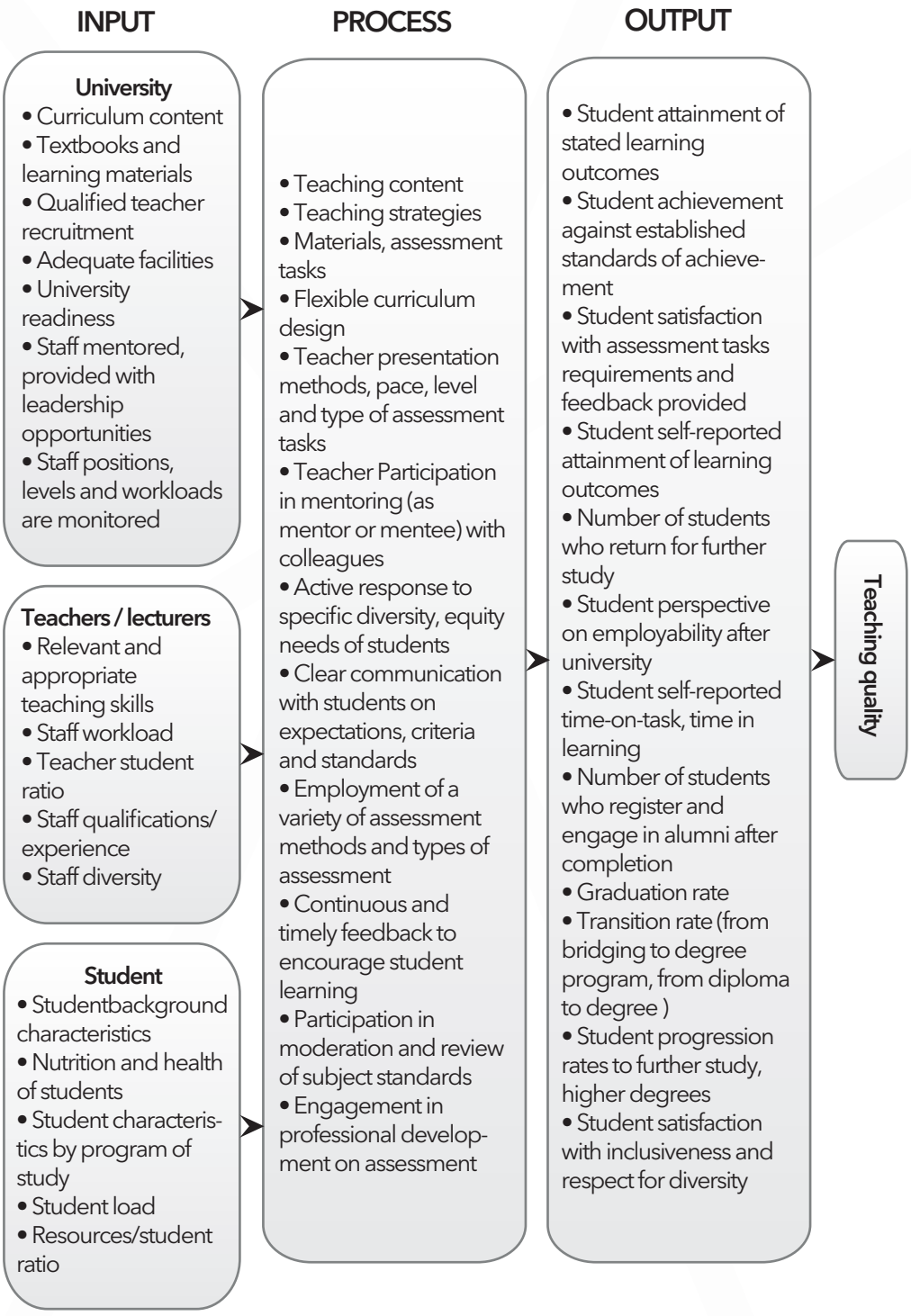
An input-process-outcome-context framework will be the basis for defining quality and to categorize different measures of quality in education (Chalmers, 2007; Chalmers et al., 2008).

Input factors: Describe the resources that go into the system. They include student attendance, support personnel, lecturers' qualifications and experience, accessibility and use of instructional materials, and use of computers in selected subjects, student background characteristics, staff workload, curriculum content, textbooks and learning materials,

teacher qualifications, training, morale and commitment, adequate facilities, parent/community support, aptitude, ability perseverance/commitment of students, nutrition and health of students and university readiness.

Process factors: Describe the activities resulting from the use and management of the input indicators within the University. Among these process factors are; Demonstration of commitment to diversity in teaching portfolio: evidence in attending training; teaching content; teaching strategies; materials; assessment tasks; flexible curriculum design e.g. presentation methods; pace;level and type of assessment tasks; participation in mentoring (as mentor or mentee) with colleagues; active response to specific diversity; equity needs; clear communication with students on expectations; criteria and standards; employment of a variety of assessment methods and types of assessment and accounting for student diversity; provision of specific; continuous and timely feedback to encourage student learning; participation in moderation and review of subject standards (and course and discipline standards, engagement in professional development on assessment, standard).

Output factors: Describe students' development while they are still in school, and include students' attitudes and achievement results; student attainment of stated learning outcomes; student achievement against established standards of achievement; student satisfaction with assessment tasks; requirements and feedback provided and student self-reported attainment of learning outcomes.


INPUT
PROCESS
OUTPUT
University
• Curriculum content
• Textbooks and learning materials
• Qualified teacher recruitment
• Adequate facilities
• University readiness
• Staff mentored, provided with leadership opportunities
• Staff positions, levels and workloads are monitored
Teachers / lecturers
• Relevant and appropriate teaching skills
• Staff workload
• Teacher student ratio
• Staff qualifications/ experience
• Staff diversity
Student
• Studentbackground characteristics
• Nutrition and health of students
• Student characteristics by program of study
• Student load
• Resources/student ratio
• Teaching content
• Teaching strategies
• Materials, assessment tasks
• Flexible curriculum design
• Teacher presentation methods, pace, level and type of assessment tasks
• Teacher Participation in mentoring (as mentor or mentee) with colleagues
• Active response to specific diversity, equity needs of students
• Clear communication with students on expectations, criteria and standards
• Employment of a variety of assessment methods and types of assessment
• Continuous and timely feedback to encourage student learning
• Participation in moderation and review of subject standards
• Engagement in professional development on assessment
• Student attainment of stated learning outcomes
• Student achievement against established standards of achievement
• Student satisfaction with assessment tasks requirements and feedback provided
• Student self-reported attainment of learning outcomes
• Number of students who return for further study
• Student perspective on employability after university
• Student self-reported time-on-task, time in learning
• Number of students who register and engage in alumni after completion
• Graduation rate
• Transition rate (from bridging to degree program, from diploma to degree)
• Student progression rates to further study, higher degrees
• Student satisfaction with inclusiveness and respect for diversity
Teaching quality

LITERATURE REVIEW

Quality of Teaching in Higher Institutions of Learning

There is a general agreement on the four types of quality performance indicators as Input, Process, Output, and Outcome (Borden, and Bottrill, 1994; Carter, Klein and Day, 1992; Cave, Hanney and Kogan, 1991; Richardson, 1994). These can be more broadly categorised as Quantitative and Qualitative indicators.

Quantitative Indicators

Quantitative indicators are defined as those associated with the measurement of quantity or amount, and are expressed as numerical values; something to which meaning or value is given by assigning it a number. These include the input and output performance indicators.

Input Indicators

Input indicators reflect the human, financial and physical resources involved in supporting institutional programmes, activities and services. Limitations concerning input indicators surround their inability to determine the quality of teaching and learning without extensive interpretation. For example, an indicator such as resource allocation should be interpreted with enrolment data (to determine resource to student ratio), resource quality (i.e. condition) and conceptual range (e.g. library book topics) to determine teaching and learning quality.

Output Indicators

Output indicators are subject to similar limitations. Output data reflects the quantity of outcomes produced, including immediate measurable results, and direct consequences of activities implemented to produce such results (Burke, 1998). The defining feature is quantity or numerical amount, and the quality of these numbers is almost entirely disregarded. Input and output measures are inherently constrained by their data-driven "quantitative" nature, which prohibits the investigation of instructional, interactive and learning processes crucial to the quality of an institution, its educational programmes and its graduates. As such, quantitative performance indicators do not demonstrate quality of education, but rather quantities of its outcomes (Burke et al, 2002).

There is limited empirical support for quantitative indicators as enhancers of teaching and learning quality. However, qualitative measures have received significant support as they focus on quality aspects and allow measurement of deep and complex issues, of which the Higher Education system is invariably composed. The use of qualitative as opposed to quantitative indicators provides information that allows a deeper understanding of the variable measured.

Qualitative Indicators

Qualitative indicators are associated with observation-based descriptions, rather than an exact numerical measurement or value. They relate to or involve comparisons based on qualities or non-numerical data such as the policies and processes for assessing student learning, the experience of a learning community, or the content of a mission statement. Outcome and process indicators lie within the classification of qualitative measures. These performance indicators typically do not involve generating the quantity of outcomes in the form of numerical data, but measure complex processes and results in terms of their quality and impact.

Outcome Indicators

Outcome measures focus on the quality of educational program, activity and service benefits for all stakeholders. These key stakeholders include students, parents, the community, employers and industry (Burke, 1998; Warglien and Savoia, 2006). Outcome performance indicators typically do not involve generating the quantity of outcomes in the form of numerical data (as do output performance indicators), but instead measure complex processes and results in terms of their quality and impact. This is the difference between output and outcome measures. While they both measure the effects of higher education, output performance indicators measure this quantitatively, and outcome measures do this qualitatively.

An outcomes-based accountability system focuses on the 'value' added to students by their higher education experience, in terms of satisfaction with the quality of their experience and the quality of the skills they have developed. This approach is aligned with the 'student as customer' culture prevalent in higher education, where 'learning' is described as identifiable skills and products. The nature of outcome indicators, encompassed by values of 'quality,' 'satisfaction' and 'learning outcomes' means that outcomes are more difficult to measure than numerical outputs. As a consequence, they are not utilised as often as their quantitative counterparts (Bormans, Brouwer, Int'Veldand Mertens, 1987; Bruwer, 1998; Romainville, 1999). However, outcome indicators are considered to be more insightful, meaningful and accurate in measuring the methods and quality of teaching and learning as they relate to the objectives of higher education. They are also more useful in providing information that can be used for enhancing teaching and learning. For example, collecting information on student satisfaction and skills is more instructive to the institution, teacher and prospective students than retention rate data, while; an indicator such as retention rate is useful from a social and economic perspective as it simplifies the complexity of the higher education experience. For this reason, qualitative indicators are considered to better account for the complexity associated with higher education.

Process Indicators

Process indicators are those which include the means used to deliver educational programmes, activities and services within the institutional environment (Burke, 1998). These measurements look at how the system operates within its particular context, accounting for institutional diversity, a common confounding factor in inter- and intra-institutional comparison.

Process indicators allow the collection of qualitative information on aspects of teaching and learning quality; such as policies and practices related to learning and teaching, performance management and professional development of staff, quality of curriculum and the assessment of student learning, and quality of facilities, services and technology. Process indicators have been identified by empirical research to be the most practical, useful and appropriate measures of quality teaching and learning within higher education institutions (Chalmers, Cunningham and Thomson, forthcoming) and are the indicators commonly reviewed through institutional audit.

Process indicators provide an understanding of current practice and the quality of that practice. This has been shown to be effective in informing further initiatives and policy decisions (Kuh, Pace and Vesper, 1997), leading to quality enhancement. They are an invaluable source of information on teaching and learning quality because they investigate the core of the student learning experience (for example; quality of teaching, curriculum, assessment, services and facilities).

Process indicators provide information and context to facilitate interpretation of output and outcome indicators. When combined with valid and reliable input measures to account for contextual diversity, and output and outcome indicators to indicate the results of teaching and learning; these measures provide a comprehensive perspective for institutional strengths and weaknesses to be identified so that further improvement and enhancement can be undertaken. Process indicators are subject to the methodological challenges of qualitative measures.

However, process measures are generally considered by institutions and their staff and students to provide better measures of the quality of teaching and learning, as they are contextualized in the institution. A summary of teaching and learning process indicators in use in Australia has been compiled with institutional tables provided to the 37 participating institutions (Chalmers and Thomson, 2008). This summary extended the teaching and learning indicators identified in an earlier review of performance indicators (AVCC, 2004). While the 2004 review found the existence and use of performance indicators was variable in Australian universities, the 2008 review found that there was evidence of widespread use of process indicators in Australian universities. However, to identify the quality of those practices and indicators, the additional steps of review, audit and/or benchmarking would need to be undertaken.

The input and process dimensions influencing the overall quality of teaching in universities

University Environment

There is mounting evidence that a suitable learning environment can contribute to quality education. UNESCO (1990) says a high quality education implies an environment that actively seeks out learners and assists them to learn as well as welcoming learners and assisting them to adapt to learning needs. University policies and their implementation must promote both physical and mental health. Besides, there must be adequate hygiene and sanitation facilities accessible to all; where possible, health and nutrition services should be in the vicinity.

University environment refers, therefore, to social, academic and emotional contexts of a University, the personality of the learning context and how it is perceived by students, staff and community. This environment or climate is influenced by a broad range of factors, from disciplinary policies and instructional quality to student and teacher morale (Loukas and Robinson, 2004). The Comprehensive Assessment of University Environments (1987) asserts that the University environment and University connectedness can be the determining factors in a learner's educational experience. In other words, when students believe that adults in the University care about them, they have high expectations for their education and will provide the support essential to their success and they thrive.

Similarly, when lecturers and staff are deeply engaged in creating a safe, nurturing, challenging University environment, their job satisfaction increases and so does their teaching quality. Consequently, a positive University environment is a product of collective effort. This review looks at four strategies which can improve University environment. These are: i) Caring relationships, ii) Academic environment, iii) Structure and safety, and iv) Participatory learning (CASE, 1987).

The empirical study by Cohen (2006) says that the University environment affects more than just academic performance; it influences students' emotions and health behaviors as well. Cohen adds that a positive University environment enhances motivation, increases educational aspirations and improves attendance and retention. On the other hand, an unhealthy University environment in which rules are unclear or arbitrary, bullying is accepted if not condoned, and teacher attitudes are indifferent, hostile or unnecessarily punitive is likely to cause high absenteeism, misbehavior and interpersonal aggression. Gonder and Hynes (1994) add that a favorable University environment reduces dropout.

Ryan (1994) observes that a good environment in education is a precondition for learning, especially where a University environment is built upon caring relationships among all participants, namely students, lecturers, staff, administrators, parents and community members. These relationships should be built on:

Student-teacher relationships: No factor is more important for positive University outcomes than the student's perception of the teacher's attitude towards them. When students believe that their lecturers care about them, see them as competent, respect their views and desire their success, they tend to work toward fulfilling those high expectations.

Teacher-staff-administrator Relationships

Positive relationships based on trust, respect and support among University adults are essential to professional fulfillment and University success. An atmosphere of collegiality influences lecturers efficacy, satisfies emotional needs, and leads to personal and professional learning. Lecturers and staff need to enjoy their work and be willing to contribute to a positive learning environment.

A study by Haynes (1996) on developed countries showed that nearly all the lecturers in Universities with the highest achievement reported strong relationships with the Principal; three-quarters reported a strong relational trust with fellow lecturers. By contrast, fewer than half of the lecturers in universities with the lowest achievement reported a strong relationship with the principal, and only a third reported strong relationships with peers.
University-parent-community relationships: Parents and community members should feel that their university has a welcoming environment. It should be accessible and open to parents' participation, recognize parents' expertise and provide opportunities for their contributions. Effective communication and collaboration with parents and the community will promote better outcomes for students (Osterman, 2000). Research demonstrates that parental support and value of education is a consistent predictor of children's academic achievement. These outcomes are enhanced when the entire community values education and demonstrates support for its Universities (Fehrmann, 1987).

Quality of University Facilities

According to a paper presented by UNICEF (2000) in Florence, Italy, physical learning facilities or places in which formal learning occurs range from relatively modern and well-equipped buildings to open-air gathering places. The paper says that, quality of University facilities seems to have an indirect effect on learning, an effect that is hard to measure. Further, some authors argue that there is inconclusive empirical evidence on whether the condition of University buildings is related to higher student achievement after taking into account students background. In contrast, a study in India that sampled 59 Universities found that of these only 49 had buildings; 25 had a toilet, 20 had electricity, 10 had a University library and four had a television (Carron and Chau, 1996). Carron and Chau add that the quality of learning facilities was strongly correlated to students' achievement in Hindi and Math. Similarly, a number of empirical studies done in developing countries concerning University facilities (Latin America), which included 50,000 students in grades three and four found that students whose universities lacked classroom materials and had an inadequate library returned significantly lower test scores and higher grade repetition than those whose universities were well equipped (Williams, 2000).

The Relevance of Content and Curriculum Development

The curriculum defines the subjects to be taught and furnishes general guidance regarding the regularity and duration of instruction in which the syllabus should be closely linked to performance standards and measure of outcome (World Bank 1995). The national goals for education and outcome statements that translate those goals into measurable objectives should provide the starting point for the development and implementation of the curriculum.

