EXPLORING OPPORTUNITIES OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) IN HIGHER AGRICULTURAL EDUCATION ENROLMENT IN KENYA

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGRICULTURAL INFORMATION AND COMMUNICATION MANAGEMENT OF THE UNIVERSITY OF NAIROBI

2011

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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To Tina, Willo and Hano

ACKNOWLEDGEMENT

I would to express my appreciation to the University of Nairobi for according me the opportunity to study M.Sc. in Agricultural Information and Communication Management degree course; and for partially meeting the tuition. In particular, my sincere thanks to my two supervisors; namely Prof. J.H. Nderitu and Dr. Njoroge Kiarie for their support and insights throughout the research and writing of this thesis. I am grateful to Dr. Fred I. Mugivance, the Course Coordinator and other academic members of staff at the College of Agriculture & Veterinary Sciences who enthused and kept me glued to the course despite grueling academic challenges.

I thank Drs. Muliro and Matofali of Egerton University, Mr. James and Mrs. M. Kisaka of Jomo Kenyatta University of Agriculture & Technology and Messrs Elavula, Macharia and Miss L. Owuor of the College of Agriculture & Veterinary Sciences, University of Nairobi without whom the facilitation in data collection would not have been easy. I am indebted to Drs. Isaiah Nyandega and Anne Khasakhala for guidance and assistance in statistical data analysis.

Lastly, I appreciate the support I received from my family; and more specifically my daughter for her input in the survey tool, my sons, for generating coding structure and converting the data into electronic form, and keying in the raw data which made the analysis a joyous exercise.

ABSTRACT

This study explores the opportunities of information and communication technology on influencing potential university students in their choice to study or not study agriculture and related sciences in purposively selected public universities; namely, Egerton University, University of Nairobi and Jomo Kenyatta University of Science & Technology. The existing body of research has highlighted factors that influence decision making among students in their choice to study agricultural programmes. It has focused on lack of information on agricultural education, negative perceptions and lack of role models as some of the factors impacting on students' decisions. On average, 572 students per year enrolled in agriculture and related programmes relative to majority of 23,790 students in other degree programmes. The research seeks to explore how the access and use of ICTs among undergraduate students could influence their choice of agriculture and related sciences as programmes of study in public universities. The study uses Krumboltz's social learning theory of career decision making (SLTCDM) which outlines four basic factors which influence decision making in career choice. The research approach is both quantitative and qualitative study based on a questionnaire distributed completed by 367 students representing three (3) public universities in Kenya. The results reveal that access and use of ICTs has no influence on the data population in choosing or not choosing to study agriculture and related sciences. There is no connection between interaction in ICTs and agricultural education. As the study is based on ex post facto data gathering, the research strategy used does not allow for wider generalization but provides an important explorative insight into the choices students make to enroll in agriculture and related sciences.

Key words: Pre-university exposure, ICTs exposure and perception

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LIST OF ABBREVIATIONS

AR4D:	Agricultural Research for Development
AET:	Agricultural Education and Training
AGRA:	Alliance for Green Revolution in Africa
BSc:	Bachelor Science
CAADP:	Comprehensive African Agriculture Development Programme
CD:	Compact Disk
CGIAR:	The Consultative Group on International Agricultural Research
COL:	The Commonwealth of Learning
CSAW:	Coalition for Sustainable Agricultural Workforce
CTA:	Technical Centre for Agricultural and Rural Co-operation
DVD:	Digital Versatile/Video Disk
EC:	European Commission
FGDs	Focus Group Discussions
FTCs:	Farmers Training Centres
GDP:	Gross Domestic Product
GIS:	Geographical Information Systems
GSM:	Global System of Mobiles
IAC:	Inter-Academy Council
ICRAF:	International Centre for Research & Agro-forestry
ICTs:	Information and Communication Technologies
IDRC:	International Development Research Centre
ICT:	Information Communication Technologies
IPAR:	Institute of Policy Analysis and Research
IP-ERS:	Investment Programme for the Economic Recovery Strategy
JAB:	Joint Admissions Board
KCSE:	Kenya Certificate of School Education
MDGs:	Millenium Development Goals
NEPAD:	New Partnership for Africa's Development
NGOs:	Non-Governmental Organizations
PDA:	Personal Digital Assistant
SLTCDM:	Social Learning Theory and Career Decision Making
SAS:	Statistical Analysis System
SMS:	Short Message Service
SPSS:	Statistical Package for Social Scientists
TV:	Television
USA:	United States of America
WAP:	Wireless Application Protocol
WWW:	World Wide Web

CHAPTER ONE

1.0 BACKGROUND TO THE STUDY

1.1 INTRODUCTION

Kenya's population has doubled over the last 25 years to about 40 million people, and rapid population growth is set to continue to grow by around one (1) million per year, meaning about 3000 people every day over the next 40 years; and will reach around 85 million by 2050 (Fengler (2010).This rapid population growth will affect Kenya's development prospects for the next decades, especially because about 80 percent of the population depend on agriculture for their livelihood. The bulk of production is based on small-scale, family-farms, producing both food and cash crops, accounting for two thirds of agricultural output (FAO, 1999). Fengler (2010) postulated that Kenya might face unprecedented challenges to produce sufficient food, feed, fibre and bio-fuel feedstock. Over the next 40 years, Kenya must produce sufficient food as well as bio-fuel feedstock to ensure a secure and independent energy supply. Failure to meet this goal will continue to perpetuate food insecurity which might lead to instability in the global, geopolitical landscape. Omiti and Obunde (2002) argued that although agriculture had been given top priority in successive national development plans since independence, poor or ineffective policy implementation had negatively affected agricultural growth. Policy failure had exacerbated poverty levels by reducing farmers' gross margins or completely throwing some farmers out of business for a variety of reasons.

The importance of the agricultural development and its potential in the increase of food security, generation of income, creation of employment and industrial development had been reiterated in the Kenya Economic Report, (2009) and the Economic Recovery Strategy (IP-ERS, 2005). The Report pointed out that the agricultural sector contributes about 25 per cent Gross Domestic Product (GDP) and provided about 70 per cent of total

employment in Kenya. About 19 per cent of formal waged workers are found in agriculture.

Worldwide, farming operations are set to face unprecedented stress in harmonizing productivity gains amidst the reality of global warming. Coalition for a Sustainable Agricultural Workforce (CSAW), a partnership of professional scientific societies and agricultural leaders in the United States of America (USA) have recognized that because agriculture largely depends on environmental conditions, future agricultural scientists will need to find solutions for mitigating climate change. According to CSAW (2010), the challenge to achieve the projected level of production in a sustainable fashion is growing ever greater because too few scientists are being trained and fewer young people are attracted to study agriculture and related sciences. In order to create a more sustainable future, there is need to prepare scientists to bring new and revolutionary approaches to agro-ecosystem management. However, mounting obstacles are encountered in attracting student enrollment into scientific fields of study to assure a plentiful and safe supply of food, fuel and fibre (CSAW, 2010).

Kenyans depend on agriculture for their livelihoods; and, therefore, one would expect that this dependence translates into a popular demand for programmes in agriculture and related sciences that would contribute towards the development of agriculture into food sufficiency. It has been noted that there is a consistent decline in interest in agricultural training at all levels of the Kenya education system. According to Vandenbosch (2006) only a few students opt to take agriculture as an examinable subject at secondary level; and only one out of four (25%) intend to seek an agricultural occupation following graduation. In tertiary institutions, those opting to train for middle-level agricultural qualifications are very few. According to Njoroge, the numbers of students enrolling into agriculture and related sciences have consistently gone down at university level; and many of those in the agricultural programmes are there not by choice (as cited in Wesonga, 2007). Frequently, they are there by default after failing to enroll for medicine, business studies and engineering among other popular programmes (Muir-Leresche &

Scull-Carvalho, 2006). Once students graduate from studying agriculture at universities, they seem to be less interested in agriculture as they seek careers associated with urban lifestyles and wider range of chances for work.

In cognizance of the prevailing enrolment situation, stakeholders in a workshop on "Agricultural Education and Training" held on 30th November 2007 pointed out that undergraduate enrolment in agriculture and related sciences in Kenya had been on the decline for the last one decade (Wesonga, 2007). The team observed that certain key issues emerged about agricultural education that had not been adequately addressed. These issues included:

i) Lack of Government statistical data to demonstrate that agricultural education in schools could provide solutions to agricultural development problems;

ii) A mismatch between stated objectives and the agricultural educational curriculum, educational quality and resources for training.

iii) Minimal efforts in addressing the attitude of trainees towards farming; and the relative absence of role models among smallholder farmers whose performance would inspire students and counteract the negative image of farming;

iv) The gradual shift of financial investment in agricultural education from primary and secondary schools to university levels leaving no systematic follow-ups to establish the demand for or the extent of mobilization of agricultural expertise; and

v) Students being assigned agriculture as a subject of study in the university when they never chose it leading to lack of motivation and professional commitment.

According to the Public Expenditure Review (2010), the average allocation to the agricultural sector for the period 2008/2009 was 6.5 per cent of the national budget. This

falls short of the Maputo Declaration (2004) that calls for at least 10 per cent of government budget. This reduction in government funding of the agricultural sector has had a domino effect to the extent that the proportion of student subscription into some degrees such as B.Sc. in Agriculture, B.Sc. in Veterinary Medicine, B.Sc. in Food Science and Technology, B.Sc. in Range Management, B.Sc. in Soil and Water Engineering, B.Sc. in Horticulture and diploma and certificate programmes at universities and institutes has considerably reduced from about 50% in the early 1990s to about 40% to date (Ngesa, 2006). This assessment is made based on employment opportunities after graduation.

Incidentally, declining student enrolment levels in agricultural education in many countries around the world have been reported (Acker, 1999; Mulder & Kupper, 2006). In citing the American experience, Tarpley and Miller (2004) stated that recruitment and retention of agricultural students at the university level had been historically important. According to Collins (2008), the trend which had existed for years was first thought to be temporary but it was later found to be both a national and international challenge. Gilmore, Goecker, Smith, Boetler, Gonzalez and Whitaker (2006) concluded then that there existed a projected shortage of available graduates in the food, agriculture and natural resources systems of the United States in the far future. Due to the concern about the substantial decline in the numbers of agriculture students, colleges of agriculture were challenged to identify new methods of increasing the diversity of their programmes (Gilmore et.al, 2006). In fact the USA Government initiated interventions through the CSAW.

Ngugi, Isinika and Temu (2005) reported that data from seven African institutions indicated that between 1980s and 1990s, enrolment levels in agriculture as a share of total enrolment fell from 5.7% to 3.3% at degree level, and from 7.6% to 3.8% at postgraduate level. The decline was thus 42%, 21% and 50% for technicians, undergraduate and postgraduate levels respectively. They argued that despite declining enrolment, there was still a strong demand for human resource capacity in the agricultural sector, making

employment prospects for agricultural graduates to be good. The current need for food security and sustainable livelihoods necessitates continual investment in agriculture, including the exploitation of information and communication technologies. According to Akinsorotan (2007), human resource in the agricultural sector which was supposed to be dominated by the young generation had been left in the hands of aged farmers. This situation had been exacerbated by the lack of interest in agriculture as a career by secondary school graduates; and those who pursue agriculture find themselves in these programmes for lack of better opportunities. From unpublished information, it seems like some students do not meet certain cluster requirements which may deny them their natural inclinations toward certain specialties for their preferred degree programmes. In addition, economic incentives and misconceptions steer students in the basic sciences away from careers in the agricultural sciences.

When student enrolment levels in higher agricultural education decline, the provision of agricultural human resource is compromised, which in turn affects the growth of the agricultural sector. Okigbo, (1992) stressed that the future of increased food production rested on giving support to the education and training of young generations studying agriculture. Hence, for the younger generation to fully participate, there should be a positive perception of agriculture as a progressive and reliable career in order to reverse the drift towards non agricultural professions. Similarly, the President of Alliance for Green Revolution in Africa (AGRA) was quoted in a Kenyan newspaper, the Daily Nation (Cheboi, S., 2009, August 26) as having said that for a change to be made in the way food was produced, it was imperative to make agriculture professional by investing in millions of smallholder farmers who grow the bulk of Africa's food.

Agriculture as a profession has a lot of potential and prospects which are also invariably characterized by constraints which need to be confronted through the rededication and refocus on agriculture as a business enterprise. Towards this end, the Kenya Government in echoing New Partnership for Africa's Development (NEPAD, 2002) goal to eliminate hunger and reduce poverty through agriculture, crafted Vision 2030 to focus on the

reduction of hunger as one of the Millennium Development Goals (MDGs) cuting across the three economic, social and political pillars to which the Vision subscribes. Vision 2030, however commits itself to maintain a sustained 10 per cent annual economic growth for the coming 25 years. This economic growth requires development in skills in agriculture and related sciences by training enough graduates with both soft and hard skills to effectively face the challenges of food production. According to the Consultative Group on International Agricultural Research (CGIAR, 2009), agriculture can be made attractive by increasing and improving formal education and training in information and communication sciences. Such capacity building can contribute to innovation in the use of new Information and Communication Technologies (ICTs) in agriculture.

Farrell (2007) observed that Kenya had made a remarkable progress by putting in place ICTs policy framework and implementation strategy, complete with measurable outcomes and time frames. In its ICTs policy, Kenya has set out the objectives and strategies relating to ICTs and education. The relevant objective in this section states that the government will encourage "...the use of ICTs in schools, colleges, universities and other educational institutions in the country so as to improve the quality of teaching and learning." This is a demonstration of the Government's commitment to utilizing ICTs in education and more particularly, providing potential for ICTs in higher agricultural education, as has been well articulated in the ICTs policy document.

