

**Technology-Mediated Open and Distance Education for
Agricultural Education and Improved Livelihoods in
Sub-Saharan Africa**



COUNTRY CASE STUDIES



*Commissioned by the
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*Edited by
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The Commonwealth of Learning (COL) is an intergovernmental organisation created by Commonwealth Heads of Government to encourage the development and sharing of open learning and distance education knowledge, resources and technologies.

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Contents

Foreword	vii
Biodata of Country Collaborators	ix
Synthesis of Eight Country Case Studies	1
Executive summary.....	1
Principal acronyms	2
1 Background.....	2
2 Procedure.....	3
3 The country reports.....	4
4 Agriculture in SSA	5
5 Agricultural education	5
6 ICT policies.....	6
7 ODL and Tech-MODE.....	7
8 Recommendations and conclusions	9
Annexure 1. Instructions for the Tech-MODE workshop, 8 June 2007, at ICRAF Nairobi	11
Annexure 2. Report to FARA from the Tech-MODE Side-Event.....	14
Annexure 3. Executive summaries from country reports	16
Stakes and Challenges for Technology-Mediated Open and Distance Education (Tech-MODE) in Agricultural Education in Cameroon	25
Executive summary.....	25
Principal acronyms	27
1 Introduction.....	27
2 Opportunities of science and technology	28
3 The promise and the peril of the agricultural sector	28
4 Time management as a prerequisite	28
5 ICT policies and strategies in Cameroon	29
6 Energy crisis in Cameroon	29
7 Structure of agricultural education in Cameroon.....	30
8 Post-secondary agricultural education.....	31
9 Distance education in higher education	33
10 National forum on distance education.....	35
11 Towards a sustainable ODL / Tech-MODE programme in agricultural education at the University of Dschang.....	36

12	Priority areas for Tech-MODE in Cameroon	39
13	Designing Tech-MODE courses for poverty reduction	40
14	Transsectoral issues.....	41
15	The threat of “borderless” education	41
16	Recommendations and suggestions	42
17	References.....	44
Technology-Mediated Open and Distance Education (Tech-MODE) in		
Agricultural Education and Training for Improved Livelihoods: A Ghana Case Study..... 47		
	Executive summary.....	47
	Principal acronyms	48
1	Introduction.....	48
2	National ICT policy	50
3	ODL and Tech-MODE for agricultural education and training.....	55
4	Recommendations for collaboration with COL, FARA and national Tech-MODE programmes	60
5	References.....	60
Technology-Mediated Open and Distance Education (Tech-MODE) in		
Agricultural Education and Training in Kenya: Opportunities and Challenges..... 63		
	Executive summary.....	63
	Principal acronyms	64
1	Agriculture in Kenya	64
2	Agricultural education and training	65
3	National ICT policy and education sector strategy.....	67
4	Status of ICT in education and training.....	68
5	ODL and Tech-MODE in education and training	69
6	Opportunities and challenges of ODL and Tech-MODE	71
7	Recommendations	74
8	References.....	75
Technology-Mediated Open and Distance Education (Tech-MODE) for		
Agricultural Education and Improved Livelihoods: A Nigerian Case Study..... 77		
	Executive summary.....	77
	Principal acronyms	78
1	Importance and status of agriculture in Nigeria	79
2	Policies and strategies on agriculture and education	81
3	Facilities, capabilities and potential to implement Tech-MODE	85
4	National information technology policy	87
5	Tech-MODE and improved livelihoods in Nigeria	88
6	Making Internet service affordable	90
7	Potential partners and government support for implementing Tech-MODE.....	93
8	Conclusions	94
9	Recommendations	95
10	References.....	96

Toward the Introduction of Technology-Mediated Open and Distance Education (Tech-MODE): An Overview of Agricultural Education and Training in Sierra Leone.....	97
Executive summary.....	97
Principal acronyms	98
1 Importance of agriculture.....	98
2 Sierra Leone – Country data.....	98
3 Agricultural education at primary and secondary schools	99
4 Formal degree and post-graduate education.....	101
5 Problems of agricultural education and training in Sierra Leone	103
6 Policy options for agricultural education in Sierra Leone.....	108
7 Policy recommendations for agricultural education and training	111
8 References.....	112
Status, Opportunities, Potential and Challenges of Technology-Mediated Open and Distance Education (Tech-MODE) for Agricultural Education and Improved Livelihoods: A Case Study of Tanzania	113
Executive summary.....	113
Principal acronyms	114
Acknowledgments	115
1 Background.....	115
2 Agriculture in Tanzania	115
3 History of open and distance learning in Tanzania.....	117
4 National and local policy environment on ODL and Tech-MODE	118
5 Institutional and individual capacity on ODL and Tech-MODE	123
6 Agricultural education at primary and secondary schools	128
7 Institutional challenges, limitations and weaknesses	128
8 The way forward.....	129
9 Conclusions	130
10 References.....	131
Status and Potential of Technology-Mediated Open and Distance Learning (Tech-MODE) for Agricultural Education in Uganda.....	135
Executive summary.....	135
Principal acronyms	136
1 Agriculture in Uganda’s economy.....	136
2 Agricultural training and education in Uganda.....	137
3 Agricultural education and training policies in Uganda.....	139
4 National ICT and distance education policies.....	141
5 Status of ICT and Tech-MODE for agricultural education and extension	143
6 Issues affecting introduction and adoption of Tech-MODE.....	144
7 Facilities and resources for implementation of Tech-MODE	148
8 Capacity strengthening needs to support Tech-MODE	149
9 Collaboration in Tech-MODE for agricultural education and training	149
10 Recommendations	151
11 References.....	152

Introduction and Adoption of Technology-Mediated Open and Distance Education (Tech-MODE) in Agricultural Education and Training in Africa: A Case Study of Zambia 155

Executive summary.....155

Principal acronyms156

1 The framework for Tech-MODE.....157

2 Economic and political context of agriculture.....157

3 Open and distance learning in Zambia.....160

4 Agricultural education and training in Zambia.....161

5 Current national policies on agricultural education and training164

6 National ICT and ODL policies in relation to agricultural research, education, training and extension165

7 Potential issues affecting the introduction and adoption of Tech-MODE for agricultural education and training.....168

8 Facilities and resources for the implementation of Tech-MODE.....170

9 Identification of capacity strengthening needs to support the implementation of Tech-MODE.....175

10 Potential and issues for effective collaboration with COL176

11 Conclusions180

12 Recommendations181

13 References.....182

Foreword

The Learning for Livelihoods Sector of the Commonwealth of Learning (COL; www.col.org) addresses the major challenges related to learning and skills development that are key for living and for improvement of livelihoods. Developing conceptual frameworks, influencing policy, enabling technology-mediated learning, and strengthening networks and partnerships are some of the strategies that COL uses for promoting learning and skills for agricultural development, poverty alleviation, and environmental protection. In this context, COL aims at building individual and institutional capacity in the use of information and communication technologies (ICT) combined with open and distance learning (ODL) in the way of technology-mediated open and distance education (Tech-MODE).

COL supports learning activities at various levels from grassroots to policy through partnerships with public, private and community-based national, regional and international institutions and organisations involved in agricultural education, extension, research and development. In sub-Saharan Africa (SSA), the Forum for Agricultural Research in Africa (FARA), and international agricultural research centres of the Consultative Group on International Agricultural Research (CGIAR) are the key international partners.

Anticipating that Tech-MODE will increasingly become an essential tool in the delivery of information, knowledge and education in sub-Saharan Africa, COL undertook eight country case studies with the help of national collaborators from Cameroon, Ghana, Kenya, Nigeria, Sierra Leone, Tanzania, Uganda and Zambia. The twenty authors and co-authors who provided the case studies are eminent practitioners and observers of Tech-MODE in agriculture. COL expects that these studies will be encouraging and useful to, and taken up by partners in the area of agricultural research and development in SSA.

COL is fortunate to have Dr. Rainer Zachmann as its consultant to put the case studies together. Dr. Anthony Youdeowei's generous support to this initiative is also highly appreciated. Both of them drew upon their experience and knowledge of

Tech-MODE in agriculture to shape and enrich the information contained in this report.

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Sierra Leone	Aliyageen Alghali, Bob Conteh, Edwin Momoh
Tanzania	Camilius Sanga, Ayubu Jacob Churi, Siza Tumbo
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Synthesis of Eight Country Case Studies

Rainer Zachmann

Executive summary

Education, training, information and communication for agricultural research and development in combination with information and communication technologies (ICT) are becoming increasingly urgent in developing countries. Technology-mediated open and distance education (Tech-MODE) – a combination of open and distance learning (ODL) with ICT – has potential to satisfy the increasing demand for education and training. With its expertise in various regions of the world, the Commonwealth of Learning (COL) wishes to expand Tech-MODE for agricultural education and improved livelihoods in sub-Saharan Africa (SSA). To enhance collaboration and synergy among several stakeholders, COL intends to identify opportunities for a complementary and catalytic role at various educational levels, from grassroots to academic education.

For the identification of its role in SSA, with the help of national collaborators, COL undertook eight country case studies with the objective of documenting an inventory of local institutions, facilities, capabilities and potential for Tech-MODE. The countries included were Cameroon, Ghana, Kenya, Nigeria, Sierra Leone, Tanzania, Uganda and Zambia. This synthesis report summarises information from the individual country reports.

As generally known, countries in SSA depend highly on agriculture, yet agriculture is a weak sector of economy. Although governments do recognize the importance of agricultural education and training in their economic policies, their implementation varies. Conventional agricultural education and training systems cannot satisfy the demand, therefore educational and training institutions are looking at ICT-mediated ODL to implement ODL.

Some countries have a long history with the application of ODL. ICT-mediated ODL and Tech-MODE is evolving quickly. But countries are at different stages with regard to ICT policies and infrastructure, especially in relation to agricultural

education. In general, a wide potential for the implementation of Tech-MODE is available in SSA.

Recommendations from the case studies for consideration by COL and interested partner organizations, particularly the Forum for Agricultural Research in Africa (FARA), fall into five interrelated subject categories: policy, infrastructure, socio-economy, capacity building and collaboration. In this context, COL's complementary and catalytic role could involve facilitating and assisting in needs assessment exercises, supporting policy issues, helping in the establishment of linkages and partnerships, facilitating the development of action plans, and assisting in the execution of action plans, including development of infrastructure, capacity building, training, development of materials, monitoring and following up.

Principal acronyms

CGIAR	Consultative Group on International Agricultural Research
COL	Commonwealth of Learning
DE	Distance Education
DL	Distance Learning
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
ICT	Information and Communication Technology(ies)
NARS	National Agricultural Research Systems
NGO	Non-Governmental Organisation
ODL	Open and Distance Learning
SSA	Sub-Saharan Africa
Tech-MODE	Technology-Mediated Open and Distance Education

1 Background

Education, training, information, and communication for agricultural research and development in combination with information and communication technologies (ICT) are becoming increasingly urgent in developing countries. Technology-mediated open and distance education (Tech-MODE) – i.e., a combination of open and distance learning (ODL) with ICT – is expanding through diverse initiatives and at various levels from agricultural grassroots to academic levels.

With its expertise in various regions of the world, the Commonwealth of Learning (COL) wishes to expand Tech-MODE in agricultural education and improved livelihoods in sub-Saharan Africa (SSA). COL has its presence in SSA, though primarily in the schooling and higher education sectors. COL's initiatives on agricultural education for improved livelihood are gaining ground and prove to be promising. To foster collaboration and facilitate synergy, through country case studies, COL wishes to identify opportunities for a complementary and catalytic

role – preferably in coordination with the Forum for Agricultural Research in Africa (FARA) – on the following levels:

- formal agricultural degree and postgraduate education,
- continuing professional education,
- lifelong learning for farming communities,
- agricultural education at primary and secondary schools.

For the Tech-MODE exercise, COL commissioned eight country studies and called on a consultant with experience in agricultural research, education, training and communication in developing countries.

2 Procedure

For the identification of its role in SSA, COL undertook eight country case studies with the objective of documenting an inventory of local institutions, facilities and capabilities for Tech-MODE. Information collected included:

- overall country situation of livelihood and status of agriculture / horticulture;
- national ICT policies and strategies for agricultural production, research, extension and education;
- individual institutions, facilities, capabilities, government support and potential available to implement Tech-MODE in collaboration with COL for
 - formal agricultural degree and postgraduate education,
 - continuing professional education,
 - lifelong learning for farming communities,
 - agricultural education at primary and secondary schools;
- recommendations, suggestions, wishes, etc. for COL.

The countries involved are Kenya and Uganda; Nigeria, Ghana and Sierra Leone; Cameroon; Tanzania and Zambia, representing East, West, Central and Southern Africa respectively.

In each country, renowned national collaborators from universities, research and training institutions collected and summarized the information:

- Cameroon – Ajaga Nji
- Ghana – Collins Osei, Reuben Aggor, Edward Badu
- Kenya – Geoffrey Kironchi, Agnes Mwang'ombe
- Nigeria – Adewale Adekunle, Adeolu Ayanwale, Morolake Adekunle, Moses Ubaru
- Sierra Leone – Aliyageen Alghali, Bob Conteh, Edwin Momoh
- Tanzania – Camilius Sanga, Ayubu Jacob Churi, Siza Tumbo
- Uganda – Moses Tenywa, Bernard Fungo
- Zambia – Mungule Chikoye, Martin Kaonga

Several national collaborators are known to the consultant from earlier contacts and the rest has been identified through wide consultation.

The study was initiated in March 2007 by contacting the national collaborators. The consultant received the first draft of a country report for review at the beginning of April 2007. Most draft reports have been presented at a side event during FARA's General Assembly, Johannesburg, South Africa, in June 2007 (FARA 2007). Revision and improvement of country reports continued all through 2007. Possibly, collaborative revision and improvement will continue even after publishing the reports on the WikiEducator platform, recently created by COL ¹.

The following description synthesizes general information from the country reports on the overall agricultural situation, agricultural education, ICT policies and status of ODL and Tech-MODE. Recommendations are the result from the discussions at FARA 2007 and from suggestions in the country reports.

3 The country reports

In the country reports, national collaborators included mostly all of the information requested, although they did not necessarily follow the sequence and structure as suggested under "Procedure" above. The writing styles are pleasantly diverse. Some collaborators described their country situation with plain facts, others combined facts with philosophy on, for example, African development perspectives, educational analyses, gender situation and extension methods. All collaborators undertook extraordinary and admirable effort in collecting and compiling relevant and valuable information.

According to one contribution, Africa offers many opportunities: natural resources, economic potential and geographical size. Even colonialism, an erstwhile obstacle, is seen as an opportunity in today's globalizing world. The African continent is threatened by two global social forces: globalization and competition. Both forces come with threats and opportunities for ODL. ODL and education became trade commodities.

The present collection of country case studies shows the most relevant opportunity: the human potential.

The Zambian authors assume that "... the capabilities of Zambia institutions to provide distance agricultural education and training with strong vocational components have not been formally assessed." This assumption is possibly true for many countries. Therefore we expect that these country case studies will be of general interest, relevance and value.

¹ COL. 2008. Technology-mediated open and distance education (Tech-MODE) for agricultural Education and improved livelihoods in sub-Saharan Africa. Country case studies commissioned by the Commonwealth of Learning Vancouver, Canada (COL). http://www.wikieducator.org/Tech-MODE_in_SSA.

4 Agriculture in SSA

The status of agriculture in SSA is well known. Figures on the agricultural and rural situation vary according to source. However, we can generalize that countries are highly dependent on agriculture. Still, agriculture remains a weak sector of economy. Nevertheless, agriculture is considered the engine of development and growth. A recent report of the International Food Policy Research Institute (IFPRI) concluded: “Agricultural growth will continue to play an important role in promoting overall economic growth and reducing poverty in most of Africa’s agrarian-based economies ... only smallholder food-staple and livestock production can generate broad-based agricultural growth”².

In all countries examined, agriculture is the main economic activity for 60 to 85% of population, depending on the country. A still higher proportion relies on agriculture as the principal source of livelihood, even in economies that historically relied on mining, such as Zambia. The contribution of agriculture to export can be as high as, for example, 85% in Tanzania. In contrast, due to the exploitation of oil, there has been a significant decline in agricultural exports in Nigeria. Nevertheless, in the same country, in spite of little interest in agriculture, the growth rate of agriculture was higher than that of the population.

Although scale and type of agriculture depends on the specific country situation, the majority of rural people live from subsistence farming. Up to 70% of population live below the poverty line (< 1 US\$ per day). Countries emerging from civil unrest, such as Sierra Leone, even need food import and food aid.

Countries try to overcome the situation through government plans, strategies and policies on agricultural research, development and education. In view of the agricultural situation at grassroots, Tech-MODE should be based on farmer’s needs and begin with the farmer (... and her husband).

5 Agricultural education

In their economic policies, countries recognize the importance of agricultural education and training. However, the implementation varies.

Since independence, in Zambia, for example, agricultural education and training reaches from grassroots to degree level. A variety of institutions are involved in lifelong learning for farming communities, agricultural education at primary and secondary schools, formal tertiary education and informal professional training. A

² Diao, X.; Hazell, P.; Resnick, D.; Thurlow, J. 2007. The role of agriculture in development; Implications for sub-Saharan Africa. Research Report 153. International Food Policy Research Institute (IFPRI; <http://www.ifpri.org>), 2033 K Street, NW, Washington, D.C. 20006-1002, U.S.A. 74 pages. ISBN 978-0-89629-161-4. <http://www.ifpri.org/pubs/abstract/rr153.asp>.

diversity of informal and formal training and education also exists in Ghana and Nigeria.

Several countries offer agricultural experience at primary level through school gardens as in the case of Cameroon and Ghana. At the junior and senior secondary level, agricultural education may be optional or compulsory, depending on the country. In Ghana, for example, agriculture starts at junior level as a compulsory subject. It becomes optional at the senior level. In Nigeria, agriculture is a compulsory subject in the new nine-year basic education curriculum for primary and secondary schools. In Sierra Leone, the ten-year rebel war affected schooling. Nevertheless, agricultural education is compulsory at all senior secondary schools. In Kenya and Uganda, agriculture is optional at secondary level. In Cameroon, "... there is no strongly enforced government policy on agricultural training in secondary schools."

Higher agricultural education through colleges, polytechnics and universities varies even more widely. Sierra Leone offers practical-oriented training for teachers of primary and secondary schools. In many countries, several public and private institutions offer certificates and diplomas in agriculture. All countries offer tertiary agricultural education through colleges and universities. Several public and private universities offer a range of agricultural disciplines in Kenya and Nigeria. The University of Dschang in Cameroon and the Sokoine University of Agriculture in Tanzania are pioneers in agricultural education and training. In Uganda, among several tertiary institutions, only Makerere University offers postgraduate degree in agriculture.

In all countries, agricultural education and training shows the usual technical, logistical and political limitations and challenges. Sierra Leone notices male-bias and lack of women participation. Generally, agricultural education and training cannot satisfy the demand, and as a consequence, educational institutions are looking at ICT to implement ODL and hence the Tech-MODE initiative.

Apart from few interesting and promising exceptions, lifelong learning opportunities for farmers seem to be limited.

6 ICT policies

Information and communication technologies are evolving quickly. However, a recent study of the Regional Agricultural Information Network (RAIN) found that human resource capacities to use and manage ICT are lagging behind³. Therefore, RAIN is initiating a regional post graduate programme in agricultural information and communication management, including ODL. RAIN is a network of the Association for Strengthening Agricultural Research in Eastern and Central Africa

³ Zachmann, R.; Musewe, V.O.; Baguma, S.D. 2005. Assessment of ICT/ICM Human Resource Capacities and Related Training Needs in the Context of Agricultural Research for Development in Eastern and Central Africa. <http://www.asareca.org/rain/index.php?option=publications&Itemid=8&lang=eng>.

(ASARECA) which in turn is a sub-regional organization of FARA. Also, FARA is involved in several initiatives related to information and education.

To facilitate such initiatives, governments are designing national policies on ICT. Countries are at different stages with these policies, especially in relation to agricultural education. In Sierra Leone, private sector activities led to a robust ICT infrastructure. However, a national ICT policy was begun recently in 2006. Uganda has no specific ICT policy for agriculture or education, although the importance of ICT is increasingly accepted, and a general ICT policy, developed in 2003, recognizes the relevance of ICT for agriculture.

In contrast, in Ghana several development strategies include ICT with specific and detailed objectives on agriculture and education. In Zambia and Nigeria, ICT policies have profound implications and far-reaching consequences for agricultural development. In Kenya, ICT is widely used in public functions, and a national education policy of 2003 gives prominence to ICT.

In general, ICT is still inadequate and unevenly distributed. A recent report of ATICS (Africa Tertiary Institutions Connectivity Survey) showed, that the average African university has a bandwidth capacity that is equivalent to a broadband residential connection available in Europe, and pays 50 times more for their bandwidth than their educational counterparts in the rest of the world⁴. In Cameroon, with deficient infrastructure, ICT remains a dream. In the educational context, the tertiary sector seems to be most advanced with the implementation of ICT. Nevertheless, there is hope for the evolution of ICT, ODL and Tech-MODE in SSA, as the digital gap is closing rapidly.

7 ODL and Tech-MODE

According to the country studies, traditional formal education cannot meet the human resource need of a social and economic development system. In Kenya, the demand for higher education has increased due to population growth and due to the increase in number of secondary school graduates. Similarly, in Ghana, the demand for higher education has increased, though women are at a disadvantage. In Cameroon, less than 25% of Cameroonians who want to study agriculture at all levels get a chance to do so, with less than 25% of overall student are females, and less than 25% of university students come from poor families. Thus, to satisfy the demand, the potential of distance education, ODL and Tech-MODE is evident, and most countries recognize their value.

In **Cameroon**, at the University of Dschang, distance education was initiated in 1988. It evolved at the Faculty of Agriculture to a programme with 20 agricultural

⁴ IDRC. 2005. Promoting African research and education networking. Summary of a study sponsored by the IDRC. http://network.idrc.ca/uploads/user-S/11247479201PAREN_Summary_study.pdf.

courses in both English and French. A national forum on distance education in 2003 with support from COL – not specifically for agriculture – identified opportunities, strengths, obstacles and constraints.

In **Ghana**, ODL existed for long time, especially for the upgrading of teachers. ODL for continuing agricultural education through collaboration with COL is new. Extension programmes by NGOs through Tech-MODE are still limited.

In **Kenya**, the University of Nairobi provides ODL in sciences, while other universities concentrate on humanities. The only notable Tech-MODE is AGORA – an information service of FAO – for NARS and faculties of agriculture. Some NGOs use ICT in their work with farmers. Extension and training programmes for farmers use technologies from research institution, such as the Kenya Agricultural Research Institute (KARI) and universities. The government is in the process of e-enabling all 4000 secondary schools. Several institutions offer a high potential and a favourable environment to implement Tech-MODE.

In **Nigeria**, the potential for Tech-MODE in agriculture concentrates around the National Agricultural Extension and Research Liaison Services (NAERLS) and the civil society Total Development International Foundation (TODEV).

In **Uganda**, ODL existed at the Makerere University since 1953 in the form of in-service training. Recently, blended ODL arrangements have been initiated to include several programs. The Department of Distance Education offers a diploma course jointly with the Open University of Tanzania. Internet kiosks offer ICT access to students, yet the demand is overwhelmingly high. Makerere University is undertaking substantial efforts on improvement of infrastructure as well as staff development. The Institute of Computing and Information Technology is a regional referral centre for ICT training. In the area of agriculture, a recent distance education project involves Makerere University with the Universities of Nairobi and Florida and the International Center of Tropical Agriculture (CIAT). Apart from Makerere University, only Martyr's University offers Bachelor of Agriculture through ODL. Telecentre projects for farmer training are also evolving. Recently, Makerere University and several Kenyan universities came together for a collaborative venture on "Strengthening of university capacity for promoting, facilitating and teaching rural innovation processes".

Sierra Leone is still struggling with basic infrastructure. Nevertheless, community radios with telephoning programmes and discussions are proliferating.

Tanzania has good experiences with telecentres. The Sokoine University of Agriculture offers technical ICT expertise and staff motivation. Potential for collaboration exists between the Sokoine University of Agriculture and the Open University of Tanzania.

In **Zambia**, shortly after independence, different forms of ODL emerged for specific educational and training needs, including agriculture. Zambian institutions historically provided ODL at several educational levels. Other ODL initiatives include in-service training, cooperative training, radio farm forums and others. Today, the potential of ODL is widely recognized. The government is committed to distance education and adopted ODL as an educational strategy in both formal and non-formal education. Also NGOs and international institutions invest in ODL. Thus, ODL is becoming increasingly attractive, although formal ODL in agriculture does not exist as yet. The infrastructure may still be rudimentary, and socioeconomic conditions may affect the adoption of Tech-MODE. However, facilities and resources for Tech-MODE are plentifully available.

In general, existing ODL is mostly dual-mode, print based, and with little or no use of ICT. However, developments are encouraging, and a wide potential is available for the implementation of Tech-MODE.

8 Recommendations and conclusions

The recommendations resulting from the country case studies encompass a wide area that cannot be covered by COL alone. Eventually, COL has to decide what recommendations fall within its purview and what recommendations must be shared with other partners. The **recommendations** presented here originate from two sources – a workshop on Tech-MODE related to the country case studies, and the country reports.

The Tech-MODE workshop began a few days before the COL-FARA Side Event, at the World Agroforestry Center (ICRAF) Nairobi in continuation of a workshop on agricultural open educational resources (AOER), also organized by COL. The workshop followed a specific procedure (Annexure 1). It workshop continued at the Side Event. Participants identified a great number of concerns and classified them into five interrelated subject categories: policy, infrastructure, socio-economy, capacity building and collaboration (Figures 1 and 2). For each of the subject categories, the working groups listed a number of recommendations for consideration by COL, FARA and other interested organizations:

Policy

- Support awareness and advocacy initiatives, targeting policy makers at all levels.
- Facilitate the integration of Tech-MODE into the mainstream formal educational system at all levels.
- Facilitate policy formulation and implementation at national level in an integrated manner in the areas of information and communication technologies (ICT), open and distance learning (ODL) and intellectual property rights (IPR) that result in increased and improved access without gender and generation barriers.
- Engage in advocacy dialogue for promoting access to Internet connectivity to various stakeholders especially the marginalized.

- Facilitate policy formulation at institutional and national levels on quality standards for Tech-MODE.

Infrastructure

- Strengthen the infrastructure to digitise information in knowledge and information institutions.
- Encourage African countries and institutions to develop infrastructures in an integrated manner in ICT and ODL that results in increased and improved access without gender and generation barriers.

Socio-economy

- Assist in the use of Tech-MODE to promote access to education and training, competitiveness and quality in agriculture, with due consideration to improving gender equity and family welfare.

Capacity building

- Support capacity building in Tech-MODE and its components, such as development and delivery of learning materials, providing learner support, implementation, monitoring and evaluation, and in governance and management of Tech-MODE-based educational programmes.
- Create an awareness about the importance of developing collaborative content that is of particular relevance to Africa, and to make it available to all users using flexible copyright licenses such as Creative Commons (<http://creativecommons.org>). Towards developing such open content, strengthen individual and institutional capacity to use free/libre open source software (FLOSS), develop open educational resources (OER) through appropriate Internet platforms such as WikiEducator (<http://www.wikieducator.org>)

Collaboration

- Integrate and lead multi-community partnerships with an aim of promoting lifelong learning opportunities for farmers, using Tech-MODE, for improving their livelihoods. Assist in bridging the missing links among all the stakeholder communities: farmers, educators, technologists, researchers, policy makers, marketers, financiers, governmental and non-governmental institutions, and national and international organizations.