Then, curriculum should emphasize a problem solving approach that stresses skill development as well as knowledge acquisition. However, the problem is that the curriculum changes are made without assurance of the availability of teaching materials to implement the changes. This indicates that there is little or no monitoring of educational materials and comparison of output on regional basis to teach physical education in primary second cycle universities.

Therefore, when changes in curriculum occur, it should be made relevant to the future life of the students (UNICEF, 2000, Baum and Tolbert, 1985). According to this, Coombs (1969) argues that, quality of education pertains to the relevance of what has been taught and learned to how well it fits the present and future learning needs of the particular learners in the question given their particular circumstances and prospects. However, in relation to relevance, appropriateness and level of content of the second cycle primary universities (5-8) of physical education curriculum had some problems which had to be solved. In relation to this, Amare (1998) pointed out that, one of the major problems of the Ethiopian education system is related to appropriateness and relevance of the curriculum, the difficulty and unnecessary burdensome number of subject areas was also a major problem.

Class Size

Large class size is another factor that affects teaching-learning process and the quality of teaching. Educators have tried to explain the number of students that should be found in a classroom for effective learning experience and creating a conducive relationship among lecturers and students. According to this, Kindared (1986) states that, class size is determined by different factors, such as the objective of teaching, nature of the subject, ability of the pupils, physical facilities and method of teaching in a particular situation. Teaching in a particular situation, and classroom should be arranged particularly based on the nature of subject and the intended outcomes to be achieved.

When the number of students in a classroom exceeds more than the normal number, all conditions of teaching and learning process also tend to exceed the managing capacity of the lecturer and University principal. It is also difficult to facilitate and create conducive environment to learn in and outside the classroom. So that, lecturers are forced to depend on one method of teaching that is lecture method which probably discourages students'

participation in the instructional process. To develop the participation of the student in group work, problem solving, co-operative learning, matching exercise and in co-curricular activities limiting the number of student in the classroom is appreciated.

Most lecturers and students prefer small class-size for effective teaching-learning process. A number of students in a class vary from class to class and from one subject to the other. According to Douglas (1954) classrooms should be convenient enough for students to learn happily and there must be sufficient space between students within the class. The typical classroom should not contain more than 35 to 36 students. In supporting the proposition within broad limits between 25 and 50 pupils change in class size influence pupils achievement modestly or not at all. But since most classrooms are not designed for more than 50 students, discipline problems can occur and may discourage the learners in teaching learning process (World Bank,1998). In general, effective teaching-learning process takes place in a relatively small class-size (Wade, 1980). Although effort is usually made to measure average class-size, for the most part, greater emphasis has been placed on the ratio of lecturers to students (Burkhead Fox and Holland, 1967).

Quality of Instructional Time

For the effective applicability of the instructional processes, efficient use of the University timetable has a significant impact on student learning. Regarding this, Becker (1978) states that, experts should allot enough time for subjects which are taught. This means that the time that students spend in the lecture hall for a particular subject should reflect the content of the subject being undertaken. Unfortunately, there are gaps in time allocation and the content of the subject being taught, especially with regards to the University which operates the shift system. Therefore, insufficient time allotted for the subject tends to limit the lecturer in the selection of content for his/her subject. Moreover, the limited time for the subject is an obstacle for the lecturer, who will not be able to cover many topics in the subject in question and will tend to use the traditional method of teaching which will have significant impact on student learning.
However, in the case of time allocation for Physical Education (Reston, 2004) supports the suggestions of Association for Sport and Physical Education (NASPE, 2001) as quality Physical Education requires adequate time, adequately prepared lecturers with opportunities for professional development, adequate facilities, and reasonable class sizes.

Relations between the University Administrations and the Lecturers

Another factor, probably a paramount one that causes inefficient instructional goal is the poor administration in the University. Regarding this, Venire (1969) has pointed out that, providing effective leadership is vastly more important than having good facilities in order to achieve desired objectives, physical education program presents a wide range of physical activities which require different facilities. Its limitation creates difficulties; these difficulties should be avoided by the most careful plan and skillful relation of lecturers and university Principals.

The aim of university Management is to make the most efficient use of available resource in order to achieve educational objectives. Therefore, the function of principals is to help lecturers in teaching their students and adjusting to their learning needs, interest as well as to their capabilities to fulfill the educational objectives. Carrying out the overall task of educational system effectively, demands technical and conceptual skill of university principals in human relations. Hence, if the university leader fails to understand the aspects of human behavior the consequence would be the lecturers possibly, hostility, poor-quality of work and reduced efficiency (Adir, 1984).

Lecturers' Knowledge Skill, Experience and Motivation

The more people know, the more they can do. The better- educated staff, the better they are able to undertake quality improvements (Sallis, 1993). It is the quality of the teacher that influences the quality of learning in the classrooms (Bear, 1989). The quality of the teaching staff is measured by their educational level of all inputs required to carry out an educational activity effectively (OECD, 1993). Therefore, lecturers are the major component in successfully accomplishing the task. They occupy almost a crucial position in modern society because they serve as a bridge to link the society and the educational system.

Regarding this, Meyer and Gayle (1996) mention that, primary second cycle university lecturers must be well educated and competent in their professional skills. This emphasizes the needs for an adequate preparation in the subjects to be taught by a primary second cycle university lecturer. Similarly, OECD (1992) argues that, improving educational quality has become a wide spread priority and in this the role of lecturers in pivotal as successful reform is realized by and through them. For lecturers to accomplish this responsibility, Musoazi (1982) suggests that, educational policy makers will need to get a much clearer picture of who lecturers are, their role in the system and the type of incentives, regulations, and training they need to motivate them to improve transmission of knowledge to students. Among other problems the quality of lecturers is most crucial, because qualified lecturers in the future should not only have knowledge, but should be devoted and faithful to their tasks.

Methods

Study Design:

A mixed methods approach incorporating futures methodologies was adopted for the study. Information was systematically gathered on the meagerly explored quality of teaching in the University of Rwanda and the forces determining this teaching quality. The study used both quantitative and qualitative methods to collect data that were used to assess teaching quality and its associated factors at the University of Rwanda (UR). Quantitative research was employed to describe the quality attributes of teaching in UR and to gain insight into factors influencing the teaching quality. Qualitative research was utilized to

understand lecturer and administration perceptions of teaching quality and the possible factors influencing them. In-depth interviews (key informant interviews) provided a flexible tool to collect narrative data describing interviewees' perspectives. This type of data can be difficult to assess using quantitative methods, particularly in the exploratory stage of research, before the hypotheses can be clearly articulated.

The study specifically used the Delphi technique as the future methodology. Saaty and Boone (1990) contend that there are four solid methods for anticipating what's to come. One is by agreement, the second is by extrapolating on patterns, the third is by chronicled investigation and similarity and the fourth is the efficient era of option ways to what's to come. Delphi is viewed as the most conspicuous of the agreement systems (Jones, 1980). Quantitative forecasting was done in this study because there was information about the past, which can be expressed as data and because there is an assumption that the future of the University of Rwanda was a continuation of the past and the present (Bijl, 1992).

The futures methodologies was incorporated in this study because: time and costs make frequent group meetings with the key informants infeasible, the heterogeneity for the participants must be preserved to assure validity of the results i.e. avoidance of domination by quantity or by strength of personality (`bandwagon effect') and because there is need to make forecasts in a field (teaching quality in higher institutions of learning after mergers in Rwanda) that is too new to have adequate historical data for the use of other methods; and where progress may be more dependent on external social and economic factors than on the technological factors intrinsic to the field.

Study population

The primary study population was undergraduate and postgraduate students at the University of Rwanda. The secondary study population was academic administrators at the University of Rwanda; they included deans of students, heads of faculties and heads of department.

Sample Size Calculation

The sample size for this study was estimated using the formula used by Krejcie and Morgan in their 1970 article

This was; $$S = \frac{X^2 NP(1-P)}{D^2(N-1) + X^2 P(1-P)}$$

S = 326 Respondents.

Sampling

To ensure overall representation with no selection bias, simple random sampling was used to sample half of the campuses (7) for study. At the campuses, systematic random sampling was used to sample the students.

This was accomplished using a lottery method where a raffle was done after writing each of all the campuses on pieces of paper and putting them in an opaque box. Seven pieces were drawn from the box without replacement and these were sampled campuses.

At the campuses, systematic random sampling was used to sample the students. In this method, the number of under and postgraduates per campus was ascertained from the relevant authorities and using this number a sampling interval was calculated using the formula below;

$$K = \frac{N}{n}$$

Where;

K = Interval
N = target population size at sampled campus
n = sample size

A list of the students was made and sampling was done on this list. Each sampled student was identified with the help of a designated university staff and approached for briefing and subsequently interview.
The table below shows the sample sizes obtained from each campus given the sampling intervals calculated;

Campus	Target sample size	Sampling interva	Sample obtained
Nyarugenge Campus	4859	13	48
Kicukiro Campus	128	1	44
Rubirizi Campus	529	1	53
Busogo Campus	1560	4	53
Rukara Campus	1600	4	53
Huye Campus	10149	28	33
Remera Campus	4815	13	42

The key informants were purposively sampled at the respective campuses on the premise of being an administrator at the sampled campus.

Data Collection Methods

This study used structured interviews, to collect quantitative data. Structured interviews were conducted because they provide precise responses from the respondent's thus increasing accuracy. This interview is described as a conversation that has a structure and a purpose (Kvale, 1996).

The researcher or any of the two research assistants asked the questions and recorded the responses as given by the students. The interviews lasted between 25 and 40 minutes. Translation of the questions into local language was done where necessary.

Key informant interviews were conducted to collect qualitative data from the academic administrators at the University of Rwanda; they included deans of students, members of the senior management team, heads of faculties and heads of department. A total of ten key informants were included in the study, however information saturation was reached at the seventh key informant. The interviewees were purposively selected as key informants on the premise of having the potential to provide rich, relevant and diverse information pertinent to the quality of teaching in UR. The interviews were conducted in English and tape recorded after consent was received.

Data Collection Tools

The quantitative set used structured paper-based questionnaires, while the qualitative set included key informant interviews. The questionnaire was interviewer administered, and comprised two parts. Part A had student demographic characteristics and Part B had quality of teaching. Key informant interview guides were designed with open-ended questions. The open-ended nature of the questions provided opportunities for both the interviewer and interviewee to discuss certain topics in more detail. Pre-testing of the questionnaires was done among 10 students at the University of LayAdventists of Kigali (UNILAK). The pre-test informed the researcher whether the questions were understood in the same way by the respondents and if they were answerable and appropriate. The pre-test also gave the researcher an idea of the time respondents take to answer the questionnaire and how it affects their responses, whether they understand the instructions, and if its format was suitable for the population (Parahoo, 2006). This exercise helped to improve the data collection tools in terms of content and order of the questions in relation to the study objectives, and where necessary adjustments were made prior to data collection.

Data Management and Analysis

Statistical Package for Social Sciences (SPSS) version 20 was used, and univariate, bivariate (using chi square test) and multivariate analyses (binary logistic regression) were done. ANOVA statistics were used at an alpha level of 5%. Qualitative information collected through in-depth interviews was transcribed and translated into English and analyzed using thematic analysis.

The data-analysis process followed a sequence of interrelated steps, such as reading, coding, displaying, reduction, and interpretation. At first, the transcripts were carefully read, and then data were coded. Reading and coding was initiated while data were collected. The data-display and reduction process was conducted at desk once all data were collected.

The inconsistencies of data (if any) were clarified through re-visit of field and reduction of non-standard data. Even during data display and reduction, the authors reviewed earlier steps to refine codes, reread texts, and revise some aspects of the analysis.

Once all of the interviews have been transcribed and entered on Microsoft Word and reviewed, a coding system was developed. Coding categories were derived from the initial research themes and questions, as well as key concepts that emerged during data collection. Coding of the interview transcripts was done by two of the co-investigators using ATLAS.ti, a text organizing software. Thematic analysis was used to identify trends of concepts in and across individual codes. Efforts were made to identify direct quotations and case studies that illuminate key data findings.

Measurement of the Variables

Teaching quality was measured basing on the questions given in the three dimensions of quality (input, process and input). Each of the questions used to assess those quality dimensions were designed uniformly with three responses which were; "To no extent", "To some extent" and "To a great extent". Each of the responses was given a score as follows;

To no extent = Score 0
To some extent = Score 1
To a great extent = Score 2

Therefore, for the input dimension which had 20 questions, the maximum score was (2 x 20) = 40

For the process dimension which had 10 questions, the maximum score was (2 x 10) = 20

For the output dimension which also had 10 questions, the maximum score was (2 x 10) = 20
To be taken as a respondent rating the quality of teaching inputs as high at UR, one had to have a minimum score of 32 out of 40 (80%)

To be taken as a respondent rating the quality of teaching processes as high at UR, one had to have a minimum score of 16 out of 20 (80%)

To be taken as a respondent rating the quality of teaching outputs as high at UR, one also had to have a minimum score of 16 out of 20 (80%)

After measuring specific levels of quality per dimension, the researcher computed an average score from the individual scores per dimension in order to obtain a composite measure of the dependent variable (Teaching quality at UR). This was done to allow for the establishment of relationships between the independent variables (quality attributes) and the dependent variable.

Ethical Considerations

Authority to conduct the research was obtained from the administration of the University of Rwanda. Participants were provided with adequate information on the research before the focus group discussion. Written consent was obtained from the hospital as well as individual research participants.

Privacy of the respondents was assured by accessing respondents in private ensuring that responses were kept private. Non-bias was assured by accessing the data for retrospective analysis without any bias to past knowledge or preconceived opinions of the subject or participants in the study

Non-discrimination of participants was assured by focusing on the study population data with no inferences to specific discriminating aspects like religion or social status. Participants had the right to take part in the study or not as they chose. Confidentiality and anonymity was assured by making the responses anonymous and identifying patients on record only through unique identifier codes and without their names. Information obtained remained confidential and was not revealed to people other than the research team.

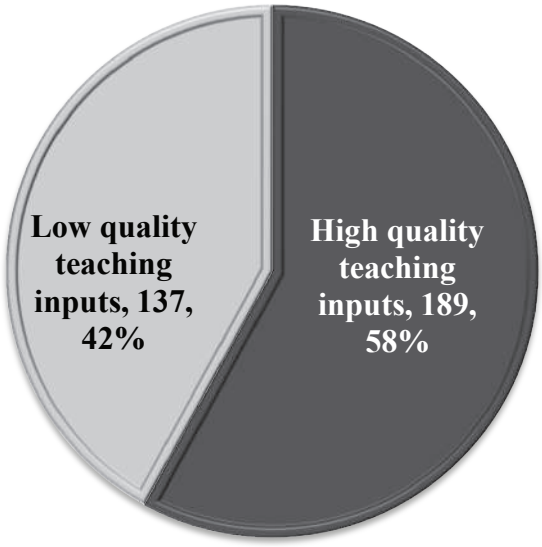
Characteristic	Frequency	Percent (%)
Campus		
Nyarugenge	48	14.7
Kicukiro	44	13.5
Rubirizi	53	16.3
Busogo	53	16.3
Rukara	53	16.3
Huye	33	10.1
Remera	42	12.9
Total	**326**	**100.0**
Age		
18 – 25 years	229	70.2
26 – 33 years	73	22.4
33 – 41 years	15	4.6
More than 41 years	9	2.8
Total	**326**	**100.0**

Gender		
Male	221	67.8
Female	105	32.2
Total	**326**	**100.0**
Current level of study		
Undergraduate (studying 1st degree)	268	822
Graduate (Masters or PhD)	58	17.8
Total	**326**	**100.0**
College of UR		
Arts and Social Sciences (CASS)	19	5.8
Agriculture,Animal Sciences and Veterinary Medicine (CAVM)	106	32.5
Education (CE)	86	26.4
Science and Technology (CST)	48	14.7
Business and Economics (CBE)	23	7.1
Medicine and Health Sciences (CMHS)	44	13.5
Total	326	**100.0**

There was a good spread of students sampled from the largest to the smallest campuses of UR. The majority of the students were aged 18–25 years (70.2%), and 67.8% were male which represents the proportion of males at UR. Majority of the students were undergraduates (82.2%) studying in STEM programs.

Level of Teaching Quality

Input Teaching Q



Students rated the quality of teaching inputs at 58% across the sampled campuses. The results obtained from the key informants on the issue of input quality happened to coincide with the quantitative results obtained above. The key informants were asked to give their views on the level of inputs from the lectures and the University in terms of quality and the following quotes exemplify their views:

"I think teacher training, morale, student background, instructional materials are inadequate. I think this has affected the quality of teaching because if teacher morale and commitment is lacking or the materials are limited, this will impact the quality of teaching."

Another one added:
"All the inputs are not adequate because University of Rwanda is still young and it requires some time to mature following the merger, some things are still inadequate….Yes they have affected quality because, you cannot provide quality education without adequate inputs like infrastructure, ICTs, etc."

"Many inputs are inadequate, specifically Internet connectivity and even the backgrounds of the students we admit moreso in as far as English speaking and comprehension are concerned as a medium of instruction, some students have challenges there, for me I think it has affected that quality of teaching as well (…..academic staff qualifications and module descriptions and seminars have helped improve the quality of teaching by application of contemporary ideas in teaching enhancement."

"Inputs are still of low quality, teacher experience and qualifications is not really good enough, the instructional materials are insufficient or scarce in some circumstances and because of these, teaching quality has been affected".