The Government has substantially reduced the taxes and tariffs levied on imports of ICTs equipment making them cheaper and more affordable. In addition, Kenya has embraced the global system of mobiles (GSM) communication which has made phone lines more accessible countrywide, making the mushrooming of internet cyber cafes evident in urban centres; and in certain rural areas in the country. Nonetheless, the rates levied for accessibility and utilization of these facilities are still prohibitive to some members of society. Although Kenya may be making concerted efforts to mainstream ICTs in education and other related areas, various reasons are known to hinder information

accessibility particularly in rural areas where most of educational institutions such as schools are found.

According to Ellen (as cited in Mtega & Malekani, 2009), factors of such nature as societal, institutional, psychological and intellectual barriers are responsible for blocking the availability of resources necessary for satisfying the information needs within the society. Institutional barriers are due to inability of the information providers to make information available. It is further argued that physical barriers to information accessibility are caused by poor information infrastructure while psychological barriers are due to the failure of the individuals to perceive their information needs or failure to obtain needed information from appropriate providers. Other factors according to Williamson (1998) include cost of the information and inability to access information by the community.

This then raises the question that "can students with personal and passionate interest in agriculture be targeted and nurtured through the use of ICTs to take up the mantle and contribute to the revitalization of the agricultural sector in Kenya?"

Marshall, Herring and Briers (1992) argued that the diverse and broader student body was generally unaware of the multi-dimensional and challenging nature of the agricultural disciplines and the exciting career opportunities open to them, despite evidence that many students had an interest in a variety of scientific, business, economic, environmental, and social issues related to food and agriculture. The problem might be that the teaching and learning environment seems not to have helped students to make the connection between those issues and a degree in agriculture and related sciences. According to International Development Research Centre (IDRC, 2000), access to information is deemed crucial to economic development during this era of a global economy supported by electronic communications. Although global institutions have made efforts using ICTs to reform the agricultural education curriculum, these efforts still fall short and are viewed as "cosmetic changes".

CGIAR (2009) observed that agriculture and related sciences are programmes that have been misunderstood; and, therefore a lot will depend on providing in-depth information about them. The primary impact of ICTs on agriculture will be through management of information and sharing of knowledge in agricultural communities. Vast amounts of data and information related to agriculture and linked temporarily and geo-spatially when accessed by individuals and communities will provide a huge potential for learning of new knowledge. This capacity in some ways already exists but in the next decade and beyond, it will certainly increase many folds, enabling communities to model and arrive at local solutions using global inputs, experience, knowledge, skills and technologies.

Reports from Technical Centre for Agriculture and Rural Development (CTA, 2007) have pointed out that agricultural science may be considered as significantly lagging behind in the frontiers of ICT. They point out that the use and application of ICTs in agriculture, sometimes termed e-agriculture, is not yet a recognized discipline in many institutions of learning, but only pursued as an adjunct to other agricultural disciplines, such as plant breeding through bio-informatics, agronomy and soil sciences by the use of Geographical Information Systems (GIS). Some countries in the first world are using sensors, devices and robotics in their precision farming and in a variety of agricultural science areas particularly for high-value cropping (CGIAR, 2009).

All the above notwithstanding, it is generally believed that new ICTs can offer real time opportunities to improve the quality of upcountry life and by extension enrolment in agricultural higher education. This study set out to explore the influence of ICTs in enrolment for higher agricultural education in Kenya. For the purpose of this study, enrolment is defined as the choice of students to register in agriculture and related sciences for attainment of a degree certificate at the end of the study. Decision to enroll may be influenced to a certain extent by access and use of ICTs, pre-university exposure to agriculture, Kenya Certificate of School Education (KCSE) aggregate mean grade and perception by gender. Programmes of choice in agriculture and related sciences include

Agriculture General, Plant Science, Food Science and Technology, Animal Science and Land Resource Use and Management.

1.2 STATEMENT OF THE PROBLEM

Enrolment of students in agriculture and related sciences in public universities in Kenya is a matter of concern. A Report of World Bank (2007) recognized it as a challenge to agricultural education and training. This was taken up by a stakeholders workshop on agricultural education and training held on November 30, 2010 with a view to addressing the issue.

At secondary school level, fewer students are choosing agriculture as an option. A scrutiny of admission data from the Joint Admissions Board (JAB, 2009) revealed that enrolment of students in agriculture in the University of Nairobi, Egerton University and Jomo Kenyatta University of Agriculture and Technology averaged 572 students per year relative to 23,790 students enrolled in other degree programmes (JAB, 2010/2011). In fact, in 2003/2004, enrolment declined from 11% to 3% (JAB, 2009). It can, therefore, be deduced that less than 1000 undergraduates are incoming into agriculture and allied sciences; and graduate annually from the three institutions.

Despite declining enrolment, there is still a strong demand for human resource capacity in the agricultural sector, making future employment prospects for agriculture to be promising. From Akundabweni's personal communication, the ratio of researchers to total population sub Saharan Africa is 48:1 million. The ratio is too low compared to that of Comprehensive African Agriculture Development Programme (CAADP)-NEPAD recommendation and compares unfavourably with the global average of 5:1.

The perception the youth have of agriculture is that it is not "modern". A more accurate awareness of the nature of work in the sector and its potential is required. ICTs might be a viable intervention strategy to capture the interest of the youth in choosing agriculture

and related sciences as programmes of study at public universities in Kenya. ICTs in fact has become necessary both for teaching and learning (Zertuche, 2005). It is argued that using ICT in a later environment could provide more wide range of alternatives such as learning climates, raise interest of both teachers and students, in effect support their motivations (Kara & Yakar, 2008. Studies have also shown that young people (between the age group 18 – 35 years) seem to be the regular users of ICTs services (Fletcher & Deeds, 1994). In order of importance, ages 18 – 35 years use e-mail, the internet, word processing to find jobs, pen pals, and financial partners, send or receive messages or mail, key in and edit documents, train in data processing. They possess better attitude to use ICT services (Adebowale & Adediwura, 2009). This potential of ICTs can be exploited in exposing the youth to all aspects of agricultural education and thereby contribute to a better visibility of agriculture and the rural sector and stimulate interest for potential undergraduates to enroll and study agriculture programmes and related sciences.

A lot will depend on providing information that can raise the visibility of these programmes. Access to such new information sources is a crucial requirement for the sustainable development of agricultural education. McClausland, Wache and Berk (1999) documented the contribution of ICTs on the capacity to identify an issue and then to identify, locate and evaluate relevant information in order to engage with it or to solve a problem arising from it. ICTs can enable students to gather, store, retrieve and disseminate a broad range of information needed by students thus transform agriculture into demand driven programmes. ICTs can also be used for student mobilization, learning and action through radio, Television (TV), public address systems and the web.

In a time when the Government of Kenya is focusing on Agricultural Sector Development Strategies for wealth generation and well-being for her people, the need for human resource capacity to drive strategies cannot be underestimated (ASDS 2010 – Vision 2030). An exploratory survey that endeavours to examine the influence of ICTs access and use among undergraduate students on their choice to study agriculture and

related sciences is therefore warranted. The study is informed by the following questions which include but are not limited to:

i) How can ICTs be used in agriculture to impact on decision making; and by extension influence what decisions potential undergraduate students make about their lifelong careers.

ii) Can ICTs motivate potential undergraduate students to choose to study agriculture and related sciences?

iii) Would pre-university exposure to ICTs make a difference in potential undergraduate students' choice of agriculture and related sciences?

1.3 OVERALL OBJECTIVE

To explore how the access and use of ICT among undergraduate students could influence their choice of agriculture and related sciences as programmes of study in public universities.

1.4 HYPOTHESES

H_{01} The likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on ICTs access and use;

H_{02} The likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on pre-university exposure to agriculture;

H_{03} The likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on KCSE aggregate mean grade.

H_{04} The likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on perception by gender.

1.5 SIGNIFICANCE OF THE STUDY

According to the New Partnership for African Development (NEPAD), sub-Saharan Africa is in dire need of expertise and competencies of scientists, professionals, technicians, teachers, civil servants and business leaders in all aspects of agriculture and related industries. This need can only be met through the creation and enhancement of quality in tertiary agricultural education by integrating ICTs in all the processes so as to create interest in agriculture. In this regard, the findings of this study will form a useful reference document on which strategies for enhancing student enrolment in agricultural higher education using ICTs can be crafted. It will also contribute to the efforts towards mainstreaming e-learning in agriculture and related sciences.

Besides, the study will augment efforts towards human resource empowerment initiatives to support network operations among university undergraduate students in public universities and scholars of agriculture through the use of ICTs that will link them to the global village of state-of-the-art agricultural knowledge. This may also assist public universities offering programmes in agriculture and related sciences in structuring their recruitment materials' to change the perception of agriculture among potential undergraduate students.

1.6 ORGANIZATION OF THE THESIS

Chapter one forms an introduction to the study. Relevant literature is reviewed in chapter two. A theoretical framework that informs this study and the description of the research methodology are provided in chapter three. Research findings and data analysis are handled in chapter four. Finally, the summary, conclusions and the implications of the findings and future research are presented in chapter five.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

This chapter outlines briefly the historical perspective of professional agricultural education which is the springboard of higher agricultural education. Factors influencing the choice to study or not study agriculture and related sciences are diagnosed. Related studies in enrolment in agriculture and related sciences are cited.

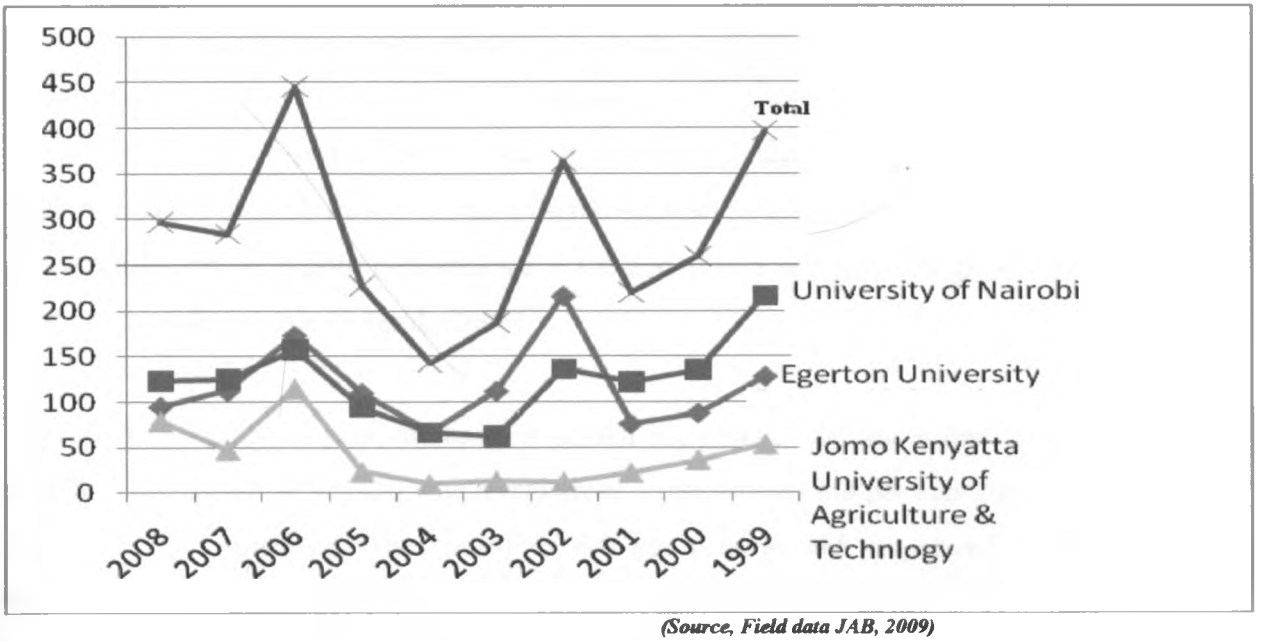
2.2 PROFESSIONAL AGRICULTURAL EDUCATION

Kenya placed considerable importance on the role of education in promoting economic and social development after the achievement of independence in 1963 (Sifuna, 1998) During this period, curricula focused on farmers' problems, resource support was by government in partnership with the private sector (such as seed and agricultural chemical companies and foreign donors); and Government investment in the agricultural sector (infrastructure such as roads, a working extension network and markets). Progressively, Kenya expanded its higher education which saw the number of universities offering programmes in agriculture rapidly increase. For example, in 1987, Egerton College, a premier of professional agricultural training was promoted from a Diploma to a Degree-awarding institution. Moi University which was founded in 1984, was also offering agriculture but only at postgraduate level. In 1997, Maseno University introduced a Bachelor's programme in horticulture. Currently, Kenyatta University has also introduced courses through the School of Agriculture and enterprise services.