The result of the Tech-MODE workshop was presented to FARA (Annexure 2).

The **recommendations from the country reports** support the outcomes of the workshop as given below:

- identify needs and action plans,
- assist in development of policies,

- facilitate mainstreaming of Tech-MODE,
- assist in identifying and managing funding,
- advise on infrastructure,
- assist in training and capacity building,
- support development of ODL materials,
- develop jointly courses through FARA, RUFORUM, etc.,
- strengthen linkages and partnerships.

The **conclusions** for COL as given under 'Background' are pre-conceived in the study framework: "COL wishes to identify opportunities for a complementary and catalytic role ...". The country studies identified plenty of opportunities for Tech-MODE in all countries examined. COL's complementary and catalytic role may include:

- identifying priorities among opportunities specified in the country reports,
- assisting in needs assessment,
- supporting policy issues,
- helping in establishing of linkages and partnerships,
- facilitating development of action plans, beginning with farmers' needs,
- assisting in the execution of action plans, including development of infrastructure, capacity building, training, development of materials, monitoring and following up.

COL initiated these country case studies with the expectation that they will be taken up and expanded by regional and international institutions such as the Forum for Agricultural Research in Africa (FARA) and the Consultative Group on International Agricultural Research (CGIAR).

Annexure 1. Instructions for the Tech-MODE workshop, 8 June 2007, at ICRAF Nairobi

Background. The recent initiatives of the Commonwealth of Learning (COL) on Tech-MODE for agricultural education and improved livelihoods look promising. COL is committed to expanding its experiences in sub-Saharan Africa (SSA). To enhance collaboration and synergy, COL wishes to identify opportunities for a complementary and catalytic role with strategic partners, such as the Forum for Agricultural Research in Africa (FARA), on the following levels:

- formal agricultural degree and postgraduate education,
- continuing professional education,
- lifelong learning for farming communities,
- agricultural education at primary and secondary schools.

The need for modern ICT and Tech-MODE for education and training in agriculture at academic, research, policy, development and grassroots communities is becoming increasingly evident. COL, therefore, is undertaking a few country case studies to

document an inventory of local institutions, facilities and capabilities for Tech-MODE, as well as describe the learning needs that can be addressed through Tech-MODE. The country studies will be discussed for further action during this workshop and eventually presented at the FARA General Assembly, June 2007.

Expected outcome. Suggestions for further action on COL's complementary and catalytic role in collaboration with strategic partners, such as FARA, on Tech-MODE in agricultural education and improved livelihoods in sub-Saharan Africa.

Procedure. Participants will be the case study collaborators and additional attendants, including participants from the preceding AOER workshop.

Rainer Zachmann explains the procedure and presents a key question that should lead to the expected outcome:

What are the challenges for COL's complementary and catalytic role in collaboration with strategic partners on Tech-MODE for agricultural education and improved livelihoods in sub-Saharan Africa?

Throughout the following presentations, workshop participants note down keywords related to the key question on A5-size cards. 1-3 words, 1 subject per card, felt-tip pen, large lower-case letters (no CAPITALS!).

Country collaborators present the executive summary and conclusions of their country reports (15 minutes each + 10 minutes for clarifications).

Someone else describes other initiatives in SSA (SCARDA, RAILS, BASIC, ...)

Krishna Alluri describes possibilities and limitations of COL.

Workshop participants jointly classify the collected keywords into subject categories.

Participants grouped around subject categories elaborate suggestions according to the expected workshop outcome (30-60 minutes). Depending on time, groups may rotate to allow interaction.

Groups present their suggestions to the plenary.

On 9 and 10 June 2007 we will continue discussing the challenges and suggestions at a COL-FARA Side Meeting in Sandton with additional stakeholders. On 15 June 2007 between 11:00 – 11:20, we will have 5 minutes to report the outcome to the FARA General Assembly.



Figures 1 and 2. Tech-MODE workshop – identification of concerns

Annexure 2. Report to FARA from the Tech-MODE Side-Event

Africa Agriculture Science Week & FARA General Assembly
10-16 June 2007
Johannesburg, South Africa

FARA General Assembly – Reporting format for Side-Events
10-11 June 2007

Name of side event:	Technology-Mediated Open and Distance Education (Tech-MODE) for agricultural education and improved livelihoods in SSA
Sponsoring organization(s):	Commonwealth of Learning (COL), Vancouver, Canada
Name(s) & email(s) of contact persons:	Krishna Alluri – kalluri@col.org Rainer Zachmann – zachmann@extension-line.de

Background/rationale of the side event (*maximum one paragraph*)

Education, training, information, communication for agricultural research and development become increasingly urgent. Open and distance learning (ODL) and Technology-Mediated Open and Distance Education (Tech-MODE) are expanding. To enhance collaboration and synergy on the use of Technology-Mediated Open and Distance Education (Tech-MODE) for agricultural education and improved livelihoods in SSA among several players, the Commonwealth of Learning (COL) wishes to identify opportunities for a complementary and catalytic role with the African national agricultural programmes and the Forum for Agricultural Research in Africa (FARA). Towards this objective COL commissioned country case studies with an aim to gain a better understanding of the national institutions, human capacities and capabilities as well as their physical facilities available and potential for Tech-MODE. Partners in Nigeria, Ghana, Sierra Leone, Cameroon, Kenya, Uganda, Tanzania and Zambia contributed to this study. The authors from these countries and other interested national and international partners were invited for further discussion to draw their perception on the issues related to the use of Tech-MODE for agricultural education and improved livelihoods in SSA.

Principal agreements/actions/recommendations (*include who is responsible for implementation & when*)

At the Side-Event the partners suggested recommendations for five interrelated issues that they identified as for the consideration of COL, FARA and other interested organisations. Each issue lists a number of recommendations.

Policy:

- Support awareness and advocacy initiatives targeting policy makers at all levels.
- Facilitate the integration of Tech-MODE into the mainstream formal educational system at all levels.
- Facilitate policy formulation and implementation at national level in an integrated manner in the areas of information and communication technologies (ICT), open and distance learning (ODL), and intellectual property rights (IPR) that results in increased and improved access without gender and generation barriers.
- Engage in advocacy dialogue for promoting access to Internet connectivity to various stakeholders especially the marginalized.
- Facilitate policy formulation at institutional and national levels on quality standards for Tech-MODE.

Infrastructure:

- Strengthen the infrastructure to digitize information in knowledge and information institutions.

- Encourage African countries and institutions to develop infrastructures in an integrated manner in ICT, and ODL that results in increased and improved access without gender and generation barriers.

Socio-economy:

- Assist in the use of Tech-MODE to promote access to education and training, competitiveness and quality in agriculture, with due consideration to improving gender equity and family welfare.

Capacity building:

- Support capacity building in Tech-MODE and its components such as development and delivery of learning materials, providing learner support, implementation, monitoring and evaluation, and in governance and management of Tech-MODE-based educational programmes.
- Create awareness of the importance of developing collaborative content that is of particular relevance to Africa, and to make it available to all users using flexible copyright licenses such as Creative Commons (<http://creativecommons.org>). Towards developing such open content, strengthen individual and institutional capacity to use free/libre open source software (FLOSS), develop open educational resources (OER) through appropriate Internet platforms such as WikiEducator (<http://www.wikieducator.org>)

Collaboration:

- Integrate and lead multi-community partnerships with an aim to promote life-long learning opportunities for farmers, using Tech-MODE, for improving their livelihoods. Assist in bridging the missing links among all the stakeholder communities: farmers, educators, technologists, researchers, policy makers, marketers, financiers, governmental and non-governmental institutions, and national and international organizations.

Side event linked to which FARA networking support function? (check one)

- Advocacy and resource mobilization
- Access to knowledge and technologies
- Regional policies and markets
- Capacity strengthening
- Partnerships and strategic alliances

Where relevant, note who has success stories, &/or useful resource people or institutions related to side-event theme

The motivation and response from NARES partners from the eight countries to the request from COL has been significant. We expect that the final outcome from the case studies will be of interest not only to COL and FARA but also for the African NARES and to global organisations such as GFAR, CGIAR, CTA

Annexure 3. Executive summaries from country reports

Cameroon – Ajaga Nji

This country case study examines the dilemma of African development with particular reference to the role of agricultural education and training in Cameroon. The study attempts to show the needs, challenges and opportunities in the development of Cameroon agricultural sector using open and distance learning (ODL). Against the backdrop of global change and technological development it discusses the role of science, technology, research and development within the context of agricultural development. Using a map showing the location of the present agricultural and livestock training institutions in Cameroon, the author argues that there is great potential for increasing the access and improving the relevance of agricultural education through information and communication technologies (ICT). He identifies priority areas for expanding technology-mediated open and distance education (Tech-MODE) in agricultural education in Cameroon. The author further stresses the need for partnerships and makes recommendations for consideration by the Commonwealth of Learning (COL) in its on-going initiatives in promoting technologies in education in the Commonwealth.

Examining a continent-wide picture of the role of technology in agricultural education, Africa offers many opportunities for economic and human development of the continent, based on natural resources, enormous economic potential, the rich and diverse geography of the continent, and even its kaleidoscopic colonial history. It is time to transform erstwhile obstacles into opportunities and face the challenge currently being imposed by limited access to, and timid use of, available technology. Tech-MODE can contribute to effective and efficient agricultural and rural development in Africa, leading to sustained livelihoods, particularly among the poor, tillers of the soil and keepers of the hearth.

In Cameroon, national development is affected by a chronic and sluggish growth in the agricultural sector which, ironically, is considered the backbone of Cameroon's future. Time is an important element in this strategy. In the 21st Century, African countries are obliged by rapidly changing circumstances to move fast and swiftly to marry science, technology and policy in their development agendas, particularly with regard to agricultural education. Unhappily, in Cameroon, ICTs are only being sluggishly encouraged and Cameroon is notoriously slow in creating an enabling environment for the rapid and widespread use of ICTs.

Cameroon's education policy is segmented among different ministries of the Government. The Government does not seem to enforce agricultural training in basic and secondary education. To the best of my knowledge, only one non-governmental organisation provides non-formal education in agriculture by distance to farmers. So far, government-owned and run agricultural training institutions offer formal post-secondary agricultural education in the country. The University of Dschang is the only institution of higher learning offering degree-level training

and education in agriculture and agriculture-related disciplines such as agricultural engineering.

Taking into account its privileged position as the only national institution for agricultural education at the tertiary level, the University of Dschang experimented boldly with innovative methods in agricultural education through distance learning in 1988 under the leadership of this author. Today, agricultural education by distance is an approved academic programme at the University at both the Associate Degree level and BSc level. This programme by distance is offered in three options: Crop Production, Animal Production and Agricultural Management and consists of 20 courses available in both English and French, essentially in print mode.

Course development is a time and labour consuming process, involving many challenges, including demand, access, equity, equality, relevance, quality, management, and funding. Several indicators give hope for Tech-MODE in Cameroon. It is in this context that this case study identifies priority areas, guiding principles, intra and transsectoral issues for ODL in Cameroon.

As a recognized leader in ODL and a catalyst, COL can assist African countries in the expansion of Tech-MODE in many aspects, from the formulation of policies, through capacity building, to implementation of sustainable programmes. Finally, the promotion of ODL must be seen to be under two global social forces – globalization and competition – that come not only with opportunities for human progress but also with threats and challenges. The promotion of Tech-MODE must be harnessed to embrace these obstacles and transform them into challenges and opportunities for sustainable development in Africa in the 21st Century.

Ghana – Collins Osei, Reuben Aggor, Edward Badu

Open and distance learning (ODL) and distance education (DE), are not new in Ghana, but can be described as being at their early stages. Providers of ODL/DE are dual mode institutions which offer small-to-medium-scale ODL/DE programmes apparently because the administrative structures needed for effective operation of large scale ODL/DE are not yet in place. Print constitutes the most important medium used by practitioners of ODL/DE programmes for education and training. This can be attributed to factors such as lack of capacity in material development other than print, unreliable electricity and a fair information and communications technology (ICT) infrastructure.

Technology-mediated open and distance education (Tech-MODE) programmes for grassroots agricultural training are currently being exploited by public and private institutions with assistance from development partners such as the Commonwealth of Learning (COL), the Technical Centre for Agricultural and Rural Cooperation (CTA) and the International Institute for Communication and Development (IICD). Pilot Tech-MODE programmes are currently used in Ghana to enhance conventional extension methods of building capacity of extension workers and farmer groups.

They are also used to enlarge the information space and the learning within it through available and supportive ICT.

In pursuit of the above, it is suggested that consideration should be given to strengthening relations with the Forum for Agricultural Research in Africa (FARA) under its programmes on Regional Agricultural Information and Learning System (RAILS) and Building African Scientific Institutional Capacity (BASIC). Support should also be provided in the networking of national, regional and international programmes in Tech-MODE for improved livelihoods and access to education.

Kenya – Geoffrey Kironchi, Agnes Mwang’ombe

Open and distance learning (ODL) in Kenya, like in many other developing countries, is characterized by, and offered through, dual mode institutions. Most of these programmes are in humanities and social sciences. Currently, one private university is offering agricultural training at a distance using print medium. A few private organizations or NGOs carry out short duration informal agricultural capacity building programmes to farmer groups and extension workers using technology-mediated open and distance education (Tech-MODE).

The Government of Kenya placed emphasis on education and training in agriculture, because of the important role it plays in the country’s economy. Although great potential exists for the use of Tech-MODE in agricultural sciences at primary, secondary, tertiary and informal levels in Kenya, its application still largely remains untapped. However, with the recent completion of the National ICT Policy (2006), the Ministry of Education, in consultation with stakeholders, developed a comprehensive National ICT Strategy for education and training, with a view to guiding the implementation of information and communication technology (ICT) initiatives in the education sector.

This country report highlights the existing potential in Kenya that the project on Tech-MODE for agricultural education proposed by the Commonwealth of Learning (COL) could build on. It is suggested that consideration should be given to strengthening relations with the existing national, regional and international institutions and networks or programmes. Priority areas for training should be identified by all participating stakeholders for support in content development and institutional capacity building.

This initiative offers opportunities for multi-institutional partnerships to prepare training content that would not only provide locally relevant and practical knowledge, but also would be internationally recognized. Tech-MODE for agricultural education would offer viable alternatives by lowering education costs, increasing professional retention and not taking trainees out of their professional roles and homes for extended periods. In addition, beneficiaries would contribute to increased and sustainable agricultural production, development in the country, poverty reduction and improved food security.

Nigeria – Adewale Adekunle, Adeolu Ayanwale, Morolake Adekunle, Moses Ubaru

The Commonwealth of Learning (COL) wishes to expand technology-mediated open and distance education (Tech-MODE) for agricultural education and improved livelihoods in sub-Saharan Africa by identifying opportunities for a complementary and catalytic role, preferably in collaboration with the Forum for Agricultural Research in Africa (FARA). For this purpose, this rapid survey was conducted to assess the status of information and communication technologies (ICT) in relevant institutions in selected countries in sub-Saharan Africa, including Nigeria.

Agriculture is the key to sustainable livelihood in Nigeria engaging about 60 to 70% of the population. Agriculture therefore has great potential for micro- and macro-economic growth and development in Nigeria. But due to governmental neglect of agriculture with the emergence of the oil industry, agricultural development experiences a major decline. Tech-MODE activities are necessary to give fillip to this sector.

The country study indicated that the political climate in Nigeria is supportive of Tech-MODE activities. Nigeria has an agricultural policy that supports the use of ICT and an ICT policy that aims at tapping the advantages of the technology to improve livelihoods. Besides, the Nigerian government has set up different agencies to implement activities in ICT guided by the policy and has fostered a good telecommunications climate. All these have synergistically fostered a climate conducive for Tech-MODE activities in Nigeria.

The country study further revealed that potential partners for Tech-MODE exist in the public and private sectors in Nigeria. Several universities have basic equipment to undertake Tech-MODE, but few are carrying out any research and development work in this area. The few that are exploring the possibilities under Tech-MODE do so only to stretch their distance learning degree awarding programmes. Many of these programmes are not currently in the area of agriculture.

The National Agricultural Extension and Research Liaison Services (NAERLS) is the only research institute that combines capacity with experience in Tech-MODE programmes for improved livelihoods. The only civil society organization with considerable capacity and experience in the use of Tech-MODE for educational and improved livelihoods is the Total Development International Foundation (TODEV) which works in such areas as agriculture, adult education, and vocational training. The University of Ibadan has recently approached TODEV to jointly explore the use of their facilities for degree-related distance learning programmes.

We recommend that COL and FARA consider working with the National Information Technology Development Agency (NITDA) and the National Space Research and Development Agency (NASRDA) for policy and macro projects, some universities for distance learning, and with NAERLS for continuing education in agriculture especially for extension officers. TODEV is the most important potential civil

society collaborator for all aspects of Tech-MODE for promoting agricultural development.

Sierra Leone – Aliyageen Alghali, Bob Conteh, Edwin Momoh

Agricultural education and training has seen a great deal of evolution over the years in Sierra Leone, and with emerging trends and improvements in science and technology, one cannot help but move along these trends. The mode of delivery of basic information in agriculture had been seen to play a pivotal role in the adoption of new technologies and innovations. Although there is presently no national policy on information and communication technologies (ICT) in Sierra Leone, provisions for ICT utilisation are embedded in the National Science and Technology Policy. At the same time, the National Education Master Plan 1997–2006 outlines plans for upgrading teachers through the mode of distance education.

Despite all the difficulties the country faces, i.e., poor infrastructure, limited degree of stability and lack of a national ICT strategy, private sector activities have led to some efforts at developing a robust ICT infrastructure. Given the present state of the country, this paper attempts to highlight the preparedness of Sierra Leone in adopting technology-mediated open and distance education (Tech-MODE) in agricultural education and training.

Tanzania – Camilius Sanga, Ayubu Jacob Churi, Siza Tumbo

This country report outlines the opportunities and challenges for Tanzania to collaborate with the Commonwealth of Learning (COL) and the Forum for Agricultural Research in Africa (FARA) in establishing technology-mediated open and distance education (Tech-MODE) in agricultural education and training. Data for this report were collected from existing research documents and through personal interviews with some of the stakeholders in the agricultural sector.

The agricultural sector in Tanzania employs approximately 85% of the labour force. The Tanzania Development Vision (TDV) 2025 reveals that agriculture continues to be dependent on rainfall and traditional technology, consequently, productivity is low and erratic. The low productivity partly reflects lack of creativity and innovativeness that limits full application of science and technology as well as development of the agricultural trade.

Information and communication technology (ICT) continues to play a key role in agricultural development. The current environment is highly favourable for the country to collaborate in open and distance learning (ODL) with local and international institutions. Tanzania has a national ICT policy, and many higher learning institutions have ICT policies which underscore the need for the implementation of ICT-based teaching and learning. These policies emphasise the use of ICT in the agriculture sector as well. Tanzania has the basic ICT infrastructures which can be used to provide agricultural education through ODL and Tech-MODE.

The Open University of Tanzania (OUT) offers formal degree and post-graduate education through distance learning. In addition, several residential-based universities, such as the University of Dar es Salaam, the National Correspondence Institute and the Moshi University College of Co-operative and Business Studies, are providing some form of distance education. Sokoine University of Agriculture (SUA) has a potential to establish ODL programmes in collaboration with OUT, because these universities have a memorandum of understanding to collaborate in teaching, learning, consultancy and research. Furthermore, SUA is the only agricultural university with staff and vast amount of electronic teaching materials in agriculture, veterinary medicine, forest and nature conservation, science, continuing education, computer science, pest management, development studies and sustainable rural development.

Life-long learning for farming communities has started through telecentres and multi-purpose community centres. Established telecentres have shown that they are affordable and are a best method to introduce ICT sustainably at the grassroots level. Examples of telecentres are Cromabu (Mwanza), Mazingira telecentres (Shinyanga), Kilosa telecentre (Kilosa), and Kibengwe telecentre (Bukoba). These telecentres provide additional avenues for ODL and Tech-MODE.

Like other developing countries, Tanzania has many challenges and promising opportunities for the use of ODL and Tech-MODE in agricultural education, but we suggest that both public and private sector collaboration with SUA and COL can extend the potential benefits of the new initiative of ODL and Tech-MODE to Tanzanians.

Uganda – Moses Tenywa, Bernard Fungo

Uganda is well-endowed with natural resources but remains a highly indebted poor country (HIPC) and one of the world's twelve poorest countries characterized by prevalent hunger, malnutrition, low life expectancy (52 yrs), high infant mortality (67/1000) and death rates (13/1000). The economy is predominantly agrarian constituting 82% of the labour force. Poverty is largely attributed to the low human resource capacity in harnessing science and information communications technology (ICT) to overcome the constraints in agricultural production (e.g. drought, pests, diseases, weeds, markets, soil infertility). A study conducted by the International Food and Policy Research Institute (IFPRI) revealed that the greatest reductions in poverty and marginal returns in agricultural production in Uganda came from investments in agricultural research and extension followed by education.

The Inter Academy Council (2004) notes that the next generation of African students must have a strong and holistic science-based training with problem solving and critical thinking skills. In addition, they must possess good communication and inter-personal skills. This is a challenge for which the existing predominantly face-to-face mode of training in Uganda is compelled to face amidst the growing population. Implicitly, the future of agricultural education and research lies in exploiting advances in technology-mediated open and distance learning (Tech-MODE)

because of its flexibility, reduced cost and interactive approach for reaching out to a larger population of learners.

This country report highlights the major ways in which agricultural education is imparted at various levels in Uganda. An attempt has also been made to explore the potential for the use of ICT in agricultural education and training in Uganda. The policy environment surrounding the use of ICT is discussed and the infrastructural, human and policy challenges facing Tech-MODE have been identified. Finally, a few recommendations have been made for strengthening agricultural education to enhance its contribution to livelihoods using Tech-MODE. It is envisaged that the information here will inform the process of nurturing a partnership between the Commonwealth of Learning (COL), the Forum for Agriculture Research in Africa (FARA) and strategic institutions involved in agricultural capacity building in Uganda.

Zambia – Mungule Chikoye, Martin Kaonga

This country report assesses the potential for introduction and adoption of technology-mediated open and distance education (Tech-MODE) in agricultural education and training in Zambia. It is based on desktop studies and interviews with stakeholders in agricultural education and training. Despite adopting expansionist post-independence educational policies, Zambia has failed to achieve the critical mass of human resources required for sustainable agricultural development because of a variety of factors including inadequate agricultural policies and reduced productivity of vital sectors (mining, agriculture and manufacturing). However, the current agricultural policy (2005-2015) recognizes that achievement of agricultural education and training targets requires strengthening of both formal and non-formal education modes because the formal education system alone cannot meet national training needs. The Government has expressed a strong political will to support open and distance learning (ODL) through education policies that recognize ODL as a complementary mode of education, and an information and communications technology (ICT) policy that seeks to integrate ICT in agricultural education and training.

Zambian institutions have historically provided ODL in non-vocational disciplines, but Tech-MODE in agriculture is a relatively new concept. The concept is complex because it has strong vocational components, requires specialised technological methodologies, depends on students' abilities to motivate and manage themselves and requires a front-loaded investment. But the national ICT infrastructure is underdeveloped. Tech-MODE is also time-consuming, expensive to set up and requires efficient administrative support. Furthermore, it is subject to market forces, attracts a more diversified clientele, and requires credible qualifications, institutional accreditation and good practice to compete with class-based systems. These challenges will determine the performance of Tech-MODE in Zambia.

An assessment of existing institutional, human and material resources, previous institutional involvement in ODL and flexibility of institutional facilities and resources concluded that:

- six potential providers of distance education (PDEs) can offer Tech-MODE in agriculture; these include the In-Service Training Trust, Natural Resources Development College, two Zambia Colleges of Agriculture, Katete Centre for Agriculture Marketing and the University of Zambia;
- PDEs need support in re-training human resources, ICT development, market research and the development of a market-centred curriculum, resources for production and delivery of training materials and seed capital to launch Tech-MODE;
- the dual mode of ODL is the most appropriate for PDEs in Zambia;
- bilateral institutional collaboration between PDEs and the Commonwealth of Learning (COL) is an ideal pattern because costs of collaboration increase exponentially as the number of partners increases;
- the front-loaded nature of the costs of distance education favours collaboration between Zambian institutions and COL in the provision of distance education;
- long-term sustainability of distance education delivery depends mainly on the commitment of the Government to develop infrastructure, implement supportive policies and invest in ODL.

This study suggests that there is great potential for introduction and adoption of Tech-MODE in agricultural education and training in Zambia, provided institutional capacities of PDEs are strengthened or developed. It also makes recommendations on how Tech-MODE in agriculture could be introduced and sustained in Zambia.



Stakes and Challenges for Technology-Mediated Open and Distance Education (Tech-MODE) in Agricultural Education in Cameroon

Ajaga Nji, PhD¹

Executive summary

This country case study examines the dilemma of African development with particular reference to the role of agricultural education and training in Cameroon. The study attempts to show the needs, challenges and opportunities in the development of Cameroon agricultural sector using open and distance learning (ODL). Against the backdrop of global change and technological development it discusses the role of science, technology, research and development within the context of agricultural development. Using a map showing the location of the present agricultural and livestock training institutions in Cameroon, the author argues that there is great potential for increasing the access and improving the relevance of agricultural education through information and communication technologies (ICT). He identifies priority areas for expanding technology-mediated open and distance education (Tech-MODE) in agricultural education in Cameroon. The author further stresses the need for partnerships and makes recommendations for consideration by the Commonwealth of Learning (COL) in its on-going initiatives in promoting technologies in education in the Commonwealth.

Examining a continent-wide picture of the role of technology in agricultural education, Africa offers many opportunities for economic and human development of the continent, based on natural resources, enormous economic potential, the rich and diverse geography of the continent, and even its kaleidoscopic colonial history. It is time to transform erstwhile obstacles into opportunities and face the challenge

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currently being imposed by limited access to, and timid use of, available technology. Tech-MODE can contribute to effective and efficient agricultural and rural development in Africa, leading to sustained livelihoods, particularly among the poor, tillers of the soil and keepers of the hearth.

In Cameroon, national development is affected by a chronic and sluggish growth in the agricultural sector which, ironically, is considered the backbone of Cameroon's future. Time is an important element in this strategy. In the 21st Century, African countries are obliged by rapidly changing circumstances to move fast and swiftly to marry science, technology and policy in their development agendas, particularly with regard to agricultural education. Unhappily, in Cameroon, ICTs are only being sluggishly encouraged and Cameroon is notoriously slow in creating an enabling environment for the rapid and widespread use of ICTs.

Cameroon's education policy is segmented among different ministries of the Government. The Government does not seem to enforce agricultural training in basic and secondary education. To the best of my knowledge, only one non-governmental organisation provides non-formal education in agriculture by distance to farmers. So far, government-owned and run agricultural training institutions offer formal post-secondary agricultural education in the country. The University of Dschang is the only institution of higher learning offering degree-level training and education in agriculture and agriculture-related disciplines such as agricultural engineering.