Process Quality

The quality of teaching process was rated high by 74% of respondents.

Output Quality

Computation of the results revealed that the quality of teaching output was at 83%. Respondents were of the view that the students of the University are employable after school, but some had reservations on this issue.

"Yes the students are employable, however, the employability levels differ depending on the way the candidate engaged with the teaching experience. There are some students I would describe as employable, many students here are not employable at regional and multinational levels."

"I think the students are employable after study completion since the programs they go

through are needed in the country and the region."

"Yes they are employable because the skills they acquire and training especially internship of six months qualifies them for employment in teaching lower secondary schools at least."

"Yes, the University of Rwanda is the best University in Rwanda and offers the best quality of education which enables the students of UR to be employed in many different fields."
On the contrary, one of the key informants was of the view that the students were employable only to some extent;

"The students are employable to some extent because the students lack enough practical sessions. This means that the number of students employed cannot be that high, they have little hands on experience."

Overall Level of Teaching Quality

The results obtained from the input, process and output quality of teaching was amalgamated to obtain the overall quality of teaching at UR. The results obtained show that the 71.8% of respondents thought that teaching was of high quality.

From the key informants' point of view, the quality was average on almost all campuses and if some reported it to be high and low, these were the minority.

"I would say average, maybe it is high in some campuses but here it is average."

"The level of teaching quality in my opinion is low because there is no qualified staff, teaching facilities are inadequate and there is not enough motivation for teachers."

"I would say that the teaching quality is average, it is being affected by a number of factors including inadequate infrastructure and staff."

"It is average due to issues of visiting lecturers who are sometimes not available on time to teach among other reasons."

A key informant from Huye campus was of the view that the quality of teaching was high, which was at variance with other key informants:

"The level of teaching quality in the University is high because the University recruits qualified staff like lecturers and another thing is that the University has full support of the government."

In addition, one member of the senior management team was of the view that the level of teaching quality was low;

"Teaching quality here is low, the lecturers are so over-worked, some are not committed to their work and the University itself is not well coordinated."

Table 2: **The Input Attributes Associated with the Quality of Teaching at the University of Rwanda**

Attribute	Quality of Teaching		X2 P value	AOR	Confidence interval	
	High (n = 234)	Low (n = 92)			Lower	Upper
Some Academic Staff in this Campus do not provide adequate training						
To no extent	24(49.0%)	25(51.0%)		.601	.121	1.132
To some extent	159(77.6%)	46(22.4%)	15.989	.530	.113	2.311
To a great extent	51(70.8%)	21(29.2%)	0.000**	1.000		
The nature of teaching in this Campus is Student- centered (Student - centered teaching focuses on the student.						
To no extent	59(81.9%)	13(18.1%)		1.369	.621	3.015
To some extent	112(65.1%)	60(34.9%)	8.475	.563	.309	1.027
To a great extent	63(76.8%)	19(23.2%)	0.014**	1.000		
The ICT infrastructure is adequate and it matches the number of students at the Campus						
To no extent	124(67.0%)	61(33.0%)	12.567	1.468	.675	3.191
To some extent	92(83.6%)	18(16.4%)	0.002**	3.691	1.540	8.847
To a great extent	18(58.1%)	13(41.9%)				

The results in Table 2 show that two input quality parameters had a significant influence on the quality of teaching. These are; provision of adequate training by some academic staff on the campus ($X^2 = 15.989$, $p = 0.000$) and the nature of teaching on the campuses being student-centered ($X^2 = 8.475$, $p = 0.014$). Having to a great extent academic staff on the campus who do not provide adequate training to students was related to three times more odds of having high quality teaching, while having student centered teaching was related to having 1.3 times higher likelihood of having high teaching quality (OR = 1). One other input parameter had a significant influence on the quality of teaching, this is the ICT infrastructure being adequate and matching the number of students at the campus ($P = 0.002$, $X^2 = 12.567$). Having such ICT infrastructure was associated with three times higher chances of having high quality teaching (OR = 3, CI = 1.540 – 8.847).

Table 3: **The Process Attributes Associated with the Quality of Teaching**

Attribute	Quality of Teaching		X2 P value	AOR	Confidence interval	
	High (n = 234)	Low (n = 92)			Lower	Upper
There is a healthy Student - teacher relationship at campus						
To no extent	34(58.6%)	24(41.4%)		.790	.395	1.579
To some extent	148(79.1%)	39(20.9%)	12.264	2.116	1.191	3.762
To a great extent	52(64.2%)	29(35.8%)	0.002**	1.000		
Academic staff present their materials using projectors and other digital methods						
To no extent	24(57.1%)	18(42.9%)		.577	.285	1.167
To some extent	106(78.5%)	29(21.5%)	7.303	1.582	.922	12.712
To a great extent	104(69.8%)	45(30.2%)	0.026**	1.000		
Academic staff at university go an extra mile as mentors						
To no extent	35(59.3%)	24(40.7%)		1.207	1.045	4.665
To some extent	165(75.2%)	41(24.8%)	9.557	2.357	1.236	8.494
To a great extent	34(55.7%)	27(44.3%)	0.008**	1.000		

According to the regression results, at campuses where student-teacher relationships was healthy to some extent, there were twice more likely to have high quality teaching (OR = 2.116, CI = 1.191 – 3.762), there was 1.5 times higher likelihood of having high quality teaching at campuses where academic staff presented their materials using projectors and other digital methods (OR = 9.557, CI = .922 - 2.712). At campuses where academic staff went an extra mile as mentors, there were twice more likely to have high quality teaching (OR = 2.357, CI = 1.236 – 4.494).

The Variations in Teaching Quality with the Type of College and Campus at UR

Table 4: The Variations in Teaching Quality with the type of College and Campus

		Sum of Squares	df	Mean Square	F	Sig.
Campus	Between Groups	31.059	1	31.059	8.470	.004**
	Within Groups	1188.033	324	3.667		
	Total	**1219.092**	**325**			
College	Between Groups	.020	1	.020	.009	.924
	Within Groups	697.355	324	2.152		
	Total	**697.374**	**325**			

An analysis of variance was done to find out whether there were any variations in teaching quality by college and campus. The results in Table 4 show that there was a significant variation in teaching quality by campus (p = 0.04, F = 8.470).

Table 5: **The Variations in Teaching Quality with the College and Campus**

Attribute	Quality of Teaching		X2 P value	AOR	Confidence interval	
	High (n = 234)	Low (n = 92)			Lower	Upper
Campus						
Nyarugenge	47(97.9%)	1(2.1%)		1.131	.659	1.941
Kicukiro	29(65.9%)	15(34.1%)		.426	.576	3.688
Rubirizi	21(39.6%)	32(60.4%)	15.243	1.651	.641	4.251
Busogo	53(100.0%)	0(.0%)	0.000	1.096	.550	2.185
Rukara	53(100.0%)	0(.0%)		1.465	.843	2.546
Huye	0(.0%)	33(100.0%)		.001	1.779	10.363
Remera	31(73.8%)	11(26.2%)				

Further still, disaggregation of the data on teaching quality by campus showed that Busogo, Rukara (100%) and Nyarugenge campus (100%) have the highest quality of teaching amongst the seven campuses sampled.

Futures Thinking Results

Using the futures methodology, it was found that more than half of the staff reported that the quality of teaching in UR was going to be better in the next 5–10 years 12(57.1%), while majority reported that in the next 5–10 years, UR was going to be more visible and among the best universities in East Africa (66.7%). The majority of the staff stated that the infrastructure in URwas going to improve in the next 5–10 years, (66.7%) while about half of them mentioned that UR has high chances of adopting better teaching methods in the future. Many of the staff were of the view that UR graduates were going to be the most employable in the country in the next 5–10 years (47.6%), whereas slightly above half of them were of the view that in the near future, most of the alumni would be returning to UR for further studies and not to other Universities (52%).

The majority of staff mentioned that to a great extent, UR will continue to be the leading University in the country in terms of quality education 14 (66.7%), and that to some extent, the mission of contributing to community service and development will be fully achieved in the next 5 – 10 years 14 (66.7%). Most but less than half of the staff were of the view that to some extent, the component of research and innovation was bound to greatly improve at the University in the near future because of the merger 10(47.6%).

DISCUSSION

The Quality of Teaching Input, Process and Output

Quality of teaching was explored using the three parameters of input, process and output. The results showed that input quality at the seven campuses was 58%. The reasons for the average level of teaching input quality were noticed to be encapsulated in five teaching input indicators which are related to both the institution (University) and the teachers and have the lowest scores. The quality of teaching process was 74%. This implies that approximately five out of the seven sampled campuses of the University of Rwanda have satisfactory process qualities of teaching. In these campuses therefore, the activities resulting from the use and management of the input indicators were by and large fairly well executed by the teachers.

On a more positive note, the results of this study showed that there was a high level of output quality of teaching at a rate of 83% at the University of Rwanda. The fact that the output factors were based on the opinions of the students regarding the perceived benefits of the education they received means that students in approximately six out of every seven University of Rwanda campuses were positive about the outcomes of their education at the University.

Overall quality of teaching was 71.8%. This high level of teaching quality was majorly contributed to by the perceived outcomes of the education, high among the students and the education process which was also regarded positively by the majority of the respondents.

Using the futures thinking methodology, the results showed that most of the academic staff were optimistic that the teaching quality of the University of Rwanda would be better in the future. However, it was noted that there were still gaps here since only 70% of the staff were positive about the quality of education that the university would have in the next ten years. An average future rating was given by all academic staff on issues to do with the quality of teaching in the University being better in the next 5–10 years. The futuristic results show that although the academic staff were optimistic about the future of the University, a section of them were not concretely sure that the University's quality of education was going to tremendously improve in the next 5 – 10 years.

The Input Attributes Associated with the Quality of Teaching at the University of Rwanda

The study established that staff at the campus not providing adequate training had a significant association with the quality of teaching at the UR ($p = 0.000$). Specifically, having academic staff on campus who provide adequate training to students was related to three times more odds of having high quality teaching (OR = 3.601, CI = 1.881 - 6.891). This is because teaching at institutions of higher learning goes beyond holding lectures with students and encompasses training both in and around the classroom so as to equip

students with hands on skills, without which the outcomes of teaching can be fully realized among the students. Therefore a campus which to no extent had teachers who do not train students was more likely to have higher teaching quality.

It was also found that the nature of teaching on the campuses being student-centered …had a significant association with the quality of teaching at the University ($X^2 = 8.475$, $p = 0.014$). Student-centered teaching methods shift the focus of activity from the teacher to the learners. According to (Oakley, 2007), these methods include active learning, in which students solve problems, answer questions, formulate questions of their own, discuss, explain, debate, or brainstorm during class; cooperative learning, in which students work in teams on problems and projects under conditions that assure both positive interdependence and individual accountability; and inductive teaching and learning, in which students are first presented with challenges (questions or problems) and learn the course material in the context of addressing the challenges

Student-centered methods have repeatedly been shown to be superior to the traditional teacher-centered approach to instruction, a conclusion that applies even if the assessed outcome is short-term mastery, long-term retention, or depth of understanding of course material, acquisition of critical thinking or creative problem-solving skills, formation of positive attitudes toward the subject being taught, or level of confidence in knowledge or skills. This explains why having student centered teaching was related having 1.3 times higher likelihood of having high teaching quality (OR = 3.601, CI = 1.881 - 6.891) at the respective campuses.

The third statistically significant input factor that influenced the quality of teaching at the University was the ICT infrastructure being adequate and matching the number of students at the campus ($P = 0.002$, $X^2 = 12.567$).
Conventional teaching has emphasized content. For many years course have been written around textbooks. Teachers have taught through lectures and presentations interspersed with tutorials and learning activities designed to consolidate and rehearse the content. Contemporary settings are now favoring curricula that promote competency and performance. Curricula are starting to emphasize capabilities and to be concerned more with how the information will be used than with what the information is.

The moves to competency and performance-based curricula are well supported and encouraged by emerging instructional technologies (Stephenson, 2001). Such curricula tend to require: Access to a variety of information sources; access to a variety of information forms and types; student-centered learning settings based on information access and inquiry; learning environments centered on problem-centered and inquiry-based activities; authentic settings and examples; and teachers as coaches and mentors rather than content experts. Technologies are able to provide strong support for all these requirements and there are now many outstanding examples of world class settings for competency and performance-based curricula that make sound use of the affordances of these

technologies (Oliver, 2000) with very positive results. This explains why in this study, having such ICT infrastructure was associated with three times higher chances of having high quality teaching (OR = 3, CI = 1.540 – 8.847).

The Process Attributes Associated with the Quality of Teaching at the University of Rwanda

The study established that there as a relationship between student-teacher relationships affecting overall campus success and the quality of teaching at the university (p = 0.002). At campuses where student-teacher relationships was healthy to some extent, there were twice more likely to have high quality teaching (OR = 2.116, CI = 1.191 – 3.762). This is because, as aligned with attachment theory (Ainsworth, 1982; Bowlby, 1969), positive teacher-student relationships enable students to feel safe and secure in their learning environments and provide scaffolding for important social and academic skills (Baker et al., 2008; O'Connor et al., 2011; Silver et al., 2005). Teachers who support students in the learning environment can positively impact their social and academic outcomes, which are important for the long-term trajectory of school and eventually employment (Baker et al., 2008; O'Connor et al., 2011; Silver et al., 2005). When teachers form positive bonds with students, classrooms become supportive spaces in which students can engage in academically and socially productive ways (Hamre and Pianta, 2001).

Students who have positive relationships with their teachers use them as a secure base from which they can explore academically and socially, to take on academic challenges and work on social-emotional development (Hamre and Pianta, 2001). This includes relationships with peers, and developing self-esteem and self-concept. Through this secure relationship, students learn about socially appropriate behaviors as well as academic expectations and how to achieve these expectations hence fostering higher teaching quality.

The use of presentation of materials using digital methods by academic staff (p = 0.026, X^2 = 7.303). This is because the projector has a number of advantages that would outdo most other visual teaching aids. Another very important benefit that the projector has over the chalkboard is that it is multipurpose and can be used to present prior prepared material, which enables lecturers to build notes, tables, diagrams, and so on; and these can be used anytime, repeatedly. If designed well and planned well, these can provide all the aides and cues that are needed during a lecture, so that one does not have to resort to the conventional note taking, which in a way facilitates learning, hence higher teaching quality ensues. This explains why there were 1.5 times higher likelihood of having high quality teaching at campuses were academic staff presented their materials using projectors and other digital methods (OR = 9.557, CI = .922 - 2.712).

There was also a relationship between academic staff at the University going an extra mile as mentors and teaching quality (p = 0.008).At campuses where the academic staff went an

extra mile there were twice more likely to have high quality teaching (OR = 2.357, CI = 1.236 – 4.494). Several studies have shown that students with mentoring relationships score higher academically. This is similar to the findings by (Campbell and Campbell, 1997) who reported that those students who had a faculty mentor "attained a higher grade-point average equivalent to between .2 and .3 of a grade point" (p. 738) when compared to students who did not have a faculty mentor. Another study done by (Fox and Connelly, 2010) showed that the mentees who participated in a peer-mentor program "achieved higher deep, strategic and surface apathetic scores after their involvement" (p. 150).
One of the major benefits of mentoring for the student mentee is the psychosocial encouragement received. Stress is often listed as one of the major reasons for student attrition yet Terrion and Leonard (2010) point out that a peer mentor "can serve as one source of support to reduce stress experienced by students and that this, in turn, has the potential to reduce the attrition rate at the University and increase overall teaching quality (Terrion and Leonard, 2010).

The Variations in Teaching Quality with College

There was a significant variation in teaching quality by campus (p = 0.04, F = 8.470). Busogo (100%), Rukara (100%) and Nyarugenge campus (97.9%) and the highest quality of teaching amongst the seven campuses sampled. There may still remain discrepancies in the service delivery at the various campuses which constitute the University. The differences in the quality of teaching by campus could lie in the variations in the quality of academic staff deployed at the respective campuses, the number of students therein and the infrastructural capacities in the campuses.

CONCLUSIONS

This paper sought to collect the evidence for change in learning and teaching. It provided a baseline for evaluation. However, the expectations were not much beyond what was provided and we needed to explore expectation and aspirations. Therefore, more work needs to be done to find credible ways to encourage feedback from students and ways to process such feedback.
Students continued to harbour concerns about the negative impacts of their honest feedback on their progress. The level of teaching quality was fairly high at the University, however, the input quality dimension was still average. Both the input and process quality parameters were associated with the quality of teaching in equal measure, and the quality of teaching varies by campus of the University.

In the light of the findings of the study, the following recommendation may be drawn:

• The University leadership should spearhead greater adoption and use of student-centered teaching methodologies. If necessary, in-service training could be provided to lecturers on how the student-centered teaching can be done; use of ODEL (On-Line

Distance Learning) envisaged to facilitate larger access to education should be introduced in this context with clear understanding of the facilitating role of the teacher and student given opportunity to access as much information as possible. In this context, logistical and institutional arrangement will have to be in place.