2.3 ENROLMENT TRENDS IN AGRICULTURE AND RELATED SCIENCES

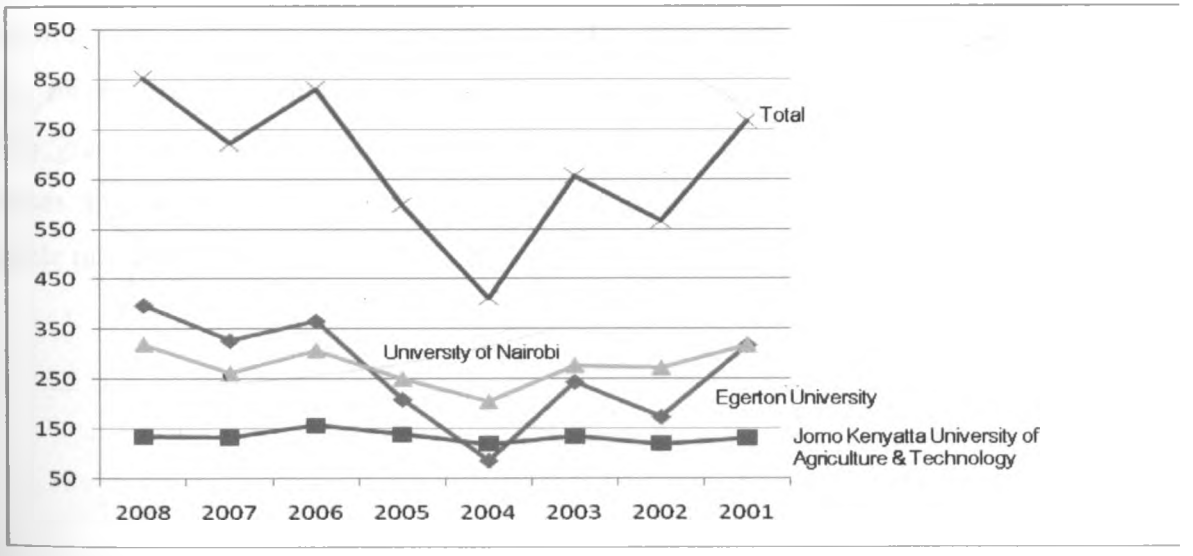
Data from 23 countries show that, on average, one out of twenty students in tertiary education chooses the broad field of agriculture. Machethe (1988) argued that the proportion of students who enrolled for agricultural degrees at universities was low, and only a few females enrolled for these degrees. Ngesa (2006) pointed out that in Kenya, the number of students in secondary schools who choose agriculture as a subject had generally remained constant at around 100,000 since 1990. There are 100,649 students enrolled in various programmes in the seven (7) public universities and emerging constituent colleges in Kenya. However, this increase in student populations at the public universities has not proportionately marched with the number of students who apply for programmes in agriculture and related sciences. Statistical data obtained from JAB (2009) indicates that the current enrolment trends in tertiary agricultural education compared with other disciplines are on some decline.

In the three (3) purposively selected public universities; namely Egerton University, University of Nairobi and Jomo Kenyatta University of Agriculture & Technology, applications for admission in programmes of agriculture and related sciences have been fluctuating, up and down as shown in Figures 1 and 2.



(Source, Field data JAB, 2009)

Figure 1: Number of applicants for programmes in agriculture and related sciences



(Source, Field data JAB, 2009)

Figure 2: Number of Applicants for programmes in agriculture and related sciences

In a period of ten years (from 1999 to 2008), a total of 2,823 students had applied to study agriculture and related sciences. From 2001 up to and including 2008, the selected

public universities admitted 5,402 students to study agriculture and related sciences. Student enrolment level was at its lowest ebb in 2004/2005 academic year. Several explanations may be given for this scenario, but one of them may be the Government's reduced funding to agriculture and a freeze on recruitment of graduates of agriculture and related sciences owing to poor performance in the agriculture sector which grew at 1.4% in 2004 (African Economic Outlook, 2006).

In the 2005/06 academic year, admissions started increasing; and again this might be attributed to the economic growth which registered a tremendous 5.8 per cent Real Gross Domestic Product surpassing the record of 4.9 per cent growth registered in 2004 (Ministry of Planning and National Development, Kenya Economic Survey, 2005).

The number of students who chose to study agriculture and related sciences in the selected three universities started declining steadily from 187 to 143 applicants in 2003 and 2004 respectively. This trend is likely to have some ramification on the future extension field staff, the personnel who will play the significant roles in agribusiness firms, the future policy analysts and programme administrators in government agencies, future graduate students and the entire future profession of agriculture and related sciences. Figure 1 summarises the implications of declining enrolment in agriculture and possible interventions.

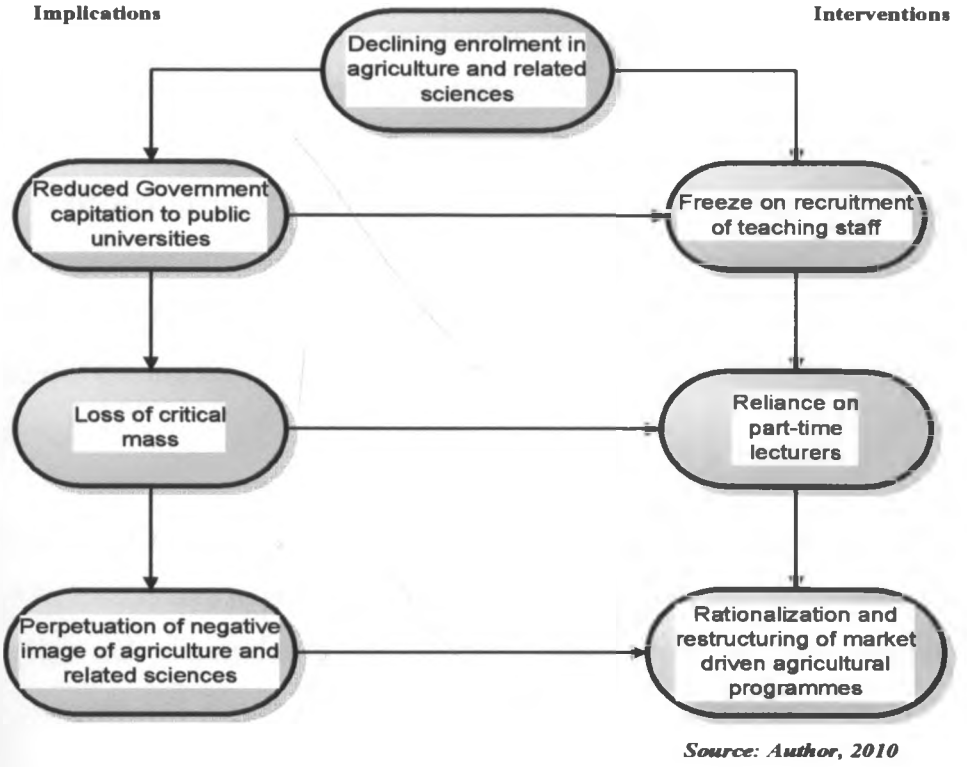


Figure 3: The implications and interventions in declining enrolments

Reduced Government capitation to public universities has caused the institutions to review their budget allocations and strategize on how to utilize limited resources. Some of the strategies adopted have been to freeze recruitment of staff. This has led to absence of specialists to teach agriculture in public universities which is now being felt as public universities of agriculture have turned to relying on part-time lecturers in specialists areas such as agronomy, agribusiness, plant science and crop protection to name but just a few.

The decline in enrolment in agricultural programmes is not unique to public universities in Kenya. In the United States of America (USA), the issue of enrolment came to the fore in 1988 when it was realized that enrolments in agriculture were declining (National Research Council, 1988). Although steps were taken in which a major reform in secondary agricultural education resulted into an increase of 29% over the previous

1988's enrolment, declining enrolments in colleges of agriculture is still one of the challenges facing agricultural education in the USA today.

In Australia, Pratley and Copeland (2008) reported that there was a decline of approximately 30% in the number of graduates from agriculture programmes from the period 2001 to 2006. The supply of agriculture graduates from Australian universities fell short of the market requirement making it urgent to re-awaken interest in programmes of agriculture.

Maguire (2000) in a paper on "Agricultural Education in Africa: Managing Change" recognized failure to attract the best quality students as one of the many challenges facing agricultural education in Africa. The paper proposed that agricultural education institutions and systems should reach out to the broader education system and partner with science, economics, sociology, environment, engineering, education, health and business departments to design and offer education programmes which will attract good quality students and make an impact on rural development.

The greater role of agriculture now experienced by Malaysia has made agricultural education more attractive to prospective students (Hussein (2002). The Universiti Putra of Malaysia has incorporated an intensive entrepreneurial training in its agricultural programmes and linking graduates with relevant organizations and state governments to obtain sustainable land to start their own agribusiness enterprises. Graduates have been trained in precision agriculture which utilizes the information technology in economics and business to tackle the problem of global competition.

2.4 SOME STUDIES RELATED TO DECLINING ENROLMENTS

According to Oniang'o and Carl (1990), African universities are a primary source of human capital for agricultural research agencies as well as the source of future academic staff members. University graduates are influential in many ways in staffing

management, funding an operation of colleges, research centres and extension services, suggesting that education and training is part of a system which serves the agricultural sector.

However, critics have argued that the African scientific community bears the responsibility of declining enrolments in agriculture and related sciences. In fact Inter-Academy Council (IAC) Report (2009) has cautioned that unless the current crisis in the African scientific community is resolved, Africa's next generation of scientists will be caught in a downward spiral. This scenario can partly be explained in the fact that students do not choose agriculture degree programmes as a priority (Chakeredza, Temu, Saka, Munthali, Muir-Leresche, Akinnifesi, Ajayi and Sileshi, 2008). Attracting young people to agriculture has been found to be a critical challenge. Agriculture has been considered as lacking respectable job opportunities. It is also associated with poverty as reflected in subsistence farmers.

Several scholars in agricultural education have attempted to address the question of declining enrolment in agriculture and have found out interesting correlations between predetermined variables. For example, the factor of gender, academic achievement and race were crucial in Hoover and Scanlon's (1991) study on enrolment into agricultural education. What emerged from this study was that race, gender and academic achievements were factors influencing enrolment.

Bell and Fritz (1992) in their survey on deterrents to female enrollment in secondary agricultural education programmes in Nebraska concluded that there was lack of information explaining both traditional and non-traditional employment opportunities for females and recommended that secondary agricultural education curriculum should be "student driven" instead of "programme driven". Marshall, Herring and Briers (1992) in a study to find out the factors that influenced students' enrolment in agriculture established that older students enrolled because of disavowance. This means students enrolled into

agriculture and related sciences due to reasons beyond their control. In other words, they disavowed responsibility for being in the agriculture programmes.

Reis and Kahler (1997) found that personal interest, possession of a farm background and participating in an agricultural course influenced students in Iowa to enroll in agricultural education. The study recommended that Iowa agricultural educators should maintain active recruitment programmes that share information about the agricultural programmes with potential students, parents, school administrators and the public.

Scott and Lavergne (2004) focused on the perception of high school freshmen and found that majority of the students still had positive perception of agriculture regardless of whether or not they had enrolled in an agricultural education class. Influential persons were the least motivating factor for students to enroll in an agricultural education class. Both minority and non-minority groups of students had positive opinions about agriculture and its related fields, but the majority of the students were less confident in their knowledge about how to prepare for those careers. The study recommended that the junior school level should be exposed to agriculture so as to broaden students' perception of agriculture and related fields.

2.5 THE ROLE OF ICTS IN LEARNING EXPERIENCES

The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2007) uses the term ICTs to refer to "forms of technology that are used to transmit, process, store, create, display, share or exchange information by electronic means. This broad definition of ICT includes such technologies as radio, television, video, DVD, telephone (both fixed line and mobile phones), satellite systems, and computer and network hardware and software, as well as the equipment and services associated with these technologies, such as videoconferencing, e-mail and blogs." The term ICTs also refers to both the "old" ICTs such as radio, television and telephone, and the "new" ICTs such as networked computers, satellite and wireless technologies and the internet. According to Paas (2008), any kind of technology can be understood as a tool or technique for

extending human capacity. In this sense, ICTs extend human capacity to perceive, understand and communicate. The mobile phone makes it possible to speak from wherever one is to others thousands of kilometers away whereas the television brings pictures of what is happening elsewhere very close to the eyes. The web supports immediate access to and exchange of information, opinions and shared interests.

New ICT are playing a major role in shaping the 21st century global economy and making rapid changes in society. Within the past decade, the new ICT tools have fundamentally changed the way people do business (UNESCO, 2002). In addition, ICT are dramatically affecting the way people teach and learn (Bayindir & Inan, 2009). ICT have, therefore, been increasingly deployed in education as tools to extend the learner's capacity to perceive, understand and communicate as seen in the increase in online learning programmes and the use of the computer as a learning support tool in the classroom. According to White (2005), universities were certainly leaders in engineering the Internet and inter-operable computer systems to connect researchers for e-mail and data exchange, the use or ICTs for education and training but have lagged behind other sectors of society.

Studies conducted on the capabilities of ICTs have found that computers enhance teaching and learning via presentations, more opportunities to practice and analyze, and more access to source material via Internet (Brown, 2002). Computers and Internet connectivity has been found to enhance communication and interaction between colleagues within faculties, between classmates, and between faculties and students. Hawkins (2002) of the World Bank Institute published Ten Lessons for ICTs and Education in the Developing World in which he argued that the use of technology motivates students and energizes classrooms and empowers girls. Hawkins (2002) advocated for the development of computer laboratories in higher education institutions in developing countries so as to work well in improving access and usage at the same time providing the accessibility of good technical support.

Furthermore, ICTs, when used wisely such as Internet can help unite people and create powerful and synergistic partnerships at local, regional and global scales (Keats & Darries, 2003). The use of Internet has enabled the formation of various forms of virtual universities within and between countries across the globe. This makes a clear point that internet as a communication medium cannot be limited by time and space; and it is enabling new local and global education synergies on teaching and learning for enhanced higher education to unlimited audiences, beyond time and distance boundaries.

According to Yonah and Cons, ICTs can also act as facilitators to decision making (as cited in Mtega & Malekani, 2009). ICTs enable communication, a process that links individuals and communities, governments and citizens, in participation and shared decision making. ICTs services such as internet are able to offer enormous benefits to rural communities and agricultural organizations. They are able to improve communication between the non-governmental organizations, government services, private sector entities and educational institutes that support rural and agricultural development. By sharing information about their activities in the fields of agriculture, rural development, forestry, fisheries, health, nutrition, and education, these agencies can better serve rural people and farmers. They can make use of "lessons learned," determine and use "best practices," and coordinate information about particular regions or successful development approaches. At the same time, rural communities and agricultural organizations can benefit equally from improved vertical channels of communication that enable rural stakeholders and farmers to communicate with decision-makers and others concerned with development.