Taking into account its privileged position as the only national institution for agricultural education at the tertiary level, the University of Dschang experimented boldly with innovative methods in agricultural education through distance learning in 1988 under the leadership of this author. Today, agricultural education by distance is an approved academic programme at the University at both the Associate Degree level and BSc level. This programme by distance is offered in three options: Crop Production, Animal Production and Agricultural Management and consists of 20 courses available in both English and French, essentially in print mode.

Course development is a time and labour consuming process, involving many challenges, including demand, access, equity, equality, relevance, quality, management, and funding. Several indicators give hope for Tech-MODE in Cameroon. It is in this context that this case study identifies priority areas, guiding principles, intra and transsectoral issues for ODL in Cameroon.

As a recognized leader in ODL and a catalyst, COL can assist African countries in the expansion of Tech-MODE in many aspects, from the formulation of policies, through capacity building, to implementation of sustainable programmes. Finally, the promotion of ODL must be seen to be under two global social forces – globalization and competition – that come not only with opportunities for human progress but also with threats and challenges. The promotion of Tech-MODE must

be harnessed to embrace these obstacles and transform them into challenges and opportunities for sustainable development in Africa in the 21st Century.

Principal acronyms

COL	Commonwealth of Learning
GCE AL/OL	General Certificate of Education Advanced Level / Ordinary Level
ICT(s)	Information and Communication Technology(ies)
NGO	Non-Governmental Organisation
ODL	Open and Distance Learning
R&D	Research and Development
S&T	Science and Technology
Tech-MODE	Technology-Mediated Open and Distance Education
UD	University of Dschang, Cameroon
UoG	University of Guelph, Canada

1 Introduction

Africa offers many opportunities. Firstly, it is richly endowed with natural resources. Secondly, the continent abounds with unmatched diversity and richness of economic potentials for effective development. Thirdly, the geographical size of the continent is a development asset that needs to be exploited. Finally, its colonial history – an erstwhile obstacle which could be transformed into an opportunity in today’s globalizing world.

The fact that the African continent was invaded, exploited and later abandoned by colonialists can be transformed into an opportunity today. Exposure and relations with the world’s major civilizations, such as English, French, Portuguese and German ought to be seen as an opportunity today for easier, friendlier, collaborative and cooperative dialogue for social, economic and political transformations in Africa.

Notwithstanding these opportunities, Africa remains the most “backward”, and “hopeless” of all the continents in the world. It has also been referred to as the “dark”, “forgotten” continent. These negative labels have been imposed by a conspiracy of circumstances that characterize perpetual underdevelopment of the region: ethnic conflicts and wars within and outside national boundaries, a yawning chasm of illiteracy, high and stubborn disease prevalence and low levels of development and application of science and technology (Nji, 2004).

All these factors negate the development of Africa’s key industry, agriculture, which is considered to be the engine or the lever of development for all the nations of the world.

2 Opportunities of science and technology

Evolutions in science and technology (S&T) hold the promise for the future of the development of the poor and emerging nations. This is enhanced by research and development (R&D), particularly in key sectors such as agriculture. Unfortunately, however, Africa is poor on both S&T and R&D for reasons widely discussed in many books on economic development and research.

What must be emphasized with respect to agriculture is that it is not so much the dearth of agricultural research that is the problem, as the limited access and affordability of the poor and rural dwellers to the available technology.

It is increasingly being recognized that open and distance learning (ODL) can increase access, diversify and improve the quality of education and enhance opportunities for improved livelihoods. Technology-mediated open and distance education (Tech-MODE) can contribute to sustainable agricultural and rural development in Africa at various levels, right from the grassroots through knowledge-production and policy formulation to decision-making levels.

3 The promise and the peril of the agricultural sector

In Cameroon, national development is being greatly hampered by the sluggish development of the agricultural sector which holds great promise for promoting development. The absence of appropriate and adequate infrastructure, weak institutions and policy to support the agricultural sector, a culture of poor management and misguided strategies stand on the way of a sustainable agricultural development (Nji, 1992).

A weak link in the agricultural development chain of Cameroon is the perpetuation of ill-adapted and untimely modes of education in the agricultural sector, even in the face of the opportunities presented by S&T in the 21st Century. All these limitations collectively conspire to put the country's economy and its future in grave peril.

Yet, there is promise for the agricultural sector in Cameroon if S&T and R&D can be efficiently harnessed for development with the primary focus on agriculture, which is considered the main engine to drive the country's development.

4 Time management as a prerequisite

One of the elements in this effort is TIME. The concept, implications and dynamics of time and its management are often either not well understood or managed. In agricultural development, time or timing is very important because agriculture is a biological science. Timing is critical in the sequencing of farm operations: land preparation, planting, weeding, harvesting, transportation, storage, processing, transformation, marketing and consumption. It is also important in the timing by

policy makers, decision makers, scientists, technologists and so on embarking on technology. Timing, therefore, is important for African scientists and leaders at all levels and sectors to work in concert for evidence-based, science and technology-assisted development.

The concept of time is also important in the design and implementation of policies that promote agriculture. This implies that policy makers and scientists must streamline their efforts to create synergies that combine science with policy. This must be done in a timely and coherent way that takes into consideration the changing times and the opportunities that come with revolutions in science and technology.

One of the much publicized advantages of ODL is its cost efficiency compared to residential instruction. Yet, many politicians and policy makers in Cameroon seem to be oblivious of the need for speedy, comprehensive and coherent educational policy that embraces information and communication technologies (ICTs) particularly in agricultural education.

5 ICT policies and strategies in Cameroon

While other countries on the African continent are gravitating to adopt S&T, particularly ICTs, Cameroon is notoriously slow to innovate. Institutional inertia and the absence of a comprehensive development strategy constrain Cameroon's development future (Nji, 2004).

As far back as 1984, Cameroon started "working" on a strategy dubbed National Computer Master Plan. The Plan never took off the ground until another plan, the Information Technology Plan was formulated and released in 2004. The Plan remains sketchy and theoretical as Cameroonians wait impatiently to see the cable or wireless networks in their homes and offices.

With less than 6% of the rural population and less than 20% of the national population connected to electricity, the use of ICTs remains a dream to many Cameroonians. Furthermore, it is estimated that less than 0.1% of the population has Internet connection. The Minister of State for Posts and Telecommunications recognizes this saga and promises to "face the challenge of adoption" of ICTs (La Nouvelle Expression, 2007:9).

6 Energy crisis in Cameroon

The energy crisis in Cameroon is another nightmarish dilemma choking, crippling and stifling the economy. This is compounded by inadequate and untimely attention to the rapidly changing demands, needs and challenges of energy in Cameroon. No new investments have been made in the energy sector since 1990 while at the same time the production efficiency of electricity in Cameroon has dropped by 40% and the demand has increased by 6% (Foute, 2007).

Tech-MODE could be the source of promise for agriculturalists and rural development partners in Cameroon and in other developing countries. But without aggressive technology and energy policies, the development future of Cameroon remains bleak in today's technological age. But the country remains optimistic just like Lukong (2007:11) who claims that "despite the hurdles of enhancing energy production in Cameroon; upcoming projects raise an iota of hope".

7 Structure of agricultural education in Cameroon

The Cameroon educational system comprises the three universal levels: basic, secondary and tertiary. The education policy in Cameroon is segmented and handled by four different and autonomous ministries: basic education, secondary education, higher education and technical education. The Ministry of Technical Education survived a short life span from 2000 – 2004 where the new cabinet assigned the portfolio of technical education to a new Ministry of Labour and Professional Education.

The practice of agricultural education in the educational system at the various levels of education is as follows:

- **Basic education.** Agriculture is not a compulsory subject on the basic education syllabus, although some schools elect to run school farms and gardens, not so much for educational purposes, as for economic and paternalistic reasons that tend to benefit the teachers and school administration more than the pupils.
- **Secondary education.** As in basic education, there is no strongly enforced government policy on agricultural training in secondary schools. However, there is a national policy on training and examination in agriculture in the Baccalaureate, the French equivalence of the General Certificate of Education (GCE) Advanced Level. Preliminary information obtained from informants suggests that a handful of high schools offer agricultural training at this level in Cameroon. However, the training is not available at distance.
- **Vocational and technical education.** Vocational and technical education is provided in Cameroon through public and private schools leading to BTS (Brevet de Technicien Supérieur) or HND (Higher National Diploma). Agriculture is taught in some private, residential technical schools, mostly owned and run by religious organizations (Catholics and Protestants).
- **Non-formal education (NFE).** Only one private institution, INADES-Formation (IF) an international NGO, is known to be on record for NFE in agriculture by distance. Farmers and rural dwellers benefit from correspondence courses run by IF on a number of agricultural topics. Learners who successfully complete a certain number of courses are awarded a certificate. There are no entry requirements and no deadlines, making the training ODL in nature.

Courses are distributed in print format to farmers in accessible areas and supplemented with broadcasts twice a week over regional radio networks. This author evaluated a project for the "dissemination of farm information to young

farmers in the North-West Province” in 1987 sponsored by the International Development Research Centre (IDRC), Canada. The ODL model of IF includes Question and Answer Series in both print and radio. No other technologies are used in this training.

Perhaps with the passing of time and changing circumstances, more NGOs might develop interest and become involved in open learning in agriculture and rural development in Cameroon in future. But the limiting factor in these endeavours could be inexperience, resources, trainers with ODL capabilities and environmental factors.

8 Post-secondary agricultural education

Formal agricultural education recognized and financed by government is offered in Schools of Agriculture under the supervision of the Ministry of Agriculture and Rural Development and Schools of Veterinary Science under the Ministry of Livestock and Animal Industries. The location of such institutions is given in Figure 1.

Schools of Agriculture

Four Colleges of Agriculture (Bambili in the North West Province, Ebolowa in the South Province, Maroua in the Far North Province and Bertoua in the East Province) offer general agriculture training for secondary school leavers. Admissions to these schools are by a competitive entrance examination.

Students who are holders of GCE OL certificates pursue studies leading to the award of a junior agricultural technical certificate after two years, while holders of GCE AL undergo studies leading to the senior technician diploma in agriculture after two years of successful studies. Approximately about 1500 candidates nationwide write the entrance examinations each year, but only between 300 and 400 are accepted totally in the four Regional Colleges of Agriculture.

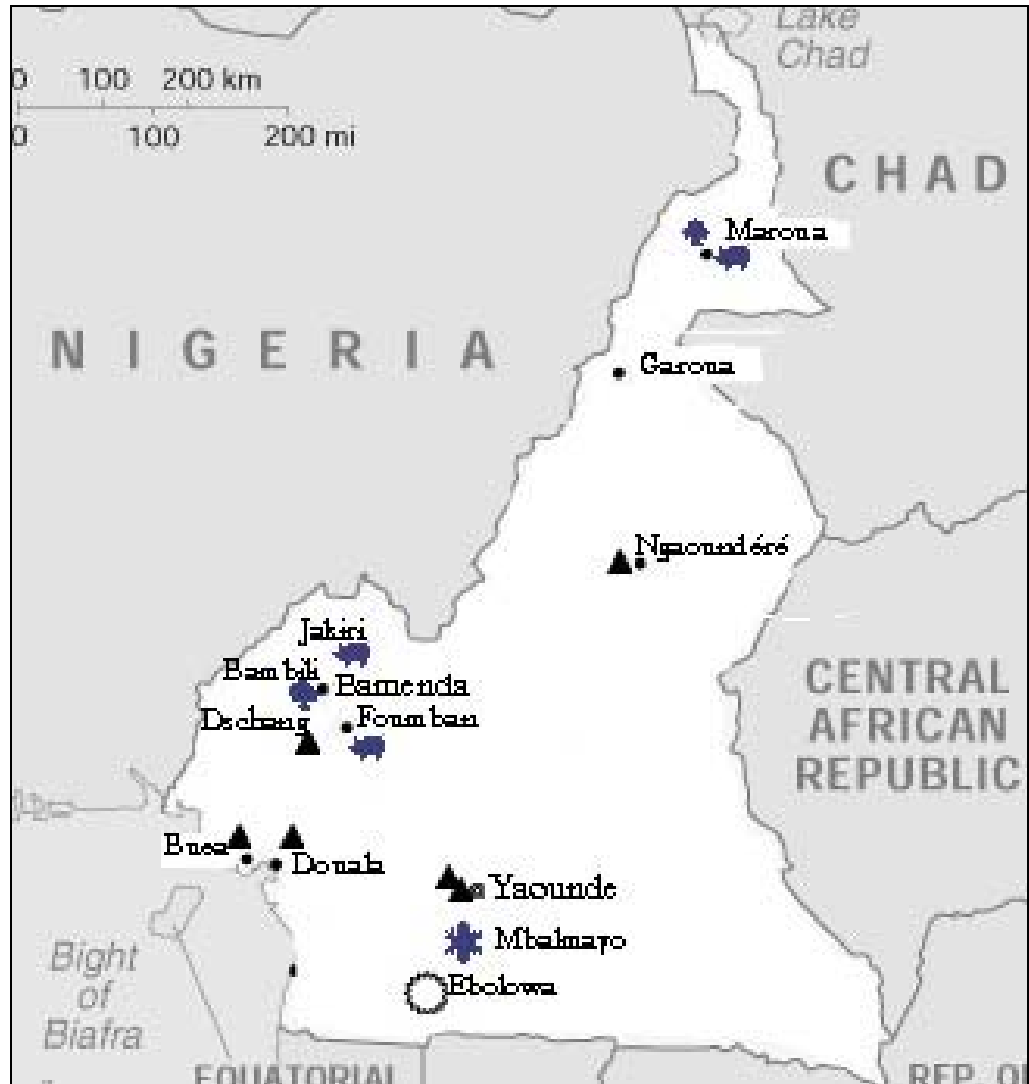
Schools of Veterinary Science

The Ministry of Livestock and Animal Industries runs and controls three schools (one in Jakiri, North-West Province, a second in Foumban, West Province and the third in Maroua, Far North Province) for the training of veterinary nurses and livestock technicians. The Foumban Centre places great emphasis on the training of technicians in the fisheries. Approximately 4000 candidates write the entrance examinations each year but only 1000 are admitted to the various schools.

Wildlife and forestry schools

The Ministry of Wildlife and Forestry runs and operates two schools: one in Maroua (Far North) and the other in Mbalmayo (Centre Province). The school of wildlife in Maroua conducts training in various areas of nature and wildlife conservation, while the school in Mbalmayo trains forest rangers. The total

residential capacity in both schools is approximately 500. All instruction in both institutions is through the residential face-to-face mode.



- ▲ State Universities
- National Centre for Animal Husbandry and Veterinary Training (CNFZV)
- ★ School of Forestry
- ⚙ Regional College of Agriculture (RCA)
- ⊙ Technical College of Agriculture (TCA)

Figure 1. Location of agricultural and livestock training institutions in Cameroon

For reasons of educational culture and administrative tradition, none of the agricultural educational institutions is considered higher education institutions in Cameroon. Three reasons account for this. First, the minimum entry qualification into the schools are not GCE Advanced Level or equivalent levels. Second, the organizational structure of the schools does not correspond to higher education nomenclature. Third, the institutions are under the control of supervisory Ministries and not under the control of the Ministry of Higher Education. The issues at stake are quality assurance and accreditation. It is argued that unless these schools are subjected to the rigour and culture of university education on these two scores at a minimum, they do not qualify as higher education institutions.

Higher education institutions

Of Cameroon's six public universities, the University of Dschang (UD) is the only institution of higher learning with a clear mandate for higher education and training in agriculture. However, the University of Ngaoundere is also mandated by official government policy (MINESUP, 1993) to offer training in the processing of animal by-products (milk, butter, cheese and yogurt). Ngaoundere is also venturing into beer and wine research purely for educational purposes. All training at the University of Ngaoundere is by residential mode (face-to-face).

9 Distance education in higher education

The University of Dschang (UD) "is a pioneer and remains Cameroon's best institution of higher learning in agricultural education and training...committed to excellence in agricultural teaching, research and outreach" (University of Dschang, 1996:1)

Distance education at UD started with a visit by an official from Dschang to the University of Guelph (UoG) in 1988. Between 1989 and 1990, teams from UD and UoG jointly wrote a proposal that was submitted to the Canadian International Development Agency (CIDA) for funding. The proposal "to establish a sustainable distance education project to train Cameroonians for a diploma in tropical agriculture" was approved for funding in April 1991 (University of Dschang, 1998).

This initiative evolved from a project to a programme in the Faculty of Agriculture and institutionalized as a programme at the University of Dschang subsequently (Nji, 1999). The Programme consists of 20 agricultural training courses in both English and French written, produced and delivered in Dschang by a team of faculty trained in distance education methodology both in Guelph and in Cameroon between 1992 and 1996. Three options were on offer: Crop production, Animal Production and Agricultural Management. Further details of this programme are as follows.

Registration

Enrolment into the programme is open to anyone who is interested in studying agriculture. There are no minimum educational requirements, age limits or

datelines regarding enrolment. However, students who desire to pursue their studies at the university level in an accredited academic programme must hold the General Certificate of Education (Advanced Level) at the time of application for enrolment.

Method of instruction

The courses are essentially in print mode and the students enrol from all ten provinces of Cameroon. Courses are sent to them by post or through contract mail delivery systems. Some students pick up their courses personally on campus.

Language of instruction

Each of the 20 courses has been written in the first language of the author (either English or French – the official languages of Cameroon) and then translated into the other language. Students write their assignments and exams in the official language of their choice.

Quality assurance

Each course has been written following a needs assessment survey and is reviewed at various stages by qualified course writers and reviewers. The entire curriculum is approved by the University Senate upon the recommendation of the faculty. The diplomas are officially recognized by the Minister of Higher Education as an academic qualification equivalent to two years of residential instruction in agricultural education at the University of Dschang.

Student assessment

Each course contains at least two mailed assignments. Two examination sessions are organized each year. The students come to the main campus of the University of Dschang either in March or July for final practicals and final examinations.

Value of the programme

Students who successfully complete their programme and wish to continue their studies in the five year degree programme of the Faculty of Agriculture in the University of Dschang write an entrance examination (provided they are holders of the GCE AL or equivalent). Each year, the Government opens 10-15 places for suitably qualified external candidates (including holders of bachelor's degrees in the sciences or agriculture-related fields).

Successful candidates are admitted into year 3 of the 5-year programme. Since 2002, five graduates of the distance education programme who went into the 5-year programme through an entrance examination have graduated with the “Ingenieur Agronome” degree awarded by the Faculty of Agriculture.

Problems

The development of distance education at the University of Dschang was not devoid of obstacles and constraints. Problems arose at the individual level where some faculty members openly opposed innovations through the institution, where faculty and university leaders built roadblocks to the development of distance education. Such road blocks included blackmail, stonewalling and institutional inertia. At the national level, obstacles included a policy vacuum for the promotion of distance education, lack of recognition for distance qualification and lack of accreditation mechanisms (Nji, 1999).

10 National forum on distance education

After several years of efforts, the Government of Cameroon agreed to organize a National Forum on Distance Education in September 2003 with substantial financial and technical support from the Commonwealth of Learning (COL). The forum identified among others the following:

Opportunities and strengths

- The pioneering experience of UD and INADES-Formation.
- Cameroon's official bilingualism to serve the CEMAC sub-region.
- Availability and willingness of partners such as COL, AUF to participate in the programme.
- Availability of AT3 Terminal in Douala for large bandwidth.
- Promising acceptance of ODL by government.
- Pressure on existing educational infrastructure and resources.
- Law of Orientation of Higher Education of April 16, 2001.
- Law of Orientation of National Education of 1998.

Obstacles and constraints

- Policy vacuum on distance education in Cameroon.
- Several forms of resistance to ODL in Cameroon.
- Institutional inertia towards educational innovation.
- Lack of infrastructure for ODL.
- Absence of trained experts in ODL.
- High cost of appropriate technologies required for ODL.
- Limited energy supply to urban areas.
- Poor communication resulting in isolation of rural areas.
- Poor remuneration/motivation of teachers and farmers.

11 Towards a sustainable ODL / Tech-MODE programme in agricultural education at the University of Dschang

A politician once told me that all it takes to deliver education by distance is:

“...to sit in front of a microphone and read out a course to students who would listen over the radio or watch TV and take down notes.”

This is a totally wrong impression of ODL and an obstacle to participation and ownership building in sustainable distance education in Cameroon. My experience in course development in distance education shows that one has to go through a minimum of 39 steps over a minimum of two years from the time a course title is determined to the time the course is delivered to the learner.

In agriculture and other technical disciplines, special attention has to be paid to practicals, hands-on experience and learning. In addition to the exceptionally high standards expected of tertiary education, ODL practice in agricultural education in Cameroon and elsewhere must respond to quality, relevance, economics of the poor and institutional capacity (Sanyal, 1999; Green and Harvey, 1993 as cited in Deshpande and Mugridge, 1994).

Furthermore, the reputation of a distance education course greatly depends on the relevance and quality of its contents for the learner; therefore, distance educators and university officials must pay particular attention to course development in order to maintain sustained partnership and retain dialogue with stakeholders and audiences (students, teachers, employers, etc.) who can readily veto the style of teaching of distance education by teachers and tutors (Tait, 1997).

For technology-assisted ODL to be sustainable in agricultural education in Cameroon, it is important to be aware of the major structural challenges facing Cameroon higher education, such as the following.

The demand and access challenge

During 1976-1986, student enrolment in higher education grew at an annual rate of 9.7%, peaking at 19,598 students in 1986. During the economic crisis period, an extraordinary phenomenon occurred confirming the sociological hypothesis that “*a crisis can increase the rate of adoption of a technology*”. Tertiary enrolment rose by 14.7% during this period, giving a student population of 44,551 full-time learners in Cameroon’s higher education institutions during 1992-1993. This enrolment continued to climb to 60,000 in 1998-1999 and now stands at about 120,000 in 2006-2007. The growth in student numbers has not been accompanied by a commensurate growth in infrastructure. Yet, the number of Cameroonians now enrolled in university studies at home represents less than 6% of the 15-24 years age bracket who qualify for university education; thus posing one of the most formidable challenges of our times: the demand for and access to higher education.

In the agricultural sector, this challenge has serious consequences for agricultural development, the engine that still drives the Cameroon economy. It is estimated that less than 25% of all Cameroonians who want to study agriculture at all levels ever get a chance to do so. This further frustrates candidates and contributes to dampen interest in agriculture.

The equity and equality challenge

Of the total number of overall student population in Cameroon’s higher education institutions, less than 25% are female, although 52% of the Cameroon population are women. Furthermore, less than 25% of the student body in Cameroon universities come from rural areas or poor families. This poses a challenge for gender mainstreaming and equal opportunity in education.

The relevance challenge

Cameroon’s tertiary education institutions lag behind others in matching educational programmes with the world of work. There is a weak relationship with the competences and skills needed by learners and the needs of employers. Tertiary education in Cameroon is grossly out of touch with the reality and needs of employees and employers.

The quality challenge

The deteriorating quality of teaching is positively related to the quality of the teacher, infrastructure and the outcomes of learning.

The management and transparency challenge

This is a crucial phenomenon and a major quality challenge. The plethoric growth of the student body in Cameroon universities (Signal, 1999) has not been accompanied by an efficient management of student records in our universities (departments, schools, faculties or institutes, and universities). The complex context of Cameroon development policy, and its interface with a complex political, cultural and social system conspire to make university management both inefficient and ineffective. Centralization of the management system and insufficient accountability obfuscate transparency.

The funding or financing challenge

Reduced funding to higher education and agriculture, and the lack of differentiation in educational costing and billing transform the education sector into a perpetual arena of financial crisis management. The solution to this problem lies in the diversification of funding sources for education with special attention to agricultural education.

The partnership crisis challenge

The future of Cameroon universities depends on their ability to develop and maintain sustainable partnerships with civil society, the private sector, regional and international organizations through collaborative initiatives and cooperation. Such partnerships diversify resources and enhance system adaptation to globalization and competition. This is particularly true of agricultural education which is relevant for national development.

The information technology challenge

This is a crucial element in the survival of educational institutions in the 21st Century. Educators and learners have common interest in upgrading their technological capabilities and improving technological skills among students, academic and non-academic staff. Competitiveness in the Information Age depends on a thorough mastery of technology.

There is HOPE. All the challenges enumerated above, tend to create a crisis in Cameroon's education sector. But there is hope. Instead of considering these challenges as constraints and obstacles to agricultural development, we should embrace them and transform our obstacles into opportunities by using appropriate technologies, strategies and policies (Nji, 1992). The following indicators are rays of hope for a technology-assisted distance learning in Cameroon in general, and agricultural education sub-sector in particular:

- Article 11(4) of Law No. 2001/005 of 16th April 2001 on the Orientation of Higher Education in Cameroon stipulates that “*distance education shall be recognized and encouraged as an alternative mode of developing higher education*”, (Ministry of Higher Education, 2001). Similar provisions have been made in the laws of orientation of education at the basic and secondary/vocational levels.
- A strong national presence of avid searchers of knowledge across all age groups and in virtually all sectors of the Cameroon economy.
- A growing interest in lifelong learning, particularly among third-generation citizens.
- Gradual but keen and growing interest of employers of the benefits and credibility of distance education and the perceived irreversibility of borderless education worldwide.
- The potential for cost-effectiveness of ODL programs resulting from a large number of learners for agricultural courses.
- The encouragement and support of friendly countries and international organizations committed to the promotion of ODL.

ODL can contribute to development and upgrading of skills (Mishra and Bartram, 2002), narrow the digital divide, assuage the knowledge and information deficit, enhance Cameroon's ability to build a knowledge society and compete effectively

in the 21st century, and thus contribute significantly to finding answers to the proverbial question of why poor people remain poor (Nji, 2004).

12 Priority areas for Tech-MODE in Cameroon

Participants to the Stakeholders National Forum on Distance Education held in Yaoundé in 2003 identified priority areas for ODL development in Cameroon. Although agriculture was not specifically mentioned, pursuing the areas proposed for ODL intervention will have a direct bearing on agriculture and rural development. The priority areas identified are:

- teacher training,
- skills and competencies development,
- employment creation and income generation,
- capacity building at all levels and in all sectors of the national economy,
- literacy improvement to meet the goals of EFA and subsequent global declarations,
- lifelong learning and continuing education.

To these goals should be added the eight Millennium Development Goals (MDG) for poverty alleviation and sustainable development which seek specifically to:

- eradicate extreme poverty and hunger,
- achieve universal primary education,
- promote gender equality and empower women,
- reduce child mortality,
- improve maternal health,
- combat HIV/AIDS, malaria and other diseases,
- ensure environmental sustainability,
- develop a global partnership for development.

At the end of day, it must be understood that in Cameroon as in other African nations, the pangs of hunger, misery and disease are the same. Therefore, a number of key guiding principles such as the following are in order:

- The **number one** problem at the roots of African underdevelopment is **not** lack of resources, not colonialism, not ethnicity but **poor governance** depicted by unaccountable, undemocratic and inefficient governments. This should be the focus of ODL in Africa.
- Education institutions at all levels in all countries are catalysts of development as they empower individuals with skills and competences that allow them to participate effectively in the development process.
- In all societies, sustainable development is achievable if development action is people-centred, problem and needs-oriented, goal-directed and focused on the common good.
- Development education must tap indigenous knowledge and maximize the use of local resources (natural, human, capital and equipment).