• Peer in-class evaluations could be considered as teaching methods assessment of UR teaching staff. The approach would allow teaching skills transfer from staff to another leading to uniformity and harmonization in teaching style. The staff qualification was indicated by some constraints undermining teaching quality. More staff should be encouraged to go for higher degree training that will enhance capacity of teaching and also research. The University will have to set standards and assessment approaches to ensure best practices and goals are achieved;

• Introducing ICT and other tools is of paramount importance since the tools will allow access to large amount of information and flexible exchange of information among peers. Use of e-resources and other database help in feeding students with the latest and updated information that may not be covered in classroom

• The University Management should put emphasis on campuses especially, Huye, Rubirizi and Kicukiro in terms of improving teaching service delivery therein, given that these had the lowest quality of teaching. It is probable that in those campuses, there exist input and systemic challenges in education service provision;

• Further research should be carried out to explore teaching quality using other quality of service assessment models and methods, for instance observations. Further studies could also consider assessing teaching quality and how it correlates in other UR campuses with larger sample sizes.

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SELECTED **PAPERS**

THE ROLE OF HIGHER EDUCATION IN MANAGING THE ENVIRONMENT

- Higher education and environmental management _ the nexus through postgraduate research

SUB-THEME 3

14TH GENERAL CONFERENCE & 50TH ANNIVERSARY
CELEBRATIONS OF THE AAU

HIGHER EDUCATION AND ENVIRONMENTAL MANAGEMENT:
THE NEXUS

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Abstract

The environment is of utmost importance and serious concern to people living in poverty. The poor often depend directly on a number of natural resources and ecosystems for their survival. Poor people are chiefly affected by poor sanitation, air pollution, contaminated water, toxic, and harmful chemicals. Due to their low education, they are particularly susceptible to environmental hazards like flood, drought, pest attack on crops and livestock and loss of biological resources which translate into loss of economic potential and numerous environmentally-related conflict. Higher and qualitative education however, equip people with problem solving skills. An empirical study was conducted in 2016 to determine the relationship between higher education and environmental management. Through the multi-stage sampling procedure, the representative sample of 180 respondents was selected for the study. Primary data were obtained with the aid of questionnaire and subjected to univariate probit regression analysis.

The results indicated that tertiary education was positive and significant ($P<0.01$), suggesting that people with higher education were more likely to adopt and apply environmental management practices and techniques than those with low educational levels. Findings further revealed that the variable, no formal education, was negative and significant ($P<0.05$) indicating that persons without formal education were less likely to imbibe environmental management measures. From the foregoing, poor people with low education must be seen first as part of the solution rather than part of the problem. Supportive policies and institutions which provide access to training and information (awareness and media sensitization) that will expand the opportunities of the poor to invest in environmental improvements are required. It is also pertinent, to address the educational activities of the non-poor since they are the cause of change and damage to the environment. Through higher education of these people, their asset accumulation will be enhanced to

expand sustainable livelihood opportunities and reduce vulnerability to environmental hazards. Higher education will further improve income and quality of growth to promote sound environmental management and protect the environmental assets. Higher education is therefore a crucial tool in managing the environment and must be a priority policy option for sustainable environmental management.

Keywords: Education, environment, management, poverty.

Introduction

Although threats to environmental quality continue to grow worldwide (Etim and Ofem, 2005), the environment provides goods (natural resources) and services (ecosystem functions) used for food production, the harvesting of wild products, energy and raw materials (World Bank, 2010). It receives and partially recycles waste products from the economy and is an important source of recreation, beauty, spiritual values and other amenities. As population increases, the amount of waste generated increases correspondingly and the capacity to absorb these waste becomes more complex (Edet and Etim, 2014). Managing the environment sustainably to provide these goods and services on which human development relies on; and also to ensure secure and equitable access by the poor to environmental assets is pertinent. According to Schwarte (2008), poor people in developing countries often rely heavily on their immediate environment for their livelihoods and are most likely exposed to environmental risks and degradation and are usually the worst represented in relevant decision making processes. Due to their low education, they are particularly susceptible to environmental hazards like flood, drought, pest attack on crops and livestock and loss of biological resources which translate into loss of economic potential and numerous environmentally-related conflict.

In Nigeria, majority of the poor reside in the rural areas and derive livelihood from farming (Etim, 2007; Edet and Etim, 2014; Etim and Edet, 2014(a) (b), Etim and Ukoha 2010, Etim et al., 2011, Etim and Edet, 2016). Agriculture is human activity that affects the greatest proportion of the earth's surface (Pagiola and Holden, 2001) and largest single source of livelihoods and income (Ohlsson, 2000), especially, in Africa. But extensive agricultural growth is considered to be a major contributor to habitat loss and reduced environmental resistance that buffers agro-ecosystems against environmental and market shocks (Pagiola and Holden, 2001). Traditionally, the poor takes the brunt of the blame for causing society's many problems including, more recently environmental degradation as it is generally believed that poverty is a major cause of environmental degradation (Amuyou et al., 2013), though, the non-poor also share in the blame. The astronomical increase in population, coupled with changing lifestyle and rising man made activities are making environmental problems more critical. Etim et al.,(2005) reported that population pressure does not only increase food demand but influences resource use and indirectly decreases food supply.

Despite the rising population, resources must be conserved as much as possible to ensure sustainability. Mikulik and Babina (2009), noted that natural resources of the earth including the air, water, land flora and fauna and especially samples of natural ecosystems must be safeguarded for the benefit of present and future generations through careful planning or management. Unfortunately, these natural resources have been bastardized by man. Poverty has propelled many families to over-use land and other natural resources. Nayar (2013) agreed that when these natural resources are over exploited, supplies is affected and managing imbalance demands assuming a slightly different approach. Therefore, changing people's attitude towards the use of natural resources is fundamental to ensure sustainability. Education has been identified and reported as an important driver of change. As posited by UNCED (1991), education is critical for promoting sustainable development and improving capacity of people to address environmental issue.

Hans Van Weeven (2000) found that education is humanity's best hope and most effective means to achieve sustainable environment and development. Institutions of higher learning are therefore challenged to produce solutions to problems arising from environmental abuses. Mikulik and Babina (2000) supported that higher institutions should take the lead in promoting environmental equilibrium by solving environmental problems and giving direction to the society. Higher education also plays a role in human and social development in terms of shaping values and ways of thinking including cultivating certain values for political, social involvement and global citizenship (Escrigas, 2008; Thomson, 2008). Qualitative education equips people from poor families with literacy, numeracy and problem-solving skills and paves way through better understanding of the intimate relationship between environment, ecology and sustainable development (Etim, 2015). By equipping young people with the relevant capabilities in addition to their environmental knowledge, they can excel at living lives aimed at caring for and respecting our planet's resources (Nayar, 2013).

The extent of environmental usage by rural farmers depends to a large extent on their level of education and environmental information. Schwarte (2008) posited that access to environmental information is increasingly important especially, in countries where people rely chiefly on natural resources. In order to formulate policies aimed at ensuring environmental sustainability, an understanding of the role of education in managing the environment is required. However, there is paucity of information on the place of higher education in management of the environment. This study, therefore, becomes imperative in filling this lacuna by empirically analyzing the relationship between higher education and environmental management.

Methodology

This study was conducted in Akwa Ibom State, Nigeria. It lies between latitude 4033' and 5033' North and longitude 7025' and 8025' East. The state has a population of 3.6 million (NPC, 2006). It is circumscribed to the North, East, West and South by Abia State, Cross

River State, River State and the Atlantic Ocean respectively. The State has six (6) Agricultural Development Programme (ADP) zones namely: Oron, Etinan, Uyo, Eket, Ikot Ekpene and Abak. It is located in the rainforest belt and characterized by heavy rains as the annual precipitation ranges between 2000-3000mm. The predominant occupations of most inhabitants of the rural communities are farming and fishing. Multi-stage sampling technique was used to select the representative farmers for this study. First, in order to give a good representation and avoid biases, three out of the six ADP zones were randomly selected. Secondly, 20 villages per ADP zone were randomly selected to make 60. Thirdly, three farmers were randomly selected per village to make a total of 180 farmers. Primary data used for this study were obtained for a period of 6 months from July 2016 to December, 2016 using questionnaires.

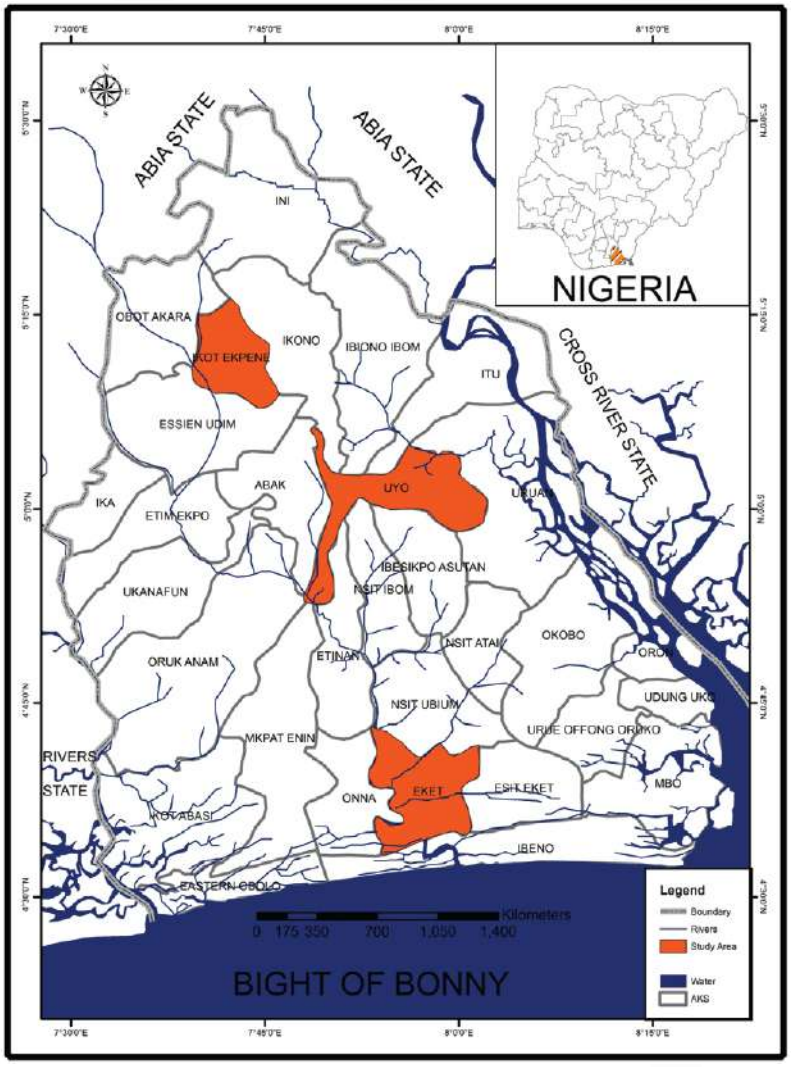

Figure 1: Map of Akwa Ibom State of Nigeria showing Location of Study

Model Specification and Analytical Technique

To estimate the role of higher education in managing the environment, univariate probit model was used to identify key factors including tertiary education likely to affect farmers' decision to adopt environmentally friendly practices.

Table 1: Description of Variables used in the Analysis of the Decision to Adopt an Environmentally-Friendly Practice

Variables	Description
Dependent DTA	Decision to adopt environmentally friendly practices (1=yes, 0= No)
Independent	
Sex	Sex of the farmer (1=Male, 0= Female)
Age	Age of the farmer in years
No formal Education	No formal schooling
Primary Education	Years in primary school
Secondary Education	Years in secondary school
Tertiary Education	Years in tertiary or higher institution
Land Tenure	(D = 1 for ownership of land, 0 for otherwise)
Access to Environmental Information	(D = 1 if yes, 0 if otherwise)
Labour	Labour employed in man days

Theoretical Model

A univariate PROBIT regression model was used to identify key factors most likely to affect the decision to adopt environmental management practices. According to Rahm and Huffman (1984); Hailu (1990); Etim and Dumkan (2016), this model has found several applications in the literature. The model is expressed mathematically as:

$$\phi(\beta\, xi) = \int_{-\infty}^{\beta\, xi} \sqrt{\frac{1}{2\pi}}\, \exp\left[\frac{-t^2}{2}\right] dt \quad - \quad - \quad - \quad - \quad (1)$$

Where $\phi(\beta xi)$ is normally distributed and represents the probability that the ith individual decide to adopt a given environmentally friendly practice. β is a vector of unknown coefficients; Xi is a vector of characteristics of the ith individual; t is a random variable distributed as a standard normal deviate; exp is the exponential function. The probability of adopting a new practice is the area under the standard normal distribution curve lying between $-\infty$ and β Xi. The larger the value of βXi, the more likely an individual decides to adopt an environmental management practice.

Empirical Specification: The univariate PROBIT model is used to identity key factors likely to affect farmers' decision to adopt environmentally friendly practice.

The empirical model for decision to adopt environmentally friendly practice is specified as;

$$Yi^* = P(Yi = i) = \beta Xi + \varepsilon i \quad - \quad - \quad - \quad - \quad (2)$$

Where Yi is the "decision to adopt DTA an environmental management practice, Yi*, the estimated value of Yi, (Yi*=i) if Yi>0, and εi is the error term which follows a normal distribution (mean μ=0, variance σ =1). P is the probability function. β is the vector of parameters to be estimated. Xi is the matrix of explanatory variables that affects the ith farmer's decision to adopt environmental management practice.

The dependent variable Yi or DTA takes a value of 1 for farmers who decide to adopt environmental management practice.

Results and Discussion

PROBIT **Model Estimate Results**

In the study, farm size of resource poor farmers in hectare is used as a proxy for wealth. From the result, the coefficient of the variable is positive and significant (P<0.01). This implies that expanding the size of farmland will likely increase the decision of farmers to adopt environmental friendly practices. Finding is consistent with similar empirical studies by Abara and Singh (1993) Fernandez-Cornejo (1996); Adesina (1996); Onyenweaku et al (2010); Etim and Edet, (2013); Etim and Benson (2016) who reported the positive impact of farm size on farmers decision to adopt environmentally friendly practice. Older farmers are less likely to adopt innovations and vice-versa.

Result in this study showed that age had a positive and significant (P<0.05) impact on farmers' decisions. Age in this study is used as an index for experience as evidence for human capital, indicating that poor farmers with many years of experience have snowballed years of observation and experimentation with different technologies and are more likely to adopt innovations earlier and faster than farmers with lesser years of farming experience. Result conforms with earlier empirical studies by Khai et al., (2008); Aye and Mungatana (2010); Etim and Okon (2013) who posited that increasing farming experience improves

judgmental evaluation of better production and environmental management decisions.

Tertiary education has an elasticity of 0.0815 and significant (P<0.01). The results suggest that farmers who have acquired some form of tertiary or higher education are more likely to adopt and imbibe environmentally friendly techniques or practices earlier and faster than those who have primary or secondary education only. These results support the fact that if higher institutions could provide trained manpower and knowledgeable expertise through environmental education, a number of environmental challenges would be resolved without jeopardizing the use of natural resources in the future. The Results also infer that higher education plays a pivotal role in environmental education and awareness by exposing the younger generation to the issues and information on environment. The Results corroborate earlier empirical reports by Zegeye et al (2001), Chianu and Tsujii (2004); Chirwa (2005) Etim et al (2013) whose findings support the case that higher education and human capital play a positive and significant place in the obtainment and evaluation of environment and agricultural ideas.

Access to environmental information has a coefficient of 0.1108 and is positively significant (p<0.01). This indicate that farmers with access to environmental information through extension contact were more likely to adopt environmentally friendly practices earlier and faster than farmers with less access to environmental information. The results conform to the fact that farmers with access to environmental information have a higher probability to adopt knowledge, skills and processes that would give rise to transformed behaviour in support of an ecologically sustainable environment. The findings are synonymous with earlier empirical studies by Schwarte (2008) that natural resources management can be enhanced if the communities are given information and environmental information play a major role in environmental decision making (Haklay, 1999).

Table 2: Probit Estimates of Farmers Decision to Adopt Environmental Management Practices

Variable	Coefficient	Standard Error	z-test	Marginal effect
Constant	0.0941	0.2651	0.3550	-
Sex	0.6821	0.5121	1.3320	0.1443
Age	0.0082	0.0037	2.2162**	0.0518
No formal education	-0.5713	0.3112	-1.8358*	0.0007
Primary education	0.1133	2.5222	0.0450	0.0426
Secondary education	0.0069	0.0035	1.9714**	0.0136
Tertiary education	0.0815	0.0258	3.1589***	0.0210
Land tenure	0.0144	0.0593	0.2428	0.1186
Access to environmental				0.0625
Information	0.1108	0.0385	2.8779***	0.0313
Farm size	0.0365	0.0098	3.7245***	0.2951
Labor	0.1088	0.0954	1.1405	0.1009

Diagnostic analysis				
Mc Fadden R-squared	0.8120			
Log-likelihood	-22.6864			
Normality test	6.1433 (0.0802)*			

Note *, **, *** represent significance at 10%, 5% and 1%

Conclusion

The study determined the relationship between higher education and environmental management. Tertiary or higher education was revealed to play a significant and positive role on farmers' decision to adopt environmentally friendly and sustainable management practices. Access to environmental information through extension contact also positively influenced farmers' decision to adopt environmentally friendly practices. In this study, higher education has been identified as an important driver of change, and our nation's future relies on a well-educated public to be wise stewards and custodians of the environment that sustains it. Our higher institutions` should be more responsive in creating awareness through environmental education, media sensitization and also by providing solutions to lingering environmental challenges.