ICT also improve horizontal communication through existing media services that serve rural stakeholders as well as stimulating interest for students to enroll in agricultural programmes. For example, throughout the developing world, rural radio and, increasingly, television broadcast services are important information delivery mechanisms. Their services improve significantly through the exchange of information

and news by way of the Internet. African news items are commonly circulated among African news agencies via the Internet.

There is need to tap the potential of ICTs to enhance data collection and analysis, and to strengthen management systems in educational institutions; to improve access to education by remote and disadvantaged communities; to support initial and continuing professional development of teachers; and to provide opportunities to communicate across classrooms and cultures. Indeed, this would strength the position of integrating ICT in agricultural programmes that would be instrumental in exposing potential students to information that would influence their career choices.

CHAPTER THREE

3.0 MATERIALS AND METHODOLOGY

3.1 INTRODUCTION

This chapter outlines the research strategy that was adopted for this study, the conceptual, framework data analysis techniques used.

3.2 SCOPE OF THE STUDY

Out of the seven (7) public universities in Kenya, it would not have been possible to include all of them in the study sample. Therefore, three (3) public universities which vary in size were purposively sampled; namely,

i) Jomo Kenyatta University of Agriculture and Technology (No=70);

ii) University of Nairobi (No=148); and

iii) Egerton University (No=298).

The selection was influenced by the fact that the University of Nairobi is the premier institution of higher learning in Kenya which started offering agriculture in 1970/71. In addition, it is currently the only university in the region that offers training in veterinary medicine since 1946. Egerton University is a premier institution of professional agriculture. It was upgraded from a diploma to a degree-awarding institution in 1986. Consequently, its diploma programmes in agriculture were dropped from 14 in 1974 to four (4) by 1998 (Ngugi et.al, 2005). Jomo Kenyatta College of Agriculture and Technology, a diploma-awarding institute since 1981, was elevated to university status in 1994. According to Ngugi et.al., (2005), the expansion of agricultural education at

theoretical and practical levels in Kenya has had positive impact on farming standards and led to an increase in production. The three universities comprise over 90% of students pursuing agriculture and science related courses in Kenya (Ngugi, Isinika, and Temu, 2005).

The population of both male and female students was sampled from a confidential search of nominal rolls available in the selected public universities. From 2001 up to and including 2008, the sampled public universities admitted 5,402 students to study agriculture. The population of female students vis-à-vis that of male stood at 39% (JAB, 2008). Out of the total number of 4960 students, a systematic random sample size of 496 was selected.

3.3 THEORETICAL FRAMEWORK

This study was based on social learning theory of career decision making (SLTCDM) by Krumboltz (1979). Two major types of learning experiences emerge; namely, instrumental and associative learning experiences. According Krumboltz (1975), four factors influence the career decision making path;

i) **Genetic endowment and special abilities**

Race, enthnic, gender, physical appearance and other characteristics impact on the way people make decisions. Individuals differ both in their ability to benefit from learning experiences and to get access to different learning experiences because of these types of inherited qualities.

ii) **Environmental conditions and events**

These include social, cultural, political, economic forces, natural forces and natural resources. These are generally outside the control of any one individual. Their influence can be planned or unplanned. For example when students find themselves

admitted into agriculture and related sciences when they never even applied for the course.

iii) Learning experiences

Each individual has a unique history of learning experiences that results in their occupational choice. They often do not remember the specific character or sequence of these learning experiences, but rather they remember general conclusions from them (personal experience such as viewing agriculture as fun). The two main types of learning experiences identified in the theory are:

a) Instrumental learning experience which consists of preceding circumstances/stimulus; behavioural responses (overt and covert); consequences. For example, if studying agriculture results in a positive reinforcement where graduates are absorbed in the job market without having to wait, then many will be attracted to agriculture as a career of choice.

b) Associative learning experience where individuals perceive a relationship between two (or more) sets of stimuli in the environment (for example, observation, reading or hearing about occupations, role models). This can result in occupational stereotypes such as perceptions people have about agricultural education.

iv) Task approval skills.

Interactions among learning experiences, genetic characterises, and environmental influences result in the development of task approach skills. These include:

a) personal standards of performance;

b) work habits; and

c) emotional responses.

Previously learned task approach skills that are applied to a new task or problem both affect the outcome of that task or problem and may themselves be modified. When these factors interact, people develop self-observation generalizations and world view generalizations. As a result, individuals engage in various behaviour patterns that lead entry into a career.

The theory posits that people need to be empowered to take action and not merely to be given a diagnosis. In this case, the study diagnosed the factors influencing the decision to choose or not choose to study agriculture and related sciences and explored the extent to which ICTs could be used as an intervention to make the programmes demand driven. Individuals will likely use the cognitive and performance skills and emotional responses necessary for career planning, self-observation, goal setting and information seeking if they have been reinforced for these behaviour, by observing valued model and by having access to people and other resources that can assist in career decision making.

The theory advocates interventions through modeling, improved instrumental and associative learning experiences, stimulation of self-observation, influence task approach skills and cognitive and performance skills. Crites (1981) suggested interventions such as diagnosis in terms of problem, definition of goals, examination of alternatives and their consequences and typical behavioural interest (modeling, sensitization and counter-conditioning).

3.4 CONCEPTUAL MODEL

Positive influences cause individuals to take action to enroll in school, prepare for work in a certain field or seek employment in that field. On the other hand, negative influences result in individuals being less likely to seek enrolment in a school or employment in the field if the "cost" exceeds perceptions of future gains and/or will not take appropriate

actions to seek training or enter the field if denied access to minimum resources needed to enter the field.

ICTs access and use, pre-university exposure to agriculture, KCSE aggregate mean grade and gender were variables which the study presumed to influence the potential undergraduate students in their choice of agriculture and related sciences. These independent variables were presumed to cause changes in the values of the dependent (criterion) variable, thus, enrolment in agriculture and related sciences. The perception by gender variable was treated as a confounding (mediator) variable. Figure 4 shows the investigator's own position on the problem of enrolment in agriculture and related sciences and gives a direction to the study.

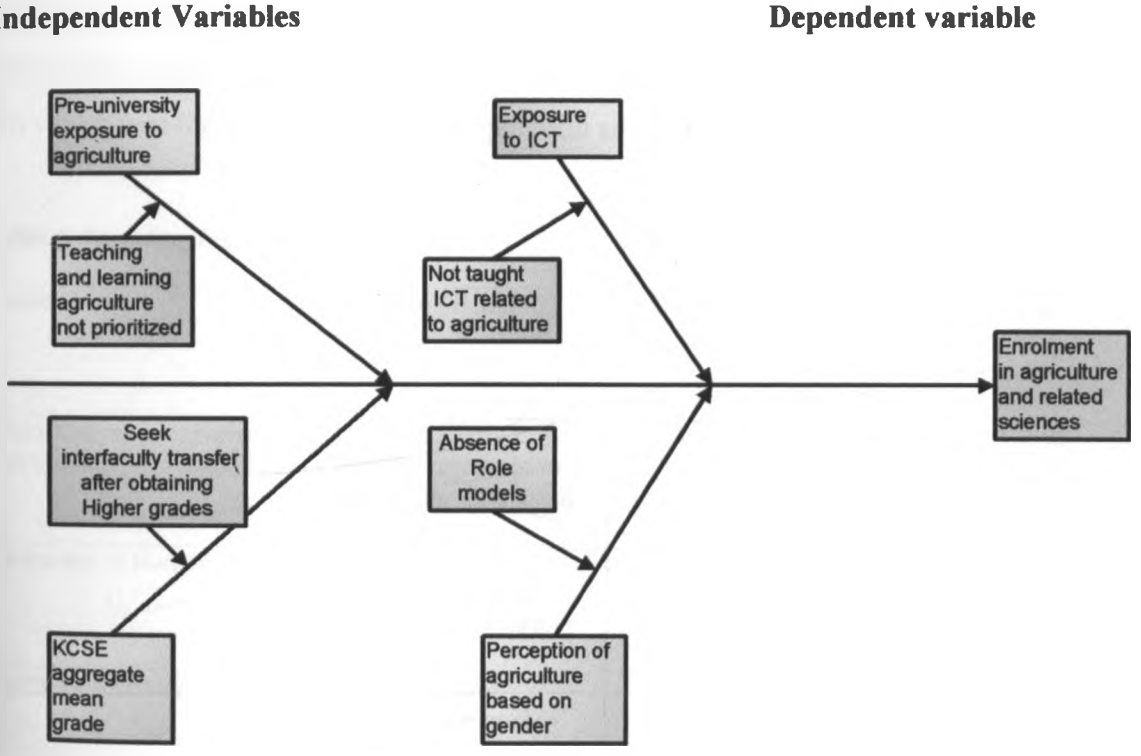


Figure 4: Variables associated with enrolment in agriculture and related

3.5 POPULATION AND SAMPLING

The population for this study was defined as all registered bona fide undergraduate students enrolled in agriculture and related sciences from the three purposively sampled public universities. The survey frame of the accessible population was established through signed class nominal rolls for first, second, third, fourth and fifth year students. The sample was obtained through systematic random sampling of a captive audience. Captive audience is an expression which was coined in 1902 to mean a group of people who listen to or watch someone or something because they cannot leave. Since the target population was 4960 the required sample size was therefore calculated using the following formula shown in **(Appendix 1)**. The required sample size for this study was determined to be 357 using Cochran's (1977) sample size determination formula for continuous data. However, due to the large defined target population of 4960, a larger sample size was thought to be desirable; and therefore, the investigator decided to use 496 which was the 10% of the target population as shown in Table 1.

Table 1: Sampling frame and size

Institution	Sampling frame	Population	Sample size Cochran's formula or K & M Table	10% Sample size
Jomo Kenyatta University of Agriculture and Technology	Undergraduates students registered in agriculture and related sciences	692	50	70
University of Nairobi	Undergraduates students registered in agriculture and related sciences	1480	106	148
Egerton University	Undergraduates students registered in agriculture and related sciences	2788	201	298
TOTAL		**4960**	**357**	***496**

(* *The adopted sample for the study)*

3.6 THE RESEARCH INSTRUMENT

The instrument for this study consisted of a self administered questionnaire with thirty-two questions. The data collection instrument was developed after comprehensive literature review. The questionnaire had both open and close-ended questions divided into three sections; namely, Section A: Respondents' data, Section B: Pre-university exposure to agriculture, reasons for choice and perceptions; and Section C: Access and use of ICTs Half of the questions were constructed using the Summated Rating Scale (Likert Scale) five-point scale with anchors labeled as: Strongly Disagree = 1, Disagree = 2, Unsure = 3, Agree = 4 and Strongly Agree = 5; and No influence = 1, Little influence = 2, Some influence = 3, Much influence = 4 and Very much influence = 5.

In Section A, the characteristics of the respondents in the questionnaire comprised the following:

i) University enrolled in;

ii) Gender;

iii) KCSE aggregate mean grade obtained;

iv) Degree enrolled in; and

v) Year of study.

Section B addressed pre-university exposure to agriculture which, according to the investigator was defined to include the following:

i) Taught agriculture in both primary and secondary school levels;

ii) Engaged in agriculture as an extra-curricular activity; and

iii) Examined in agriculture at the KCSE level

The Section also contained a scale of 19 items which were designed to identify predictors in the choice of individual students as having enrolled in agriculture and related sciences. Study respondents were asked to indicate the level of influence or no influence from each of the scale items using a five-point Likert-type scale with the following response values: No influence =1, Little influence =2, Some influence =3, Much influence =4, and Very much influence =5. Respondents were also asked to respond to a nine (9) item scale by indicating their level of agreement or disagreement with each of the scale items using a five-point Likert-type scale with the following response values: Strongly Disagree=1, Disagree=2, Unsure =3, Agree=4 and Strongly Agree=5.

Section C sought to establish the extent to which respondents were exposed to ICTs through access and use. Exposure to ICTs was operationalized to include but not limited to the following:

i) Undergraduates' definition of ICTs;

ii) Indication of knowledge, access and use of computers at both primary and secondary school levels;

iii) The extent to which computer courses were taught at both primary and secondary school levels;

iv) Interaction with computers through extra-curricular activities and computer club;

v) Pre-university level of computer proficiency;

vi) Familiarity with ICTs;

vii) Taught computer course(s) in agriculture in the first, second, third, fourth and every year of study;

viii) Types of computer courses taught;

ix) The location where computers could be accessed and used;

x) The most frequently used software;

xi) Familiarity with search engines; and

xii) Suggestions on how ICTs could be used to make agriculture demand driven.

The questionnaire is located in **(Appendix 2)**

The study also used Focus Group Discussions (FGDs) approach which is a qualitative type of research where a trained moderator asks the group questions while the group responds to the questions (Ary, Jacobs & Razavieh, 2002). Patton argues the FGDs are not discussion or decision making groups, and they do not have to reach a consensus on the topic. FGDs object was to get high quality data in social context where participants could consider their own views as well as the view of others (as cited in Villard, 2003). FGDs have been found to be useful where there is little information available about a topic (Ary, et.al, 2002); and insight is necessary for explanatory or preliminary studies (Krueger, 1994).

The literature search on the topic had indicated that no study had been done on ICTs and enrolment in higher agricultural education. It therefore, seemed necessary for the investigator to begin learning about this topic through FGDs. This allowed the

investigator to gain insight into what the research subjects were thinking (Ary, et.al, 2002). FGDs have a high face validity because the comments from participants are believable (Krueger, 1994). The list of questions for the FGDs guideline is located in (**Appendix 3).**

3.7 VALIDITY OF THE INSTRUMENT

Validity of the instrument was established through expert opinions, literature review and pretest of both open and close ended questions. Two supervisors together with a panel of faculty members from the Department of Agricultural Economics with expertise in data collection validated the instrument and found it to be a valid tool for exploration in the study.