- ODL courses must be designed to encourage creativity, imagination and innovativeness in the learner and the ability to finding solutions to local problems.
- ODL in Africa must address governance issues, transparency, good citizenship, and responsibility.
- Courses should be developed to generate knowledge on national and global issues and to crystallize a culture of progress based on science and technology.

13 Designing Tech-MODE courses for poverty reduction

Based on the above guiding principles, a new breed of course authors will be needed. Course and programme designers must be equipped with skills in analytical and critical thinking so as to better address the needs of farmers and rural people most of whom are not literate in English or French and can ill-afford course materials due to limited economic resources.

On the learner's side, the level of maturity of learners and their limited capacity for independent study, lack of resources, the specific forces that shape the psychology and sociology of in-school and out-of-school learners (Yates and Bradley, 2000; Robinson and Latchem, 2003; Keith, 1999; Gibson, 1994) are factors to be taken into consideration while training the trainers for sustainable ODL programmes in Africa. Intrasectoral considerations include:

At the basic education level:

- Functional literacy (reading, writing and numeracy),
- Open schooling for school drop-outs and victims of social exclusion.

At the secondary and vocational education level:

- Initial training leading to diploma and certificate awards,
- Education in life skills and vocational competences,
- Non-formal, community and adult education,
- Teacher education and professional development,
- Continuing education.

At the tertiary level:

- High level human resource development,
- Creative thinking, problem-solving and reflection,
- Strategic planning,
- Management of natural, human, financial and capital resources,
- Policy formulation and decision-making,
- Research, science and technology development,
- Governance, quality control and assurance,
- In-service teacher training.

14 Transsectoral issues

These are themes that cut across all the sub-sectors of the education spectrum. An aggressive ODL initiative in Cameroon will do well to keep the following issues in mind:

- Audiences and characteristics of distance learners.
- Student support systems including student assessment and course evaluation.
- Technological issues (access, availability, affordability, convenience appropriateness, efficiency).
- Leadership and management.
- Resources such as availability, affordability and mobilization.
- Cost and benefits of alternative delivery systems and modes.
- Policy environment (political will and commitment).
- Cost-benefit analysis in ODL development and delivery.
- The inherent social nature and purpose of education.

15 The threat of “borderless” education

As the initiative for promoting ODL in African agriculture is being considered, advocates of ODL need to keep in mind that the African continent is seriously threatened by two irreversible global social forces: *globalization and competition*. Both come with threats and opportunities which all stakeholders should be urged to strive to marry and manage for the development of a sustainable ODL system.

A movement is taking hold in the World Trade Organization (WTO) to make higher education a commodity. In this context, tertiary education can be traded and bought just like any other commodity. In an era of globalization, this means that the actors involved in the education market must be prepared for competition. Such preparedness for competition includes building synergies, alliances, collaboration and cooperative linkages.

Quality is a key element in the commercialization of a commodity. Therefore, the future of any educational system depends on the quality of its products. And the quality of such products depends on the quality assurance mechanisms of the system that produces them.

Careful course development and preparation are the first key steps in assuring quality education. In the context of the changing tertiary education landscape, a number of key new actors are emerging in the “borderless” tertiary education market place from “click” (virtual universities) to “brick” (traditional universities).

Unfortunately, Cameroon is currently not ready or armed enough to embrace any one of the two evils. These facts and macro-dynamics call for novel, inward-looking organizational structure or a sort of looking-glass and a paradigm shift to

confront the inevitable wave of change that is being brought about the revolutions in science and technology.

The development of ODL in this time and age also compels us to be aware of the rapid shifting away from classic discipline-led approach to teaching and learning, and the growing interest in applied knowledge in all fields of study resulting in the blurring of the erstwhile distinction between basic and applied science and research. Unfortunately, Cameroon will be slow to come on-board.

Molecular biology and biotechnology, advanced materials sciences, microelectronics, information systems, robotics, intelligent systems and neuroscience as well as environmental science, technology and engineering are among the most significant new areas embracing new organizational and management designs (Gibbons, et al, 1994; World Bank, 2002).

What this means for Cameroon's ODL future is that all initiatives to promote ODL in the country must take into consideration the realities of these new configurations in knowledge creation which may imply not only a reconfiguration of academic departments but also the design and construction of novel professional and institutional road maps.

This implies that programme designers and course authors will be expected to adopt interdisciplinary and multidisciplinary attitudes, trans-disciplinary work ethics, and the ability and willingness to work in teams rather than as individuals.

For example, a course developed by a **subject matter specialist** with the participation and input in graphic design from an **instructional designer**, using an appropriate technology mix under the guidance of a **media specialist** with the final touches of an **editor** and a cover **designer** will have more content and context appeal than a course designed by a subject-matter specialist alone.

Besides, the experience in teamwork that will be learnt from developing ODL materials will inevitably contribute to improving the quality of residential instruction and the development of the team spirit and collective responsibility that agriculture portends.

16 Recommendations and suggestions

The following recommendations might be useful in initiatives to expand Tech-MODE for agricultural education and improved livelihoods in Cameroon in the face of dwindling and sometimes misguided financial resources and the dictates of structural transformations in the on-going paradigm shifts:

- Capacity and institution building are crucial for the promotion of Tech-MODE. The training of a critical mass of technicians and managers should also be given serious thought.

- Funding is crucial but this must be tied to technology access through increased bandwidth, cost savings, reliability and the quality of the technology.
- The Tech-MODE budgets should be determined from the bottom up including a detailed costing of the design and presentation in Cameroon.
- The media mix, availability and expected results and impacts should be well determined taking into consideration the strengths and weaknesses in Cameroon.
- Seriously consider marrying careful preparation with persuasive presentation through clarity and meaning in Tech-MODE material for all learners, particularly primary, secondary and vocational school level and for lifelong learning with low levels of literacy in English and French.
- In higher education, first year or undergraduate courses challenge the course authors, media specialists and designers to be more creative, imaginative and innovative. Tech-MODE methodology should take this variation into account.
- Enhancing cost savings in Tech-MODE by encouraging higher enrolment rates and promoting cheaper student management with appropriate technologies is crucial for sustainability of the strategy.

From my experience developing the distance education programme at the University of Dschang from 1988 to 2000, the timeframe for setting up a distance education programme is given below.

Conception, design and approvals	3 years
Implementation, i.e., training, course development, marketing	3 years
Institutionalization	6 years

This adds up to twelve years from project idea to the stage of a functional accredited academic program in an educational institution. It may be noted that the development of course materials for Tech-MODE delivery may take even longer time. But this timeframe will change with the goal or objective.

It should and will change in contexts blessed with strong political will and commitment, institutional leadership committed to the ODL or Tech-MODE, resources available for programme development and delivery, a trained core of professionals or academics involved in the programme as well as a peaceful, progressive and stable political environment. Partnership, cooperation and collaboration at national, sub-regional, regional and international levels are also crucial.

It must be noted that the distance education programme at the University of Dschang was developed during a period of economic and political turbulence, institutional uncertainty, limited stakeholder capacity and awareness of the potentials of distance education. These factors should be taken into consideration in the development of Tech-MODE methodology, strategy and goals.

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Technology-Mediated Open and Distance Education (Tech-MODE) in Agricultural Education and Training for Improved Livelihoods: A Ghana Case Study

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Executive summary

Open and distance learning (ODL) and distance education (DE), are not new in Ghana, but can be described as being at their early stages. Providers of ODL/DE are dual mode institutions which offer small-to-medium-scale ODL/DE programmes apparently because the administrative structures needed for effective operation of large scale ODL/DE are not yet in place. Print constitutes the most important medium used by practitioners of ODL/DE programmes for education and training. This can be attributed to factors such as lack of capacity in material development other than print, unreliable electricity and a fair information and communications technology (ICT) infrastructure.

Technology-mediated open and distance education (Tech-MODE) programmes for grassroots agricultural training are currently being exploited by public and private institutions with assistance from development partners such as the Commonwealth of Learning (COL), the Technical Centre for Agricultural and Rural Cooperation (CTA) and the International Institute for Communication and Development (IICD). Pilot Tech-MODE programmes are currently used in Ghana to enhance conventional extension methods of building capacity of extension workers and farmer groups. They are also used to enlarge the information space and the learning within it through available and supportive ICT.

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In pursuit of the above, it is suggested that consideration should be given to strengthening relations with the Forum for Agricultural Research in Africa (FARA) under its programmes on Regional Agricultural Information and Learning System (RAILS) and Building African Scientific Institutional Capacity (BASIC). Support should also be provided in the networking of national, regional and international programmes in Tech-MODE for improved livelihoods and access to education.

Principal acronyms

COL	Commonwealth of Learning
CSIR	Council for Scientific and Industrial Research
CTA	Technical Centre for Agricultural and Rural Cooperation
DE	Distance Education
FAO	Food and Agriculture Organisation of the United Nations
FARA	Forum for Agricultural Research in Africa
GIMPA	Ghana Institute of Management and Public Administration
GSS	Ghana Statistical Services
ICT(s)	Information and Communications Technology(ies)
ICT4D	ICT for Accelerated Development
KNUST	Kwame Nkrumah University of Science and Technology
LAN	Local Area Network
MoFA	Ministry of Food and Agriculture
NGO	Non-Governmental Organisation
ODL	Open and Distance Learning
Tech-MODE	Technology-Mediated open and distance education
UCC	University of Cape Coast, Cape Coast, Ghana
UEW	University of Education, Winneba, Ghana
UG	University of Ghana, Legon, Ghana

1 Introduction

Ghana is a low-income country with a population of 22 million people and about a third of the population living below the poverty line (www.cia.gov/library/publications/the-world-factbook/geos/gh.html). Agriculture remains the main economic activity in Ghana and it is the source of livelihood for about 60% of the workforce (The Ghana ICT for Accelerated Development Policy, 2003). The agricultural sector also accounted for about 35% of Gross Domestic Product (GDP) and 65% of the labour force in 2001 (www.nationsencyclopedia.com/Africa/Ghana-ECONOMY.html). Consequently, like many developing countries in Africa and elsewhere, agriculture plays a pivotal role in Ghana's economy and, by association, Agricultural Research and Development (AR&D) is extremely important.

Most people involved in agriculture in Ghana are subsistence farmers handling little or no marketable surplus. According to the Ghana Statistical Services (GSS, 2002) the incidence of poverty among food crop producers is the highest among the

socio-economic groups. Several factors, including recurrent drought in parts of the country, deforestation, soil erosion, pest and diseases and inadequate access to agricultural information, play major roles in reduced agricultural production and productivity. Government policy frameworks such as the Medium Term Agricultural Development Programme (MTADP) and the Agricultural Services Sector Investment Programme (AgSSIP) have all aimed at improving the agricultural sector.

1.1 Agricultural education

The Government of Ghana recognises the importance and role of agriculture in the economy of Ghana and hence the inclusion of agriculture as a subject in the formal education system. The Ghana educational system provides for a nine-year Compulsory Universal Education (6 years of primary education and 3 years of junior secondary school level), followed by a middle-level of 3 year senior secondary/technical/commercial and vocational education. The tertiary level consists of all diploma and degree-awarding institutions.

Formal agricultural education in Ghana starts at the Junior Secondary level as a compulsory subject. However, it becomes an optional subject at the Senior Secondary level. The universities and the diploma-awarding colleges are the tertiary institutions responsible for preparing agricultural professionals and mid-career agriculturists.

They include:

- The University of Ghana (UG), Legon, Accra which offers a two-year agricultural diploma program, a bachelor degree and post-graduate degree programmes (M.Sc, M.Phil, Ph.D) in agriculture.
- The Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi offers bachelor degree and post-graduate degree programmes (M.Sc, M.Phil, Ph.D) in agriculture.
- The University of Cape Coast (UCC) in Cape Coast offers a bachelor degree, a Bachelor of Education degree and post-graduate degrees (M.Sc, M.Phil, Ph.D) in agriculture.
- The University of Development Studies (UDS) in Tamale offers a bachelor degree and a master's degree in agriculture.
- The University of Education, Winneba (UEW), Mampong Campus offers a Bachelor of Education degree in agriculture and post-graduate degrees (M.Sc, M.Phil) in agriculture.
- Some private universities (e.g. Catholic and Methodist Universities) also offer agriculture at the bachelor's level.

The Kwadaso Agricultural College is the only diploma-awarding agricultural institution outside the University system and is under the Ministry of Food and Agriculture (MoFA). It aims at equipping extension agents with the requisite knowledge and skills in modern agricultural techniques.

1.2 Agricultural training

Agricultural training in Ghana covers a wide range of activities with trainees in diverse areas of agriculture and has often targeted farmers and technical facilitators like agricultural extension workers. Training for extension agents and farmers varies from short to long term. According to the Food and Agriculture Organisation of the United Nations (FAO; 1992), “the length of a training activity can vary from short term training activities such as one day field demonstrations to longer term training that may last several months”.

Agricultural extension programmes provide the much-needed help to farmers in the form of practical field advice and improved technologies from research institutions and the universities. It is therefore imperative that retraining programmes are organised to provide opportunities for extension workers to conduct independent or group educational projects in environments similar to those they face in their extension activities.

Training for extension workers in Ghana is provided by agricultural research institutions, universities and partner programmes and projects. There are five formal post-secondary agricultural colleges under MoFA where personnel are educated and trained for 3 years as agricultural technicians or officials in activities related to agriculture. There are also agricultural vocational institutes at Wenchi, Navorongo and Aswansi that provide formal agricultural training to practicing and prospective farmers ensuring immediate availability of skilled and trainable labour force. Extension and farmer training programmes rely on face-to-face teaching and learning through traditional training, demonstration plots and field days. Modern farmer training and extension approaches and methods such as Farmer Field Schools are in use to avoid a top-down approach to effecting change and promoting farmer participation and empowerment. However, these approaches tend to be slow, are small in scale and limited in coverage.

2 National ICT policy

2.1 Ghana ICT for Accelerated Development National Policy

The Government of Ghana has placed a strong emphasis on the role of ICT in contributing towards the country’s economy. The country’s medium term development plan captured in the Ghana Poverty Reduction Strategy (GPRS I&II) Paper and the Education Strategic Plan 2003-2015 incorporate the use of ICT as a means of reaching out to the poor in Ghana. The Ghana ICT for Accelerated Development (ICT4D) Policy represents the Vision for Ghana in the information age. The ICT4D Policy is aimed at addressing a number of developmental challenges facing the country as a basis for achieving a number of policy goals and objectives. The Ghana ICT4AD Policy takes into account the aspirations and the provisions of key socio-economic development framework as elaborated in documents such as the Vision 2020 – The first steps; the Ghana Poverty Reduction Strategy (GPRS)-2002-2004 and the Coordinated Programme for Economic and Social Development of Ghana (2003).

The specific objectives of the agriculture and education policy are to:

- facilitate the modernisation of the agricultural sector through deployment of ICT to improve on its efficiency and productivity;
- aid the process of the development of national human resource capacity and the nations R&D capabilities to meet the changing needs and demands of the economy;
- promote an improved educational system within which ICT is widely deployed to facilitate the delivery of educational services at all levels of the educational system;
- accelerate the development of women and eliminate gender inequalities in education, employment and decision-making by building capacities and providing opportunities for girls and women through the deployment and exploitation of ICT.

The priority focus areas of this policy related to agriculture and education are:

- accelerated human resource development;
- deployment, exploitation and promotion of ICT in education;
- modernisation of agriculture and the development of agro-based industry;
- deployment and spread of ICTs in the communities;
- capacity development in R&D, scientific and industrial research;
- facilitation of the development of the private sector.

2.2 Agriculture and natural resource sector strategies

The Ghana ICT4D Policy provides sector strategies for policy implementation. It indicates that ICT will be used to modernise the agricultural sector to substantially improve value-addition and yield, and develop a dynamic and vibrant export-oriented agrobusiness industry. This will be achieved through:

- deploying and exploiting ICT to support the various activities of the agricultural sector, including the commercialisation of key sub-sectors and the improvement of current agricultural practices;
- developing geographical information system (GIS) applications to monitor and support sustainable usage of natural resources; developing food insecurity and vulnerability information to document who, where and why people are being affected by this issue;
- creating ICT awareness for all types of farmers at all levels nationwide, including empowering farm extension workers with relevant ICT skills; establishing an agriculture information system to provide support for the planning, production, storage and distribution of natural resources;
- encouraging market research through the use of ICTs to improve farmers' decision making abilities to align supply with market demands and to access new and foreign markets;
- linking farmers and farmers' groups and associations through ICT to resources and services needed to improve agricultural livelihoods;

- establishing linkages between agricultural education, research and development, farming, agro-industry and marketing;
- improving research competency and promoting the application and transfer of new technologies, such as biotechnology, to develop a modernised and globally competitive agriculture sector;
- promoting the creation of agricultural export production villages;
- improving rural infrastructure development and encouraging irrigation farming;
- supporting the private sector to add value to traditional crops while strengthening the production of non-traditional export commodities.

2.3 Education sector strategies

The educational sector strategy provides that ICT will be used to transform the educational system to provide the requisite education and training services environment capable of producing the appropriate types of skills and human resources required for developing and driving Ghana's information and knowledge-based economy and society. This will be accomplished by:

- improving and expanding access to educational, training and research resources and facilities through the use of ICT;
- making the educational system more responsive to the needs and requirements of the information and knowledge-based economy and society;
- developing and restructuring ICT curricula for all levels of educational systems;
- transforming Ghana into an ICT-literate nation driven by information and knowledge;
- promoting ICT awareness and computer literacy within the public at large; encouraging the exchange of ICT education and training between local and international educational institutions;
- introducing computers for all levels of educational institutions;
- promoting e-learning and training systems to complement traditional campus-based systems;
- developing the ICT skills capacity for the management and staff of the Ministry of Education and educational institutions at all levels;
- developing educational management, information systems and technical and vocational education programmes to enhance the quality of educational management at all levels;
- ensuring access to higher education to a large section of the population through the provision of high quality and robust programmes and online courses.

2.4 Status of ICT in education and training

Ghana is one of the first African countries to liberalise its telecommunication sector and has made tremendous progress in ICT infrastructure deployment. But like many parts of Africa, access to ICT still remains highly inadequate and unevenly distributed with an urban bias. The ICT revolution has also been a mobile revolution leaving behind the Internet and computing.

Table 1 provides some statistics on ICT infrastructure and usage in Ghana.

Table 1. *Statistics on ICT infrastructure and usage in Ghana*

Indicators	Numbers
<i>Fixed line operators</i>	2
Ghana Telecom	328,000
Westel	3,000
Total fixed line telephone subscribers	331,000
<i>Cellular mobile phone operators</i>	4
Areeba	1,600,000
Tigo	530,000
One Touch	450,000
Kasapa	75,000
Total cellular mobile phone subscribers	2.8 million
<i>Internet data service providers</i>	29
VSAT data operators	57
Public/Corporate data operators	25
Internet users (2004)	368,000
Internet users per 100 inhabitants (2004)	1.72
Personal computers per 100 inhabitants (2004)	0.52

Sources: National Communications Authority and ITU Basic Statistics, 2005

The Ghanaian tertiary education sector is the most advanced in the deployment and use of ICT in the country. All the country's major universities have their own separate ICT policies, which include an ICT levy for students. This enables students to have access to 24 hour computer laboratories with broadband connection. However, not all tertiary institutions in the country are equally endowed and there are instances where the computer facilities are run purely by the private sector as cyber cafes on campuses.

In the basic and secondary education sector, a project to set up computer laboratories in all science schools in the country has led to a significant number of computer laboratories across the country. A computer levy of \$ 3.20 is allowed to be charged as ICT fees in most secondary schools. There is, however, a great disparity between public and private schools as well as between urban and rural areas in their access to ICTs. In schools, where facilities for ICT exist, a number of teachers are using

the Internet for research. Current ICT initiatives and projects in educational institutions are summarised in Table 2.

Table 2. *ICT initiatives and projects*

Activity	Description	Organisation	Funding source
Global E-Schools and Communities Initiative (GECSI)	Expand the deployment of ICTs in schools in Ghana and to promote the effective use of ICT to achieve Ghana's educational and community development objectives.	Ministry of Education, Youth and Sports	SIDA and the Irish Government
NEPAD E-Schools	Supporting six schools in six regions with ICT infrastructure.	Ministry of Education	HP, Microsoft, Oracle, and Cisco
Intel-Elearning Centre (Accra Girls)	Pilot project to establish Africa's first WiMAX connected school, to be located in Ghana, West Africa .	Accra Girls Secondary School	Intel
Presidential Special Initiative on Distance Learning	TV show on Mathematics, Science and English broadcast nationwide and sold on CDs.	Ministry of Education	Government of Ghana
HP Digital Community Centre (KNUST)	High-speed ICT infrastructure at KNUST and for community learning and technology centres.	KNUST	HP
Research and Educational Network (REN)	Facilitate the interaction and collaboration between researchers in institutions and the world.	University of Ghana	World Bank/infodev
GIMPA Distance Learning Centre	Connecting members of central government's policy and decision makers, managers, academics, politicians, professionals, development partners and donors, etc. to a global knowledge exchange.	GIMPA	World Bank
Associated Schools Project Network (ASPnet)	Ghana's ASPnet has twinned with many schools abroad, including schools in Denmark, Great Britain, Mexico and the USA. The network has facilitated exchanges among teachers and students.		UNESCO
Microsoft – Partners in learning programme	Supporting schools with technology and training.	Ministry of Education	Microsoft/Government of Ghana

Activity	Description	Organisation	Funding source
Global Teenager Project	Using the Internet and especially e-mail to catalyse structured exchanges among schools and teachers.	Rescue Mission Ghana	School Net Africa and International Institute for Communication and Development (IICD)
Innovative Best Teacher Award	Awarding teachers who excel in using ICT in education.	Ghana Education Service	Government of Ghana
Catch IT	Fostering the development of ICT clubs throughout Ghana helps to prepare the youth for ICT related jobs	AYF/OVF	
Expanding Education Networking	Involves a total of 50 schools in Accra, Kumasi, Cape Coast, Tema and other areas	iEARN /SchoolNet Ghana	
e-Education package for schools	Offer affordable financing at competitive rates for qualifying educational institutions towards Broadband Internet access via VSAT anywhere in Ghana.	Accelon, Standard Trust Bank, ICT Education Support Africa Foundation	Accelon
The Fiankoma Teacher Programme (FTP)	Uses the Internet and other digital media as tools to promote development awareness by linking together networks of teachers in Ghana and the UK.		

Source: ICT4Africa/Country Report, Ghana

3 ODL and Tech-MODE for agricultural education and training

3.1 Distance education in tertiary institutions

The demand for higher education in Ghana has increased in recent years as a result of population growth and increase in the number of secondary school graduates. Higher costs coupled with limited and deteriorating facilities associated with the country's traditional residency-based higher education system have put higher education out of reach of many, especially women (Aggor et al, 1992). Distance Education (DE) and Open and Distance Learning (ODL) have therefore become necessary to meet the education and training needs of a large number of students in Ghana.

ODL has always been part of the Ghanaian education scene. It used to be known as correspondence courses two to three decades ago. From 1982, a number of distance education initiatives have become operational. For example the Modular Teacher

Training Programme (MTTP) was introduced to upgrade 7,537 untrained teachers academically and professionally (Mensah and Owusu-Mensah, 2002). Four Ghanaian public universities have pursued DE programmes since 1996: University of Ghana (UG), Legon, Kwame Nkrumah University of Science and Technology (KNUST), University of Cape Coast (UCC) and University of Education, Winneba (UEW).

UEW distance education programme took off in 1996 becoming the pioneer in university level DE in Ghana (Mensah and Owusu-Mensah, 2002). By 2001, UCC and UG had started diploma programmes in basic education and Youth in Development respectively. The UCC also offers a 3-year diploma in basic education. The aim of the basic school programmes is to upgrade the academic and professional competence of teachers.

Thus, the target of UEW and UCC programmes is the same population. KNUST currently offers DE programmes such as BSc. Building Technology, BSc Computer Engineering and MSc Industrial Mathematics. In 2007 KNUST started a Executive Masters in Business / Public Administration programme specially designed for part-time study by working professionals. The Ghana Institute of Management and Public Administration (GIMPA) is also poised to start an electronically-delivered ODL in Ghana.

The common features all the universities providing DE programmes share include the following:

- They are dual-mode institutions.
- They see DE as having the advantage of providing for a large number of qualified applicants who do not get admission into face-to-face programmes as a result of limited access to tertiary education and providing opportunity for working adults to combine work and study.
- The mode of delivery is predominantly print with little or no use of ICT.
- Trained human resources in DE at the university level are low.
- They organise occasional face-to-face tutorials especially during university holidays.
- DE is operated on a small-to-medium-scale in all the tertiary institutions except for UCC (over 20,000 students) and UEW (over 12,000 students).

3.2 ODL for continuing agricultural education and training

The use of ODL for continuing agricultural education is a new phenomenon in Ghana (Aggor and Osei, 2003). Although radio has been used in the delivery of agricultural information for several years, it has not been effectively combined with other media for continuing education for extension workers and farmers. Through collaboration with COL, Ghana piloted a 3-year continuing agricultural programme on healthy vegetable production for extension workers and farmers through Tech-MODE. The success of the programme led to the extension of the programme to three women- dominated farmer groups with a grant from the project on Gender, Agriculture and Rural Development in the Information Society (GENARDIS).

CSIR-Crops Research Institute (CSIR-CRI) is currently collaborating with COL to scale-up continuing agricultural education programme with extension workers and farmers in the transitional zones of the country. The delivery mode is print, radio, audio-cassette and the cellular phone.

The CSIR-Institute for Scientific and Technological Information (CSIR-INSTI) has collaborated with the Technical Centre for Agricultural and Rural Cooperation (CTA) to repackage agricultural information into radio programmes in local languages with Community FM radios in Ghana. They have also provided information support services to farmers, extension workers, the research community and producers of radio programmes through the Question and Answer Service supported by CTA (GAINSNEWS, 2006). With support from the national agricultural research system (NARS), INSTI provides information to research scientists, lecturers, students, policy makers and research managers with information on demand through the AGORA portal.

Some agricultural NGOs working with rural farmers are helping boost production and marketing of their products by giving them access to vital information through the use of ICTs. The Ghana Information Network on Knowledge Systems (GINKS), a Ghanaian NGO, provides the farmers with access to information such as crop advice and market pricing through video, computer software programmes and cellular phone. Information delivery through Tech-MODE is currently routed through projects and programmes and are, therefore, small in scale. The need to scale-up information delivery through Tech-MODE to reach large numbers of farmers cannot therefore be overemphasised.

3.3 Opportunities and challenges of DE/ODL/Tech-MODE in Ghana

Though the mode of delivery in the DE/ODL programmes is predominantly print in most institutions of higher learning, it is encouraging to learn that the Ghana Institute of Management and Public Administration (GIMPA), a tertiary institution is planning to start an electronically-delivered ODL in Ghana. This it is hoped will encourage other institutions implementing DE programmes to begin using ICT as well.