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SELECTED **PAPERS**

HIGHER EDUCATION AS A TOOL FOR PROMOTING DEMOCRATIC GOVERNANCE

- Higher education and promotion of democracy through the breaking of prison bars

SUB-THEME 4

14TH GENERAL CONFERENCE & 50TH ANNIVERSARY
CELEBRATIONS OF THE AAU

HIGHER EDUCATION AND PROMOTION OF DEMOCRACY THROUGH THE BREAKING OF PRISON BARS

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Abstract

The study was meant to establish the extent to which prisoners in Zimbabwe access education. Prisoners are a special group who have democratic rights to equitable access to all basic benefits that society offers. Whilst Zimbabwe has been observed to put effort in empowering prisoners in various practical areas, this study gathered that the country had not yet realized better processes of enabling prisoners to attain university degrees or qualifications as well as other vocational skills offered outside prison walls. Zimbabwe is signatory to the United Nations Declaration Charter for human rights which regard education as a basic human right that should be provided to all. The country is also striving to fulfil goal number two of the Millennium Goals, which focuses on universal education. The gap noted is that, prisoners in Zimbabwe are denied the opportunity to study in conventional institutions while serving their term. This is because conventional institutions do not have special educational facilities to reach out to people behind bars.

The study gathered through focus group discussions, interviews and literature reviews, that those inmates in Zimbabwe's major prisons such as Chikurubi and Hwahwa receive primary and secondary education as well as vocational training, whilst small prisons like Bindura 'Chawagonahapana' rehabilitate inmates in the form of entrepreneurial skills development. While this is so, inmates are short changed in pursuing diploma and degree qualifications or vocational trainings that are outside what is offered by the Zimbabwe Prison Services. Higher education can be utilized as a tool for promoting democratic governance in Zimbabwe and Africa as a whole. This is through utilization of Open and Distance Learning Models (ODLM) that have emerged in the higher education fraternity. As part of rehabilitation and empowerment processes, it is recommended that, Zimbabwe Prison Services (ZPS) and other prison services in Africa initiate collaborative approaches with Open and

Distance Learning Institutions (ODLI). The Open and Distance Learning mode is the bolt cutter that can break the prison bars and liberate inmates.

Key words: Inmates, Access, Inclusion, Education, Open and Distance Learning.

Background

Higher education as a tool for promoting democratic governance is called for in mobilising processes that allow inclusion of people from diverse backgrounds to realise their educational potential. Inmates are a special population that demands attention in attainment of higher education whilst serving their term. According to the Dakar World Education Forum (2002), the basic principles for the treatment of inmates or prisoners include provision for further education and education of the illiterate so that they can be integrated or seek gainful employment after their release. This means that, in addition to it being a human right, education, if provided to prisoners, can help in the reintegration and rehabilitation process. But it appears for most inmates in Zimbabwe and Africa as a whole, a prison sentence means deprivation of the right to adult education. In this competitive market place, nations are striving to maximize the potential contribution of all their members; hence the exclusion of a significant number of people in academic pursuance impedes this goal and weakens the overall economic potential of a country. Thus one avenue by which prisoners can effectively be empowered as well as to readily gain employment and compete for positions at higher levels is to compete through academic attainment or through undertaking vocational education and training.

Based on this background, the study sought to find out to what extent higher education has reached out to inmates in Zimbabwe and the following questions guided the study:

- What educational provisions are there for inmates or convicts in Zimbabwe?
- Do inmates have access to diploma and degree programmes?
- Do inmates have the freedom to study programmes beyond prison walls?

Review of Related Literature

In 1996 and 2002, the Kampala Declaration on Prison Conditions in Africa and the Ouagadougou Declaration on Acceleration Penal and Prison Reform in Africa were both adopted respectively (African Commission on Human and Peoples' Rights, 1996). Both instruments strive to improve the conditions of African prisons. At international level, the Council of Europe adopted the European Prison Rules developing transparent and consistent prison policy (UNAIDS 2013). However, even if the African Union were to adopt similar guidelines, insufficient resources and instability plagued the implementation of any proposed reform. According to Steinberg, (2010) health data in many African prisons is not as readily available as is in the United States, but evidence suggests that the trends are similar. A number of researches (United Nations, 2011; Viljoen, 2014; Cherubin-Doumbia, 2004) revealed that

diseases are more prevalent among African prison populations as opposed to free populations. For example some estimates from South Africa place the HIV infection rate amongst its prisoners at two times that of the general population (Viljoen, 2014). Adjei, Armah, Gbagbo, Ampofo, Quaye, Hesse and Mensah concur that even the HIV prevalence rate among Ghanaian prison guards has been found to be higher than that of the population at large. More so, African prisoners were also found to suffer disproportionately from abnormal deaths. According to Sarkin (2008), in 2002, at least 100 Ghanaian prisoners died of mal-nutrition and diseases resulting from lack of sanitation and overcrowding and prisoners in Kenya, Nigeria and Ethiopia have died as a result of similar conditions.

Thus Dissel and Ellis lament that, despite the grave consequences of overcrowding in African prisons, prison capacity has not increased nor have prisons been renovated or privatized as they have in North America and Europe. While privatization has yet to reach Africa, other means of reform have been implemented in some countries. In 2006, Nigeria for instance released twenty-five thousand prisoners, some of whom had been awaiting trial for a decade (UN, 2008). Whilst this move was noble, there is a danger of released inmates recommitting crimes because of lack of empowerment. As long as issues making people commit crimes are not addressed, there is no guarantee that released prisoners are not going to reoffend. Thus the issue of over-crowding is most likely to be a vicious cycle as released prisoners are likely to commit crime when they get back in society and be imprisoned again. In such a scenario, prisons in Africa will remain overcrowded. According to World Prison Brief (2015), the conditions of prisoners in many African countries are afflicted by severe inadequacies including, high congestion and poor sanitary conditions.

While there is no excuse for the conditions in which African prisoners dwell, reviewed literature seem not to be bringing out rehabilitation strategies that can correct the situation of overcrowding in prison which includes empowerment and change of mindset among individuals. In this regard, Higher Education can be more proactive and play a larger role in mitigating overcrowding prison conditions. This can be done through giving inmates education and opportunities they wouldn't have previously had access in order to benefit them in their lives after their release.

The United Nations Universal Declaration on Human Rights and the Standard Minimum Rules for treatment of prisoners are some of the agreements ratified by several countries recognizing the need to educate prisoners (Dakar World Education Forum, 2002). According to the UN (2009), the basic principles for the treatment of prisoners include, provision for further education for prisoners and education of illiterate prisoners so that they can be integrated into the educational system and become employable after serving sentence.

Two-thirds of released adult male prisoners in England are reconvicted within two years (Bynner, 2009; Sculler, 2009). The reason could be that, they may have lacked maximum rehabilitation in terms of behaviour change or socio-economic empowerment. Education for prisoners is important, not only as a basic human right, (USIS,1998) but in order to break

the cycle of reoffending by providing qualifications and skills for employment on release (Department of Business, Innovation & Skills [BIS], 2006) and by providing social and human capital (Gerald,2008; Schuller,2009; Hughes,2007). This is to say, returning home with confidence and hope, ex-inmates are able to find and hold satisfying jobs in a range of fields. Thus regardless of the path they choose, all are radically less likely to return to prison and are far better prepared to lead productive and fulfilling lives when free.

Research Methodology

The study was a non-experimental; it lent itself towards qualitative research methodology. A qualitative approach to research is an approach that advocates the study of direct experiences taken at face value (Cohen, Manion and Morrison 2010; Creswell, 2013). In other words, the methodology was based on the assumption that, behaviour is determined by the phenomena of experiences rather than by external objective and physically described reality. Grounded theory was used for this research. Convenient sampling and snowballing was used to select ex-convicts and prison officer whom were individually interviewed. Raw data gathered from interviews was analysed by using descriptive techniques. In order to increase credibility of the findings, direct responses were highlighted in the paper to reflect observations and major views of interviewed individuals. Data saturation was reached on the tenth inmate and three prison officers respectively. Received data were summarized and interpreted based on predetermined themes.

Data Capture and Analysis

In-depth interview was the tool used to collect evidence on the following variables:
- Educational opportunities of inmates.
- Inmates' access to post-secondary education.
- Inmates' freedom of study choice.

Sources of evidence that was documented in this study included tape-recorded interviews. Data were collected from a single interview and group type interview. Single interview means an individual interview, whilst a group-type refers to interviewing a group of people with common characteristics, for example, ex-convicts from different prisons in Zimbabwe. The perceptions of these ex-convicts and prison officers were analysed to determine data patterns which became the basis of the conclusions of the research.

The coding system was used. The researcher went through five stages or phases of analysis as indicated in table 1 below and came up with findings as presented in this paper.

The analytic tools used were commensurate with obtained qualitative data as is indicated below;

Table 1: **Phases of Analysis**

Tool	Description of use
Stage 1	Researcher met individual ex-inmates and prison officers to find out on their experiences on inmates educational opportunities and challenges.
Stage 2	Group meetings with ex-inmates to share experiences and discuss emerging themes, opportunities and challenges of inmates' access to education.
Stage 3	Changing of data into text, verbatim, in preparation for coding process.
Stage 4	Coding - Searching for main categories and sub-categories. Data was coded exhaustively capturing the main variables of the study which were educational opportunities, freedom of study and educational challenges.
Stage 5	Presentation of Findings - a narrative account was constructed around the main themes of study.

Demographic Characteristics of Participants

Below are profiles of inmates who participated in the individual and group interviews. It presents their pseudo names, gender, alleged crimes committed, marital and social status and level of education.

Table 2: **Individual Interviews: Profile of interviewed ex-inmates N=10**

Pseudonym Names	Gender	Age	Alleged Committed Crimes	Marital Status	Level of education before imprisonment	Sentence Served
No problem	male	33	House Breaking	married	O Level	5
Gringo	male	27	Theft	single	Form 1	3
Nomatter	male	45	Theft	divorced	Grade 7	2
Gafa	female	29	Assault	single	O Level	1
Airtime	male	29	Alleged rape	single	Diploma	25
Cellphone	female	26	Violence	single	A Level	3
Smiley	female	35	Theft	single	O Level	2
Situation	male	24	Alleged rape	single	O Level	15
Network	male	31	Shop break	single	O Level	6
Hardlife	male	47	Theft	married	Form 2	5

From Table 2, it can be depicted that the majority of individuals who participated in the study aged between 24 to 47 years. The majority of participants served terms that ranged

between 1 to 6 years and these can be considered as short term sentences. What this suggests is that the majority had the chance to go back into society sooner and continue with their day to day activities. Only two participants had had extreme sentences, that is 15 years and 25 years, but they had also served their years in prison and were back in community. Though they served their term differently, what can be noted is that they were all below and within middle age period. Twenty-four to forty-seven is a very critical age in terms of production, hence such ages need to be empowered educationally. Job retirement age according to the Zimbabwe labour laws is 60 years to 65 years.

Below are profiles of prison officers who participated in the individual and group interviews. It presents their pseudo names, work experience, age and gender.

Table 3: **Individual interviews: Profile of interviewed Prison Officers N=3**

Pseudonym Name	Work Experience	Age	Gender
Mr. Health	10 years	35 years	Male
Mrs. Cremora	6 years	28 years	Female
Mr. Guava	15 years	38 years	Male

Table 3 shows that, all participants had worked as prison officers for more than five years. This suggests that they had adequate knowledge of the systems, procedures and experiences of prison environment. More work experience made information sourced from them credible.

Findings: Experiences and Perceptions from Former Inmates

Wide evidence was gathered from former inmates through individual interviews and focus group discussions that there were limitations on the education of inmates. Though the researcher could not access those currently in prison due to Zimbabwe Prison and Correctional Services (ZPCS) security reasons, valuable information was sourced from inmates who had just left prison. Snowballing technique assisted in reaching out to those who had recently been released from prison hence information on current educational activities was obtained.

a. Inmates Educational Opportunities

Most data captured revealed that inmates did not have substantial or equal access to adequate educational opportunities. This inadequate access was expressed by a number of respondents. Some of the sentiments are captured below:

- Some of our colleagues were able to write their 'O' and 'A' Levels whilst serving.
- I did my 'O' Level whilst I was in prison.
- It depends on one's background, those with sound financial resources can study.

Personally, I couldn't because there was nobody to fund me.
- The environment is not friendly for study even if I would have wanted to.
- The opportunities are there especially for studying up to Form 4.

What the above entails is that, in Zimbabwe, there is that allowance for inmates to study. That allowance is however thwarted by many challenges which included funding.

b. Inmates' Challenges in Accessing Post-secondary Studies.

Participant's views on access to post-secondary studies were sought. Below are some of their responses:

- Some of us wanted to, but it is not easy to study for a diploma or degree whist in jail, there are no resources for such.
- The problem is, you need to go to university to study for a degree and there are no university programmes in prisons.
- Even if I wanted to, I did perform poorly at secondary level. I could not be employed due to poor results at school, hence I had to be self-employed in the form of house breaking (laughs). Sorry about that, I have reformed.
- I hold a Form 4 certificate with good passes. My parents passed away a few months after I had written my Ordinary Level exams and that was the end of my academic life. I had siblings to feed so one thing led to another and I ended up in jail.
- I had no one to finance my college education and I needed food so the only source of income was my body. I condemn this way of life because it led into violent behaviour which saw me getting arrested.

In general, the respondents concurred that whilst they could have loved to pursue their education, circumstances unique to each one prevented them. Whist a few admitted that they were not academically gifted, the underlying main challenges that were brought out was poverty. The researcher wanted to find out if the participants would have loved to study if they were given the opportunity to study for a diploma or degree. These were some of the responses:

- I would have loved to, but then my qualifications are below the entry requirements. I have 3 'O' level passes.
- A! Mother, who would want to miss that opportunity.
- Imagine I served 12 years in prison and I came out with nothing gainful. I'm not saying prisons are colleges but I feel their rehabilitation programmes should remove that which saw some of us behind bars. Of course I can't rule out agricultural skills but I would have loved to acquire more skills in the form of a degree. I need to be gainfully employed, I'm sick of prison life.
- Surely I could have accepted there and there.
- That could have been great for me. I was a teacher and I was studying for a degree

through ODL but could not continue because I got arrested. Anyway, I intend to continue when I settle.

c. Inmates Freedom to Choose Programmes for Study

From discussions and interviews with ex-inmates, it was gathered that most prisons in Zimbabwe do not offer diplomas and degrees to inmates who qualify to do such studies. Some of the sentiments are captured below:

- I think degrees are attained by those housed at bigger prisons such as Hwahwa and Chikurubi.
- No, not at all. But most are taught agriculture, sewing, woodwork, music etcetera. I did agriculture.
- At …(name of prison mentioned), we were all made to concentrate on vocational skills courses offered there.
- We concentrated on agriculture and sewing so that we sustained ourselves during our stay there.
- Our main focus was on practical activities such as agriculture, music, carpentry, sewing, cooking to mention some. But we were not given certificates for that, they were meant for sustaining us.
- I think it is not easy for people serving short sentence to study for a diploma or degree even if resources are available because they may leave prison before they are through.

Findings: Experiences and Perceptions from Prison Officers

On the issue of access to education by inmates, interviewed prison officers gave their views. Some of the sentiments are captured below:

- Inmates are given access to academic education. In fact, academic education is provided in the form of general education or literacy classes.
- Some inmates leave prison with 5 'O' levels or more while some attain their 'A' level qualifications there.
- O, yes, skills development is part of rehabilitation and correctional services. We offer up to vocational services. We offer education to inmates at whatever level, as long as the inmate's family have the resources.
- Yes, inmates can pursue a diploma or degree but they have to source funds.
- Sure. But I have noted that only those from economically sound backgrounds enjoy this facility. Most convicts as I have observed come from low income backgrounds and cannot afford.

On the issue of funding opportunities, it was noted that no company or donor is interested in funding education of inmates. The comments below suggest the above:

- The funding facility is there but it only comes from the government which is already overburdened with other responsibilities and this affects our coffers. They are in most cases empty.
- Iripo asi yava yezita (literary meaning, the funding facility is there but the coffers are at most times empty),

On access of inmates to academic programmes offered beyond the prison walls, some of the prison officers' responses were;

- Yes, 'O' level and 'A' level for example are offered by outside institutions and inmates do the studies through correspondence.
- For 'O' level and 'A' level, yes. But for post-secondary qualifications, inmates take up programmes offered by the prison services.

The findings suggested that for post-secondary education, inmates are made to make do with vocational services provided by a particular prison where they will be serving their sentence. Some of the comments which suggest the above are captured below:

- Zimbabwe Prison and Correctional Services (ZPCS) usually offer practical or vocational services in the likes of agriculture, sewing, woodwork, music to mention a few.
- We offer correctional programmes and those that may enable them to be self-employed e.g agriculture, woodwork etc.

In a group interview with ex-inmates, it was gathered that most inmates had interest in developing themselves academically or vocationally if given the opportunity, but the challenges that were revealed by most was on access to education facilities. Responses from both ex-convicts and prison officers reflected that whilst education facility for inmates is availed in Zimbabwe, it is mostly in the form of literacy development, secondary education and practical skills. Post-secondary education is a challenge to be accessed as it is expensive to most prisoners and more so, it is not easy to access conventional institutions which offer diplomas and degrees. Instead, Zimbabwe Prison and Correctional Services (ZPCS) has put in place limited post educational programmes that it offers and these are mainly practical subjects such as agriculture, music, wood work, sewing and a few others.