3.8 RELIABILITY OF THE INSTRUMENT

Reliability is the degree of consistency that the instrument or procedure demonstrates: Whatever it is measuring, it does so consistently (John, Bushery, Brick, Serverynse & McGuiness, 2003). The more consistent the results given by repeated measurements, the higher the reliability of the measuring procedure; conversely the less consistent the results, the lower the reliability. After the University of Nairobi Board of Postgraduate Studies approved the registration of the research proposal, the Faculty of Agriculture, College of Agriculture and Veterinary Sciences granted a letter of introduction and authority for the investigator to conduct the study. The instrument was then pilot tested for reliability using representatives from the College of Agriculture & Veterinary Sciences who were later not included in the sample. The coefficient for internal consistency was calculated for the 100% questionnaire return rate.

In this study, reliability was estimated by using the split half technique, which is most widely used method of estimating internal consistency. The questionnaire was split into two sub tests each, using the odd numbered questions for one set and the even numbered

questions for the other. Pearson's Product Moment Correlation Coefficient (r) which ranges from -1.0 to +1.0 was used **(Appendix 4)**. According to Pearson's Product Moment Correlation Coefficient formula, a reliability coefficient of 0.732 was obtained from the pilot study. If a test has a strong internal consistency most measurement experts agree that it should show only moderate correlation among items 0.70 to 0.90 (Nunnally, 1978). The higher the Alpha is, the more reliable the test is.

3.9 PROCEDURE FOR DATA COLLECTION

The self administered questionnaires were distributed to a captive audience of undergraduates students in Jomo Kenyatta University of Agriculture and Technology, University of Nairobi and Egerton University. The investigator followed up and collected most of the questionnaires as and when they were ready. Two FGDs which were conducted involved a total of 28 participants; nine (9) drawn from the University of Nairobi and 19 from Egerton University. The investigator outlined the purpose of the study and the criteria for inclusion. The FGDs sessions which lasted for 50 minutes each were facilitated by the investigator who took the role of a moderator and was assisted by three (2) students who took notes. The role of the moderator was to lead the group in discussions by asking questions and directing the flow of the conversation. No tape recorder was used. Table 2 provides data on each focus group.

Table 2: Data on focus group discussions for Egerton University and University of Nairobi

FGDs	DESCRIPTOR								
		Gender		Degree programme enrolled in				Year of study	
	No. of Participants	Male	Female	Agric. Econ.	Agric. Ed. & Ext.	Food Sc. & Techn.	Vet. Med.	1st	4th
Group 1	19	12	7	7	2	10	~	10	9
Group 2	9	6	3	4	1	2	2	~	9

(Source, Field data, 2010)

3.10 DATA ANALYSIS TECHNIQUES

The following hypotheses formed the basis upon which data was collected and analysed.

H_{01} The likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on ICTs access and use;

H_{02} The likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on pre-university exposure to agriculture;

H_{03} The likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on KCSE aggregate mean grade.

H_{04} The likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on perception by gender.

After data collection, the questionnaire was coded. Data on independent and dependent variable was subjected to descriptive analysis which comprised frequencies, bar and line charts, and Pearson's Chi Square cross-tabulations of the relevant variables with the help of Statistical Package for the Social Sciences (SPSS), version 16.0.

3.11 LIMITATIONS

3.11.1 Several studies have been conducted the world over on enrolment issues in agricultural education programmes. Most of these studies have been conducted in the United States of America (USA), Canada, India, Iran, Australia, New Zealand, Nigeria, just to name but a few. All these areas have their own varied social, economic and political characteristics that may have a bearing on the behaviour of enrolment of undergraduate students into agriculture and related sciences. In

Kenya, scholars of agriculture and related sciences have focused on this issue within the purview of perceptions which are purely attitudinal. At the moment, there is limited information on studies that have focused on the use of ICTs as predictors in enrolments.

3.11.2 The findings of the study may not be used as a generalization in such a socio-economically diversified system as found in Kenya; more particularly in private universities which are also offering training in agriculture and related sciences.

3.11.3 ICT operates and are greatly influenced by many other factors well beyond the control of the study.

3.11 DELIMITATIONS

3.11.1 The study was confined to enrolment in three selected public universities out of the current seven.

3.11.2 Any intended generalizations should take into account the proportionate variances in historical, geographical and respective institutions.

3.12 BASIC ASSUMPTIONS OF THE STUDY

The study had the following assumptions:

3.12.1 The sample was representative of undergraduate students studying agriculture and related sciences in public universities.

3.12.2 The instrument used had validity and was measuring the constructs.

3.12.3 All the respondents would answer the survey questions truthfully.

3.12.4 All respondents were undergraduate students enrolled in agriculture and related sciences in three (3) selected public universities; and had similar perceptions about the programme.

3.12.5 Both male and female respondents had technical skills that could enable them access and used ICTs facilities in their respective universities; and recognized the role ICTs could play in making agriculture and related sciences demand driven.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 INTRODUCTION

This chapter presents the results derived from the analysis of data from the 367 respondents. Majority of the respondents (53.2%) were from Egerton University. This was by virtue of Egerton University being a premier institution that offers agriculture to a larger population of students. Most questionnaires were satisfactorily completed, an indication that the subject was of interest to the respondents.

4.2 DESCRIPTIVE ANALYSIS RESULTS

The 367 respondents were broke down into 1st year undergraduates 28.3%, 2nd year 21.3%, 3rd year 18.8%, 4th year 29.7 and 5th year 1.4%. First, the views of first year students might provide the investigator with a better picture of the pre-university ICTs experience that could be built on. Secondly, fourth year students, who were finalists provided a good opportunity for understanding what ICTs needs of future students might be However, the least represented group was the fifth year undergraduate students due to non-response which was treated as missing data and not included in the sample data. Table 3 gives the details of the characteristics of respondents. The gender split was 61.6% male to 32.4% female. The distribution of the sample of the study consisted of male and female population in public universities which is (61%) for males and (39%) female undergraduate students enrolled in higher education in Kenya (JAB, 2010). Hence the sample population was not biased. Respondents who obtained B+ and A- aggregate mean grades in KCSE were 54.2% and 31.6% respectively. This indicates that students who obtain high grades are admitted into agriculture and related sciences in accordance with the JAB predetermined criteria. This tends to contradict the study by Hoover and

Scanlon (1991) that potential enrollees into agriculture have lower academic achievements.

Table 3: Characteristics of respondents enrolled in agriculture and related sciences

Variables		Frequency	Percentage
Respondents from public selected public universities	Egerton University	192	52.3
	University of Nairobi	128	34.9
	Jomo Kenyatta University of Agriculture & Technology	47	12.8
Gender as a variable in perception of agriculture	Male	248	67.6
	Female	119	32.4
Aggregate mean grade in KCSE indicative of academic achievement	A (78 and above)	4	1.1
	A- (71 - 77)	116	31.6
	B+ (64 - 70)	199	54.2
	B (63 – 69)	34	9.3
	B- (56 – 62)	5	1.4
	C+ (49 - 55)	5	1.4
Degree enrolled in agriculture and related sciences	Agriculture general	132	36
	Food Science & Technology	116	31.6
	Land resource & Agricultural Technology	17	3.7
	Animal Science	35	9.6
	Plant Science	6	1.6
	Agri-business	1	0.3
Year of study in agriculture and related sciences programmes	First year	104	28.3
	Second year	78	21.3
	Third year	69	18.8
	Fourth year	109	29.7
	Fifth year	5	1.4

(Source: Field data, 2010)

4.3 INFLUENTIAL FACTORS IN ENROLMENT

4.3.1 KNOWLEDGE, ACCESS AND USE OF ICTS AMONG RESPONDENTS

The study sought to establish the level of ICTs knowledge among undergraduate students by asking the respondents if computers were available in both primary and secondary schools they attended. Also various levels in ICTs knowledge, familiarity, computer courses taught, locations where computers were accessed, the most frequently used software and search engines were considered.

Respondents were required to define the term ICTs. The indicated that 65% knew ICTs as "information communication technology which incorporates media used for transmitting information to facilitate communication. It also comprises all the technological advancements that have been released to facilitate information sharing which involves electronic devices such as computers, videos, telephones, mobile phones, CD-ROMs, TVs, radios etc". The definition did not deviate from the operational one provided by UNESCO (2007). By implication, majority of the respondents in the sample population were able to conceptualize ICTs. Table 4 shows both frequency count and column percentages (in parenthesis) of the undergraduate students exposed to ICTs in form of knowledge, access and use.

Table 4: Knowledge, access and use of ICTS

ICT exposure	Frequency	
	Yes	No
Computer knowledge	249 (67.8%)	16 (4.4%)
Access to ICTs	174 (47.4%)	79 (21.5%)
Taught courses	8 (2.2%)	327 (89.1%)

(Source: Field Data, 2010)

As shown in Table 5, it is evident that 69.2% of the respondents found computers more available at secondary school level whereas 48.2% were taught as a subject at primary

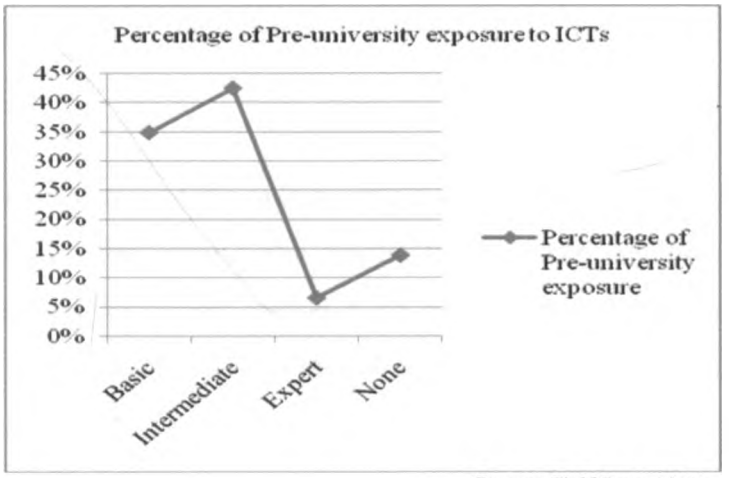
school level. Exposure to computer was more of an extra-curricular activity in both secondary and primary schools.

Table 5: Pre-university exposure to computer

Scale	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Computers available in primary school	61	16.6%	300	81.7%
Computers available in secondary school	254	69.2%	103	28.1%
Taught computer as a subject in primary school	35	9.5%	317	86.4%
Taught computer as a subject in secondary school	178	48.5%	177	48.2%
Learnt computer as extra curricular	209	56.9%	146	39.8%
Had a computer club in primary school	24	6.5%	331	90.2%
Had a computer club in secondary school	142	38.7%	214	58.3%

(Source: Field Data, 2010)

Further, undergraduates had knowledge and skills in computer applications at various levels from basic, intermediate, expert to none at all as shown in figure 5. It is interesting to note that about 13.9% of the undergraduate students do not have any computer knowledge and skills at all. Much as this appears to be a small percentage, it may have adverse long term ramifications on ICTs access and use among undergraduate students in public universities. The sample data shows that 34% had basic computer, 42.5% intermediate and 6.5% expert skills respectively.



(Source: Field Data, 2010)

Figure 5: Pre-university exposure to ICTs

Respondents listed the following courses which were taught alongside their agriculture courses.

i) Introduction to computers;

ii) Information technology;

iii) Computer applications for research;

iv) Biometry statistics; and

v) Computer programming and design.

In the FGD sessions, participants reported that although they were offered courses in computer skills, the entry behaviour of individual students was not considered. For instance, in the first year, 56.4% students were taught some of the computer courses. More students (73.6%) were taught computer courses in second year whereas 2.5% were taught in third year. In fourth year, (1.9%) of the students were taught computer courses.

Such a scenario points out that as students advance in their academic mobility, the chances of being taught a computer course in selected public universities tend to decrease considerably.

Undergraduate students were of the opinion that the computer courses taught were basic and lacked academic stimulation. The implication is that whatever undergraduate students learnt insofar as computer courses were concerned, there was no direct relation to agriculture and related sciences. This means there is a gap in this area that requires to be addressed.

Regarding familiarity with ICTs; and in view of the given definition, data in Table 6 summarises the ICT status among the respondents. In fact, majority of the undergraduate students were familiar with almost all the ICTs (both new and old) that were put to them in the questionnaire. This demonstrates the availability of room to exploit the potential of ICTs in making agriculture and related sciences demand driven.

Table 6: Familiarity with ICTs

Types of ICT	ICTs Knowledge			
	YES		NO	
	Frequency	Percentage	Frequency	Percentage
Computer	334	91	19	5.2
Mobile phones	352	95.9	5	1.4
TVs	345	94	11	3
Video	336	91.6	17	4 6
CD-ROM	295	80.4	54	14.7
Internet	326	88.8	30	8.2
Radio	343	93.5	12	3.3
Bluetooth wireless	1	0.3		
ipod mobile phone	1	0.3		

(Source: Field Data, 2010)

Table 7 shows where students accessed and used ICTs. Computers were accessed through computer laboratories, cyber-cafes, libraries, at home, classrooms and computer clubs. Computer laboratories (60.2%) and cyber cafes (55.9%) were the most likely places

where students accessed and used computers. This was driven by the need to learn how to draw upon text, index, Web and electronic libraries as information sources and cross reference information sources. One can deduce from this survey that libraries in public universities have not adequately integrated ICTs in the provision of library services to students. In addition, there is minimal use of ICTs in classrooms/lecture theatres based on the responses given.