The increasing human capacity strengthening in ICT through training workshops, seminars and courses is welcome. It is envisaged that collaboration with local and international institutions for human capacity strengthening in ICT will go a long way to achieving the government's objectives of making ICT a tool for development. The liberalisation of the telecommunication sector in Ghana, coupled with the current expansion of telephone services and ICT in educational establishment have all contributed to the increased use of ICTs in Ghana. Ghana is currently connected to its neighbours by satellite earth stations – 4 Intelsat (Atlantic Ocean) and microwave radio relay link to Panaftel system. Fibre optic submarine cable (SAT-3/WASC) provides connectivity to Europe and Asia (www.cia.gov/library/publications/the-world-factbook/geos/gh.html).

The major challenges facing the development of the full potential of ICT for education, research and agricultural development in the county include:

- Power supply: Its absence in rural areas and its unreliability, even if available, affects the use of ICT as delivery media.
- Inadequate hardware (computers) and soft ware (programmes): Their absence affects the quality of materials produced for DE/ODL/Tech-MODE programmes.
- Little or no training for ICT personnel: Personnel involved in DE/ODL/Tech-MODE programmes have little or no ICT training hence the limitation of media used in DE/ODL/Tech-MODE programmes.
- Limited use of ICT: Even where available, ICTs are put into limited use. For example, there is little or no use of ICT for e-conferencing. In 2004, Internet users per 100 inhabitants was 1.72 and hence the low use of emails for information delivery. It is also known that overall use of computers is limited to basic application such as word processing.
- Low bandwidth and connectivity: Low bandwidth is a contributor to slow website update. Internet connectivity, even in institutions of higher learning, is not accessible to most staff and students.

3.4 Potential agriculture-related institutions with ODL focus

Table 3 provides a summary of formal agricultural institutions and available facilities and resources in Ghana which can be shared or developed to provide quality ODL programmes in agriculture.

Table 3. Agricultural institutions and available facilities in Ghana

Institution	Facilities	Capabilities/Resources	Potential to implement Tech-MODE
<i>Formal agricultural degree and post-graduate education</i>			
1 University of Cape Coast, Cape Coast	<ul style="list-style-type: none"> • Faculty of Agriculture • Faculty of Distance Education 	<ul style="list-style-type: none"> • Internet access • LAN • Continuing education for basic teacher education ongoing • Library • Resource centres 	High
2 University of Ghana, Legon	<ul style="list-style-type: none"> • Faculty of Agriculture • Department of Distance Learning and Continuing Education 	<ul style="list-style-type: none"> • Internet access • LAN • Continuing education on Youth Development ongoing • Library • Resource centres 	High

Institution	Facilities	Capabilities/Resources	Potential to implement Tech-MODE
3 Kwame Nkrumah University of Science and Technology, Kumasi	<ul style="list-style-type: none"> • Faculty of Agriculture • Faculty of Distance Education • Department of Distance Learning and Continuing Education 	<ul style="list-style-type: none"> • Internet access • LAN • Continuing education courses in computer science ongoing • Library • Resource centres 	High
4 University of Education, Winneba	<ul style="list-style-type: none"> • Faculty of Education • Department of Distance Learning and Continuing Education 	<ul style="list-style-type: none"> • Internet access • LAN • Continuing education for teacher education ongoing • Library • Resource centres 	High
5 Ghana Institute of Management and Public Administration (GIMPA)	<ul style="list-style-type: none"> • Department of Distance Learning 		High
<i>Continuing professional education</i>			
6 CSIR-Crops Research Institute, Kumasi	<ul style="list-style-type: none"> • Training, Communication and Publication Unit 	<ul style="list-style-type: none"> • Internet access • LAN • Continuing education in rural development ongoing • Library 	High
7 CSIR- Institute of Scientific and Technological Information	<ul style="list-style-type: none"> • Ghana Agricultural Information System 	<ul style="list-style-type: none"> • Internet access • LAN • Continuing education in rural development on-going • Library 	High
8 Ministry of Food and Agriculture (MoFA)	<ul style="list-style-type: none"> • Techiman Metropolis 	<ul style="list-style-type: none"> • Telephone • Agricultural • Information Centre • Continuing education in rural development ongoing 	High

3.5 Mechanism for the introduction of Tech-MODE

The Continuing Agricultural Education Project, Ghana (2001-2005), implemented by the University of Ghana, CSIR-Crops Research Institute and the Ministry of Food and Agriculture provides a well-tested approach for introducing Tech-MODE in a community (Osei and Aggor, 2006). The mechanism involves the following steps:

- Conduct of a stakeholders workshop to discuss preparatory activities and institutional roles and responsibilities in the project.
- Conduct of a training needs assessment survey of extension agents and farmers to determine learning needs of extension agents and farmers.
- Conduct of a workshop in content development for ODL materials by selected resource persons.
- Training of Extension Agents and radio producers in the use of ODL materials.
- Facilitating the broadcast of agricultural programmes and participation of extension officers and farmers in radio programmes and discussions.
- Facilitating farmer-groups to access agriculture information through radio and audio Cassette recorders and discussion groups.
- Providing support for programme delivery to farmer-groups through meetings (extension fora, farmer radio listening groups).

4 Recommendations for collaboration with COL, FARA and national Tech-MODE programmes

The following are recommendations for collaboration among potential Tech-MODE partners:

- Strengthen linkages, collaboration and sustain partnership among DE/ODL/ Tech-MODE providers within and outside countries.
- Establish fora for discussions and strengthening of national, regional and international linkages.
- Facilitate the creation of logistical partnership with stakeholders like the mass media (radio, television) and service providers (library, Internet, postal service).
- Support the development of ODL materials especially those other than print.
- Assist in the provision of training to update practitioners of Tech-MODE programmes.
- Link ODL programmes with FARA's RAILS Network Programme.

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Technology-Mediated Open and Distance Education (Tech-MODE) in Agricultural Education and Training in Kenya: Opportunities and Challenges

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Executive summary

Open and distance learning (ODL) in Kenya, like in many other developing countries, is characterized by, and offered through, dual mode institutions. Most of these programmes are in humanities and social sciences. Currently, one private university is offering agricultural training at a distance using print medium. A few private organizations or NGOs carry out short duration informal agricultural capacity building programmes to farmer groups and extension workers using technology-mediated open and distance education (Tech-MODE).

The Government of Kenya placed emphasis on education and training in agriculture, because of the important role it plays in the country's economy. Although great potential exists for the use of Tech-MODE in agricultural sciences at primary, secondary, tertiary and informal levels in Kenya, its application still largely remains untapped. However, with the recent completion of the National ICT Policy (2006), the Ministry of Education, in consultation with stakeholders, developed a comprehensive National ICT Strategy for education and training, with a view to guiding the implementation of information and communication technology (ICT) initiatives in the education sector.

This country report highlights the existing potential in Kenya that the project on Tech-MODE for agricultural education proposed by the Commonwealth of Learning (COL) could build on. It is suggested that consideration should be given to strengthening relations with the existing national, regional and international institutions and networks or programmes. Priority areas for training should be

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identified by all participating stakeholders for support in content development and institutional capacity building.

This initiative offers opportunities for multi-institutional partnerships to prepare training content that would not only provide locally relevant and practical knowledge, but also would be internationally recognized. Tech-MODE for agricultural education would offer viable alternatives by lowering education costs, increasing professional retention and not taking trainees out of their professional roles and homes for extended periods. In addition, beneficiaries would contribute to increased and sustainable agricultural production, development in the country, poverty reduction and improved food security.

Principal acronyms

CGIAR	Consultative Group on International Agricultural Research
COL	Commonwealth of Learning
ICT(s)	Information and communication technology(ies)
KACE	Kenya Agricultural Commodity Exchange
LAN	Local area network
ODL	Open and distance learning
RAIN-ASARECA	Regional Agricultural Information Network of the Association for Strengthening Agricultural Research in Eastern and Central Africa
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SEAC-DE	Strengthening Agricultural and Environmental Capacities through Distance Education
Tech-MODE	Technology-mediated open and distance education

1 Agriculture in Kenya

Agriculture is an important sector for Kenya directly contributing about 26% of the GDP and supporting the livelihoods of about 80% of the population. Only 16% of the land mass is endowed with the potential for rain-fed agriculture. The rest of the country is arid and semi-arid lands, mainly used for range-based activities and pastoralism. The development of the agricultural sector in Kenya mainly relies on rain-fed agriculture. The rapidly increasing population, currently estimated at 33 million, continued to exert pressure on the agricultural resource base. This coupled with frequent droughts adversely affects the country's food security position. Roughly, half the country's population live below the poverty line. Therefore, there is a need for the country to explore ways for ensuring increased agricultural production and productivity to meet the growing food, poverty and employment challenges.

Most people involved in agriculture in Kenya are subsistence farmers handling little or no marketable surplus. According to the Kenya Poverty Reduction Strategy

document, the incidence of poverty among food crop producers is the highest among the subsistence farmers and pastoralists. Recurrent droughts in most parts of the country, land degradation, pests and diseases, inadequate or lack of farm inputs, and inadequate access to information play a major role in reduced agricultural productivity. The government policies and strategy papers (Economic Recovery Strategy and Strategy to Revitalize Agriculture) identify food security and poverty alleviation as the main government development objectives. These policy frameworks single out agriculture-led development as fundamental to cutting hunger, reducing poverty, generating economic growth and promoting sustainable use of natural resources in the country.

2 Agricultural education and training

Kenya's agriculture is confronted with many challenges, but human-resource capacity building is undoubtedly one of the most important prerequisites for science and technology advancement of the Kenyan agricultural production systems. One strategy to address this need would be to enhance development and promotion of partnerships with developed countries carrying out and developing research and development capacities in agriculture (FARA, 2004). Although there has been significant progress in building human capacity, there is still a major capacity for adequately addressing the country's technological needs.

Since independence in 1963, the Government of Kenya placed considerable emphasis on education and training in agriculture, given the important role it plays in the country's economy. Therefore, agriculture as a subject is offered at all levels of the formal education system. The Kenyan educational system consists of three major levels: primary, secondary and tertiary. The primary level has eight years of compulsory universal education, while the secondary level lasts for four years. There are 3 categories of tertiary education: certificate, diploma and degree. Certificates and diplomas are mainly awarded after 2-3 years of technical/commercial or vocational education at a middle-level college or polytechnic, while a degree is awarded after a minimum of 4 years of training at a university. Agriculture is offered as an optional subject at the secondary level.

There are several public and private training institutes in Kenya that offer education and training in agriculture certificate and diploma levels. Those who complete certificates and diplomas are designated as technical assistants and as technical officers, respectively, when they secure employment either in government or non-governmental organizations.

Currently, there are seven public and six private universities in Kenya. Five of the public and two of the private universities offer degree programmes in agricultural sciences. The universities preparing agricultural professionals and mid-career agriculturists in various disciplines are given in Table 1.

Table 1. Universities offering agricultural programmes

University	Year established	Status	BSc degree	MSc degree
University of Nairobi	1964	Public	Agriculture, Agric. Education & Extension, Agribusiness, Food Science. & Technology, Food Nutrition & Dietetics Range Management, Management of Agroeco-systems & Environment	Agronomy, Horticulture, Plant Breeding, Plant Pathology & Plant Protection Soil Science, Animal Science, Agric. Economy, Food Technology, Applied Human Nutrition, Agric. Res. Mgt.
Egerton University	1986	Public	Agriculture, Agric. Education & Extension, Agribusiness, Horticulture, Food Science. & Technology, Home Economy, Animal Science	Agronomy, Horticulture, Plant Breeding, Soil Science, Animal Science Agricultural Economics, Agricultural Engineering
Jomo Kenyatta Uni. of Agric. & Technology	1989	Public	Agriculture, Horticulture, Food Science. & Technology, Home Economics	Agronomy, Horticulture, Plant Breeding, Plant Protection Soil Science, Agribusiness
Moi University	1985	Public	Agriculture, Horticulture, Seed Science & Technology, Home Economy	Agronomy, Seed Science, Soil Science
Maseno University	2000	Public	Agriculture, Horticulture	Agronomy, Horticulture
Paraton University of East Africa	1984	Private	Agriculture, Agricultural Education & Extension	Agricultural Education & Extension
Kenya Methodist University	2000	Private	Agriculture, Agricultural Education & Extension	Agricultural & Rural Development

The curricula offered by most universities and training institutes cover a wide range of disciplines in the broad areas of crops, livestock production and processing. Depending on the mandates of institutions, however, specialized courses and programmes are also on offer. Examples of such specialized courses are horticulture, seed science and dairy production, which target specific commodities in the agricultural sector.

Since 2004, the College of Agriculture and Veterinary Sciences, University of Nairobi, started offering demand-driven certificate and diploma courses in horticulture, crop protection, artificial insemination and fertility management, as well as fish inspection. These courses are in high demand and mainly attract those already in employment.

To date, all the universities listed in Table 1, except Kenya Methodist University (KEMU), conduct their agricultural training programmes using the regular face-to-face teaching. KEMU uses dual mode of instruction, blending print-based ODL with face-to-face mode.

Most agricultural graduates are deployed as extension staff in the government Ministries of Agriculture, Livestock and Fisheries or Cooperative Development. Training of farmers by extension workers is mainly carried out at Farmers Training Centres spread all over the country. These agricultural extension programmes aim at empowering farmers with practical skills and making them aware of improved technologies, usually obtained from the centres of the Kenya Agricultural Research Institute (KARI) and/or the universities. The length of training can vary from short-term training activities, such as one-day field demonstrations, season-long training in Farmer Field Schools, to a long term training that may last several weeks at Farmers Training Centres. Extension and farmer training programmes rely on face-to-face teaching and learning through traditional training, demonstration plots and field days.

3 National ICT policy and education sector strategy

In Kenya, the Government established policies designed to promote and facilitate the use of information and communication technologies (ICT) in education both for teaching and learning. The Ministry of Education adopted ICT broadly in the following three ways:

- 1 ICT as an administrative tool which is also known as eGovernment. In pursuing eGovernance in education, the primary focus is on mainstreaming ICT in all educational operations and service delivery for regional and global competitiveness.
- 2 ICT for teaching and learning also known as eLearning. eLearning aims at mainstreaming ICT in the teaching and learning process to ensure the integration of ICT in teaching and learning.
- 3 ICT for education management also known as Education Management Information System (EMIS). The EMIS focuses on providing education managers and administrators with accurate and timely data for better and informed decision-making

In 2005, a National Education Policy in which ICT in education was given prominence was published. To implement this policy, the Ministry in collaboration with its partners developed a five-year programme for the entire sector, which

defined investment programmes and provisional budgets to support various education and training programmes.

With the recent finalization of the National ICT Policy for the country, the Ministry in consultation with all stakeholders developed a comprehensive National ICT Strategy for Education and Training, which is currently guiding the speedy implementation of ICT initiatives in the education sector. The approach and vision outlined in this strategy will not be realized if vast numbers of schools continue to be marginalized in terms of access to and use of ICT. The Ministry, therefore, set up a Ministerial ICT Committee to coordinate and monitor the implementation of the various innovative solutions for education and training.

4 Status of ICT in education and training

Kenya has not liberalized its telecommunication sector, despite having developed a National ICT Policy that places emphasis on the key role it would play in the country's development. Some modest progress has taken place in the last five years with private sector investments in ICT infrastructure deployment. But access to ICTs still remains highly inadequate and unevenly distributed with high concentration in urban and peri-urban areas. The mobile telephony revolution made greater strides than the internet and computing revolution. Table 2 shows the levels of ICT infrastructure and utilization in Kenya.

Table 2. *ICT infrastructure indicators in Kenya*

Indicator	Proportion / Numbers
Internet penetration	4.4%
Cyber cafes	>1500
Computer penetration	2%
Mobile phone penetration	16%
Television penetration	60%
Radio penetration	90%
Fixed line telephone operators	1
Fixed line telephone subscribers	1 per 100 population
Mobile phone operators	2
Mobile phone subscribers	5 per 100 population
Total cellular mobile phone subscribers	5.5 million

Source: Ministry of Education (2006a)

Latest estimates indicate that Kenya has an Internet penetration of 4.4%, more than 1000 cyber cafes, a computer penetration of 2%, television penetration of 60%, radio penetration of 90%, and mobile phone penetration of 16% (Ministry of Education, 2006a). By world standards, these statistics indicate that Kenya is lagging behind many countries in these technological indicators, but it is a basis that can be built upon in future.

In the education sector, use and application of ICT is most advanced in the tertiary level, mainly in the universities. However, not all tertiary institutions in the country are equally endowed and there are instances where the computer facilities are run at a rudimentary level, without internet connectivity. In such cases, users purely rely on private sector cyber cafes, sometimes several kilometres from the institutions.

To start the process of increasing ICT access in Kenyan schools, the Ministry recently funded the acquisition of ICT equipment for 142 secondary schools. The Ministry intends to continue releasing funds to support schools in groups until approximately all the 4,000 secondary schools are e-enabled. The Ministry, in collaboration with the public and private sectors, formed the Kenya ICT Trust Fund in February 2004, with a mandate to mobilize corporate contributions for furthering ICT for education initiatives (Ministry of Education, 2006b). The Fund developed a strategic plan for 2006-2011 that sets out the goals and outcomes it aims to achieve. Through its partners, the Trust has been able to equip more than 800 secondary schools with ICT equipment, training and software.

5 ODL and Tech-MODE in education and training

The development of ODL in Kenya has been in response to a number of educational needs. The demand for higher education in Kenya increased in recent years as a result of population growth and increase in the number of secondary school graduates. Higher costs coupled with limited and deteriorating facilities associated with the country's traditional residency-based higher education system have put higher education out of reach for many people especially women and also for many others who are already employed. ODL has therefore become necessary to meet the education and training needs of a large number of students in Kenya (Odumbe, 2006).

Some of the common elements most of the public universities and other tertiary institutions providing ODL programmes share include the following:

- They are dual-mode institutions, providing both face-to-face and ODL forms of instruction.
- They all recognize ODL as having the advantage of providing for a large number of qualified applicants who do not obtain admission into the face-to-face programmes as a result of limited access to tertiary education and providing opportunity for working adults to combine work and study.
- The mode of delivery is predominantly print based with little or no use of ICT.

- Trained personnel in ODL at the university level are few, and found mainly in the Education and Extra-Mural Faculties.
- They organize occasional face-to-face tutorials especially during university holidays
- Except the University of Nairobi and the Kenyatta University, ODL is operated on a small-scale in other institutions.
- Most institutions have concentrated on training in the humanities, because of the difficulty associated with conducting practical experiments that are necessary in science courses. However, the University of Nairobi successfully offers programmes in sciences through ODL.

Little progress has been made with regard to ODL and Tech-MODE in Kenya. An exceptional case, however, is the Rockefeller Foundation funded initiative to provide AGORA (Access Global Online Research in Agriculture) e-journals to the National Agricultural Research System (NARS), which includes faculties of agriculture (www.aginternetwork.org). This has been valuable to lecturers, research scientists and post-graduate students in accessing agricultural research publications through the AGORA portal, free of charge.

The Kenya Agricultural Commodity Exchange (KACE), a private sector firm launched in 1997 to facilitate linkage between sellers and buyers of agricultural commodities, currently provides relevant and timely marketing information and intelligence (www.kacekenya.com). KACE uses an internet-based Regional Commodity Trade and Information System (RECOTIS) for dissemination of market information. RECOTIS is an electronic database of clients interested in buying, selling, importing, exporting or distributing agricultural commodities. To this end, KACE provided a transparent and competitive market price discovery mechanism and harnessed ICT for rural value addition and empowerment.

At several locations within the country, some non-governmental organisations (NGOs) working with rural farmers are helping farmers boost production and marketing of their products by giving them access to vital information through the use of ICTs. An example is the Arid Lands Information Network-East Africa (ALIN-EA) that supplied farmers with computers to access information such as crop production advice and market pricing (www.alin.or.ke). Information delivery through Tech-MODE is currently routed through projects that are mostly short-term and small scale. There is need to scale-up such information delivery through enhanced and sustainable Tech-MODE to be able to reach a large number of farmers and agribusiness people at all times.

6 Opportunities and challenges of ODL and Tech-MODE

Opportunities

Potential of the agricultural and related sciences institutions for Tech-MODE

Table 3 provides a summary of some formal agricultural and related sciences institutions and available facilities and resources in Kenya.

Table 3. Resources and capabilities for some selected agricultural institutions

Institution	Faculty/Unit	Capabilities/Resources	Potential to implement Tech-MODE
University of Nairobi	Faculty of Agriculture	Internet access	High
	School of Distance Education	LAN	
	ICT Centre	Well established ODL programmes in education	
		Libraries (ejournals)	
	Extra-Mural resource centres around the country		
	Teaching staff		
Kenyatta University	School of Environmental Sciences	Internet access	High
	School of Education and External Studies	LAN	
		Continuing education	
	African Virtual University-Kenya	Library	
	Teaching staff		
Egerton University	Faculty of Agriculture	Internet access	Medium
	Faculty of Education	LAN	
		Resource Centre	
		Library	
	Teaching staff		
Ministry of Agriculture	Training and Extension Agricultural Information Centre	Policy and strategy documents	High
		Training and field manuals	
Kenya Agricultural Research Institute	Documentation Centre	Internet access	Medium
	Research & Training Section	Research outputs	
		Library	

Institution	Faculty/Unit	Capabilities/Resources	Potential to implement Tech-MODE
CGIAR Centres based in Nairobi-Kenya	WAC, ILRI, CIP, ICRISAT, TSBF/CIAT	Internet access Capacity building eLibrary Research outputs Research scientists	High

Currently, at all levels of training and education, the main mode of delivery in the ODL programmes is predominantly print material. With the assistance of COL and other development partners, the existing facilities and infrastructure could be enhanced and new programme using Tech-MODE developed.

Training in computer literacy

The increasing human capacity strengthening in ICT through training workshops, seminars and courses is contributing significantly to the number of people that can learn through Tech-MODE. It is envisaged that collaboration with local and international institutions in ICT human capacity building will go a long way to achieving the government's objectives of making ICT a tool for development. The need to train trainers in the use of ICT, to develop ICT user skills among education administrators and a capacity to provide local support for ICT users is recognised in the policies and plans.

Access to World Wide Web and mobiles

The private sector played a key role in the establishment of cyber cafés in urban areas that provide public access for those who can afford to pay. Access to information is also growing rapidly in both urban and rural areas through growth and expansion of mobile telephony.

Favourable policy framework

The development of ICT policy and strategy documents is an indication of the political goodwill of the government for ICT in Kenya. The government made the inclusion of ICT in all the sectors a national priority. In the Kenya Education Sector Support Programme (KESSP), it is clearly stated and budget lines indicated to support e-learning. This is due to recognition that e-learning will be necessary if government is to satisfy the ever-growing demand for education without always building new classrooms. To promote computer literacy, the government emphasized training of government employees in basic computer skills through the e-governance programme. The government equipped the Kenya Institute of Education with the initial capacity to digitise the national curriculum, starting with that of secondary schools.

The government is encouraging the telecommunication sector to address infrastructural imbalance through the Universal Service Fund (USF) under the national regulator, the Communications Commission of Kenya (CCK). The government has also been in the forefront seeking and creating partnerships to collaborate in policy development and implementation, to encourage investment in ICT development, to increase network access and to share the cost of network accessing.

Partnerships and collaboration

The existing partnerships and collaborations within the country and region would be a good entry point for COL to enhance Tech-MODE adoption in agricultural training and education. Examples of such initiatives are RUFORUM, RAIN-ASARECA, AVU-Kenyatta University and SEAC-DE. This would develop and enhance synergies to utilize the strengths of the various collaborating institutions, especially in joint course content development or sharing of resources and to avoid counter productive competition.

Challenges

Alongside the opportunities that exist, the challenges to be looked into include the following:

- Lack of or inadequate basic infrastructure such as electricity, telephone, and Internet connectivity. Where Internet exists, it is mainly low bandwidth. Even in institutions of higher learning, there is only limited accessibility to most staff and students.
- Inadequate or lack of hardware and software which affects the quality of materials produced for ODL and Tech-MODE programmes.
- Personnel involved in ODL programmes have little or no ICT training hence the limitation of media used in ODL and Tech-MODE programmes. Capacity for producing digital learning materials is limited or where it exists, it is restricted to few institutions of higher learning.
- Even where available, ICTs are put into limited use, especially in government offices. In general, the overall use of computers is limited to basic application such as word processing, basic data analysis and storage.
- Meeting the cost of maintaining equipment, staff training, connectivity, content materials acquisition and development and consumables. Most institutions now levy an ICT surcharge on students, which many may not be able to afford.
- There is a general dependence on donors for the implementation of national ICT and other policies and for infrastructure and equipment at government and institutional level.
- There is currently a substantial reliance on content developed elsewhere, which may not be relevant locally. There is a need for local development of materials in indigenous languages using local examples for the farming communities.
- The notion of international collaboration on matters of content development, training and support services has not yet been explored aggressively.

7 Recommendations

Some of the general recommendations are as follows:

- The level of interest among those leaving school in studying agriculture at tertiary level is not encouraging. This has partly been attributed to the quality and content of educational programmes currently delivered.
- Agriculture education should be integrated with the natural resource sciences and linked strongly to rural development needs. This would also require changes in the teaching and learning tools and environments.
- Making ICTs and Tech-MODE an integral part of teaching agriculture would be a strategy to attract youth to agricultural sciences, and therefore make room for their involvement in production and enterprises at a later stage.
- There is a need for inter-institutional collaboration, both at the national and the international levels, and interdisciplinary interactions and partnerships are essential. Networking becomes necessary for this to function effectively. More efforts and resources should be committed to support this approach.
- Since there is historical evidence of ODL in non-vocational courses, the capabilities of Kenyan institutions to provide distance agricultural education and training with strong vocational components need to be formally assessed to inventorise existing potential and needs of Technical, Industrial, Vocational and Entrepreneurship Training (TIVET) through Tech-MODE.
- There is a need to initiate teachers by using e-learning methodologies for in-service training. The government is currently in the process of acquiring consultants to assist in this field. It is expected that the research would help formulate a strategy to develop an e-learning policy and adequate content for piloting before full implementation.
- Implementation of the laying of the proposed optical fibre network in the country to link up with submarine cables must be accelerated. When this project is completed, it would significantly improve the bandwidth and thus Internet connectivity in the country. This would not only enhance training using Tech-MODE, but also market information sharing for agricultural commodities such as that provided by KACE (www.kacekenya.com).

The following recommendations pertain to the mechanism for the introduction of Tech-MODE:

- There is a need to facilitate and organize a stakeholders' workshop for sensitization about the use of Tech-MODE in agricultural and related sciences, the role that COL would play, the preparatory activities and institutional roles and responsibilities in potential projects.
- In a collaborative arrangement, the role of COL should include initiating and undertaking needs assessment, prioritizing, monitoring, evaluation and impact assessment, while the role of the benefiting local institutions could involve implementing, monitoring, certifying and evaluating the programmes.
- It is imperative to carry out a training-needs assessment survey to identify and document learning needs at all levels of agricultural training in the country,

ranging from formal degree programmes to the needs of field extension personnel and farmers, given the diversity in terms of levels of education and also in the farming systems.

- COL must support the development of Tech-MODE training materials by conducting capacity building workshops for content developers nominated by the participating local institutions at different levels, including field extension personnel and farmers.
- Training of extension agents and radio producers in the use of developed Tech-MODE materials, and also facilitate the broadcast of agricultural programmes and participation of extension officers and farmers in radio and discussions is necessary.
- Mechanisms must be in place to facilitate farmer-groups to access agricultural information through radio and audio cassette recorders and discussion groups, and also provide support for programme delivery to farmer-groups through meetings e.g., extension fora, farmer radio listening groups, etc.
- COL could link with the already established/existing programmes and initiatives in the country or region, such as RUFORUM, RAIN-ASARECA and SEAC-DE to facilitate the production of relevant training content, and also support in capacity building in Tech-MODE for the personnel drawn from various institutions.