Main Themes that Emerged from Individual and Group Interviews

Main themes and subthemes were noted during interviews. These are presented below:
- Most inmates in Zimbabwe have the opportunity to do 'O' and 'A' levels, but face challenges of accessing college or university education.
- Most inmates cannot access post-secondary programmes offered outside prison walls.

• Financial constraints affect inmates' endeavour to further studies.
• Inmates mostly make career choices within the range or limit of rehabilitation programmes offered by a particular prison.
• Most prisons emphasise on rehabilitating their inmates through practical programmes such as woodwork, carpentry, building, dress making, food and nutrition, music and agriculture.

Findings: Inmates and Access to Education in Zimbabwe

This research revealed that Zimbabwe Prison and Correctional Services (ZPCS) are making great efforts to rehabilitate inmates so that they may be able to fit and be integrated into society after serving sentence. This is through basic literacy whereby illiterate prisoners are taught how to read and write, ordinary and advanced level, vocational training. It was noted that academic education is provided in the form of general education or literacy classes. These enable inmates to learn to read, write and perform basic mathematical computations. This is especially important in correctional setting and for rehabilitation purposes. As was pointed out by one prison officer, most inmates are under-educated and most come from poor backgrounds and have little or no experience in vocational skills.

More so, rehabilitation and reintegration of most prisons in Zimbabwe is in the form of giving inmates access to primary and secondary education as well as access to vocational trainings in the form of practical programmes. In such instances, inmates are offered courses in agriculture, woodwork, music, peace-keeping, non-violence and human rights, meant to promote their self-esteem, tolerance and conflict management skills. Such educational programs offered inside prisons are typically provided and managed by the prison systems where they reside. The goal of such activities is to prepare the prisoner for success outside prison and to enhance the rehabilitative aspects of prison. Funding for the programs is provided through official correctional department budgets and the prisoners or their families. Educational opportunities have been observed to be divided into two general categories, viz, academic education and vocational training. The whole idea of such programmes is to give prisoners or inmates in Zimbabwe another chance.

In a discussion with some prison officers at an exhibition show, it was noted that, some prisoners were attached to some agricultural institutions and they receive necessary education and skills in agriculture that help them later to smoothly be integrated in society. Female prisoners are taught income generating skills such as sewing, bread making etc. There are education officers responsible for these programmes. The methodology used in the prisons involves the use of internal trainers who are part of the prison service staff. Prisoners use the participatory approach whereby they carry out discussions on their own in addition to day-to-day practical learning and tutorials.

Whilst this is so, it was noted through individual and group interviews that for post- secondary education, inmates were not free to choose programmes offered outside the prison

walls because they were not easy to access. More so, most inmates had limited source of finance. Smaller prisons on the other hand are said to find it difficult to offer educational courses. The reasons are mainly because the prisoners in latter prisons come for short term sentences therefore it is difficult for them to start new programmes as they might not complete them. In addition, some of the prisons do not have the required infrastructure for educational purposes. Thus there are limited choices of academic and vocational attainment offered to inmates. The findings revealed that whilst efforts are being made by prisons in Zimbabwe to empower inmates with vocational skills, these skills are limited in that; prisons make do with resources within their reach. The study noted that, mostly, prisoners are equipped with practical skills such as agriculture, sewing etc which are offered by a particular prison. Inmates fail to access Higher education facilities because they cannot access conventional universities whilst serving sentence.

Conclusion

The study concluded that most inmates in Zimbabwe face challenges of accessing colleges or university education. Career choices are based on limited programmes offered by particular prisons. Most prisons emphasise on rehabilitating their inmates through practical programmes such as woodwork, carpentry, building, dress making, food and nutrition and other income generating programmes. There was less emphasis on post-secondary programmes such as diploma and degree programmes.

Higher Education and Democratic Governance through Education of Inmates

Higher education can be a tool for promoting democratic governance and for mobilising processes that allow inclusion of inmates in post-secondary education studies, thus empowering them for gainful employment after release. This in turn may reduce crime and overcrowding in jails. Zimbabwe and other African countries with similar situations can use higher education as a tool to reduce overcrowding in prisons. Research indicates that high and expensive rates of recidivism fall to less than 22% if significant educational opportunity is offered to inmates (Bell, 2011). Ministry of Higher Education in Zimbabwe should hence close the gap of crowded prisons by working in partnership with the Zimbabwe Prisons Correctional Services in empowering inmates through education. Democratic governance calls for processes that reach out to all. Higher Education institutions such as universities should redesign their paradigm and desist from 'brown paper' type of education, but encourage their students and their institutions to participate in solving problems faced by their communities. Universities and colleges that offer diplomas and degrees through Open and Distance Learning mode (ODL) can be utilized. Open and Distance mode in Higher Education can be central in enabling people in special circumstances, such as inmates to make academic achievements because the model is not limited to the walls of the classroom, it can break the prison bars and reach out to the inmates. Prisoners cannot attend lectures in conventional universities while serving sentence. Thus Open and Distance Learning institutions in Zimbabwe can embark on a university community partner-

ship so that a smooth coordination in the learning of inmates is enhanced. In other words, higher education can play a critical role in the mobilization of prisoners so that when they are mainstreamed, they can make a meaningful contribution to society. This is to say, democratic governance in higher education can be enhanced by utilizing models that break prison bars and reach out to inmates.

Inmates need vocational training and academic education for easier reintegration into society after release. However, sceptics may argue that prison education is most likely to produce nothing more than better educated criminals. But many studies have shown significant decreases in recidivism. An American study for instance found that, one million dollars spent on correctional education prevents about 600 crimes, while that same money invested in incarceration prevents 350 crimes, (Bozos and Hausman, 2004). Such findings suggest that correctional education is almost twice as cost-effective as a crime control policy. Nicaragua and Burkina Faso have been observed to make great strides towards providing prisoners with education whether general education or vocational training courses (Hammersley and Atkinson, 2007). Thus such educational empowering stance should be adopted by Zimbabwe and other developing countries too. However, Hammersley and Atkinson (2007) lament the abuse of prisoners which is still rampant in most countries world over. Such situation has made it very difficult to advocate for the provision of education to this special population.

Such stereotyping tendencies and negative attitude towards inmates has seen their plight rarely noticed by most countries. Yet they include the most downtrodden and vulnerable babies and older children imprisoned with their mothers, the mentally ill as well as the innocent who failed to prove their innocence in courts. The point is, not all inmates in prisons world over committed crime. Even if they did I feel prisons should be places of positive transformation and that entering prison should not mean losing hope. In other words, deprivation of freedom need not mean deprivation of humanity. Thus education as a human right issue should be given priority. It should not be an alternative but governments should put efforts in providing individuals education of their choice. This can be through putting in place loan facilities where inmates who so wish to access advanced programmes can access such loans and study Higher Education programmes through ODL.

Higher Education institutions in Zimbabwe for instance, can play significant role in offering short courses for prisoners who are on short term sentence as is the case of small prisons like Bindura 'Chawagonahapana.' There can also be arrangement between ZPCS and ODL institutions such as Zimbabwe Open University (ZOU), a state university, to ensure that prisoners continue and complete their courses after release. For inmates on long term sentences, ODL universities can collaborate with ZPCS so that strategies are put in place that enable an effective provision of various education programmes. Through collaborative efforts by higher education ODL institutions and ZPCS, free education can be presented to a stipulated number of inmates who show great reform and commitment to studies. This

may act as a corrective and rehabilitative measure that other inmates may so wish to emulate for benefits attached. As part of the rehabilitation process, awareness campaigns for inmates on the value of education can be organised so that they see the value of education in empowering them. This is vital in increasing numbers of prisoners undertaking higher education certificates, diplomas and degrees for empowerment purposes.

Prison education has a democratic effect. Some inmates in Turker (2011) used the concept of rehabilitation and their educational achievement as a springboard to freedom. Taylor who received his bachelor's degree, masters and doctoral degrees behind bars in a maximum-security prison, appealed to the governor to grant clemency for becoming a changed man (Dacher, 2011. Also, a student inmate in Nussbaum (2011) had this to say,

'When faced with a confrontation, I walk away. I don't let them bother me ….I don't react to everything they say. In the past I would have fought the girl, [but now] I don't have want to lose this degree programme I'm being sponsored for', (Nussbaum, 2011:14)

This implication of the inmate student's assertion is that, studying for a diploma or degree becomes something for inmates to live for and an incentive to be a better person. Higher education programmes in this case can contribute in modifying inmate's behaviour to a more positive one; it is the logical view of incarceration.

Thus collaborative education projects between higher education institutions in Zimbabwe and ZPCS can be put in place to promote learning of inmates through technology. These institutions can liaise with the Ministry of Science and Technology as well as the Ministry of Communication and Technology so that appropriate software with guaranteed security are installed in prisons for educational use. Solid technological infrastructure is an institutional barrier that needs to be overcome to enable engagement with e-learning in excluded groups, (Egnon and Helsper, 2011). For Zimbabwe, use of the e-learning mode for inmates may be feasible as long as resources are made available. The researcher found out that Prison Officers in Zimbabwe are furthering their studies at local universities and such behaviour can cascade to the inmates as the knowledge gained can benefit them. The higher education ODL institutions, as is the case with ZOU can employ such prison officers as part-time tutors and enhance them with basic e-learning skills so that they may in turn assist inmate students studying through ODL.

Educators in higher education institutions may also need continuous professional development and support in the use of appropriate teaching and learning technologies. Assumptions however cannot be made that appropriate technology is always available. As such lack of Internet access may inhibit distance learning but should not prohibit it. Traditional channels of communication in distance learning still exist and can also be utilized if required (self-study, print (modules) and non-print materials, group work tutorials) so that inmates access relevant education they may require and of their choice. Higher Education institutions and Zimbabwe Prison Correctional Services, for instance, can make arrangements for

lecturers to provide face-to-face tutorials for prisoners so that grey areas in their modules are explained and this can be a minimum of three times per semester. If given the chance to enhance themselves academically and vocationally, prisoners may have a greater chance of living healthy and productive lives that benefit them and society after their release.

While Zimbabwe, like most African countries is in transition from political and economic challenges, its challenges have been noted to be magnified within its detention systems, thus thwarting maximum support to inmates' education. According to ex-inmates, of late, the country has been concentrating on the welfare of inmates in the form of food provision and medication. Now that the economy has become more stable, crime can be minimized by empowering prisoners through provision of life skills or appropriate education that may enable them to be integrated into formal or informal employment.

End Notes: This research was motivated by an in-law who was imprisoned for 12 years. After he had served his term, he did not bring with him any additional qualifications that would have enabled him to be integrated in the employment sector. Meanwhile, family members had been taking care of his daily needs with the hope that soon he would be self-sustained through farming. He was a security guard during the time of conviction and we noted with concern that he had not improved himself in terms of career development for the past 12 years.

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SELECTED **PAPERS**

MOBILISING RESOURCES FOR HIGHER EDUCATION IN AFRICA

- Developing and promoting open scholarship for researchers in africa

- Sustainable survival strategies in a volatile economic environment_a case of zimbabwean universities

SUB-THEME 5

14TH GENERAL CONFERENCE & 50TH ANNIVERSARY
CELEBRATIONS OF THE AAU

DEVELOPING AND PROMOTING OPEN SCHOLARSHIP FOR RESEARCHERS IN AFRICA

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Abstract

Access to scholarly resources and participation in the creation and use of the world's knowledge are among the challenges facing African researchers and students. 'Through Open Access (OA), researchers and students from around the world gain increased access to knowledge, publications receive greater visibility and readership, and the potential impact of research is heightened (Swan 2012, p3). Hence, for developing economies like Africa, the OA concept is brilliant and comes as a windfall. However, most of the champions and strong advocates of OA continue to be in the Western world and other advanced countries (LSE, 2015).

This paper promotes OA as an economically sound option to the traditional regime of paid-access to the world's knowledge output. In particular, it facilitates an understanding of some issues related to OA and examines three strategies that promote OA. Open scholarship in its various forms is explored. Advocacy activities are highlighted as themes that need to be picked up by academic librarians and/or university research offices. The paper also highlights value-added OA resources and notable examples of how librarians are making OA resources visible and accessible.

Introduction and Background

There is renewed attention by the African Union (AU), the African Development Bank, and the World Bank to position tertiary education on the development agenda in Africa. The establishment of the 'Pan African University' by the AU aims to take tertiary education and research to a higher level. Development players, policy makers, and relevant organizations concur that higher education must be centrally placed in the strategic development plans

of African nations for a meaningful and sustainable economic development to take effect (Teferra 2014; cited in AAU, c2016). With the world increasingly moving toward a knowledge economy, higher education helps economies keep up and catch up with more technologically advanced societies. This is because the creation and transfer of scientific knowledge are critical to building and sustaining socio-economic welfare and integration in the global economy. Ultimately, no region or nation can remain a simple "user" of new knowledge but must also become a "creator" of new knowledge. Closing the innovation gap is a necessary role of universities; innovation and technology transfer must become important missions as teaching and research (UNESCO, 2010; cited in AAU, c2016).

It is welcome news to see the unprecedented expansion in African higher education which is unparalleled in the last decade. This carries a solid promise in situating Africa as a significant, even critical player, in the global knowledge society if expansion is concurrently augmented with quality. According to a recent study (Teferra, 2015; cited in AAU c2017), Africa now boasts 20 million students in its higher education system studying in around 2,000 institutions. In Ghana for instance, there were less than 10 universities until the early 1990s with no single private university. Today, Ghana has 75 private universities, and 12 public universities (NAB, 2017). Teferra (2015; cited in AAU c2016) however notes that it is insufficient merely to increase the number of graduates but stresses a corresponding improvement in quality.

Prominent among the challenges of African researchers and students are access to scholarly resources and participation in the creation and use of the world's knowledge. It is a must that resources need to be provided in sufficient amounts on a regular and predictable manner, if [African tertiary] institutions are to operate at an acceptable level of academic competence fitting the competitive global knowledge economy (Teferra, 2013; cited in AAU, c2016). It is imperative that the resource base of higher education institutions, especially in Africa, is both expanded and consolidated. (Teferra, 2013; cited in AAU, c2016). 'Through OA (OA), researchers and students from around the world gain increased access to knowledge, publications receive greater visibility and readership, and the potential impact of research is heightened (Swan 2012, p3). Hence, for developing economies like Africa, the OA concept is brilliant and comes as a windfall. Yet most of the champions and strong advocates of OA continue to be in the Western world and other advanced countries (LSE, 2015).

This paper discusses open scholarship in general and situates OA in the context of a developing opportunity for economies like Africa that face challenges in their efforts to compete in the world's knowledge economy.

Open Scholarship

According to the Association of Research Libraries (ARL), Open scholarship which encompasses OA, open data, open educational resources, and all other forms of openness in the

scholarly and research environment, is changing how knowledge is created and shared (ARL, c2017). For higher education in Africa, open scholarship offers opportunities for growing their institutional capabilities to compete favourably in the world's knowledge economy. Open Educational Resources (OER) "are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge" (ARL, c2017). Examples of OERs are Coursera, MITOpen CourseWare, and MOOCs (Massive Open Educational Courses).

Open Access (OA)

According to UNESCO (2012), a number of issues contribute to the importance of OA:

- There is a problem of accessibility to scientific information everywhere
- Levels of OA vary by discipline, and some disciplines lag behind considerably, making the effort to achieve OA even more urgent
- Access problems are accentuated in developing, emerging and transition countries
- OA is now joined by other concepts in a broader 'open' agenda that encompasses issues such as Open Educational Resources, Open Science, Open Innovation and Open Data
- Some initiatives aimed at improving access are not OA and should be clearly differentiated as something different.

The benefits of OA come in many forms. OA: improves the speed, efficiency and efficacy of research; is an enabling factor in interdisciplinary research; enables computation upon the research literature; increases the visibility, usage and impact of research; and allows the professional, practitioner and business communities, and the interested public, to benefit from research. OA is achieved by two main routes:

- OA journals, the 'gold' route to OA, are a particularly successful model in some disciplines, and especially in some geographical communities
- The 'green' route, via repositories can capture more material, faster, if the right policies are put in place. Additionally, 'hybrid' OA is offered by many publishers: this is where a fee can be paid to make a single article OA in an otherwise subscription-based journal.
- Other ways of making research outputs, including articles and data open are by posting them on publicly available websites such as research group site, departmental websites or authors' personal sites.

Author Concerns about Open Access

Authors have many OA concerns, for instance they worry about whether they are allowed to make their work OA because of copyright restrictions imposed by their publishers. They

also worry about how easy it might be to deposit an article in their repository. Some mistakenly think OA equates to vanity publishing – paying to have your article published. This is not the case as OA journals employ the same peer review practices as traditional toll-gate journals. Other commonly mistaken concerns include: preservation – archived e-prints may not continue to exist or be accessible in perpetuum on-line, just like on-paper; authentication - you can never be sure whether you are reading the definitive version of an e-print online, the way you can be sure on-paper; corruption- e-prints can be altered or otherwise corrupted online in ways they could not be corrupted on-paper; certification - papers are not certified on-line the way they are in a journal on-paper; evaluation - there is no evaluative process on-line as there is on-paper; paying the piper- someone surely has to pay for all this: you cannot get something for nothing; downsizing – it may force journal publishers to shrink to a non-sustainable size, and then where would we be? Plagiarism – it is so much easier to steal someone else's text on-line, and publish it as one's own than it is to do on-paper. It is because of these concerns that every effort should be made to promote OA.