Table 7: Access and use of computers

Location of ICTs	Accesss and use of ICTs			
	YES		NO	
	Frequency	Percentage	Frequency	Percentage
Computer laboratory	221	60.2	137	37.3
Cyber cafe	205	55.9	153	41.7
Library	140	38.1	217	59.1
At home	97	26.4	259	70.6
Classroom	5	1.4	352	95.9
Computer club	5	1.4	352	95.9

(Source: Field Data, 2010)

Microsoft Word was the most frequently used software (82.6%), Power Point (31.1%) and Access (21.3%). Google (92.4%) was the frequently used search engine, followed by Yahoo (71.7% as shown in Table 8.

Table 8: Familiarity with search engines

Search engines	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Google	339	92.4	16	4.4
Yahoo	263	71.7	92	25.1
Others (Alta Vista, Bing/hotmail/MSN)	17	4.6	4	1.1

(Source: Field Data, 2010)

In responding to the question about the adequacy of ICTs facilities, 75.7% of the respondents affirmed that their interactions with ICTs met their needs and gave the following reasons for their response.

i) It was easy to access research information through the internet.

ii) On-line book notes, current affairs and exchange of information with friends was accessible.

iii) ICTs infrastructure was available in form of spacious computer rooms in the libraries, computer laboratories, education resource centres and in faculties making it easy and fast to access and use information.

iv) Computer applications in agriculture and applied science had made the courses interesting.

v) Internet was used to keep updates on knowledge in agriculture especially in designing structures and knowledge about food value addition.

The study further sought to establish the means through which undergraduates obtained agricultural information. Five options were provided; namely, researchers, extension service personnel, farmers, the press, Non-Governmental Organizations (NGOs) and others. It emerged that 53.4% of the respondents received agricultural information from researchers whereas 41.4% received from the press, 15.3% from extension service personnel, 14.4% from NGOs, 7.9% from farmers and 2.5% from others. This question was necessary for the intention of gauging how much undergraduate students interacted with stakeholders in agriculture. By establishing the extent of interactions, mechanisms that are ICT based would be devised to make agricultural education popular in order to attract increased enrolment. From the responses given, there is an indication of lack of interaction with farmers who are key on issues of agriculture.

For the purposes of this study, computer exposure was the level of ICTs knowledge acquired prior to joining and during their study at university, the access and use. Twenty-eight items designed to gauge computer knowledge, access and use among undergraduate students were combined into a new variable and subjected to the Pearson's Chi Square test. The sample results revealed that the likelihood that potential undergraduate students

would choose to study agriculture and related sciences is not dependent on ICTs access and use. The null hypothesis was therefore accepted.

4.3.2 Pre-university exposure to agriculture

Pre-university exposure to agriculture was one of the factors which was identified as crucial in decision making regarding the choice of agriculture as a lifelong career. Pre-university exposure to agriculture and related sciences was interpreted as the extent to which undergraduate students were taught agriculture at either primary or secondary school, engaged in agriculture as extra-curricular activity for example through 4K Club and having been examined in the subject at the KCSE level. Responses to questions whether they were taught agriculture, engaged in as an extra-curricular activity or examined at KCSE level are captured in Table 9 which shows both the frequency and column percentages. Out of 367 sample data, 64.4% had been exposed to agriculture before joining public university of their choice.

Table 9: Pre-university exposure to agriculture

Taught as a subject	Frequency	Percentage
Yes	186	64.4%
No	122	39.6%
Total	**308**	**100%**

(Source: Field Data, 2010)

Figure 5 shows the proportions of students who chose agriculture and related sciences as programmes of study at the selected public universities.

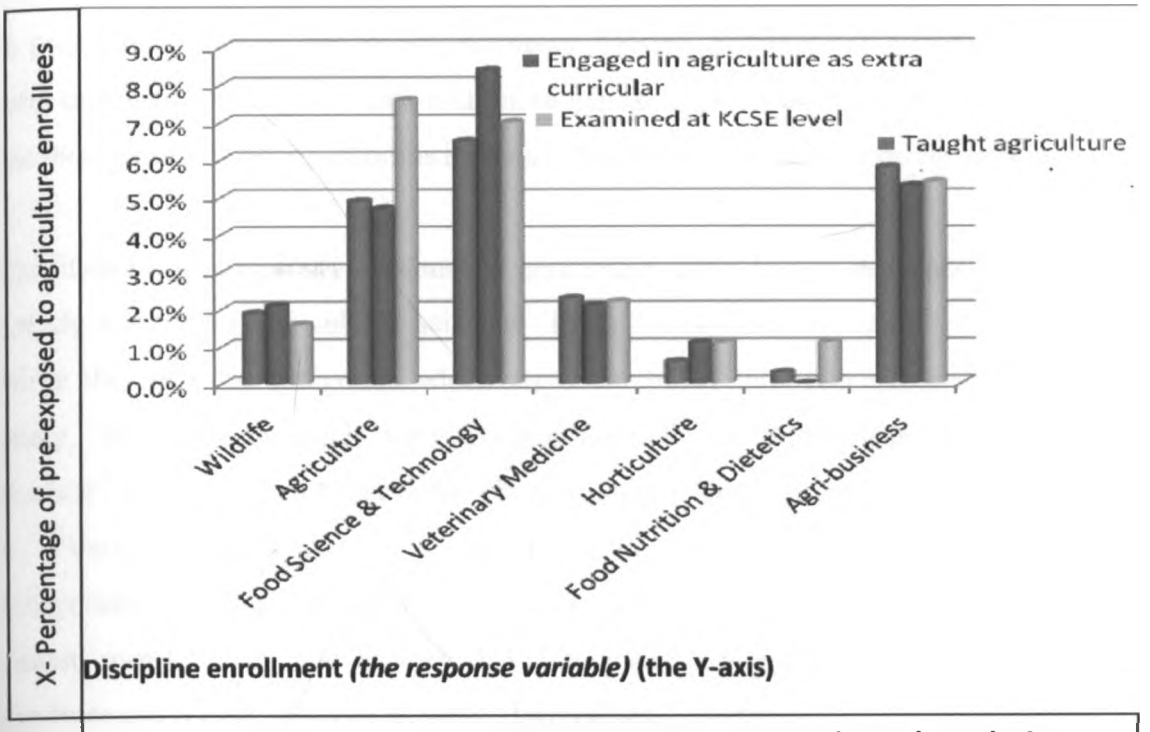


Figure 6: Pre-university exposure and enrolment in agriculture

(Source: Field Data, 2010)

The computed Pearson's Chi Square indicated that there is a highly significant relationship between pre-university exposure to agriculture and the choice to study agriculture and related sciences at the university. Therefore the null hypothesis that the likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on pre-university exposure to agriculture was rejected. For example, Egerton University had 40.2% of the undergraduate students who had been taught agriculture in both secondary and primary schools; and chose to enroll in agriculture and related sciences. This prior exposure could have contributed to a positive image relative to agricultural education. Besides, students who enrolled may have had a career objective which was congruent with agricultural programmes offered at public universities. This finding is crucial in determining the influence of exposing students to agriculture at an early stage and how it impacts on future career choices. Reis & Kahler, (1997) while studying factors influencing enrolment in agricultural education programmes in Iowa High School recommended that agriculture instructors should share information about agriculture programmes with students, particularly "sharing goals of

the programme, content and its achievements. Leising, Sommer and Cecchettini (1992) found out that providing students with more exposure to the agriculture industry by the time they are in secondary school is likely to affect their attitudes and career choices.

In addition to pre-university exposure to agriculture, other factors influenced the choice to study agriculture and related sciences. Table 10 captures the rating of influencers against the response categories which were combined into two nominal categories; namely, "No influence" and "Very much influence". The items classified in the "No influence" interpretive category were 17. In summary, two (2) items were classified in the "Very much influence" category. From a logical point of view "Occupational/employment opportunities" and "personal interest" tended to be the most frequent responses on the factors that influence undergraduates' choice to study agriculture and related sciences in public universities.

Table 10: Factors perceived to influence enrolment in agriculture and related sciences

Role model influences		Frequency	
		Very much influence (5)	No influence (1)
1	Graduates of universities that offer agriculture and related sciences		15.50%
2	A student enrolled in agriculture and related sciences		18.30%
3	A fellow student		25.90%
4	A teacher in secondary school		18.00%
5	Career master,		15.80%
6	Parent(s)		14.40%
7	Guardian		20.20%
8	Past agricultural experience		15.80%
9	Occupational/employment opportunities	16.90%	
10	Farming background		14.40%
11	Interest in agriculture as a subject in secondary school		15.50%
12	Fun in agriculture in an interesting agricultural course		14.70%
13	Personal interest	20.20%	
14	A friend		21.50%
15	A male relative		24.30%
16	A female relative		27.20%
17	Agricultural club e.g., 4KClub		20.20%
18	Agricultural shows		15.50%
19	Local agricultural officers		24.00%

(Source: Field Data, 2010)

Response Scale: Very much influence = 5, Much influence = 4, Little influence = 2, No influence = 1.

4.3.3 Academic achievement at secondary school

Regarding the variable of academic achievement operationalized as KCSE aggregate mean grade, Table 11 shows a cross-tabulation of degree programmes in agriculture and related sciences which the respondents had chosen as first choice and the corresponding mean grades which were obtained in KCSE. The results of the computed Pearson's Chi Square showed that enrolment into agriculture and related sciences was dependent on KCSE aggregate mean grade obtained. The null hypothesis that the likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on KCSE aggregate mean grade was therefore rejected in view of the fact that selection of students to study various degree programmes at public universities is pre-determined by the JAB criteria. There is a significant relationship between KCSE mean grade and the choice to enroll in agriculture and related sciences. Majority of the respondents had B+ and A- as KCSE mean grades. KCSE mean grade tends to influence choice of agriculture and related sciences as a course of study. During selection of KCSE candidates to study agriculture at public universities, those with highest aggregate mean grade are considered for agriculture and related sciences. This finding is conversely associated with Hoover and Scanlon (1991) that students who planned to enroll in agricultural education were more likely to be academically less talented than their respective non-enrolling counterparts.

Table 11: Cross-tabulation of degree chosen and KCSE aggregate mean grade

Degree chosen	KCSE MEAN AGGREGATE					
	A	A-	B+	B	B-	C+
Wildlife		0.9%	2.0%	2.9%		
Agriculture	25.0%	1.7%	6.5%	11.4%		20.0%
Food Science & Technology		5.2%	7.0%	5.7%		20.0%
Veterinary Medicine		4.3%	1.5%	2.9%	20.0%	
Horticulture			0.5%			20.0%
Food Nutrition & Dietetics			1.0%			
Agri-business		1.7%	7.0%			

(Source: Field Data, 2010)

4.3.4 Perception of agriculture and related sciences given a set of impressions

Perception was considered a factor in the choice to enroll in agriculture and related sciences. Undergraduate students responded to a nine (9) item scale indicating the level of agreement or disagreement with each of the scale items using a five-point Likert-type scale with the following response values: Strongly Disagree=1, Disagree=2, Unsure =3, Agree=4 and Strongly Agree=5.

It has been found that with the Likert scale data, the best measure to use is the mode, or the most frequent response. The mode of the most frequent response is indicated against the listed impressions as shown in Table 12. On one hand, a group of respondents (61.7% males and 61.3% females) showed that they strongly agreed with the impressions that agriculture had opportunities and career advancement, however, it was associated with subsistence farmers. This is an indication that agriculture as a discipline and/or enrolment into it was not immediately accounted for by the negative impressions. None of the respondents ran down agriculture.

Table 12: Undergraduate students' perception of agriculture

1st, 2nd, 3rd, 4th and 5th Year students' Perception of Agriculture	Frequency				
	Impression	**Strongly agree (5)**	**Agree (4)**	**Disagree (2)**	**Strongly disagree (1)**
Agriculture is rural in nature	Negative			91.8%	
Associated with physical work	Positive		92.3%		
Has opportunities	Positive	94.2%			
Has career advancement	Positive	91.8%			
Associated with subsistence farmers	Positive	92.9%			
Has relaxation and recreational activities	Positive		92.6%		
Jobs are not salaried	Negative				92.6%
negative high school experiences	Negative				92%
Used as a form of punishment	Negative				92.6%

(Source: Field Data, 2010)

Response Scale: Strongly Disagree = 1, Disagree = 2, Agree = 4, Strongly Agree = 5.

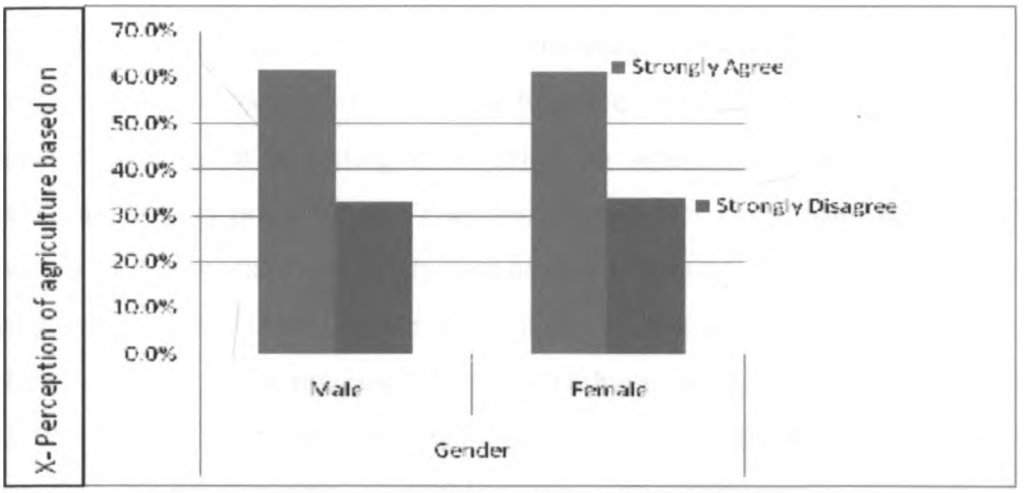
Ranking of the pre-selected five (5) impressions which incorporated availability of information about agriculture and related sciences became crucial for the study in establishing the role information played in decision making. As shown in Table 13, the majority of the respondents (99%) ranked "the profile given to agriculture and related sciences in university career forms" as highest in discouraging enrolment in agriculture and related sciences. Also ranked highly in the same category was "there is nothing new to learn about agriculture" and "policy makers pay lip-service to agriculture and related sciences".