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Technology-Mediated Open and Distance Education (Tech-MODE) for Agricultural Education and Improved Livelihoods: A Nigerian Case Study

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Executive summary

The Commonwealth of Learning (COL) wishes to expand technology-mediated open and distance education (Tech-MODE) for agricultural education and improved livelihoods in sub-Saharan Africa by identifying opportunities for a complementary and catalytic role, preferably in collaboration with the Forum for Agricultural Research in Africa (FARA). For this purpose, this rapid survey was conducted to assess the status of information and communication technologies (ICT) in relevant institutions in selected countries in sub-Saharan Africa, including Nigeria.

Agriculture is the key to sustainable livelihood in Nigeria engaging about 60 to 70% of the population. Agriculture therefore has great potential for micro- and macro-economic growth and development in Nigeria. But due to governmental neglect of agriculture with the emergence of the oil industry, agricultural development experiences a major decline. Tech-MODE activities are necessary to give fillip to this sector.

The country study indicated that the political climate in Nigeria is supportive of Tech-MODE activities. Nigeria has an agricultural policy that supports the use of ICT and an ICT policy that aims at tapping the advantages of the technology to improve livelihoods. Besides, the Nigerian government has set up different agencies to implement activities in ICT guided by the policy and has fostered a

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good telecommunications climate. All these have synergistically fostered a climate conducive for Tech-MODE activities in Nigeria.

The country study further revealed that potential partners for Tech-MODE exist in the public and private sectors in Nigeria. Several universities have basic equipment to undertake Tech-MODE, but few are carrying out any research and development work in this area. The few that are exploring the possibilities under Tech-MODE do so only to stretch their distance learning degree awarding programmes. Many of these programmes are not currently in the area of agriculture.

The National Agricultural Extension and Research Liaison Services (NAERLS) is the only research institute that combines capacity with experience in Tech-MODE programmes for improved livelihoods. The only civil society organization with considerable capacity and experience in the use of Tech-MODE for educational and improved livelihoods is the Total Development International Foundation (TODEV) which works in such areas as agriculture, adult education, and vocational training. The University of Ibadan has recently approached TODEV to jointly explore the use of their facilities for degree-related distance learning programmes.

We recommend that COL and FARA consider working with the National Information Technology Development Agency (NITDA) and the National Space Research and Development Agency (NASRDA) for policy and macro projects, some universities for distance learning, and with NAERLS for continuing education in agriculture especially for extension officers. TODEV is the most important potential civil society collaborator for all aspects of Tech-MODE for promoting agricultural development.

Principal acronyms

COL	Commonwealth of Learning
FARA	Forum for Agricultural Research in Africa
ICT	Information and Communication Technology(ies)
IT	Information Technology (ies)
IFANET	Information Network
IITA	International Institute of Tropical Agriculture
NAERLS	National Agricultural Extension and Research Liaison Services
NASRDA	National Space Research and Development Agency
NCC	Nigerian Communications Commission
NITDA	National Information Technology Development Agency
ODL	Open and Distance Learning
Tech-MODE	Technology-Mediated Open and Distance Education
TODEV	Total Development International Foundation
VSAT	Very Small Aperture Terminal

1 Importance and status of agriculture in Nigeria

Nigeria has a land area of 983,000 km², out of which only 740,000 km² are suitable for agricultural production. Currently, about 392,000 km² are under permanent pasture, with another 28,000 km² under permanent crops. Only 279,000 km² are used for arable crop production. Cropping intensity is high with respect to arable land used with about 250,000 km² (25 million hectares) cultivated each year by small land holders.

Nigeria is a populous country. Figures from the census conducted in 2007 put the current population at 140 million people. About 60 to 70% of this population, which lives in rural areas, is directly or indirectly engaged in agriculture.

After oil, agriculture is the most important economic sector in Nigeria, contributing about 42% to the GDP. Nigeria has tremendous agricultural potential. Rural Nigeria is divided into the following seven agro ecological zones:

- a semi-arid zone found only in the northern region,
- the savannah found in the northern and middle regions,
- a small highland area found in the middle and southern regions,
- a larger transition environment of savannah derived from the forest overlapping the southern and middle regions,
- mangroves in the Niger Delta,
- fresh water swamps in the Niger Delta,
- lowland rain forest in the south.

The agro-ecological setting and technology base, in principle, determine the production systems. Two production systems dominate these zones. The first is the traditional production system, which is found in all parts of the country consisting of land holdings of less than 2 hectares with a variety of food crops intended mainly for consumption purposes. The second is the improved irrigation system which comprises the improved small scale irrigation using low lying or water logged areas for crop and livestock production as well as large scale mechanized and commercial irrigation farming schemes.

Soils and climate in Nigeria allow the cultivation of a wide range of crops including cassava, yam, and cowpea (of which Nigeria is the largest world producer), millet, sorghum, maize, soybeans, groundnut, cocoa, cashew, potatoes, oil palm and others.

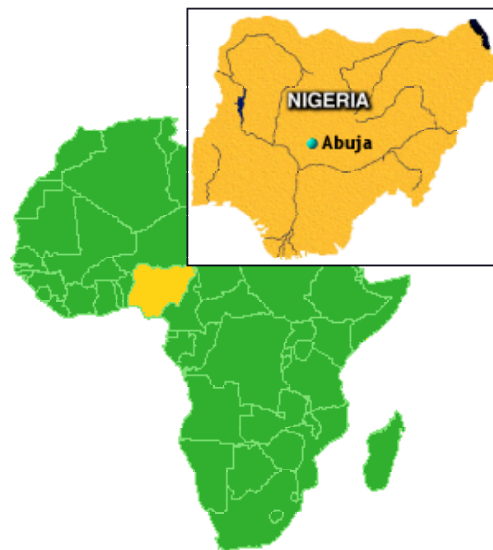


Figure 1. Location of Nigeria

Over the years, agriculture in Nigeria has suffered a decline in its contribution to the total exports. It declined from an absolute contribution of 70% in 1960, when Nigeria obtained independence, to about 2%. The decline was largely due to the discovery of oil in the coastal region and the phenomenal rise of oil shipments. This corresponded with a fall in the production of traditional export crops like cocoa, palm oil, rubber, and ground nuts, of which Nigeria was once a world leading exporter. For example, production of cocoa, currently Nigeria's biggest non-oil export earner, has remained around 160 000 tonnes per year since 1995 compared with an annual average of 400 000 tonnes at its peak before the oil boom. The government has been making some efforts to encourage private investment in agriculture and agro-industries by providing incentives including tax relieves, finance credit and extension services but without much success.

Growth of the agricultural sector has been low partly due to the inadequate level of support. During 1993-1997, growth in the agricultural output averaged 3.5%. This was higher than the population growth rate which was estimated to be 2.7. The agricultural growth rate at this period compares with a period of stagnation in the first half of the 1980s when the growth averaged just over 0.5%. Low agricultural growth rate in the early 1980s was due largely to low produce prices, marketing restrictions and a drought which occurred at the time. Agriculture picked up a little after the economic reforms that were introduced in 1986. The reforms included trade liberalization, dissolution of marketing boards, and improved producer prices facilitated by the devaluation of the currency.

This stage also coincided with the period when the World Bank supported agricultural extension services and research activities, which synergistically helped the farmers to increase their productivity. From 1986, the agricultural sector in Nigeria grew

steadily. Growth in the sector averaged 3.8% during 1986-1992, 4.25% in 1997, 4.5% in 1999 and 4.74% in 2001. The cash crop sector which had been abandoned for several years also benefited from this fillip as many farmers reactivated their previously abandoned fields.

Unfortunately, this renewed interest was not sustained, nor did it result in increased investment in cash crop production or in agroindustries using cash crops. Increased food crop production at this period contributed to a sharp fall in food imports from 19.3% in 1983 to 7.1% in 1991. Much of the increase in agricultural output in recent years resulted from an expansion of the area under cultivation rather than from increased productivity.

In general terms, the agricultural sector in Nigeria has been hampered by inadequate access to information about improved technologies of production, processing and marketing, lack of access to inputs and output markets and lack of investment in the development of improved farming technologies.

Land degradation is a major environmental issue in Nigeria. Degradation of the natural resource base resulted in a reduction of economic, social and environmental benefits. Land degradation is due to several factors including erosion, desertification, poor agricultural practices, and socioeconomic factors. Natural hazards are due to biophysical conditions, which act as predisposing factors for land degradation. Poor agricultural practices like deforestation and removal of natural vegetation, over-exploitation of vegetation and over-grazing contributed to degradation.

Some of the socio-economic circumstances that contributed to environmental degradation include land pressure and poverty, manifesting in farming systems characterized by small sizes, and in risk reduction objectives rather than profit maximization. Other factors include imperfect markets and poor access to inputs, both of which make expansion difficult.

2 Policies and strategies on agriculture and education

The first national policy on agriculture was adopted in 1988. It was adopted after the results of many years of neglect of the agricultural sector had become obvious. This policy was reviewed in 2003. The Nigerian agricultural policy aims at the attainment of self-sustaining growth in all the sub-sectors of agriculture and the structural transformation necessary for the overall socio-economic development of the country as well as the improvement in the quality of the life of Nigerians. The broad policy objectives include:

- Attainment of self-sufficiency in basic food commodities with particular reference to those which consume considerable shares of Nigeria's foreign exchange and for which the country has comparative advantage in local production.
- Increase in the production of agricultural raw materials to meet the demands of an expanding industrial sector.

- Increase in the production and processing of exportable commodities with a view to increasing their foreign exchange earning capacity and further diversifying the country's export base and sources of foreign exchange earnings.
- Modernization of agricultural production, processing, storage and distribution through the infusion of improved technologies and management so that agriculture can be more responsive to the demands of other sectors of the Nigerian economy.
- Creation of more agricultural and rural employment opportunities to increase the income of farmers and rural dwellers and to productively absorb an increasing labour force in the nation.
- Protection and improvement of agricultural land resources and preservation of the environment for sustainable agricultural production.
- Establishment of appropriate institutions and creation of administrative organs to facilitate the integrated development and realization of the country's agricultural potential.

The main features of the policy include the evolution of strategies that will ensure self-sufficiency and the improvement of the level of technical and economic efficiency in food production. This is to be achieved through formal and several types of informal education.

2.1 Formal agricultural education

Agriculture is a compulsory subject in the new nine-year basic education curriculum for primary and junior secondary schools. To complement the theoretical base, primary schools in Nigeria are mandated to establish agricultural gardens where crops and livestock are to be kept for practical hands-on experience for school pupils. This however is more practicable for schools in rural areas where land is not a constraint.

At the secondary school level, students can pursue their areas of interest by taking the subjects at the school certificate level. There are further opportunities at the diploma and degree levels in agricultural colleges, universities and faculties. Middle level teachers are produced through the colleges of education.

The Federal Department of Agricultural Sciences oversees agricultural research in Nigeria through the recently established Agricultural Research Council of Nigeria. The Agricultural Research Council coordinates the activities of 18 National Agriculture Research Institutes (NARI) and 20 Federal Agricultural Colleges. Selected commodities are assigned to different institutions which carry out basic, applied, adaptive and farming systems research on the assigned commodities. They are also responsible for the production of breeder seeds for bulking. Four of the institutes are university-based: the Institute of Agricultural Research and Training (IAR&T) of the Obafemi Awolowo University, and the Institute for Agricultural Research (IAR), the National Animal Production Research Institute (NAPRI), and the National Agricultural Extension and Research Liaison Services (NAERLS), all associated with the Ahmadu Bello University.

The National University Commission (NUC) in Nigeria coordinates the activities of the Universities of Agriculture and other Universities having faculties of agriculture. Nigerian universities offer facilities for post graduate courses in all aspect of agriculture.

2.2 Continuing professional education

The Agricultural and Rural Management Training Institute (ARMTI) offers opportunities for continuing professional education in the area of agriculture and rural development in Nigeria. ARMTI is a parastatal under the Federal Ministry of Agriculture and Rural Development of the Federal Government of Nigeria. An Act of Law established ARMTI in 1980. Its mission is to improve management practice in the agricultural and rural sector through appropriate management interventions for poverty alleviation. In this regard, ARMTI has been mandated to conduct special studies and research into management needs and problems in agricultural and rural sectors; conduct training needs analysis; provide management training as part of interventions for identified needs and problems (including gender, ICT and youth related issues); provide consultancy services towards improving managerial effectiveness and efficiency in the sector; disseminate agricultural and rural information and contribute to policy development for effective management.

The Nigerian Institute of Social Economic Research (NISER) was established as a research and consultancy parastatal of the Federal Government of Nigeria. The functions of NISER as stated in the Act of 1990, establishing the institute, are to provide consultancy services to the Federal and State Governments, their agencies and organizations, in the field of economic and social development, to conduct research into the economic and social problems of the country with a view to the applications of the result thereof, to organize seminars and conferences on problems of economic and social development in the country, whether on its own account or on behalf of the government or their agencies, and to cooperate with Nigerian universities, research institutes and other institutions in the mobilization of the county's research potential for the task of national development and dissemination of research findings for the use of policy makers.

2.3 Lifelong learning for farming communities

Lifelong learning for farming communities is coordinated at two levels: governmental and non-governmental. Governmental facilities are coordinated by the Project Coordinating Unit (PCU) of the Federal Ministry of Agriculture and Rural Development (FMARD). PCU was created in the year 2000 following a merger of two separate departments carrying out project coordination and project monitoring and evaluation functions. PCU coordinates the activities of the Agricultural Development Programs (ADPs) established in each of the states of the country. The ADPs are charged with the dissemination of most agricultural technologies. The ADPs which started in the 1970's, fuelled with the World Bank money and armed with the Training and Visit System of the World Bank, were

introduced to fill the yawning gap between research and end users in the agricultural sector. Minor extension services are also carried out by FMARD.

The Nigerian Civil Service in general and the FMARD, in particular, employ a large cadre of staff in various departments to deliver extension services. These staff members need to be primarily trained to deliver demand driven services for sustainable development. Training intensity has been low for majority of these institutions especially in the last decade. Besides induction courses, most staff do not receive any other type of training. The FMARD conducts training only on an ad hoc basis and as such there is no organized career development for the staff. The ADPs paid more attention to training of staff especially when the World Bank fund was still available. Even in this case, the training programme was decided and delivered in a top down version without taking into consideration the perceived needs at the grassroots. It also paid little attention to the systemic mode of operation of the farming enterprises. Furthermore, it ignored basic principles and concepts that can assist the farmer to see farming as a business and therefore move towards transformation.

All states have agreed to operate a unified extension service in each state through a decision of the National Council of Agriculture. Under this approach, a single village-level extension agent, backed by an appropriate extension supervisor and subject matter specialists, is the farmers' principal contact for the dissemination of agricultural technologies. Operation of an unified extension system requires proper linkages of national and state agricultural services which are not in place at the moment. Limitation in terms of well trained staff and inadequate logistic support pose a problem, but the bigger challenge is to develop an affordable system responsive to the needs of the farmers. Therefore, developing an effective institutional framework, and having a critical mass of well trained extension staff who will continually access further knowledge, will enhance the responsiveness of the rural and agriculture institutions to meet the needs of the farmers. Tech-MODE has a role to play in this area.

Some civil society organizations have been involved lately in the provision of services to farmers and other members of the society in different parts of the country.

Notable among these is the Total Development International Foundation (TODEV). TODEV works with farmers using open and distance learning (ODL) and ICT to provide valuable services of linking farmers to information to produce, process and market their commodities, linking farmers to inputs and output markets, and providing other tangential services in health, adult literacy and economic development at the grassroots level. TODEV involves research and other tangential agencies including, input dealers, transporters, banks and end users in a network to address farmers problems. TODEV has a website (www.todev-intl.org) and Internet facilities for staff and for the coordination of activities in the created network of ICT and ODL operations.

In this network, there are four remotely placed centres also connected to the Internet and with appreciable ICT facilities through which the work with farmers and rural community dwellers take place. They are planning to have about 20 more of such centres to be established with ICT facilities including the Internet. The University of Ibadan is currently exploring the possibility of using the facilities of TODEV to advance their distance learning project into rural areas.

Information Network (IFANET) is another agency that provides information to the populace. IFANET has Internet connectivity and appreciable ICT facilities at the headquarters. From the headquarters, they provide web-based information services to the populace on their database. They are, however, not really engaged in any kind of work with farmers.

3 Facilities, capabilities and potential to implement Tech-MODE

By virtue of its geographical position, Nigeria, like other countries of West Africa, has the advantage of the SAT 3 Cable system running from Europe, through the coast of West Africa, to the tip of South Africa and ending up in Asia.

A \$638 million fibre optic system with the potential capacity of up to 120 Gps provides good opportunities for countries lining its route. The challenge for Nigeria, like other countries on the route, is to develop national backbone infrastructures to ensure the full utilization of the cable system. Nigeria has made some efforts in creating the backbone required for tapping from the benefits of the cable system.

In the years of its military rule, Nigeria paid little attention to ICT. However, since the change over to democratic rule in 1999, the leadership has made some remarkable strides in positioning the country for a flourishing ICT industry. Some significant measures were taken to provide the required infrastructural backbone for the ICT industry in Nigeria, including the following:

- Launching of the National Telecommunications Policy in 2000
- Development of a Comprehensive Science and Technology Policy in 2001
- Development and launching of the National Policy on Information Technology in 2001
- Establishment of the National Information Technology Development Agency (NITDA)
- Launching of a programme for the Nigerian Satellite system by the National Space Research and Development Agency (NARSDA)

In addition, the Nigerian government liberalized the sector and gave priority to ICT issues. All these measures provide a good foundation for a smooth take off of the ICT industry.

The Nigerian IT policy strongly backs up a smooth implementation of Tech-MODE projects in Nigeria. The vision and mission statements indicate the focus desired

for the ICT industry in Nigeria. The vision is to make Nigeria an IT capable country in Africa and a key player in the information society using IT as the engine for sustainable development and global competitiveness. The mission is to ensure that IT is used for education, creation of wealth, poverty eradication, job creation and global competitiveness.

The IT policy clearly indicates the sectors in which desirable impacts are wanted. These sectors are human resource development, infrastructure, governance, research and development, health, agriculture, urban and rural development, trade and commerce, arts, culture and tourism, national security and law enforcement and fiscal measures.

Some of the sectors clearly enumerated in the policy have incorporated ICT in their activities and have developed Tech-MODE projects. The educational sector stands out clearly among others in the development and implementation of Tech-MODE projects. Some of the projects developed in the area of education include:

- National Virtual Library Project,
- Education Management Information System Program,
- National Open University of Nigeria and Distance Learning Programs,
- Computer in Schools Initiative,
- Nigerian University Network,
- National Teachers Institute Teacher Training Program by Distance Learning.

All these form a strong basis for the implementation of Tech-MODE in Nigeria.

The government has attempted to liberalise the ICT sector. This has seen the licensing of a Second National Operator, the GLOBACOM Limited, and the attempted sale of the other First National Operator, the Nigeria Telecommunications (NITEL). The sale ran into some hitches and NITEL has been put under the care of some consultants who have been given the responsibility of reviving it.

The introduction of the Global System for Mobile (GSM) telecommunication was a major advance in the development of the ICT sector. With the launch of GSM in August 2001, the nation moved up from a teledensity, i.e., number of telephone lines per 100 subscribers, of 0.5 to 18% in March 2006. Today Nigeria has two GSM providers MTN and Vmobile and two national operators (NITEL and GLOBACOM). Nigeria had a total of 1.2 million landlines by 2005 and a total of 21.5 million mobile lines in 2006. It has been projected that by the end of the year 2008, there will be up to 30 million lines in Nigeria making it the fastest growing telecommunication market in the world.

4 National information technology policy

The Federal Executive Council of Nigeria approved the National Information Technology Policy in March 2001. The National Information Technology Development Agency (NITDA) was established in April 2001 to implement the policy. Initial steps towards the implementation of the policy led to the development of some projects, a few of which are listed below.

Public Service Network (PSNet)

PSNet is to address the major problems of ICT infrastructure, which will serve as a pipe for ICT services. It consists of a Very Small Aperture Terminal (VSAT) sited in state capitals. This VSAT will provide Internet access for that central location and all other locations connected to the centre using broadband wireless access technology. The various sites around the country are then connected to each other through a virtual private network. Nine states were completed in the first phase of the project.

Human Capacity Building

Human capacity building is another focus for NITDA. It is one of the foundations on which the IT policy is based. Others are infrastructural capacity and institutional capacity building. Towards realizing this goal, NITDA has forged a thriving partnership with public and private organizations in what has become a public-private partnership (PPP).

The Enterprise Technology Centre (ETC) is one such important PPP. ETC is a partnership between NITDA and two private companies to provide IT training for Civil Servants. In Nigeria, it is rather difficult for a private company to embark on the training of very top officials of the civil service. ETC, which is located within the Federal Secretariat, has provided training for these top officials.

The Head of the Civil Service of the Federation led all the permanent secretaries for a two-week training programme. This enlightenment has greatly aided NITDA in the bid to integrate IT into the public service. With the training of the top officials, NITDA has provided an enabling environment for the private sector to train civil servants from the lower cadre.

NITDA has also collaborated with several multinationals and international organizations to deliver specialized training in some train-the-trainer workshops. These institutions include UNESCO, International Centre for Theoretical Physics (ICTP), Cisco Systems, etc. For instance, NITDA collaborated with ICTP by hosting the first African Workshop on Open Source and Web Technologies for Development earlier in the year 2003. There has also been collaboration with UNESCO on the Virtual Library and Virtual Laboratory Projects for Nigeria.

Mobile Internet Unit

The Mobile Internet Unit (MIU) is a locally made bus that has been converted into a mobile training and cyber centre. Its interior has 10 high-tech workstations all networked and connected to the Internet to facilitate access to several IT resources. It is equipped with printers, a photocopier and a number of multi-media facilities. Internet access is provided via VSAT equipment with a 1.2m dish mounted on the roof of the bus. The unit is also equipped with a small generator to ensure regular power supply.

The MIU provides everything needed in a high-tech cyber centre and it has the added advantage of being mobile. It takes the Internet to places that have no other means of access, e.g., the rural areas. It has also been deployed to various schools (primary and secondary) and the plan is to get all states and possibly Local Government Areas to have their own MIUs so as to facilitate the penetration of the Internet and ICT around the country.

A number of other projects such as National ICT Inventory, Strategic Action Plan for the IT Policy and the e-government (e-accounting and e-statistics) have also been embarked upon. Some of these were initiated in collaboration with the Italian government.

5 Tech-MODE and improved livelihoods in Nigeria

Tech-MODE and education

The teaching and use of computing and IT facilities in tertiary institutions have increased significantly. Many of the colleges of education are already integrating IT into their main courses. But, the secondary education level is lacking in the use of IT. Apart from the private secondary schools, virtually all public secondary schools do not have IT facilities. Several do not even have a single computer. The government, however, is promoting the use of computers and Internet literacy among secondary school students and has recently made it compulsory for secondary school graduating students to register for their examinations and check their results through the Internet.

If it is economically not feasible for secondary schools to individually own PCs the possibility for PC pools could be explored. For example, all Local Government Councils should establish computer and Internet Resource Centres to which secondary schools would be allowed access on an agreed time schedule. This was done in the case of Government Trade Centres in the past. TODEV experimented with this in two separate Local Government Areas (Atisbo and Ibarapa East Local Government of Oyo State) and achieved a high levels of success. Furthermore, IT and computing should be integrated into secondary school curriculum and the teaching of these made compulsory.

Tech-MODE and creation of wealth

It is reported that more than US\$ 4 billion was invested in the Nigerian ICT sector over the past few years. Obviously, such a huge investment must have generated new employment opportunities and wealth for a number of people. The major challenge is how to structure such wealth so that it becomes regenerative by channelling it through more job creating ICT-based ventures.

One study conducted in 2003 showed that only a small proportion (6%) of those who use the Internet say they use it for research. It is common knowledge that most young people use the Internet to chat and play games or for some other form of entertainment. This is a regrettable situation amounting to a gross wastage of the potential of the Internet especially for a developing society that could use it to accelerate development by focusing on learning.

For young people, the key issue here is what policies and programmes could be put in place to begin to change the current perception of the Internet from one of being almost a modern play thing towards one of being possibly the most powerful means today for sourcing, disseminating and sharing information knowledge. Youth and women empowerment programmes should be put in the front burner for ICT to become popular.

For adults, what is required is a series of seminars and workshops to educate them on the various levels of investment opportunities in the ICT sector, viable locations for investment, how to source for funds and manage such ventures. It is also important to establish programmes around their means of livelihood to help them adopt the Internet as a wealth creation technology. The experience of TODEV shows, when rural people see an economic advantage in the Internet, they come out of their timidity and embrace it. The challenge is to create programmes that will sufficiently create the link and deliver the goods.

Tech-MODE and poverty eradication

A critical component of eradicating poverty is the removing of impediments to wealth. Lack of access to information is one such impediment. Today, investments are currently being made that increase the access to ICT services. With the assistance of agencies such as NITDA, TODEV and IFANET, ICT services are even gradually beginning to trickle down to rural areas. Tech-MODE has a role to play in improving access to ICT and thereby removing these impediments. GLOBACOM, which is one of the national carriers, is laying fibre-optic cables across the length and breadth of the country to deliver Internet facilities in private houses in all parts of the country. These cables can also serve as easy access points for enlarged decentralized mass access delivery systems in remote parts of the country.

Tech-MODE and job creation

Tech-MODE can assist in meeting the millennium development goals relating to job creation. What is taking place in Nigeria whereby indigenous Nigerian

companies such as Zinox, Omatek, Beta and Unitec are designing and building their own branded computers and related equipment in Nigeria has become part of the process of industrialization of the country. This is creating job opportunities for thousands of Nigerians in the production line. Cybercafés and ICT Business Resource Centres have grown phenomenally from a mere 800 in 1999 to over 20,000 now, most of them employing an average of five people. There were 1500 Internet hosts in 2006 and 5 million Internet users by 2005. Most of these were linked to the numerous cyber cafes located all over the country.

Besides these locally generated jobs, other jobs are generated from outside the continent. The United States of America and Europe will outsource close to five million ICT related jobs, primarily in Call-Centre services, over the next few years. The challenges are how to position Nigeria in terms of infrastructure and skills to benefit from this new wave of job creation. ODL could help in training and re-training Nigerians for this emerging market. In conclusion, the whole world is in demand of programmers to oil the engine of development in this information age. Nigerian youths with interest in ICT can be mobilized and empowered to fill this gap.

Tech-MODE and global competitiveness

The world is gradually transforming into one global economy propelled by developments in information technology. Only nations which are e-ready and e-prepared can compete effectively in this new economic scenario. The challenge now is to secure a niche of competitive advantage for Nigeria while systematically and sustainably growing our infrastructure and developing our IT skills.

6 Making Internet service affordable

International Internet connectivity to Nigeria accounts for well over 50% of ISP costs. A significant saving could be achieved and the price to subscribers reduced, if a local Internet exchange could be installed in Nigeria to eliminate the need to switch internationally for Internet traffic within Nigeria.