Strategies that Promote Open Access

Strategies to promote OA fall into three main categories - policy-oriented, advocacy-based and infrastructure (UNESCO 2012). There is no doubt that policy development by significant research funders, institutions and other organizations has increased awareness on OA and accelerated its development where the policies apply. Policies serve to promote the aims and objectives of OA, to engender interest and action and to serve as examples for others. The overall objective of any policy guidelines is to promote OA by facilitating understanding of all relevant issues related to the concept.

Advocacy activities like the celebration of OA Day and OA Week are events that highlight the importance of OA to the academic community. These themes can bring countless benefits as they promote OA to peer-reviewed work, the new norm in research and scholarship. Championed by the library, such events can be organized with the university graduate school or research office. Advocacy is not limited to dedicated organizations, though. It takes place on the ground, locally across the world. 'The launch of OA Day in 2008 by the Public Library of Science was so successful that the next year the event lasted a week and has done so ever since. In 2010, OA Week involved thousands of events in 90 countries and the movement is growing even bigger (UNESCO, 2012, p 42). Strategies based on advocacy have focused on two main things – creating an evidence base for the benefits of OA, and making the case to policy makers, funders and research managers. The research library community [mainly in the Western world] has a strong voice in OA advocacy, as would be expected. The Scholarly Publishing and Academic Resources Coalition (SPARC) and its European and Japanese counterparts is a highly effective advocacy organization that has effected change at many levels. The European Research Library Network (LIBER) and Electronic Information for Libraries (EIFL) are both strong advocates of OA.

Open Access can only be fully achieved if the right infrastructure is in place to enable global access and true interoperability. What has been achieved so far is the establishment of a web-based network of repositories and OA journal collections, supporting organizations that set and uphold technical standards, develop technical solutions for outstanding problems and promote OA (UNESCO, 2012). Free Open Source Software (FOSS) is available for educational institutions to build their ICT infrastructure. Invariably, however, there is a need for computer laboratories to conduct basic computer classes, allowing students to complete their assignments, conducting specialized ICT classes, providing access to the library system, making available learning management systems and facilitating email communications (Wooi Tong, 2004).

Adding Value to OA Resources

There are several ways in which OA resources can be made visible and accessible to the researcher. The library at St. Margaret College in Ghana has created a portal for OA resources providing access to peer reviewed journals from multiple sources, including Directory of OA Journals (DOAJ), Bioline International, SCIRP, RPJ, and AJOL (see Appendix). Relevant textbooks and e-books can be accessed free from Bookboon. A portal for lecturers contains online courses like MIT OpenCourseWare and Coursera, Harvard citation style from Anglia Ruskin University, and PaperRater, afree online plagiarism software.

Academic librarians are eager to orient patrons to free and OA materials in their databases, digital repositories and websites. These materials include journal literature, textbooks and open educational resources. 'Discovery of OA content has been improved by catalogues that index open metadata and link resolvers that point to quality internet resources' (Martin, 2010). Librarians and staff save money and patrons' time by helping them find open course materials and scholarly works, and the library benefits from reduced subscription costs and by promoting local intellectual capital.

Bhatt's (2010) paper is a summary of a project that was completed at Florida Gulf Coast University Library for providing online access to 80 OA e-journals and digital collections. The paper includes a hyperlink to Google docs for a list of these collections and their URLs. Along with proper instructions and guidelines for setting up access, the author also discusses the actual status of full text, copyright requirements, license issues, collection peculiarities and user interfaces of these collections.

OA textbooks (OATs) and Open Educational Resources (OERs) are being lauded as a viable alternative to costly print textbooks. Some academic libraries are joining the OER movement by creating guides to open repositories. Others are promoting AOTs and OERs, reviewing them, and even helping to create them (Okamoto, 2013). Okamoto analyzes how academic libraries are currently engaged in OA textbook and OER initiatives. By drawing on examples of library initiatives across the United States, she illustrates how

libraries are facilitating the adoption and implementation of these affordable resources. The practical issues related to including OA journals in academic library's online catalogue have been examined by Schmidt (2007). Some of these include possible alleviation of budget constraints, providing more robust holdings, difficulties of maintaining titles, and indexing for access.

Librarians have a difficult time managing OA resources. To find out why, Bullock, Hosburgh and Mann (2015) surveyed librarians about their experiences and the strengths and weaknesses of management systems. At the session, they shared survey results, reflected on OA workflows at their libraries and updated audience members on relevant standards and initiatives. Survey respondents reported challenges related to hybrid OA, inaccurate metadata, and inconsistent communication along the serials supply chain. Recommended solutions included the creation of consistent, centralized article-level metadata and the establishment of OA collection development principles for libraries. Librarians deploy systems to manage OA content, most commonly - link resolvers, online public access catalogues (OPACs), database and journal lists, discovery services and research guides. When asked to describe the biggest challenges of OA management, respondents most commonly mentioned the sheer number of available resources (26%), various types of unreliability (22%), and lack of OA collection development criteria (13%). These responses attest to librarians' struggle with assimilating OA resources into the rest of the collection (Bullock, Hosburgh & Mann, 2015).

Additionally, librarians are using open source software to access and promote OA. Examples are Unpaywall widget that searches for free-to-read versions of paywalled papers, OA Button, Google Scholar for free scholarly articles, and Sci-Hub (which has some copyright issues).

Recommendations and Conclusion

Open scholarship which encompasses OA, open data, open educational resources, and all other forms of openness in the scholarly and research environment, is changing how knowledge is created and shared. We live in a society that is increasingly Internet-centric, and this shift in the way that we communicate, connect, share, and do business with each other has deeply impacted scientific research and academic publishing. The overall costs of providing OA are far lower than the costs of traditional 'toll-gate' forms of dissemination. Africa's scholars should take advantage of the benefits of OA resources. Many researchers struggle with the decision of whether to publish in an OA journal versus a traditional (and perhaps more well-established) journal. The four main factors to consider when making this decision are visibility, cost, prestige, and speed (Conte, 2017).

Visibility - Publishing your article in an OA journal means that more people are likely to see it, simply because more people will be able to access it. Indeed, a study (cited by Conte, 2017) showed that full-text downloads of OA papers were 89% higher, PDF downloads

were 42% higher, and unique visitors were 23% higher than those for subscription-access articles. Additionally, your data will be available to educators and the general public, most of whom do not have access to expensive journal subscriptions.
Cost - Both traditional and OA journals may charge a small fee at the time of submission to cover editorial and peer review-related costs. The difference arises in the post-acceptance fees. Traditional journals commonly charge per page (often $100-250 each) and/or per color figure ($150-1000 each). However, OA journals typically charge a flat "article processing charge" that can range from $8 to as much as $5000 (Cell Reports). In some cases, when authors genuinely do not have the means to pay publication fees, they can apply for full or partial waivers, depending on their financial capability.

Prestige - Journal Impact Factor (IF), as a measure of quality is being questioned. IF is only meant to indicate the quality of an entire journal, not the quality of individual articles published in the journal (Anon, 2013). Therefore, alternative indicators of journal prestige have been developed in recent years. Researchers should look up other indicators for journal quality, like SNIP and Eigenfactor score, to get a better idea of journal prestige and influence. High-IF OA journals are available in a variety of fields. In the field of biology, the OA journals PLOS Biology, BMC Biology, and PLOS ONE ranked 1st, 4th, and 10th by IF, respectively, in 2009 according to Journal Citation Reports. Additionally, that same year, PLOS Computational Biology, BMC Systems Biology, and BMC Bioinformatics ranked 1st, 3rd, and 4th in the category of mathematical and computational biology (Conte, 2017).

Speed - The traditional method of paper publication creates significant delays due to the need to bundle articles into issues and backlogs of publishable articles due to space limitations. Indeed, a recent study examined 135 journals listed in the Scopus citation index and showed that the time from acceptance to publication is significantly shorter for OA journals compared with traditional journals (Conte, 2017). Thus, if speed is an important factor in your decision regarding where to publish, an OA journal may be the best choice.

Increased Citations - Furthermore, OA increases citations as indicated through 15 highly cited papers on SPARC Europe's overview page: The OA Citation Advantage (SPARC, 2017). Evidence of how OA is changing the landscape of the publishing industry overall can be seen in the many once-traditional journals that are now considered as "hybrid" OA publications. These journals allow authors to pay an extra "OA fee" to ensure free access to their article.

The paper concludes that the three key issues of policy, advocacy and infrastructure for OA are being addressed by most higher education institutions in the western world. African research institutions can do the same.

a. Policy-Orientation - Many institutions of higher learning have developed policies on OA as seen by the two examples below:

The faculty of the University of Kansas (KU) is committed to sharing the intellectual fruits of its research and scholarship as widely as possible and lowering barriers to its access. In recognition of that commitment and responsibility, the KU faculty is determined to take advantage of new technologies to increase access to its work by the citizens of Kansas and scholars, educators, and policymakers worldwide. In support of greater openness in scholarly endeavors, the KU faculty agrees to the following: (details of faculty expectations) … and make their research publicly available in the KU OA institutional repository.

On December 9, 2014 the senate of Leipzig University passed the following policy regarding OA as defined by the Berlin Declaration on OA to Knowledge in the Sciences and Humanities:

• Leipzig University supports scientists who publish scientific OA formats and strengthen independent and alternative OA publishing routes
• Leipzig University requests all scientists to publish their scientific works in OA journals, provided that a suitable journal was available.
• Leipzig University supports scientists to cover the cost thereby incurred.
• Leipzig University expects from the scientists that they make use of their right of self-archiving and publish their works as pre- or post-prints in an OA version. For this purpose Leipzig University Library operates the university repository.
• Leipzig University recommends its scientists to maintain their right to publish electronic OA versions of their respective texts online.

b. Advocacy - Despite widespread acceptance of OA, and significant backing from institutional and government funding sources, progress towards widespread OA adoption has been slow (Parsons, 2017). Open Access advocacy includes participation in programmes like Compact for Open-Access Publishing Equity (COPE)) and OA Week. Compact for open-access publishing equity supports equity of the business models by committing each university to "the timely establishment of durable mechanisms for underwriting reasonable publication charges for articles written by its faculty and published in fee-based open-access journals and for which other institutions would not be expected to provide funds."

Research institutes and universities have established open repositories (the Green route to OA) as a requirement for raising and maintaining high academic standards and as part of internal quality assurance. Advocacy resources on OA exist to raise awareness and champion the course of making research freely available. One such resource, the IFLA Toolkit, provides relevant materials that can inspire and sharpen your effort in advocating support for the OA (OA) drive. In addition, this Toolkit constitutes an instrument with global relevance that can be used for capacity building for the Library and Information Science profession (IFLA, 2015). The main purpose of the Toolkit is to provide materials that can be used by Library staff to strengthen advocacy efforts in support of OA that can result in more institutions signing the Berlin declaration; enhanced information services and improved staff skills and capacities. The Toolkit pulls together ways in which National Library and

Information Associations and IFLA Sections can support the IFLA statement on OA.

c. Infrastructure for OA resources is noted to include:

i. Open Source software, e.g. DSpace, Fedora, EPrints; or Hosted solutions,
e.g. Digital Commons, SimpleDL, ContentDM, DSpaceDirect.
ii. Policy framework and advocacy campaigns such as OA week
iii. Repositories- institutional, subject/disciplinary specific or data
iv. Training and capacity building for researchers, librarians, and institutional policy makers (as drivers of change)
v. Participation in advocacy and awareness creation, eg. OA Week (organized annually by SPARC, in October for 2017 edition) or OA day activities
vi. Funding for article publications (APC, by institutions and funding agencies) and direct support from funding agencies, eg IDRC grant to improve OA journals from the Global South.
vii. The Confederation of Open Access Repositories (COAR) is an international association with over 100 members and partners from around the world representing libraries, universities, research institutions, government funders and others. The Confederation of OA Repositories brings together the repository community and major repository networks in order to build capacity, align policies and practices, and act as a global voice for the repository community. It shares the vision of a sustainable, global knowledge commons based on a network of OA digital repositories. (COAR, 2017).

With such an opportunity to save money and expand the scope of dissemination, there is a strong incentive for African tertiary institutions to embrace OA as a means of advancing research and knowledge creation. There is a large reservoir of OA resources to guide policy, standards, training, and implementation of OA in Africa. Academic librarians should exploit these resources to confront access challenges to scholarly resources and increase Africa's participation in the creation and use of the world's knowledge. The unprecedented expansion in African higher education in the last decade is one of the necessary ingredients for the widespread adoption of OA in Africa.

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Appendix

Statistics for DOAJ: 9,525 Journals, **6,766** searchable at Article level, **129** Countries, **2,443,746** Articles

Summary of Nursing and allied health sources from DOAJ

Public health -36 journals
Mental health- 6 journals
Medical nursing – 1 journal
Nutrition- 20 Journals
Statistics & Research –21 journals
Sociology- 16
Microbiology- 22 journals
Psychology- 51 journals

The webpages for the individual journals will be searched through a journals portal on the library homepage.

Scienctific Research Publishing -SCIRP http://www.scirp.org/ SCIRP is an academic publisher of open access journals. It also publishes academic books and conference proceedings. SCIRP currently has mo re than 200 open access journals in the areas of science, technology and medicine.

Research Publish Journals- RPJ http://www.researchpublish.com/ Research Publish Journals is a worldwide open access peer reviewed online International Journal publishing Organization

Sustainable Survival Strategies in a Volatile Economic Environment :
A Case of Zimbabwean Universities

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Abstract

The economic and political environment in Zimbabwe from 2000 to date was and is still so complex and volatile, such that it does not allow for any reasonable planning of budgeting activities at state universities. Hyperinflation has led to raised poverty levels, unemployment, financial crisis, which culminated into inadequate provision of learning infrastructural facilities, delayed payment of salaries, strike actions and lack of commitment to work among staff members at universities. This was exacerbated by economic and political sanctions levelled against Zimbabwe by Western countries, as well as the land issue, political unrest and socio-economic instability. The study examined various sustainable survival strategies Zimbabwean universities are using to mobilise resources in such a volatile business environment. In this study, a qualitative phenomenological case study design was adopted to explore survival economic strategies used by universities in a challenging economy. The study made use of in-depth interviews, focus group discussions and open-ended questionnaires.

The responses from open-ended questionnaires, interviews and focus groups were analysed using an inductive approach which allowed patterns, themes, and categories to emerge. The research established that universities in Zimbabwe have realised the need to augment government economic efforts through innovations. Consequently, the engagement in income generating projects or activities such as; internationalisation of the universities and recruitment of foreign students who pay tuition at levels higher than the government controlled levels paid by local students. The parallel and block release programmes engaged by the universities attract mainly employed learners, and the tuition levels are not controlled by government. Universities are also engaged in commercial farming, poultry production, cattle ranching as well as market gardening. Other commercial activities

engaged by the universities include, brick molding, printing services, as well as water purification. On the way forward, it is critical to note that man's best resource is the human mind, hence African universities can only survive with imaginative, creative and innovative leadership since Government support continues to dwindle as economies continue to face challenges.

Keywords: sustainable, resources, volatile economy and phenomenological.

Background of the Study

Financial sustainability has been one of the key challenges for sub-Saharan African public universities in the last three decades. The Zimbabwean economic and political environment can be best described as volatile, uncertain, complex and ambiguous (Gono, 2015). This was exacerbated by economic and political sanctions levelled against Zimbabwe by Western countries, the land issue, political unrest and socio-economic instability (Shizha and Kariwo 2016, Chinyoka, 2013). In line with the above, Zimbabwe's economy remains in a fragile state, with an unsustainably high external debt and massive deindustrialisation and informalisation, (Monyau & Bandara, 2014; Nyamwanza, 2014) affecting the effective running of state universities which depends largely on government grand and support. This has had a serious implication on the quality assurance system, resulting in the establishment of the Zimbabwe Council of Higher Education (ZIMCHE) in 2006 (Garwe, 2013 and Mutenda, 2012). According to the World Bank (2010:74) independently generated resources from universities contribute about 28% of the revenue of higher education. The share of own resources is lowest (5% or less) in Madagascar and Zimbabwe, and highest in Guinea-Bissau (75%). Generally, the pressure to achieve financial sustainability was strong across all universities in sub-Saharan Africa.

University education in Zimbabwe is heavily subsidized by the government. Public higher education systems in Zimbabwe are historically heavily dependent on the fiscus (80%) for their capital and recurrent expenditures (Madzimure, 2016). The same author alluded that only 15% funding comes from the fees and 5% from other sources. In the past three years, Zimbabwe had been experiencing serious economic, social and political challenges and the government had failed to live up to its responsibility of supporting universities fully from the fiscus. Underfunding from the government had resulted in archaic and primordial technological equipment in higher institutions of learning (Mutenda, 2012 and Garwe, 2014). Gandawa (2016) cited in Madzimure (2016) reported that the laboratories in most institutions are poorly equipped and lack reagents to use. The computer/student ratio in most universities is pathetic and the Internet is unbearably slow. Lack of hands-on skills had resulted in production of graduates who were ill-prepared for work in the industry (Chimbganda, 2014). On the way forward, Akinkugbe (2000) concluded that measures related to cost-sharing or cost recovery could be used at the tertiary education level to correct the imbalance in the funding scheme.