Table 13: Ranked claims perceived to discourage/encourage enrolment in agriculture and related sciences

Claims	Frequency		
	1	2	3
Lack of information about agriculture and related sciences	100%		
The profile given to agriculture and related sciences in university career forms			99%
There is nothing new to learn about agriculture			99%
Policy makers pay lip-service to agriculture and related sciences			99%
Students of agriculture and related sciences do not find jobs after graduation		99%	

(Source: Field Data, 2010)

The data on perception was then subjected to the Pearson Chi Square test. The column percentages for male and female respondents were identical. The results of the Computed Pearson's Chi Square as shown in Figure 7 revealed that there was no difference between male and female students in their perception of agriculture and related sciences hence the null hypothesis that the likelihood that potential undergraduate students would choose to study agriculture and related sciences is not dependent on gender was accepted.



Discipline enrollment *(the response variable)* (the Y-axis)

Source: Field Data, 2010)

Figure 7: Cross-tabulation of gender and perception

One possible explanation for the similarity in perception of agriculture by gender could be attributed to the concerted efforts made by faculties in the selected public universities in ensuring agriculture and related sciences are popularized among undergraduate students. Students who are involved in agriculture will tend to have more positive perceptions of agriculture. This is contrary to Bell & Fritz (1992) that career, information, counseling and programming are either consciously or unconsciously influenced by the perception of "gender appropriate" occupational roles. It has been argued that students have not been able to broaden their perceptions of agriculture and its related fields, making negative images of agriculture overriding barriers to future enrolments. Participants in the FGDs who chose to study agriculture and related sciences out of their own volition pointed out that gender was not an issue in their choosing agriculture as a lifelong career.

During FGDs, respondents pointed out that agriculture was a broad course which had so much information and knowledge that opened the mind and was activity-oriented yet it was given a very low profile. However, participants reported that they perceived "shame"

and "anxiety" when they had to explain to their respective communities that they "were at the university studying agriculture!" Participants understood agriculture in very broad terms as gaining "knowledge that moves one from the conventional way of participating in agriculture to one of providing information on inputs combined with factors of production and market orientation". They pointed out that in the past, agriculture had been thought of as a subsistence activity "but now, it is thought of as a business activity – produce food crops and sell". It was the opinion of the undergraduate students that agriculture needed to be appreciated as an agricultural science that led to successful business. Participants expressed views that initially agriculture had been an occupation of "a farmer with low level income or middle income crop and livestock, marginalized and associated with rural people – '*maskini*' (meaning the poor), livestock keepers associated with North Eastern and Eastern provinces".

Through exposure to agriculture participants expressed their newly acquired passion for agriculture and related sciences; and reiterated the need for it to be viewed as a profession like other professions; and make information available through ICTs regarding career opportunities in agriculture.

4.4 SUGGESTIONS ON USING ICT TO MAKE AGRICULTURE PROGRAMMES DEMAND DRIVEN

In responding to a statement that "ICTs orientation in the first year would go along way in making agriculture and agricultural" related sciences popular as careers of choice among students", 64% of the respondents strongly agreed that ICTs orientation in the first year would go along way in making agriculture and related sciences demand driven; although, 28.9% strongly agreed that they were personally equipped to be able to use ICTs in confronting challenges facing the farmer in Kenya. Respondents gave the following suggestions that could make programmes in agriculture and related sciences at public universities demand driven through integration of ICTs.

i) Government policy makers should acknowledge and recognize the importance of ICT in agriculture.

ii) Heads of agricultural departments should provide accurate and adequate information through ICTs on matters concerning agriculture and its importance.

iii) Installation of computers and internet in all secondary schools to enable students to visit sites on agriculture and get encouraging information.

iv) Engage undergraduate students in orientation programmes of younger students in secondary schools who wish to pursue agriculture and related sciences at tertiary level.

v) Use ICTs to advertise the content of agricultural courses. Organize video shows on agriculture and new technologies in homes, markets, schools and agricultural clubs in the country.

vi) Furnish potential farmers with new information in order to increase awareness and hence attract more prospective students to accept courses in agriculture and related sciences.

vii) Give scholarship to students as a reward for studying agriculture.

viii) Create jobs based on agriculture in ICTs for agriculturalists. Educate students on career opportunities in agriculture and related sciences. Hold career talks whereby successful people in agriculture related sciences educate students.

ix) Encourage agriculture clubs; and include ICTs content as a unit in the curriculum of agriculture and related sciences.

x) Incorporate information related to agriculture in mother tongue and Kiswahili.

xi) Agricultural related industries to advertise their need for people with ICTs skills in agriculture.

xii) Integration of agriculture to ICTs systems by creation of demand driven ICTs software for agriculture. Introduction of e-learning in agriculture.

xiii) Development of agricultural based computer games so as to induce students to know what agriculture is all about.

xiv) Take workshops and seminars to colleges offering agriculture.

Overall, 64% strongly agreed that the use of ICTs in agriculture and related sciences was likely to make the agricultural sector increase production potential in Kenya. This is an indication of optimism which should be maximally exploited by incorporating ICTs in agriculture and related sciences in order to make it demand driven.

The results that there are no differences between those who were pre-exposed to ICTs and those who were not pre-exposed; and that access to ICTs did not influence the choice of agriculture and related sciences for those enrolling at undergraduate provides an opportunity in which attempts can be made to use ICTs in agriculture with a view of making it popular among the youth. It is evident from the study results that there is a tendency to have no connection between ICTs and agricultural education as taught either at colleges or schools. To fill this gap, there is need to integrate ICTs in the agricultural curriculum at both basic and tertiary levels of education

It has been argued that modern ICTs, play a key role in communicating knowledge and information to rural agricultural communities (Harris 2004. ICTs provides development

solutions and have been described as one of the main enablers of poverty reduction (Juma & Yee-Cheong 2005). ICTs can speed up the extension of development services in areas such as healthcare, education and agriculture (Van Audenhove, 2003). Further, ICTs can help strengthen partnerships and provide a framework for shared learning, and have led to increased use of networked information environment and development of platforms for better sharing and exchange of information and knowledge. ICTs has also been used in Africa to deliver education modules on farming practices which are delivered by audio/radio, web-based means, CD-ROM, video and print format under the CERP Project (Pye, 2003).

Increasingly, ICTs are being used for accessing agricultural information, financial information, market information, surveys and agribusiness (Akiiki, 2006). Maru (2004) pointed out that the use of ICT is ever-present in national agricultural research systems in Sub-Saharan Africa, while Grimshaw (2005) observed that there was consensus that ICTs plays an important role in development by linking users to up-to-date information, skills and markets.

With the proliferation and widespread availability of contemporary ICTs, many restrictions and impediments of the past have been removed. As students and teachers gain access to higher bandwidth, more direct forms of communication and access to sharable resources, the capability to support quality learning settings will continue to grow. Therefore, ICTs are impacting on what is learnt and dominating life and work of educational institutions which are requiring that graduates are able to display appropriate levels of information literacy, "the capacity to identify an issue and then to identify, locate and evaluate relevant information in order to engage with it or to solve a problem arising from it (McCausland, Wache, & Berk,1999). McCausland et.al, (1999) argued that through technology facilitated approaches, contemporary learning settings encouraged students to take responsibility for their own learning such as movement towards problem based learning; and increasing the use of the web as an information source.

Reeves (1998) considered ICTs by their very nature as tools that encouraged and supported independent learning. Students using ICTs for learning purposes become immersed in the process of learning and as much more students use computers as information sources and cognitive tools, the influence of technology on supporting how students learn will continue to increase. The educator and thinker, Alavi (1994) stated that "Many educators, students, and employers intuitively feel that the integration of the computer into the learning experience will enhance learning. This should increase the student's ability to apply knowledge and skills to future problem solving situations". UNESCO (1998) stated that "The rapid breakthroughs in new information and communication technologies will further change the way knowledge is developed, acquired and delivered. It is also important to note that the new technologies offer opportunities to innovate on course content and teaching methods and to widen access to higher learning". Rosswall (1999) observed that the ICTs enhance higher education in a number of ways:

i) It enables the effective storing or sorting of information, and can offer new fast ways of communication;

ii) It enables the reduction of information quantity towards a higher quality and better structure;

iii) It can be integrated into teaching and learning strategies – and used to support relative learning theories; and

iv) ICT (computers, Inter and Intranet) can be used to create new types of Interactive learning media for improved quality, equity, and access in higher education.

Through ICTs, the diffusion and sharing of knowledge can be enabled through open access to information and better coordination of knowledge. ICTs facilitate the creation

of networks locally, regionally and globally, leading to collaborative and interdisciplinary approaches to problem-solving and research diversification through shared knowledge-bases, online fora and collaborative spaces. Measures and efforts must be undertaken to further integrate ICTs in agriculture programmes in order to make them demand driven among potential university students

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF METHODOLOGY

This study was conducted using a survey research design. The statistical population included 4960 undergraduate students enrolled in agriculture and related sciences in the three purposively sampled public universities, namely; University of Nairobi, Egerton University and Jomo Kenyatta University of Agriculture and Technology A sample of 496 students was selected using a systematic random sampling method. The study used Krumboltz's social learning theory of career decision making (SLTCDM) which contributes to the definition of enrollment as a problem and offers interventions. The instrument utilized in this study was based on a questionnaire which was formulated during the review of related literature.

The instrument consisted of thirty-two questions divided into three sections: demographic characteristics, pre-university exposure to agriculture, perception of agriculture and exposure to ICTs. FGDs approach was a qualitative effort which was used to meet the objective of the study. Reliability and validity of instrument were determined through opinions of faculty members and the application of Cronbach's Alpha Reliability Test which realized a good consistency of 0.732. The total respondents' return rate was 74%. The data were analyzed using quantitative and qualitative descriptive statistics which were subjected to cross-tabulation and Pearson's Chi Square computations.

5.2 SUMMARY OF MAJOR FINDINGS

The study revealed that access and use of ICTs had no influence on the data population in choosing or not choosing to study agriculture and related sciences. There was no connection between interaction in ICTs and agricultural education. However, exposure to

agriculture was very essential in making students recognize the importance of agriculture and the motivation to choose to study it as a lifelong career. Whereas exposing students to agriculture is very important if they must choose it as a career, the results however emphasize personal interest as a key factor. It was also established that gender was not a factor in the choice to enroll into agriculture and related sciences. There was also no difference in perception of agriculture by gender.

5.3 CONCLUSION AND IMPLICATIONS

In conclusion, pre-university exposure to ICTs was not a factor in enrolment. Secondly, pre-university exposure to agriculture was a factor in enrolment. Third, there was no gender difference in perception of agriculture.

5.4 RECOMMENDATIONS

Since this was an exploratory study; and the findings indicate that ICTs is not a factor in enrolment in agriculture and related sciences, the following recommendations were made.

5.4.1 Use ICTs to stimulate the interest of young people in agriculture

ICTs have been found to open up new avenues of accessing information thereby changing the relationship between students and between students and teachers. O'Hagan has suggested that ICTs can be used to present and provide content, assess students' learning, provide feedback, scaffold students' learning and enable peer to peer collaborating learning (as cited in Ng'ambi & Czerniewicz, 2007). The study recommends that ICTs should be used in developing learning materials that animate and simulate various agricultural situations in order to promote the learning of agriculture and problem solving such as simulating weather partners and modeling of food preservation and storage.

5.4.2 Collaborations and partnerships with sector ministries

The Government in conjunction with Ministries of Agriculture, Livestock Development, Education, Higher Education, Fisheries Development, Water and Irrigation, Forestry and Wildlife, Information and Communications, Lands, Environment and Mineral Resources, Development of Kenya and other Arid Areas should make a deliberate effort using the revenue funds for county governments to provide well equipped agricultural computer laboratories with internet and instructional materials, pre-requisite for all schools at the basic level of the first eight years.

5.4.3 National creation and design of websites on agricultural issues

The Ministries of Education, Agriculture, Livestock and Information and Broadcasting should set up an agriculture programme website which can help increase the use or ICTs in agricultural education and provide links to help teachers and students access agricultural educational information readily.

5.4.4 Development of an ICTs core course in agriculture and related sciences

Students of agriculture and related sciences in public universities should be required to enroll in a course on computer application and vocational technical education in order to make students personally responsible for their own learning through acquisition, discovery, dialogue, practice and creative learning events associated with the media forms such as lecture notes online, streaming videos of lectures, DVD, multimedia including digital video, audio clips and animations, CD based DVD or web, hyper media, multimedia resources and information gateways, e-mail discussion fora, blogs, drill and practice, tutorial programmes, simulations, virtual environments, simple existing tools as well as specially created programmable software.

5.4.5 Agriculture ICTs piloted project in selected secondary schools

The Ministry of Education should initiate a pilot project of 20 secondary schools from each county to act as catalysts for massive transformation of agriculture using ICTs; and brand them as centres of excellence. Schools of information technology in public universities should create partnerships with a view to tailoring ICTs tools and services geared towards the needs of students in both primary and secondary schools; and assist in building their capacities to use the tools and services regardless of economic status and gender of individuals.

5.4.6 Initiation of contracts with public universities alumni

Public universities should initiate joint attractive seminars, courses, competitions for high school students both at the university and directly at school, participation in specialized fairs, information leaflets, high quality presentations, fliers, brochures could improve the image of agriculture. Newspapers, journals and magazines can also influence young people who are seeking information (such as agri-business – contract farming) on which to base a decision that is important for future lives.