Following the deregulation of the Telecoms sector from 1992, private sector participation, at various levels of the ICT sector, has grown significantly. Expectedly, this has thrown up a number of issues and challenges, some of which are discussed below.

Structure of the industry and management issues

Computing, telecommunications and broadcasting are converging technologies. However, each of these is managed by different entities viz NITDA manages computing, Nigerian Communications Commission (NCC) manages telecommunications and the National Broadcasting Commission (NBC) manages broadcasting. Furthermore, each of these is parented under different Ministries, i.e., NITDA in the Ministry of Science and Technology, NCC under the Ministry of

Communications and NBC under the Ministry of Information. The present structure has merit to the extent that there are a lot of problems in each of the sectors to be solved and therefore requires the existence of separate agencies to focus on each specialized area.

However, with time and as convergence services such as Multimedia services grow in volume and complexity, and many of the sectoral issues such as bandwidth and content are sufficiently under control, it may become imperative to consider a structural alignment of these agencies for coherence of policies and management. The Government, however, needs some assistance in getting the alignment right.

Inventory of resources

As the nation prepares for e-governance, a critical success factor is the determination of ICT resources available in the government. Our survey shows, that government for example, uses 10% of telephones in offices in Nigeria and 38% of Internet connections in offices and establishments in the country. Yet, the networking of these facilities to facilitate governance and access to government information services, is grossly lacking. This is another area where the government needs support.

Procurement

If industrialization in the ICT sector is to succeed, then a case has to be made for import duty protection. Presently, imported/branded systems carry a 2.5% as import duty while local manufacturers also pay 2.5% for components that invariably come from different countries which further add to their cost. Consequently, their products are not competitive. This is obviously a disincentive to further invest in local manufacture/assembly of computer systems. We recommend that the import duty on the components for local manufacture of computers be reduced to encourage local production leading to the creation of local jobs.

Training and capacity building

The total population employed in the ICT sector is estimated at 446,000 people (296,000 in IT and 150,000 in Telecoms) by NITDA. We observed a growth rate of 18.6% in the new jobs created between 2000 and 2001, and a growth rate of 26.6% in the new job created between year 2001 and 2002. This trend is expected to continue given the significant investments being made in the ICT sector and the average growth rate of organizational IT budgets of 8.7% over the period 2000 to 2001. In the contrary, the output of relevant ICT graduates from the tertiary institutions grew at only about 6% over the same period. Continuing education and training is necessary to prepare these graduates adequately for employment in the ICT sector.

Training certification

To address the problem of low quality of the output of our tertiary institutions and to prepare them more adequately for the ICT Industry, we recommend that NITDA should develop a curriculum to make it more relevant to local situations and to provide booster/ refresher courses. This can be done in partnership with relevant training institutions and with appropriate certification from NITDA.

Pricing of services

The pricing of ICT services in Nigeria, in many cases bear no relationship to the cost of providing such services, particularly, in the absence of effective competition in the delivery of these services. Pricing is often arbitrarily fixed due to lack of competition. We recommend that while NITDA may not fix prices of IT systems and services, it could set benchmarks to guide the consumer in paying appropriate prices.

Service level agreement

The absence of service level agreements that can be enforced to protect consumers is indeed a bane in the development of the sector. Our survey reveals that only about 23% of the service providers have any form of Service Level Agreements, which is indicative of the general level of apathy to customer-care and the quality of service delivery. This has translated into poor service delivery by various service providers. We recommend that NITDA develops a programme of education for customer-care and consumer protection.

Technology issues

The problem in the ICT sector is not so much the adequacy of technology as the appropriate application of technology to obtain optimum solution. There is currently a problem in this area in Nigeria. Most of the application packages used by people are used at sub-optimal levels. This can only be corrected by the establishment of a mechanism to train and retrain users.

Infrastructure

A significant revelation of our survey is that the problem of infrastructure is not so much its adequacy to our present and future needs as in the utilization and access to the infrastructure. For example, while capacity may be overprovided in certain locations, it is grossly underprovided in others. This was observed even for some critical applications. Typically, the oil companies who are major consumers of data access bandwidth do not have a landing point of SAT-3 fibre optic cable.

Although there has been some argument that vandalism of cables has been a disincentive to the establishment of an independent landing point for this sector, we think the government could explore options that will put the cables away from the reach of vandals. Besides, where bandwidth is available, access to it at the so called “last mile”, is expensive to the consumer who has to bear the major expense

of providing the last mile access. We recommend that NITDA initiates a work plan with the NCC or the Ministry of Communications to develop a National Infrastructure Master Plan.

Technical standard and quality of service

Apart from international standards of equipment specification, the ICT Industry seriously lacks both technical and operational standards and enforcements. The implementation of wireless services both for telephony and for Internet is a case in point where some consumers are connected at the fringe of the range of the wireless service with poor and intermittent reception for the same price as consumers at the optimum point of the service. While it is important to adopt an accelerated strategy to extend service to underserved areas, maximum effort should be put in to protect the quality of the service delivered.

Effectiveness of technological reporting

Most Nigerians who read and write cannot operate computers themselves and know little or nothing about the uses and potential of information and communication technology. Much of the write-ups they come across in newspapers have not helped at all to demystify ICT language and discussions. And so, they simply turn over the page and look for other softer issues covered by the newspapers.

Technological reporting is still in its infancy in Nigeria, much of it being still quite heavy going, even for the initiated. There is now the urgent and strategic need to communicate with, and to make an impact on, millions of uninitiated Nigerians, offering vital knowledge that is now new to them. Therefore, policies and programmes must be put in place to develop persons who can communicate effectively to lay audiences, the growing body of otherwise difficult ICT concepts. Capacity building is a major requirement in this respect

7 Potential partners and government support for implementing Tech-MODE

Potential collaborators on Tech-MODE in Nigeria exist in all sectors of the economy. NITDA is one example. NITDA which is the de facto agency for coordination of IT activities has sufficient human and material resources with abundant goodwill from the Federal Government. Another agency which is equally important is the National Space Research and Development Agency (NASRDA). NASRDA is equally endowed and like NITDA enjoys the support of the government. However, NASRDA is more engrossed in the application of tech-MODE to secondary school education and the health sector. The biggest challenge is to get them to buy into agricultural projects or engage with the main stream of existing projects. Currently, it is developing a mega Tech-MODE project with TODEV to ensure that rural farmers derive benefits from the recently hoisted Nigerian Satellite.

In the agricultural sector, all research institutes have acquired adequate resources but only the National Agricultural Extension Research Liaison Services (NAERLS) has sufficient orientation in the use of Tech-MODE. The International Institute of Tropical Agriculture (IITA) collaborated with the NAERLS to implement some Tech-MODE related projects in the year 2000. The potential of NAERLS for Tech-Mode research and development is high as they have demonstrated their ability to apply Tech-MODE to lifelong learning for farmers.

In the educational system, there are several universities with sufficient resources to undertake Tech-MODE related activities at different levels of learning. A total of 82 universities were surveyed including the new Open University in Nigeria. Thirty of them are owned by the Federal Government, 28 by the states and 23 were privately owned.

In all, private universities had more ICT facilities than the Federal and the state-owned universities. Consequently privately owned universities also had higher computer/people ratio. Many of them are already involved in distance learning activities.

Prominent civil society agencies that have been involved in Tech-MODE related activities include TODEV and IFANET. While TODEV is focused on agriculture as the central issue on which other issues are attached, IFANET is focused on social issues. They both have good ICT facilities and Internet connectivity. TODEV already has a network of 4 centres coordinated for Tech-MODE related activities and is working with some partners to develop 20 more centres. In each of the 4 centres in TODEV's network, Tech-MODE related activities cover the areas of adult education, vocational training, agriculture with a focus on farmers' health and lifelong learning. IFANET circulates an electronic newsletter on social issues and governance. They both have their headquarters in Ibadan.

8 Conclusions

The Commonwealth of Learning (COL) wishes to expand technology-mediated open and distance education (Tech-MODE) for agricultural education and improved livelihoods in sub-Saharan Africa by identifying opportunities for a complementary and catalytic role, preferably in collaboration with the Forum for Agricultural Research in Africa (FARA). For this purpose, this survey was conducted to assess the status of ICT in relevant institutions. The survey indicated that the political climate in Nigeria is supportive of Tech-MODE activities.

Nigeria has a fast growing ICT industry nurtured by a favourable government policy which has positioned the country at a vantage level for Tech-MODE related activities. The country study revealed that potential partners for Tech-MODE exist both in the public and private sectors in Nigeria. Several universities have basic equipment to undertake Tech-MODE, but few are carrying out any research and development work in this area. The few that are exploring the possibilities under

Tech-MODE do so only to stretch their distance learning degree awarding programmes. Many of these programmes are not currently in the area of agriculture.

NAERLS is the only research institute that combines capacity with experience in Tech-MODE programmes for improved livelihoods. The only civil society with considerable capacity and experience in the use of Tech-MODE for educational and improved livelihoods is TODEV. They are exploring possibilities in agriculture, adult education, and vocational training. TODEV was recently approached by the University of Ibadan to jointly explore the use of their facilities for its degree-related distance learning programmes.

COL and FARA can both take advantage of the rapid developments to implement their Tech-MODE related projects. To succeed in Tech-MODE activities in Nigeria, COL and FARA may want to collaborate with NASRDA, NITDA for policy issues and for macro activities covering the whole Nation. For distance learning, ready partners exist in a number of universities including the Nigerian Open University and the National Teachers Institute. For continuing education in the agricultural sector and for lifelong learning for farmers, NAERLS is important. The most prominent civil society involved in Tech-MODE activities currently is TODEV. TODEV could be an important partner for all facets of the application of Tech-MODE.

9 Recommendations

The theme of COL's Three-Year Plan for 2006-2009 is Learning for Development. This plan addresses an agenda that includes the UN's Millennium Development Goals, the goals of Education for all and the Commonwealth's objectives of peace, democracy, equality and good governance. Increasing and improving human learning is the key to fulfilling most aspects of this agenda. Tech-MODE has a key role to play in ensuring that Nigeria is on the path to accomplishing this development agenda. In particular, the following areas are recommended:

- COL in collaboration with IITA and some local agencies in Nigeria have already developed some models for facilitating rural learning for farmers in the context of Tech-MODE. This led to a great impact in the pilot area. COL in collaboration with FARA (through DONATA and RAILS) can expand the scope of the pilot project in order to increase the impact.
- COL is currently collaborating with the National Open University of Nigeria for distance learning. COL can expand this collaboration. The partnership with FARA (through SCARDA) can include agriculture. Other African universities that are willing could also be partnered with. Special courses can be developed for in-service practitioners to improve their confidence in the performance of their duties.
- Although there are 82 Universities in Nigeria, they do not offer admission to more than 30% of qualified candidates. This gives a lot of room for distance learning. COL and FARA can intensify work in this area by bringing into partnership willing private sector and civil society practitioners. REDCAPA works with a network of Universities to deliver distance learning programmes

in Latin America. Willing Civil Society Organizations in Nigeria could also be empowered to do the same. On the other hand, COL can promote the establishment of a Virtual University in Nigeria for the whole of Africa.

- COL can work with FARA to use all the facilities emerging in Nigeria including the satellite to initiate sub-regional programmes that will benefit rural agriculture in the sub-region.

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Toward the Introduction of Technology-Mediated Open and Distance Education (Tech-MODE): An Overview of Agricultural Education and Training in Sierra Leone

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Executive summary

Agricultural education and training has seen a great deal of evolution over the years in Sierra Leone, and with emerging trends and improvements in science and technology, one cannot help but move along these trends. The mode of delivery of basic information in agriculture had been seen to play a pivotal role in the adoption of new technologies and innovations. Although there is presently no national policy on information and communication technologies (ICT) in Sierra Leone, provisions for ICT utilisation are embedded in the National Science and Technology Policy. At the same time, the National Education Master Plan 1997–2006 outlines plans for upgrading teachers through the mode of distance education.

Despite all the difficulties the country faces, i.e., poor infrastructure, limited degree of stability and lack of a national ICT strategy, private sector activities have led to some efforts at developing a robust ICT infrastructure. Given the present state of the country, this paper attempts to highlight the preparedness of Sierra Leone in adopting technology-mediated open and distance education (Tech-MODE) in agricultural education and training.

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Principal acronyms

COL	Commonwealth of Learning
ICT	Information and Communication Technology(ies)
NGO	Non-Governmental Organisation
Tech-MODE	Technology-Mediated Open and Distance Education
T&V	Training and Visit (system)

1 Importance of agriculture

Agricultural education training (AET), information and communication for agricultural research and development in combination with information and communication technologies (ICT) cover a wide range of educational activities with the primary aim of achieving human resource development throughout the rural economy of any nation. AET and ITC form part of the opportunities for the training of the rural producers, their household members and workers, for the preparation and upgrading of the professional and para-professionals who serve them and for the streaming of national agricultural programmes within international development.

During the past three decades, international attention has been directed at agricultural production in general, and specifically at the development of the agricultural sectors of the world's lesser developed nations. Characteristically, these nations (mostly in sub-Saharan Africa, Asia and Latin America) are heavily dependent on agriculture as their primary economic activity. Agricultural development for these countries is crucial. These nations have been typically found to:

- have extremely high percentages of their populations engaged in agriculture;
- maintain a high percentage of agricultural exports in relation to total exports;
- contribute heavily to the gross domestic product (GDP) through their agricultural products.

Ironically though, agricultural GDP per agricultural worker rarely exceeds even half the per capita GDP. Thus, although developing nations are highly dependent on agriculture, agriculture remains a weak sector of their economics. Sierra Leone is no exception.

2 Sierra Leone – Country data

Sierra Leone has a population of about 5 million, with more females than males. An annual increase rate in population of about 4.0% has been recorded (Statistics Sierra Leone, 2006). Sierra Leone has one of the highest maternal mortality rates in the world and one of the lowest life expectancy rates. There are about 13 indigenous African ethnic groups in the country make up about 90% of the population. The Mende and Temne form the greatest proportion of the ethnic groups from the

South-Eastern and Northern parts of Sierra Leone, respectively. Each accounts for about 30% each of the population. A sizeable number of Creoles live in the Western area, where Krio is the lingua franca. About one third of the population lives in the capital and other urban areas; the rest live in the rural areas. The Western and Eastern areas of the country are the densest in terms of distribution of population.

In 1992, although about 75% of the nation was engaged in agriculture as their main source of livelihood, this sector contributed to only 38% of the GDP. Food aid increased from 36,000 tons in 1979/1980 to 45,000 tons in 1992/1992. During that same period, Cereal imports too increased from 83,000 tons to 133,000 tons. A four-fold increase in these aids has been seen in the recent years.

Other basic indicators for development including health, education, manufacturing and development of infrastructure have not been encouraging (World Bank 2004). It is against this backdrop that the authorities in Sierra Leone developed the Agricultural Master Plan.

3 Agricultural education at primary and secondary schools

Primary school level

The first role of primary school education in any community is to shape and strengthen children as members of the society in relation to their natural environment (the parents, teacher, peers and the world at large). The first stage of development at this age, therefore, is crucial in reforming them to be useful members of the society. Children with a good primary education in agriculture are more likely to be:

- able to identify the uses of different farm implements,
- able to combine farm inputs better than their illiterate counterparts,
- well prepared to appreciate continued agricultural education at secondary level and determine better-input selection (because of their ability in basic literacy and numeracy) which their illiterate counterparts lack.

Research has shown that four years of primary schooling can lead to an increase in agricultural output by 8%. This schooling is helpful in many ways. For instance, it increases the awareness amongst children, which will in turn have positive effects on the health, life expectancy and population growth of the society.

Furthermore, when a child starts schooling early, it greatly enhances his/her cognitive and non-cognitive attributes. These advantages become even more apparent when the curriculum includes agricultural sciences right at the primary school level. Agricultural education at the primary school level in Africa is probably of utmost importance to the child because of its numerous benefits.

As the first formal education the child receives, it helps him/her to perceive the world, his/her peers, environment and the society in which he/she lives. Since Sierra Leone now has the 6-3-3-4 education system with agricultural education

being offered at the primary school with the aim of teaching the child appropriate methods of simple cultivation of crops and rearing of animals; a combination of this with simple rudiments of literacy and numeracy and civic education all form the rubric of basic education that can help the child to be a useful citizen in the rural society.

The UN declaration of Universal Primary Education projected that by the year 2000, all primary school-going children should be in school, and that it was mandatory on all governments to work towards this objective. Despite this pledge, many African children of primary school-going age are out of school. Some have dropped out of school or have never entered one.

For those unfortunate ones in Sierra Leone, the reasons are similar to those in other countries in the entire continent: lack of resources (social and physical infrastructure), lack of funds, poor motivation and incoherent educational policies. The ten-year rebel war further exacerbated the appalling situation among all primary schools; those in the rural areas are particularly the most disadvantaged. As there are limited prospects for any decent life for the rural communities, the urban pull has become a major factor, all but in a negative way.

Although it is difficult to address the rural-urban migration in general, the case of primary school dropouts could be minimised. One plausible way of addressing this issue is to revisit the agricultural science curriculum for primary schools. The curriculum should be made more attractive in the sense that after graduation the students can be gainfully employed in the rural areas. The curriculum should, therefore, be broad-based rather than specific.

Secondary school level

In some countries, agricultural education and training is taken as a vocational subject in the sense that after completing the secondary school programme, the graduates will leave school and enter into employment. In other countries, however, agricultural education is taken as a general subject so that after completing secondary school, the student continues into higher education.

In Sierra Leone, agricultural education and training has been serving the needs of both the general and vocational students. Programmes in agricultural education at secondary level, therefore, have been broad-based so as to meet the needs of both the groups. Before the civil war broke out in 1991 (and probably to date), over 70% of the nation's population lived in the rural areas and over 80% of the secondary school pupils had rural backgrounds – agriculture being the dominant economic activity in these areas. Agricultural education is therefore an important subject in the Sierra Leone school curriculum.

It is against this background that agricultural education is a compulsory subject in all senior secondary schools in Sierra Leone. As there are limited opportunities for

school graduates in Sierra Leone, agricultural education and training is a vital route to self-employment. It equips pupils with basic skills, knowledge and aptitudes in crop production, livestock management, crop and livestock protection processing, and distribution and marketing, surveying, soil and water management, and agricultural cooperatives.

Despite the above advantages agricultural education is supposed to offer to the rural people, research has shown that most of the school graduates, especially males, migrate to the cities and engage in 'better' jobs than those offered by agriculture in the rural areas.

Secondly, girls are not often encouraged to enrol in agricultural education and training, as it is often regarded as a male job. The subject being offered as an alternative to home economics further gives girls little scope of taking agriculture in secondary schools. Perhaps, this has been the most important reason why the participation of women in agricultural education and training at all levels has been low since the colonial era.

However, the present curriculum mandates all pupils to take agricultural science at both primary and secondary levels. It is hoped that this will create more awareness about the importance of the subject amongst girls in schools.

4 Formal degree and post-graduate education

In Sierra Leone, the role of agricultural education in the training colleges is to train teachers to teach agricultural science in both primary and junior secondary schools. The programmes in training colleges are not skill-specific but rather general. The programmes at the agricultural training centres (Makali, Makama, Njala National Agricultural Training Centre, Rokupr, etc.) are practical-oriented because the clientele are usually extension workers or agricultural 'Instructors'.

Agricultural education at the university level is more broad-based. It prepares students to teach in senior secondary schools, training colleges, agricultural institutes and to take up agricultural leadership careers in the ministries of agriculture and education.

Here, little attention is paid to the training programmes for farmers. It was not until in the 1980s that some consideration was given to the implementation of university outreach programmes for rural farmers, the Out of School Project in Agriculture. Even where this programme has been designed, no special attention has been paid to rural women who produce most of the food for the nation. Sierra Leone is endowed with vast natural resources (fertile land, optimum climate and acceptable crops), for sustainable agricultural production. The effective use of these resources could only be achieved through research, training and extension education both at formal and non-formal levels.

Colleges and universities of agriculture are therefore seen as being primarily responsible for the preparation and career development of personnel for generation of agricultural knowledge, dissemination and application of the knowledge systems to appropriately target farming needs. Non-formal education as a means of reaching the rural poor for effective rural development is therefore the need of the hour.

This being so, there are several institutions of higher education in Sierra Leone which offer agricultural education. Some of these are listed here.

Njala University

Njala University was established as a public institution in Sierra Leone, by the Universities Act of 2005 with a responsibility to undertake training in agriculture, education, environmental sciences, social sciences, community health sciences and technology at both undergraduate and postgraduate levels. This institution came into existence on the 1st August 2005, when the Universities Act of 2005 became operational. The university operates on two campuses, i.e. Bo and Njala campuses. The Bo campus constitutes the Schools of Education, Community Health Sciences and Social Sciences while the Njala campus houses the Schools of Agriculture, Environmental Sciences and Technology. The Bonthe Polytechnic Institute is an affiliate of Njala University. The major objectives of the university are teaching, research and public services.

The precursor, Njala University College, has its origins in the government-established agricultural station built in 1912 at Njala in the Southern Region of the country. The station trained agricultural technicians and extension agents. In 1964, with the support of the government of Sierra Leone and the University of Illinois in the USA, the station was upgraded to a university college with two faculties, education and agriculture.

Milton Margai College of Education and Technology

The Milton Margai College of Education and Technology (MMCET) has a student enrolment of about 3,000. It has the status of a polytechnic and brings together the Milton Margai College of Education, the Freetown Technical Institute and the Hotel and Tourism Training Centre. MMCET offers courses leading to the Higher Teacher's Certificates and B.Ed. degrees. There are also certificate and diploma courses in engineering, hotel and catering, performing arts, agriculture and social sciences.

Makeni Teachers' College

The Makeni Teachers' College was upgraded, through the Polytechnics Act of 2001, to the Northern Polytechnic, incorporating the Islamic College Magburaka and the Magburaka Trade Centre. Since 2004, it has, resumed operations in Makeni after the rebel war. The student population is currently about 1,000. Programmes offered include the Teacher's Certificate and Higher Teacher's Certificate, with courses in agriculture, practical and creative arts, home sciences and others.

Eastern Polytechnic

The Eastern Polytechnic, established in 2001 under the Polytechnics Act, is made up of the Bunumbu Teachers' College and the Kenema Trade Centre, both in the Eastern Region. It has about 1,500 students pursuing various technical, vocational and teacher education courses for Teacher's Certificate, Higher Teacher's Certificate and Bachelor of Science degrees in agriculture and a wide range of courses.

Freetown Teachers' College

The Freetown Teachers' College has a student enrolment of about 1,000. Recently, it became a dual mode institution, training teachers both by conventional and distance modes for the Teacher's Certificate and Higher Teacher's Certificate. The college will soon be merged with the Freetown Trade Centre to form the Freetown Polytechnic. In the meantime, Freetown Teachers' College continues to offer courses in agriculture and other subjects at the Teachers' Certificate and Higher Teachers' Certificate levels.

Port Loko Teachers' College

Port Loko Teachers' College is located in the northwest of the country, and trains teachers for the Teacher's Certificate and Higher Teacher's Certificate, with courses in agriculture, practical and creative arts and home science. It will be upgraded into a polytechnic in the near future.

National Agricultural Training Centre

This is supported by the Ministry of Agriculture, but forms part of the Faculty of Agriculture of Njala University.

5 Problems of agricultural education and training in Sierra Leone

Agricultural Education and training is faced with a lot of problems in Sierra Leone. These problems include lack of national and local policies and policy environments, delivery methods of agricultural education extension and farmer training, research and extension linkages, institutional bureaucracies, finance and resources, and poor women participation. The most crucial problems are presented here.

5.1 Finance and resources

Financing farmer's education programmes is a crucial factor in all developing countries. Providing adequate budget for education at both formal and non-formal levels in Sierra Leone has been a problem for the past three decades. This has been largely due to resource constraints.

Sierra Leone ranks as the least developed in the world: The per capita Gross National Product (GNP) currently stands less than \$130 with only 1.4% of the total

annual budget allocated to education. (World Development Report, 2004). With this small budget allocation, procurement of resources has been extremely difficult.

Grossly inadequate resources have hampered the teaching of agricultural education. Most schools that offer agriculture as a subject lack adequate facilities like agricultural machinery, chemicals and other teaching aids and facilities (the Sierra Leone Government Report 1995). Most schools continue to use crude tools with the result that practical agriculture is relegated to manual labour thus making the subject unpopular in Sierra Leone nowadays.

One other major problem is that in most rural schools, classrooms are overcrowded and seating accommodation is inadequate. Research shows that crowded classroom situations have negative effects on the academic achievement of the child. With overcrowded and large classes, the teacher's job becomes even more tedious and unpleasant. Getting all of the pupils' attention is often problematic because of the following:

- the sheer size of classes makes monitoring of students work difficult;
- administering regular tests and assignments is tedious;
- roll-calls and other attendance checking is strenuous;
- pupils distraction is common;
- disciplinary problems are common.

The teaching of modern agriculture is stressed because of the poor resource situation in schools. In the university and other higher educational institutions, the use of crude tools is also common. Modest beginnings were made to equip institutions in the early 1970s. Foreign governments and other donor agencies, in their bid to equip the newly established colleges and the university generously donated tools and equipment to these institutions.

However, the culture of poor management and maintenance has left most of the tools and equipment out-dated and dilapidated. With no money for maintenance or replacement through donated aid packages or otherwise, these institutions continue to use what they have. This has not only affected the teaching of the subject but also dissuaded many students from enrolling for the programme.

The Department of Agricultural Education at the Njala University is currently in a state of resource crisis. There are no overhead projectors, computers, machinery in teaching laboratories, etc. As a result, the teaching process is predominantly theoretical with little meaningful practical work. This had and continues to have serious effects not only on the quality of the graduates but also on the teaching and research processes. This apparently had seriously affected the participation of farmers in training programmes.

5.2 Extension method

The introduction of extension education dates as far back as the colonial era. During that time, the role of extension was not so much for improving the standard of peasant agriculture as it was for enabling the farmers to earn more money to pay more taxes to the then colonial government.

These early methods which were seen to 'improve production in agriculture' did not benefit the farmers very much but they did benefit the colonial commercial firms. This was so because in these situations, extension services provided packages of practice to be followed while coordinator services supplied necessary inputs (seeds, fertilizers, insecticides, etc.) and marketing services usually through marketing boards or private companies.

Therefore, extension approaches were not popular in the colonial era. The colonial masters dictated what to plant and where to sell the produce. Often the packages of practice were compulsory. Farmers were not merely taught, they were ordered under pain or penalty to observe certain soil conservation rules, to cultivate specific land with specific crops, to follow prescribed cultivation practices and time schedules and to sell their product only to designated organisations at designated prices. It was therefore little wonder that the farmers generally viewed the extension agent less as a friend and more as a representative of a distant government that was out to exploit the masses.

Currently, the main extension approach is the Training and Visit (T&V) system introduced with the support of the World Bank. In this system, extension packages in the form of improved farming techniques, fertilizers and improved planting materials, etc. are transferred to farmers. This system evolved from the growing needs of the farmers for information on improved farming techniques.