Over the past decade, many African countries, including Zimbabwe, have sought alternative ways to financial sustainability of tertiary education systems. Many national governments, including the Zimbabwe Minister of Finance, Chinamasa in August 2016 also made it clear that it was no longer possible for public universities to depend only on the state for financing. Consequently, universities have been challenged to generate their own funds. There is therefore dire need for higher education institutions to consider varying the sources of funding against the background of dwindling funding from the government. Various stakeholders, such as families, civil society, government and private sector should be involved. Other innovative income generation ways include, the organization of short courses, collaborative research or consultancies, centers of excellence, fundraising, industrial doctorates and incubation centers (Gurira, 2012). Based on existing research efforts on revenue generation for public universities, this study endeavors to examine and evaluate survival strategies adopted by state universities in Zimbabwe in order to cope in a volatile economic environment.

The situation calls for universities to be proactive, and hence come up with locally-driven solutions to boost both economic activities and employment creation to support the growth and survival of universities. Thus this study focused mainly on survival strategies adopted by state universities in Zimbabwe to cope in a volatile economic environment. Despite the great diversity that exists in Zimbabwean universities, all tertiary education systems are continuously under pressure owing to the expansion of student population and the rising costs of teaching and research (World Bank, 2010).

Objectives of the Study

The study was guided by the following objectives;
- To explore survival strategies adopted by state universities in Zimbabwe in order to cope in a volatile economic environment
- To evaluate the impact of adopted economic survival strategies on the performance of Zimbabwean universities
- To recommend the survival strategies that can be adopted in a volatile economic environment in order to enhance performance of Zimbabwean universities.

Research Design

In this study, a qualitative phenomenological case study approach was used to highlight the specific issues and to identify phenomena as perceived by the actors to come up with survival strategies to cope in a volatile economic environment. The study aims at ultimately enhancing the performance of state universities in Zimbabwe. The phenomenological case study permits the integration of as many methods as possible to explore a contemporary situation and to understand a complex social phenomenon exploring survival strategies in a poverty stricken economy (Yin, 2012, Saunders, Lewis, & Thornhill, 2010).
McMillan & Schumacher (2010) posit that one of the advantages of this approach is that it

allows the researcher to gain an understanding of social phenomena from participants' perspectives in their natural settings. In concurrence, Chinyoka (2013) also says that the design is flexible to use and allows for a systematic collection of data as one has to penetrate the realities of the situation. In this case, the researcher was as open minded as possible in trying to identify the survival strategies adopted by state universities in Zimbabwe in order to cope in a volatile economic environment.

Population

The population of this study was teaching, non-teaching staff and counsellors from three purposively sampled state universities in Zimbabwe.

Sample and Sampling Methods

In this study, the sample of twenty one (21), six (6) teaching and non-teaching staff from each university and three (3) counsellors, one from each university, were purposively sampled. The sample was thus selected on the researcher's judgment from various heads of departments, sections, faculties and management, looking for those who have had experiences relating to the university budgeting process at universities in Zimbabwe. Purposive sampling was considered by Rubin and Babbie (2016); Creswell (2013) and Pellissier (2007) as the most important kind of non-probability sampling to identify the primary participants.

Data Gathering Methods

The study made use of in-depth interviews, focus group discussions and open-ended questionnaires. There were three focus groups, one from each university composed of the teaching staff and the non- teaching staff. Johnson and Christensen (2014 emphasise that the focus group is an efficient, economical way to collect data from several people at the same time, although this benefit is counterbalanced by the fact that less information is obtained than in individual interviews. A total of fifteen; three Vice- Chancellors, three university bursars, three deans, three heads of departments from the non-teaching staff and also three counsellors were interviewed by the researcher.

According to Kvale (2009) an interview allows participants to convey to others a situation, in this case, survival strategies in order to cope in a volatile economic environment with the aim of enhancing performance of state universities in Zimbabwe, from their own perspective and their own words. Furthermore, Johnson and Christensen (2014) postulate that an interview provides in-depth information about the participant's ways of thinking. To authenticate findings from interviews and focus group discussions, the open-ended questionnaire was also completed by twelve university staff members. In open-ended questions, possible answers are not suggested, and the research participants answer questions in their own words. Such questions usually begin with how, what, when, where, and why.

Data Analysis

The responses from open-ended questionnaires, interviews and focus groups were analysed using Tesch's inductive approach to allow patterns, themes, and categories to emerge rather than being imposed prior to data collection and analysis (Leedy & Ormrod, 2005 and Patton 2012). Creswell (2013) is of the view that thematic analysis uncovers embedded information at the same time making clear what respondents said and thus was used in analysing the data of this study. Participants' responses were recorded verbatim and read thoroughly and repeatedly. The data gathered during this study was organised under themes, based on the narrative explanations and opinions of respondents.

Trustworthiness of data

The research instruments were validated and the credibility and trustworthiness of data was ascertained. Member checking was adopted to ensure accuracy of data and to identify convergence and divergence in viewpoints credibility of the data (Flick 2014: 511; Kasayira and Gwasira, 2015). The researcher also used a pilot study and triangulation to boost trustworthiness of data.

Ethical Considerations

The approval/permission to carry out this study was secured from the Ministry of Higher and Tertiary Education, as well as from the selected university vice-chancellors, faculty deans, chairpersons, lecturers and non-teaching staff. The ethical considerations that were observed in this study include informed consent, confidentiality, deception and debriefing. Through informed consent, the participants were made aware of both the advantages and disadvantages of participation thus, the benefits and risks were clearly outlined. Participants were guaranteed that the data collected in this study would be used for the purpose of this study only. Pseudo names were used in the reporting of findings of this study.

Findings and Discussion

From the study, the researcher found out some survival strategies adopted by three state universities in Zimbabwe in order to cope in a volatile economic environment as follows:

Figure 1: Summarizing themes derived from the study

The discussion of the findings was done in line with the major research questions. The themes that were yielded by the empirical study as shown in fig 1 above are internalization, the adoption of the parallel and block release programmes, higher education marketing and innovations, introduction of commercial farming, supporting of research activities and various income generating projects.

The volatile operating environment in Zimbabwe challenged university authorities to come up with survival strategies. These challenges were without precedence and thus traditional references were not applicable. As Professor R.J. Zvobgo put it, 'the greatest asset of an organisation is the human mind.' Management had to fully exercise their minds and forget about appealing to the government for the funding of their activities. These strategies (fig 1) have seen three state universities in Zimbabwe able to operate with relative stability and provision of basic requirements.

Theme 1: Internationalisation

The study established that while currently facing economic challenges, Zimbabwe had facilities better than most African countries. Moreover, the education standards were highly regarded owing to the performance of Zimbabwean graduates employed across the globe. Universities have taken advantage of this good reputation to attract students from other African countries. During interviews, one chairperson of GD (pseudo name) university said:

My university has managed to attract about a thousand students from other countries. The majority of the students are coming from Namibia. Some come from as far as the Democratic Republic of Congo (DRC), South Sudan, Swaziland and South Africa.

A faculty dean from another state university lamented that:

Our university to date has attracted a significant number of students from neighbouring countries. The majority of the students are in the Faculty of Education and the Department of Social Sciences. We have over 300 hundred students in the Faculty of Education alone and this is a marked achievement.

During interviews, a finance director from one of the universities posited the following advantages of having foreign students at his university:

The advantage of foreign students to our university is that they bring more foreign currency. At my university, they pay more than double of the tuition fees paid by local students. Attracting many of them to my university simply means generating more money for the university. Unlike our local students, these students do not have problems paying their tuition fees. They pay in cash. Our local students have negotiated for payment plans sometimes which they do not own.

Since public funding for higher education has been going down, especially in Sub-Sahara Africa parents who can afford are sending their children where they feel their children will get the best education. The study also established that while fees payable by local students are controlled by the government, foreign students pay higher fees. Universities have set up recruitment teams moving to targeted countries for students' enrolments. Quite a signif-

icant number of students from other African countries are recruited every semester and have become a significant source of revenue. Almost all the participants interviewed also echoed the same sentiments. In support of the above, Materu (2006 & 2007) posits that in an increasingly knowledge-based global economy, linkage and cooperation between nations and institutions have become indispensable. The most relevant and plausible points of entry for such exchanges towards knowledge adaptation, generation and dissemination are the higher education institutions. Internationalisation also constitutes drivers of revenue generation and diversification (Guerrero-Cano, Kirby, & Urbano, 2006). Internalisation has encouraged higher education to become more business-like, as public universities are encouraged to seek additional funding from non-state sources (Sawyer, 2004; Vaira, 2014). This simultaneously creates new opportunities and expands the field of competition for universities, which need financial means to improve their attractiveness. This study also gathered that internationalisation represents a substantial cost for universities, particularly in research, but it also creates new revenue possibilities, for instance through fostering "cross border" research collaboration.

Theme 2: Higher education marketing

As government support continued to dwindle, universities realised enrolment figures were very important and were engaged in cut-throat competition for students. The three universities studied adopted strategic marketing as a strategy to create, communicate and deliver value to students. Marketing teams comprised teaching and non-teaching personnel engaged in outreach programmes within and outside the country. One of the interviewee posited that:

The university marketing team had done a sterling job. This had boosted enrolment and significantly increased the contribution of tuition from 5% in 2005 to an average of 42% in 2016 in the universities studied. They had so far managed to attract students from very remote areas who were qualified for university education. Some of our students were coming from as far as Binga, Gokwe, Chikombedzi and Mberengwa.

One participant highlighted that:

Marketing of universities also depended on teaching, non-teaching staff, programmes offered by the university and also structural development of the university. My university boasts of many user-friendly courses which are relevant to community needs. We now have many campuses in Zimbabwe, including, Harare, Masvingo, Bulawayo, Mashava and Gweru.

Participants from the three universities all highlighted that their universities market their courses on their websites. A university's homepage is the hub of its web presence in attempting to appeal to a diverse range of visitors (Vaira, 2014). Website navigation is an integral component of overall site architecture from which all content can flow (Materu,

2007). To achieve this, it has become common for universities to ensure their homepage is a clearly laid out portal with all of the content that students are looking for online. This means websites often now feature elements such as "well-placed navigation bars" and engaging visuals (e.g., slideshows, multimedia content, etc.), and ensure that "calls to action" (e.g., "Apply Now" buttons) feature prominently throughout the website experience. Government support is not enough to cover salaries (Mutambara and Chinyoka, 2017). The study also established that the three universities studied have developed and updated their university mission statements; mission statements which focus on updated educational quality that is abreast with the changing world, staff development and research opportunities, as well as proper governance and management of state universities.

Theme 3: The Parallel/Block Release & Introduction of Short Courses

The universities studied also came up with programmes which were conducted during times suitable for the working population. Learning centers were established at strategic locations for the convenience of the working scholar. The working students in turn paid higher tuition. Tuition derived from these nonconventional programmes was used partly to incentivise staff and to aid in administration activities. The three universities studied also came up with innovative strategies designed to regularly introduce new short term courses which were in line with the socio-economic demand. The universities were re-examining their operations in this changing world; they strategically re-positioned themselves in response to current demands of the new economy. This means that they were varying their degree curriculum, bringing in programmes relevant to the national economy and responsive to the prevalent labour market demands. To a larger extent this led to an increase in enrollment and attracted skilled lecturers, thus curbing brain drain. The study established that there was also corporate support among state universities to share knowledge and ideas on issues pertaining to university education and operation. Corporate sectors encouraged the branding of prospective graduates so that they were assured of job availability on completion of studies.

In line with the above, many public universities have moved towards offering special versions of high-demand courses at high tuition levels. Such efforts include evening courses, summer courses, short courses, online courses, credentialing programmes in areas demanded by the labour force and offerings abroad (Hinchcliff, 2000). Vocational master's programmes where short courses can be linked as modules can fall under this category (Douglas, 2008). Currently, the demand for education greatly exceeds the supply.

Educational services and short-term training is the first category of revenue generation activity for public universities. Many public universities have been responding to external opportunities aggressively, targeting such diverse student markets as corporate learners, professional enhancement learners, degree-completion adult learners, pre-university learners, remediation and test preparation learners, and recreational learners (Hearn, 2003). These educational services focus not only on students seeking degree programmes

but also on students seeking non-degrees pre-and post-baccalaureate certification (Hearn, 2003; Levine, 2000; Ouma, 2007). Some universities have benefited financially from creative state-level mechanisms to stimulate workforce training and development in the form of short-term or long-term programmes for industry and other stakeholders.

Theme 4: Research Activities

Participants from the three universities highlighted that one of the cardinal values and purpose of universities was research. Reduced government support led to reduced availability of funding for research. Universities motivated staff to seek extramural support for research. This encouraged the academic staff from the three universities to engage in research that impacts on society. The quality was significantly improved with guidance and administrative support. Establishment of research and quality assurance offices resulted in most of the universities being able to attract funding from Non-Governmental organisations. Many universities are repackaging and re-organising their research and analysis capabilities, often in pursuit of revenue (Clark, 2008). Prominent initiatives involve business incubators, technology transfer offices, research and technology centers and parks, small business development centers, and research collaborations with private industry and the government. Some scholars suggest that more revenue comes from more applied and problem-solving research (Gulbrandsen & Smeby, 2005). Profit-oriented firms may be more interested in applied research, the benefits of which are relatively easy to appropriate, than in basic research.

Thus higher education promotes cooperation and collaborative works with development partners, regional counterparts and communities, as well as teaching and research institutions locally, regionally and globally (Materu, 2006). Vaira (2014) also argued that the European Framework Programmes for Research, has provided a strong incentive to increase collaborative research activities across many countries. In practice, research contracts cover most of the research and development work undertaken for various external stakeholders in order to generate revenue (Leslie & Slaughter, 1997). Through interviews, a university bursar mentioned that:

Some of the revenue generation activities in research may be organised into separate university-owned spin-off companies. Money can be earned from patents and licenses, direct consultancy or commercial research partners. Consultancy is one stage further than contract research from core academic activities. It is normally undertaken primarily for financial gain.

Joint research projects or commissioned research seem to be among the most common forms of cooperation between public universities and their regions and are likely the important sources of nongovernmental resources and co-learning (Benneworth & Sanderson, 2009). In this regard, several universities have been establishing science parks for fostering their revenue generation. In Zimbabwe, research centers of excellence were established

across the country with researches suitable for each region. These researches received tremendous support as they were contributing to the betterment of lives. In Kenya, the Department of Research Capacity Development (RCD) focuses on capacity development for researchers by rendering financial assistance to postgraduate and postdoctoral candidates, and offering staff funding and development opportunities (Nderu, 2013). The Department of Innovation Support and Technology Transfer handles the issues of Intellectual Property (IP) and commerciality for the innovations. In terms of innovation, it assists researchers to obtain and negotiate external research-related grants and contracts, and provides some funding for those projects that may have a commercial sable IP (Nderu, 2013).

Theme 5: Commercial Activities/ Income Generating Projects

The government of Zimbabwe embarked on land redistribution from 2000. Universities applied and were allocated farming land. Commercial farming activities have proved to be a significant source of revenue. Provisions for students and staff meals are acquired from university owned farms. Universities are engaged in cattle ranching, crop farming and poultry among other activities with great success.

Revenue from non-academic services such as, catering and accommodation services, bookshops, rental income, restaurants, stocks, commercial investments (farms and hotels), health services, printing and photocopying, including brick moulding, printing services as well as water purification.

There is also the exploitation of university facilities for commercial purposes. At one university studied, revenue was generated by leasing university property to private entities. During interviews, a participant from one of the universities echoed the following sentiments:

Many universities invest in their facilities to obtain revenue from such facilities as rental, residences, catering, consultancy, libraries, museums, training centers or resource centers, printing and binderies, sport facilities, language centers and scientific test equipment. All offer reliable and constant possibilities for earned income. Thus, universities have considerable opportunities to exploit their facilities to generate income.

Several universities were increasingly privatising their facilities to enhance revenues. Revenue can be received from leasing university property to private entities or by the exploitation of university facilities for commercial purposes (Geiger, 2002; Kirp & Roberts, 2002). Universities can also generate revenues through retail. This may include sales of diverse university products and services to diverse customers. In more advanced universities, it consists of patenting and licensing, creating incubators, science parks, and university spinouts, and investing equity in startups, among others (Mowery et al., 2004; Siegel, 2006).

The Future

It is critical to note that, a man's best resource is the human mind. African universities can survive with imaginative, creative and innovative leadership. Government support will continue to dwindle as economies continue to face challenges. Universities must therefore invest in themselves if they are to remain viable centers of higher learning. This means that they must provide yearly budget allocations for educational materials, library acquisitions, research, staff development, and the maintenance of buildings and equipment. Appropriate economic models and fresh directions for development must be crafted by universities. Academically and financially sound universities are an imperative for Sub- Saharan Africa. From the forgoing, and in order to increase access, maintain standards of educational quality, and ensure institutional stability, universities must diversify their financial bases, particularly through cost-recovery for non-academic services, the introduction of targeted fees, and a calculated expansion of income-generating activities.

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DESIGNED AND PRINTED BY OWL DESIGN: +233 241 63 1555

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