5.5 FUTURE STUDIES

This was an exploratory study focused on ICTs in enrolment for higher agricultural education in selected public universities in Kenya. To this extent, future research should use the baseline findings of this study to establish generalizability; and go a step further to focus on how ICTs competencies can be harnessed and channeled into innovative ways of packaging materials and information on agriculture that can be used as motivators in attracting, recruiting and retaining students in agriculture and related sciences in public universities in Kenya.

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APPENDICES

APPENDIX 1: COCHRAN'S (1977) FORMULA OF SAMPLE SIZE

$$n = \frac{Z^2 (pq)}{d^2}$$

Where:

n = the desired sample size (if the population is greater than 10,000).

z = the standard normal deviate at the required confidence level.

p = the proportion in the target population estimated to have characteristics being measured.

q = 1-p.

d = the level of statistical significance set.

$$n = \frac{(1.96)^2 (.50)\ (.50)}{(.05)^2}$$

$$n = 384$$

$$nf = \frac{n}{1+n)/N}$$

Where:

nf = the desired sample size (when the population is less than 10,000).

n = the desired sample size (when the population is more than 10,000).

N = the estimate of the population size.

$$nf = \frac{4960}{1+4960/384}$$

$$nf = 357$$

APPENDIX 2: LETTER OF AUTHORITY TO CONDUCT THE STUDY

UNIVERSITY OF NAIROBI

COLLEGE OF AGRICULTURE & VETERINARY SCIENCES
FACULTY OF AGRICULTURE

Our ref: A56/70289/09
Tel.: 020-2181354
020-3592734/5/6/7/8/9
Fax: 632121

P.O. Box 29053-00625
Kabete
Kenya.
email: deanagric@uonbi.ac.ke

22nd March 2010

TO WHOM IT MAY CONCERN

RE: **ESTAMBALE TRYPHAENA NABAKWE – A56/70289/09**

This it to confirm that Estambale Tryphaena Nabakwe is a Master of Science student in the Department of Agricultural Economics, Faculty of Agriculture.

She is carrying out a Master of Science research entitled **"The Role of Information and Communication Technologies in the Enrolment for Agricultural Higher Education, Kenya"**

Any assistance accorded to her during this period of her research work will be appreciated.

Thank you,

Yours faithfully,

UNIVERSITY OF NAIROBI
P. O. Box 29053 - 00625
NAIROBI

PROF. S.I. SHIBAIRO
DEAN,
FACULTY OF AGRICULTURE

SIS/bwm

APPENDIX 3: PEARSON'S PRODUCT MOMENT CORRELATION COEFFICIENT (r)

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{N}}{\sqrt{(\sum x^2 - \frac{(\sum x)^2}{N})(\sum y^2 - \frac{(\sum y)^2}{N})}}$$

Where,

$\sum x$ = *the sum of scores in x distribution.*
$\sum y$ = *the sum of scores in y distribution.*
$\sum xy$ = *the sum of the paired xy scores.*
$\sum x^2$ = *the sum of squared scores in the x distribution.*
$\sum y^2$ = *the sum of squared scores in the y distribution.*
N = *the number of paired x and y scores*

To adjust the correlation coefficient obtained between the two halves of the questionnaire, the following formula known as Spearman-Brown Prophecy Formula was applied, in which,

$$rxx^{l} = \frac{2roe}{1+roe}$$

Where,

rxx^{l} = *the reliability of the original test*
roe = *the reliability coefficient obtained by correlating the scores of the odd statements with the scores of the even statements.*

Hence the reliability was computed as follows:

$$\rho = 3975 - \frac{(96)(625.25)}{30}$$

$$\rho = \sqrt{770.6 - \frac{(96)^2}{30}(39625 - \frac{(652.52)^2}{30}}$$

$$\rho = \frac{3975 - 2000.8}{\sqrt{770.6 - (307.2)(39625 - (14192.74)}}$$

$$\rho = \frac{1974.2}{\sqrt{(770.6 - 307.2)(39625 - (14192.74)}}$$

$$\rho = \frac{1974.2}{\sqrt{(462.8)(25459.26)}}$$

$$\rho = \frac{1974.2}{\sqrt{11782546}} = 0.575$$

$$\textit{Spearman's Brown Prophecy formula} = \frac{2 \times 0.575}{1 + 0.575} = \frac{1.15}{1.57} = 0.732$$

APPENDIX 4: QUESTIONNAIRE

QUESTIONNAIRE FOR STUDENTS IN PUBLIC UNIVERSITIES OFFERING AGRICULTURE AND AGRICULTURE RELATED SCIENCES

INSTRUCTIONS

I am conducting an exploratory study on the use of ICT on Enrolment for Higher Agricultural Education in Kenya. This study requires your honest opinion about the questions asked. You are therefore assured that your responses will be treated with utmost confidentiality. It is of significance important to the study if you wrote the name of your university. Please indicate what you personally consider as the most suitable answer by putting a tick (√) on one of the preferred option. For the questions that require your own opinion/answer, please fill in the blank (–). Your opinions are extremely important for understanding the complex issues surrounding revitalization of agriculture for food security in Kenya. You are kindly requested to respond to all the questions. I thank you for your cooperation and positive response.

SECTION A (RESPONDENTS' DATA)

1. What is the name of your university?

   _____

2. Indicate your gender in the space provided.
   Male ( ) Female ( )

3. What mean aggregate did you attain in your KCSE?_____

4. In what degree programme of the university are you enrolled? _____

5. What is your current year of study in the university? _____

SECTION B (PRE-UNIVERSITY EXPOSURE TO AGRICULTURE)

6. Did you have any exposure to agriculture at your primary or secondary school you attended before you joined the university as:

(a) A taught subject? Yes ( ) No ( )

(b) An extracurricular activity? Yes ( ) No ( )

(c) An examinable subject at KCSE? Yes ( ) No ( )

7. In order of preference list the degree course you selected to study at the university?
   1st choice _____2nd choice_____ 3rd choice _____3rd choice 4th choice _____ None_____

8. If agriculture was your first choice, what influenced your selection? **(Tick whichever is appropriate)**

Influence	5=Very much influence	4=Much influence	3=Some influence	2=Little influence	1=No influence
Graduates of universities that offer agriculture and agricultural related sciences					

A student enrolled in agriculture and agricultural related sciences					
A fellow student					
A teacher in secondary school					
Career master					
Parent(s)					
Guardian					
Past agricultural experience					
Occupational opportunities					
Farming background					
Interest in agriculture as a subject in secondary school					
Fun in participating in an interesting agriculture course					
Personal interests					
A friend					
A male relative					
A female relative					
A agricultural club e.g. 4K Club					
Agricultural shows					
Local agricultural officers					
Other (Specify)					

9. What is your perception of agriculture and agricultural related sciences?

Perception	5=Strongly agree	4=Agree	3=Unsure	2=Disagree	1=Strongly disagree
Agriculture is rural in nature					
Associated with actual physical work					
Has opportunities					
Has career advancement					
Associated with subsistence farmers in my region					
Has relaxation and recreational activities					
Jobs are not salaried					
Negative high school experiences					
Used as a form of punishment in school					

10. By writing the number in the bracket provided, rank the following factors that make agriculture and related sciences not to be selected by students:

Lack of information about agriculture and related sciences.	( )
The profile given to agriculture and related sciences on the career forms.	( )
There is nothing new to learn about agriculture and related sciences.	( )
Students of agriculture and related sciences do not find jobs after graduation.	( )
Policy makers pay lip service to agriculture and related sciences.	( )

SECTION C (ACCESS AND USE OF ICT)

11. What do you understand by the term ICT?

_____

12. Were computers available in the primary school you attended?
Yes ( ) No ( )

13. Were computers available in the secondary school you attended?
Yes ( ) No ( )

14. Were you taught computer as subject in
a) Secondary school? _____
b) Primary school? _____

15. Did you learn or use computers as an extra curricular activity?
Yes ( ) No ( )

16. Did you have a computer club in
(a) Primary school? Yes ( ) No ( )
(b) Secondary school? Yes ( ) No ( )

17. What was your level of ICT before you joined the university?

Basic (beginner)	( )
Intermediate	( )
Expert	( )
None	( )

18. Which of the following ICT are your familiar with?

Computer	Yes ( )	No ( )
Mobile phone	Yes ( )	No ( )
TV	Yes ( )	No ( )
Video	Yes ( )	No ( )
CD ROM	Yes ( )	No ( )
Internet	Yes ( )	No ( )
Radio	Yes ( )	No ( )

Other (Specify)_____

19. Have you been taught a computer course in agriculture and related sciences?
Yes ( ) No ( )

20. If Yes, list the computer course(s) taught? 21. In which year were the computer course(s) taught?
Put two of the below in one line to reduce the size of the thesis

First year only	( )
Second year only	( )
Third year only	( )
Fourth year only	( )
Every year	( )

22. Where do you frequently access and use computers?

Library	( )
Computer laboratory	( )
Classroom	( )
Club	( )
Cyber café	( )
At home	( )

23. Which software do you use most frequently?
Microsoft Office Word ( )

Microsoft Office Power Point ( )
Microsoft Office Access ( )
Microsoft Office Publisher ( )
Other (Specify) _____

24. Which search engines are you familiar with?
Google ( )
Yahoo ( )
Wikipedia ( )
Other (Specify) _____

25. Are the current ICT adequate for your needs?
Yes ( ) No ( )

26. If "Yes" please give reasons
_____

27. If "No" please give reasons

28. Who relays the agricultural information to you through ICT?
Researchers ( )
Extension service personnel ( )
Farmers ( )
The press ( )
NGOs ( )
Other (Specify) _____

29. ICT orientation in the first year would go along way in making agriculture and agricultural related sciences popular as careers of choice among students.
Strongly agree ( )
Agree ( )
Unsure ( )
Disagree ( )
Strongly disagree ( )

30. You are personally well equipped to be able to use ICT in confronting challenges facing the farmer in Kenya.
Strongly agree ( )
Agree ( )
Unsure ( )
Disagree ( )
Strongly disagree ( )

31. List ways in which ICT can be used in agriculture and related sciences to make courses demand driven.
_____

32. The use of ICT in agriculture and a related sciences is likely to make the sector increase its production potential in Kenya?
Strongly agree ( )
Agree ( )
Unsure ( )
Disagree ( )
Strongly disagree ( )

APPENDIX 5: FOCUS GROUP DISCUSSION GUIDE

Name of the moderator..... **Name of institution**.....

Date of FGD..... **Place of FGD**.....

Number of participants.....

1. **General introduction questions**
   Objective: To create rapport with participants and set everyone talking.
   i) What are some of the general or specific experiences you have had since your admission to this university?
   ii) How do you view your enrolment into agriculture and science related courses?
   If yes or no probe for each answer.
2. **Agriculture and science related courses**
   Objective: To find out participants' views on agriculture and related sciences in the university, and about the demand for courses that students enroll in.
   Develop a discussion on courses enrolled in agriculture and related sciences.
   Discuss
   a) What are your views on agriculture and related sciences?
   b) How do you define agriculture and science related courses?
   c) How has it been defined in the past?
   d) How do other people/society perceive it?
   e) In general, what are the advantages and disadvantages of agriculture and agriculture and related sciences?
3. **Enrolment**
   Objective: To find out the participants' knowledge on enrolment into agriculture and science related courses and why students would want or not want to enroll in agriculture and related sciences.
   What does enrolment in agriculture and science related courses mean to you?
   Discuss
   a) Where did you first hear about agriculture and related sciences?
   b) Why did you or did you select/not select agriculture and related sciences?
   c) Do you know of anyone who selected agriculture and science related courses as a first choice?
   d) What might have been the reason(s) for selecting/not selecting agriculture and science related courses?
   e) What do you think are the advantages for enrolling/not enrolling into agriculture and science related courses at the university?
4. **ICTs**
   Objective: To find out the participants' level of knowledge in ICTs.
   Let us discuss different types of ICTs
   a) What are some of the ICTs you know of?
   b) Do you have nicknames for them?
   c) Look at each ICT separately and ask the following questions related to it.
   i) What did you hear about ICTs?
   ii) What do you know about them?
   iii) Do you know how ICTs work?
   iv) Do you know how to use ICTs?
   v) What are the advantages?
   vi) What are the disadvantages?
   vii) What do other students say about each ICTs?
   (By discussing this issues misinformation and rumours will come up)

5. **ICTs services**

Objective: To find out the courses taken and if ICTs are used in teaching agriculture and science related courses.

To find out levels of satisfaction with ICTs as a service in course delivery

i) What do you think about the ICTs services in your course?

ii) Which courses are offered using ICTs?

iii) In all the courses you have registered for, how many times in a week are ICTs used?

iii) Does the use of ICTs add value to your learning about agriculture and science related courses?

iv) Apart from your course in agriculture and science related courses, where else are ICTs used?

6. **More facts of information about ICTs**

Objective: To find out ICTs related issues and how the participants would like them addressed through curriculum.

This will enable the development of agriculture and science related course curricula which are integrative in order to create information and knowledge awareness among students.

Discuss

a) Now that you are enrolled in agriculture and related sciences, what information would you want to receive via ICTs about agriculture and science related courses?

b) Apart from ICTs, what other media would you like to get this information?

c) Do you have access to the following ICTs? – computer, internet, radio, tv, newspapers, e-journals, blogs, etc

d) Do you use the following?- computer, internet, radio, tv, newspapers, e-journals, blogs, etc.

e) Tell me what issues in the curriculum you would like to be addressed through ICTs?

f) At what level of the course would you prefer to be incorporated?

g) What is your opinion about the integration of ICTs in agriculture and agricultural related science courses?

h) Of what effect will it be on enrolments into agriculture and agricultural related sciences?

Thank for sparing your time to discuss with me this issue.