This transfer of technology, as it is usually called, had come under fierce criticism over the past decades (Chambers, 1983). Chambers specifically advanced the following criticisms against the training and visit system:

- focus of extension on elite farmers rather than the poorer ones for whom the packages may be more meaningful (elitism);
- failure of the extension staff to visit farmers during the rainy season (dry season-bias extension);
- exclusion of women from extension exercises (male-bias extension);
- selection of specific sites for extension exercises (site-bias extension).

In Sierra Leone, the Ministry of Agriculture, Forestry and Food Security, rural development projects, non-governmental organisations and, to a lesser extent, the university department of extension and rural development and research institutions carry out extension services. A modified training and visit system is the main method of extension practised.

However, modern approaches to extension are currently shifting towards the participatory approach, which often advocates the active involvement of the farmers in identifying their own problems and using their indigenous knowledge in combination with research packages to solve their problems. In this case, the extension practitioners are seen more as facilitators than teachers. This approach needs to be rigorously followed by extension personnel. Proponents of the participatory approach argue that farmers are more likely to adopt a system of farming in which they have participated in its formulation than in one that is trainer-centred and is being commandeered by “strangers”.

Although farmers in Sierra Leone had often come under criticisms by the extension officers for their reluctance to adopt innovation packages, a close examination of their situation will justify their reluctance. The fact that most of the farmers are illiterate does not mean that they are conservative. They are intelligent people with a wealth of experience and therefore are careful with whatever farming decisions they make.

Indeed, it is true that essential inputs such as improved seeds, fertilizers, crop rotation, are vital in agricultural improvement but experience shows that the improved seeds, though may be high yielding, are often vulnerable to local environment pests, diseases, weeds and climate. Moreover, farmers consider other qualities such as palatability, storage and consumer acceptability as key factors. Where new crops fail to meet these qualities, no matter how high yielding they might be, they will be rejected by most farmers. They do so because of the risks involved.

In this case, the farmers will prefer their local varieties, as there is assurance of some harvest at the end of the season. What the extension personnel must do is to combine research, farmer empowerment and other emerging innovations to the farmers' advantage.

Innovations such as crop rotation have been widely recommended as an alternative to shifting cultivation or brush fallow. However, proponents usually fail to realise that this demands the use of fertilizers, which our local farmers cannot afford. Even for those farmers who can afford the costs, the fertilizers are often not available on the market when most needed. In addition, the application of crop rotation itself demands technical skills for which our local farmers need special training. Where such training is not adequately provided, one cannot blame the farmers if they fail to adopt the new technologies.

In Sierra Leone, the most effective farming season is during the rainy season because peasant agriculture is highly dependent upon rain-fed conditions. Extension services are appreciated most during this time. However, poor road networks lack of transportation and poor communication networks limit the activities of the extension workers limit the activities of the extension workers.

Furthermore, extension workers usually have large areas to cover. With the current extension worker to farmer ratio of 1:1200 – 1500, it is difficult to accomplish their tasks effectively (Williams, 1989).

Elitism in extension has been widespread in Sierra Leone since its introduction. Extension packages are usually directed to richer farmers because they are more and clearly specified, and achievable goals must be built into project agreements. These need to be based on open discussions between all the parties involved (including the beneficiaries institutions) at the pre-planning phase.

5.3 Staff shortage

Agricultural education at all levels in Sierra Leone suffers greatly from acute staff shortages. The causes of shortages are usually due to poor motivation in the public services, especially in the teaching profession. Most agricultural schools and colleges are situated in the provinces where social amenities are poor. Electricity shortages, poor accommodation, poor transportation facilities and the generally low salary structures make teaching in the rural areas unattractive. This does not only dissuade new graduates from taking up teaching appointments but also continue to trigger mass exodus of agricultural science teachers from the classrooms to other professions.

5.4 Poor women participation

Women are the key architects of agricultural development in this predominantly agrarian and less developed nation. Despite the huge contribution they make, women's participation in agricultural education and training is by far lower than their male counterparts.

Women farmers in rural Sierra Leone are the most disadvantaged. They are the poorest, most illiterate and are normally discriminated against in terms of extension and education. The average illiterate rate currently stands at 79% for men and 89% for women (World Development Report, 2004). Buvinic (1994) argues that for effective participation of women in the development process, they should be provided with the necessary logistics because; "...the constant demand for women in the participation of national development should be accompanied by continued availability of the necessary facilities that would enable them to carryout their activities more effectively with less difficulties...".

5.5 Toward Tech-MODE – Is Sierra Leone prepared?

Given the present situation where the T&V system of extension service cannot adequately address the needs of the farming population of the country, the imminent use of "better" means of reaching a wider public becomes imperative. The present information, communication technology systems offer such opportunity, but its affordability and sustainability becomes the bigger question in a country with little or no electricity supply. This notwithstanding, the proliferation of

community radio in all district headquarters of the country has, in the most recent past brought farmers and their extension worker a little more closer. Telephoning-in programmes have been incorporated in radio discussions, and questions that would have waited in the minds of the farmer for a much longer period could be addressed by the discussion panel that may comprise both farmers and experts.

However, in the tertiary educational system, the use of computers and the internet has become the vogue, such that teaching/learning materials can now be posted on the network of schools or on the World Wide Web. These and other policy-related issues offer opportunities for moving Sierra Leone towards Tech-MODE as implemented in other parts of the world.

6 Policy options for agricultural education in Sierra Leone

6.1 National ICT policy

The formulation of a national policy on ICT began in 2006 and was expected to be finalized by 2007. A Telecommunications Act of 2006 has however been passed, which has set the pace for the establishment of a regulator National Telecommunications Commission, with the responsibility for licensing and spectrum management among others.

Although there is presently no national policy on ICT, provisions for ICT utilisation are embedded in the National Science and Technology Policy. At the same time the National Education Master Plan 1997–2006 outlines plans for upgrading teachers through the mode of distance education. Despite all the difficulties that the country faces, private sector activities have led to some efforts at developing a robust ICT infrastructure.

The present National Science and Technology Policy of Sierra Leone makes provision for the development of ICT through collaboration and partnerships with organisations both within and outside the country. The proliferation of the providers of Internet connectivity through the satellite, the mobile phone service providers and the subscribers as also the reduction in tariffs on their usage are the possible indicators of the government's commitment to the expansion of ICT in the country. The formulation of an independent ICT policy is thus imminent. Table 1 shows statistics on ICT infrastructure and usage. Table 2 contains an analysis of the factors influencing ICT adoption in Sierra Leone.

Table 1. Statistics on ICT infrastructure and usage

Indicators	Numbers
Fixed Line Operators	1
Total Fixed Line Telephone Subscribers	23,327
Cellular Mobile Operators	5
Total Cellular Mobile Subscribers (2005)	297,000
Mobile subscribers (per 1,000 people) (2004)	22
Internet users per 100 inhabitants (2004)	2
Personal Computers per 1000 inhabitants (2004)	12

Source: http://www.wikieducator.org/ICT4Africa/Country_Report_Sierra_Leone

Table 2. Analysis of factors influencing ICT adoption

Factors	Enabling Features	Constraints
Policy framework and implementation plans	A commitment in the education master plan	Lack of a national and educational ICT policy
Gender equity and access to ICTs	Emphasis on girl-child education	Inequality in access to education between boys and girls
Infrastructure and access	Commitment to the completion of the Bumbuna Hydro Electric power by the end of 2008	Erratic supply of electricity/ high costs of telephone connection and the long-distance charges
Collaborating mechanisms	Partnerships and opportunities with other organisations	Slow pace of feedbacks
Human resource capacity	Increase in private initiatives providing ICT training	Inadequate supply of skilled ICT labour in Sierra Leone
Fiscal resources	Free primary education	Lack of adequate government resources for education
Learning content	Increased level of capacity building	Lack of any standardised ICT curricula
Procurement regulations	National Procurement Policy instituted	Unregistered trading
Attitudes	Strong commitment on the part of teachers and administrators	Lack of adequate teaching/learning materials
Sustainability	A positive political will	Heavy reliance on donor projects

6.2 Problems and emerging trends

Research has shown that agricultural educational policies are major factors that affect the delivery of agricultural education and implementation of agricultural innovations. The following policy-related issues were identical in redefining agricultural education and training delivery system in Sierra Leone:

- There is a lack of any coherent policy framework for agricultural education, due in part to the lack of coordination amongst the various agencies involved, and the fact that responsibility for implementation is usually shared amongst several ministries, as well as various private sector bodies including non-governmental organisations (NGOs). There is also a frequent lack of any coherent dialogue on policy issues, either between donors and beneficiaries, or amongst donors themselves.
- Agricultural education and training systems require strong linkages; amongst the various institutions involved, across the formal/non-formal divide, and between the different organisations responsible for training research and extension. These are often weak or non-existent in Sierra Leone.
- While it is apparent that projects which link European and other foreign training institutions with those in Sierra Leone could achieve some “success” in terms of objectives set, there is often a lack of external evaluation. The long-term impacts of links are rarely assessed.
- The identification of training needs should be the natural starting point for policy formulation, and for institutional reform and curriculum development. However, there is often a lack of labour market studies for the renewable natural resource sector, and of training needs assessment amongst rural producers and their households. There are particular needs for the identification of new target audiences, and for the assessment of particular training needs of women. The needs assessment process itself ought to be of a participatory nature, but often it is not.
- Curriculum development is a common entry point for intervention in agricultural education and training systems, and tends to lead to relatively stable innovations. However it is beset by dangers of irrelevance, of modelling the past and of the failure to provide for dynamic adaptation to the changes in the external environment. Increasingly, agricultural education curricula need to address emerging global issues (sustainability, environmental issues, gender, etc.) and to deliver job-related and transferable skills.
- The revitalisation of agricultural extension training requires the development of institutional management capabilities, including skills for strategic planning, pre-appraisal, monitoring and evaluation. There is frequently a lack of entrepreneurial leadership, which is able to innovate in areas such as developing outreach programmes, and management of linkages and network building.
- Human resource development must be a priority area. In particular training institutions need to be able to recruit staff with the right background, aptitudes and commitment for the whole range of activities (teaching, research, outreach, networking, etc).

- Several link projects have illustrated the importance of creating a critical mass of change-oriented staff, through provision of “training of trainers programmes either in-country or overseas. In the same way, leadership development can be facilitated through a balance of in-country and overseas training. Much potential exists for the further development of a split-site PhD programme.
- The achievement of sustainability should be a primary aim of all donor support for agricultural education and training projects as well as capacity building strategies.
- Agricultural education and training programmes for Sierra Leone are in need of rationalization, in the light of current social and economic trends. In some cases, private initiatives are on the increase, and there is frequently a growth of NGO involvement, especially in the “village-level” and farmer training programmes. Part of the rationalization process has led to the creation of more integrated learning systems, with strong formal/non-formal linkages affected through the field schools, new partnerships between public and private sector institutions and the exploitation of new potentials for distance learning. The latter can provide more cost-effective delivery systems, and can be targeted at more remote and vulnerable groups not reached by the conventional methods of agricultural education and training.
- There is also a need to seek new roles for existing institutions, with greater diversification of function and the exploitation of partnership between the public and private sectors as well as among the different types of training institutions. The notion of creating interactive learning networks amongst tertiary institutions, school, local NGOs and the rural people’s organizations also need to be explored.
- The wider dissemination of the results of agricultural education and training research, as well as of successful innovations and models, could contribute to the process of revitalisation This needs to include greater cross-fertilisation between the different regions of Sierra Leone.
- The emergence of technology-mediated open and distance education is gaining grounds in Sierra Leone. The introduction of open and distance education gives the learning population wider options of enrolment and a more convenient means of capacity building. However, the Tertiary Education Commission of Sierra Leone is faced with the task of quality assurance and accreditation. At the moment, the commission is yet to come to terms with this trend.

7 Policy recommendations for agricultural education and training

To address the problems and emerging trends listed in the preceding section, there must be coherent and realistic policies to effect the revitalization of agricultural education and training. The most crucial include the following:

- A national mechanism is needed to ensure that agricultural education and training policy-setting is treated as an integrated whole, with clear lines of communication amongst all private and public sector agencies involved.

- National agricultural education and training systems need strong links between formal and non-formal sectors, and also among research, teaching and extension.
- There should be clear lines of communication amongst all donor agencies involved in supporting agricultural education and training and between donors and implementing agencies.
- National curricula for any part of the agricultural education and training system should allow for local variability, be responsive to changes, and provide pathways for educational progression.
- Recruitment into the public sector agricultural education and training institutions should be related to all their aims and objectives, including (where appropriate) commitment to outreach and farmer first approaches.
- Donor support for agricultural education and training should always provide for sustainability through open discussions with beneficiaries at the pre-planning stage, and must include human resource development and capacity building elements to allow sufficient timescale for institutional change.
- The institution of an ICT policy that makes adequate provision for the introduction of Tech-MODE at the local level in particular and international level in general is of paramount importance. Accordingly, COL and other partner institutions have to assist in the provision of technical support and advocacy role.
- The Tertiary Education Commission of Sierra Leone has to work with COL and other partner institutions in formulating a quality assurance policy on open distance learning.

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Status, Opportunities, Potential and Challenges of Technology-Mediated Open and Distance Education (Tech-MODE) for Agricultural Education and Improved Livelihoods: A Case Study of Tanzania

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Executive summary

This country report outlines the opportunities and challenges for Tanzania to collaborate with the Commonwealth of Learning (COL) and the Forum for Agricultural Research in Africa (FARA) in establishing technology-mediated open and distance education (Tech-MODE) in agricultural education and training. Data for this report were collected from existing research documents and through personal interviews with some of the stakeholders in the agricultural sector.

The agricultural sector in Tanzania employs approximately 85% of the labour force. The Tanzania Development Vision (TDV) 2025 reveals that agriculture continues to be dependent on rainfall and traditional technology, consequently, productivity is low and erratic. The low productivity partly reflects lack of creativity and innovativeness that limits full application of science and technology as well as development of the agricultural trade.

Information and communication technology (ICT) continues to play a key role in agricultural development. The current environment is highly favourable for the country to collaborate in open and distance learning (ODL) with local and international institutions. Tanzania has a national ICT policy, and many higher learning institutions have ICT policies which underscore the need for the

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implementation of ICT-based teaching and learning. These policies emphasise the use of ICT in the agriculture sector as well. Tanzania has the basic ICT infrastructures which can be used to provide agricultural education through ODL and Tech-MODE.

The Open University of Tanzania (OUT) offers formal degree and post-graduate education through distance learning. In addition, several residential-based universities, such as the University of Dar es Salaam, the National Correspondence Institute and the Moshi University College of Co-operative and Business Studies, are providing some form of distance education. Sokoine University of Agriculture (SUA) has a potential to establish ODL programmes in collaboration with OUT, because these universities have a memorandum of understanding to collaborate in teaching, learning, consultancy and research. Furthermore, SUA is the only agricultural university with staff and vast amount of electronic teaching materials in agriculture, veterinary medicine, forest and nature conservation, science, continuing education, computer science, pest management, development studies and sustainable rural development.

Life-long learning for farming communities has started through telecentres and multi-purpose community centres. Established telecentres have shown that they are affordable and are a best method to introduce ICT sustainably at the grassroots level. Examples of telecentres are Cromabu (Mwanza), Mazingira telecentres (Shinyanga), Kilosa telecentre (Kilosa), and Kibengwe telecentre (Bukoba). These telecentres provide additional avenues for ODL and Tech-MODE.

Like other developing countries, Tanzania has many challenges and promising opportunities for the use of ODL and Tech-MODE in agricultural education, but we suggest that both public and private sector collaboration with SUA and COL can extend the potential benefits of the new initiative of ODL and Tech-MODE to Tanzanians.

Principal acronyms

COL	Commonwealth of Learning
EASSy	Eastern Africa Submarine Cable System
FARA	Forum for Agricultural Research in Africa
ICT(s)	Information and Communication Technology(ies)
ODL	Open and Distance Learning
OUT	Open University of Tanzania
SSA	Sub-Saharan Africa
SUA	Sokoine University of Agriculture
TDV	Tanzania Development Vision
Tech-MODE	Technology-Mediated Open and Distance Education
TENET	Tanzania Education Network

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The Authors wish to thank all researchers whose work has been cited in this paper. The introduction part has been taken from COL. Tanzania's agricultural background has been taken from a research project proposal of C. Sanga, Dr. S. Tumbo, Prof. L.J.M. Kusiluka and Dr. F. Kilima sent to PANTIL.

1 Background

Education, training, information, communications for agricultural research and development in combination with information and communication technologies (ICT) are becoming increasingly important for agricultural production and productivity. With its expertise in various regions of the world, the Commonwealth of Learning (COL) wishes to expand technology-mediated open and distance education (Tech-MODE) for agricultural education and improved livelihoods in sub-Saharan Africa (SSA).

COL has its presence in SSA, particularly in the primary, secondary and higher education sectors. COL's initiatives on agricultural education for improved livelihood are gaining importance. Similar initiatives are underway by various other organisations. To enhance collaboration and synergy, COL wishes to identify opportunities for a complementary and catalytic role – preferably in coordination with the Forum for Agricultural Research in Africa (FARA) at the following levels:

- formal degree and post-graduate education
- continuing professional education
- lifelong learning for farming communities
- agricultural education at primary and secondary schools

This country report presents some background information on the current status of agricultural education and training in Tanzania and the opportunities for promoting Tech-MODE for agricultural education and development in Tanzania.

2 Agriculture in Tanzania

The agricultural sector employs approximately 85% of the labour force in Tanzania and it contributes significantly to the country's Gross Domestic Product (Ministry of Agriculture, 1996; Katani, 1997; United Republic of Tanzania, 1999). The sector also plays a vital role in the agro-processing industry and trade. Statistics show that agricultural products account for 85% of exports (Kullaya et al., 1998).

The Tanzania Development Vision (TDV) 2025 reveals that agriculture continues to be primarily dependent on rainfall and traditional technology. Consequently, productivity is low and erratic, suggesting that available natural resources have not been adequately mobilised and effectively utilised to promote sustainable agricultural development. The low productivity partly reflects lack of creativity and innovativeness

that limits the full application of science and technology and the development of agricultural trade.

The development of agricultural trade in Tanzania has been hampered by many factors including lack of proper marketing policy; unregulated economic liberalisation process, and lack of appropriate information. Other factors are inefficient agricultural support services such as credit; good transport system, extension services and cheap sources of electricity and water. Lack of clear marketing and trade policies; difficult regulatory procedures and lack of strategic campaigns on investment in agricultural trade also hinder agricultural development (Bates et al., 1983). These constraints have negative impacts on market intelligence, competition and commodity prices.

Most farm-gate prices in Tanzania are usually set by retailers and middlemen depending on spot prices in urban markets. This mode of pricing is justified based on asymmetric market information (i.e., market participants do not have access to the same information because the market fails to facilitate the exchange of information). Mbwana et al. (1983) provide supportive evidence that middlemen tend to benefit more than farmers because they have more access to market information and can speculate.

ICT has continued to play a key role in agricultural development. Policy-makers, farmers, researchers, students, traders, extension workers and general community at large need appropriate information for better allocation of scarce resources; designing more effective programmes; monitoring and evaluation of the agricultural programmes; effective and efficient delivery of extension messages and technologies; and provision of quality services to their clients.

In Tanzania, agricultural information is mainly disseminated through agricultural extension officers. The information dissemination system has not been as effective as envisaged due to many reasons: the system lacks ownership by the clientele and is more over, not demand driven. There is poor coordination and linkages between farmers, extension agents and researchers. Poor intersectoral linkages and poor agricultural support services coupled with inadequate macro-economics policies and low efficiency makes sustainability of the system questionable (Rutatora et al., 2005).

The importance of agricultural information and the ineffectiveness of the current information dissemination system call for a need to assess the potential of introducing new options in ICT that are suitable for the agricultural sector and which can be easily utilized by extension officers, farmers, processors and traders. The option also demands that district agricultural offices be fully equipped with ICT and information packages, hardware and software that are user-friendly and easy to adopt within the district agricultural planning process. This emphasises the need for having learning/knowledge centres or community centres in each district.

Early establishment of telecentres and multi-purpose community centres has shown that these are the affordable way to introduce technologies sustainably at the grassroots. Examples of telecentres are Cromabu in Mwanza; Mazingira telecentres in Shinyanga; Kilosa telecentre in Kilosa and Kibengwe telecentre in Bukoba. Introducing efficient ICT for the agricultural sector shall enhance systematic data collection, collation and analysis as well as information dissemination to stakeholders to assist them in decision-making (Tutor, 2004). The use of ICT can also play a major role in an effort to identify and respond to the emerging opportunities in improving livelihoods through the agriculture sector.

Promotion of ICT has been identified as one of the driving forces for the realisation of the TDV 2025. The TDV 2025 stipulates that advanced micro-electronic ICTs are central to competitive social and economic transformation. ICT costs are continuing to fall while their capabilities and the resultant profitability enhancements are increasing. These technologies are a major driving force for the realisation of the Vision. This technology should be harnessed persistently in all sectors of the economy to benefit all social groups with a view to enabling the meeting of basic needs of the people, increasing productivity and promoting competitiveness.

Those working in remote areas need to network with more advanced knowledge / learning centres or telecentres and with each other. Such networking will also facilitate the generation of better local information to shape policies, strategic plans and tactical decisions for developing a stronger agricultural base. Tanzania has a vast and diverse agricultural resource base and can become a major player in global agricultural trade by harnessing appropriate ICT for agricultural development. In addition to facilitating improvement in efficiency and productivity, ICT can bring about an overall qualitative improvement in life by providing timely and quality information for decision-making. This is only possible when all stakeholders in the agricultural sector in Tanzania are ICT-educated.

Sokoine University of Agriculture (SUA), which is a resident-based university and mandated to teach, conduct research and undertake outreach programmes in agriculture, must incorporate new initiatives like ODL in order to provide education to a large number of students, extension officers and farmers. Furthermore, it needs to introduce new forms of teaching such as lifelong learning. Currently, SUA uses the face-to-face mode of instruction to teach university students, as well as television programmes, publications and classes for outreach programmes.

3 History of open and distance learning in Tanzania

The Open University of Tanzania (OUT) is a distance education institution that serves local and international students. It started in 1992 and uses the traditional method of disseminating teaching and learning materials (McHarazo and Olden, 2000). Printed course materials are delivered to students mainly by postal services. However, OUT also uses public carriers and OUT staff too deliver these materials

during their visits to the regional learning centres (Perraton, 2000; McHarazo and Olden, 2000).

SUA has a potential to establish ODL programmes in collaboration with OUT because these universities have a memorandum of understanding to collaborate in teaching and research. OUT students who are in Morogoro regions normally use SUA as their main learning centre where libraries, laboratory and classrooms facilities are used during vacations.

OUT has not been the only ²Distance Education institute, there are others including the Institute of Adult Education, the National Correspondence Institute and Moshi University College of Co-operative and Business Studies (which is a constituent college of SUA). In 1995, the United Nations Commission for Refugees (UNCR)³ started ODL initiatives at refugees' camps using radio and Internet through VSAT powered with solar energy.

4 National and local policy environment on ODL and Tech-MODE

Tanzania's national ICT policy⁴ and SUA's ICT policy⁵ underscore the need for the implementation of an ICT-based ODL and Tech-MODE. The national and institutional policies place emphasis on use of ICT in the agricultural sector. Other SUA documents which are in an electronic format (e.g. prospectus⁶, calendars, tracer studies⁷, investment guide⁸) provide more information about the university.

All the conventional ICT infrastructures are available in Tanzania⁹ which include fixed lines services, cellular mobile services, data communication services, Internet service provision, broadcasting services, and postal services. The infrastructures can facilitate the implementation of ODL and Tech-MODE. An inventory of available infrastructures and service providers in Tanzania include public fixed networks, largely those operated by TTCL and ZANTEL (mainly on copper, wireless and microwave), public mobile networks, those operated by MIC (T) Ltd., VODACOM (T) Ltd., CELTEL (T) Ltd., and ZANTEL (mainly on wireless and microwave), fibre optic networks, especially those operated by TANESCO, TAZARA, TRC, ITN and SONGAS and satellite-based networks featuring those operated by Data Service Providers.

The details of infrastructures and services offered by different internet service providers in Tanzania are shown in Tables 1-3. Table 1 gives information on fixed

² <http://www.col.org/forum/PCFpapers/donge.pdf>

³ <http://www.unesco.org/iiep/eng/focus/emergency/guidebook/Chapter11.pdf>

⁴ <http://www.tanzania.go.tz/pdf/ictpolicy.pdf>

⁵ <http://www.suanet.ac.tz/cc/docs/ictpolicy2002.pdf>

⁶ <http://www.suanet.ac.tz/prospectus.PDF>

⁷ <http://www.suanet.ac.tz/jobsurvey.html>

⁸ <http://www.suanet.ac.tz/investment/investment.pdf>

⁹ http://www.itu.int/osg/spu/cybersecurity/contributions/Tanzania_Ulanga_paper.pdf

line and microwave system, Table 2 provides data on wireless/mobile connection, and Table 3 mainly shows satellite based connections. The data presented in these tables reveal the importance and opportunities which exist in Tanzania with regard to ICT and therefore the potential of ICT in the country.

The Internet costs might drop in future when Eastern Africa Submarine Cable System (EASSy) project will be implemented. EASSy is the undersea fibre optic cable that will link the countries of East Africa to the rest of the world (<http://eassy.org>). Also, there is another initiative to connect all the education¹⁰ institutions in Tanzania. This initiative is meant to ensure that the benefits of EASSy project will be easily realised.

The future seems to favour ICT application which will use mobile device. According to Gillwald et al. (2005), in Tanzania, more people have access to mobile devices than to normal computers.

2% of all households in Tanzania have at least one working computer while 15% of all households with working computers are connected to the Internet. 44% of people in urban areas have access to mobile phones while in rural areas only 8% of people have access to mobile phones (Gillwald et al., 2005, pages 154-160).

Any new initiative like ODL and Tech-MODE, therefore must use the potential of mobile devices in facilitating teaching and learning. This is possible if blended learning and teaching can be adapted (dual mode or a mix of face-to-face and e-learning). Mobile learning has been practised for a long time in Tanzania, it has been done using radio and hard copy (books, texts books, etc). The challenge ahead is to incorporate new ICT.

¹⁰ http://www.wideopenaccess.net/files/webform/submission/Tenet_Kondoro_06.pdf

Table 1. Availability of Fixed Connectivity in Tanzania (Adapted from Sheriff, 2006)

Type of Connectivity	Equipment Cost	Recurrent Cost	Geographic Reach	Reliability	Quality of Service	Bandwidth	Downtime Compensation	Ease of Deployment	Some Providers
Dial-up	<US\$50	<US\$50 / month + toll cost	National	Good depending on quality of telephone line	Basic, given bandwidth	Max 36.6Kbps	Most ISP do not offer compensation	Very Easy	Almost all ISP
Cable : UTP	Depends on ISP – usually low – approx. US\$100	Per PC ranging from \$40-\$70. Bandwidth purchase varies widely depending on ISP	Limited to reach of each ISP	Poor to Good depending on the infrastructure of the ISP	Poor to Good depending on the infrastructure of the ISP	Varies widely from ISP to ISP. Per PC may range from 4Kbps to 128Kbps. Bandwidth purchase depends on quantity of bandwidth agreed with ISP	Most ISPs donot offer compensation. Larger customers can demand an SLA. In SLA there can be a clause for refunds	Involves pulling UTP cable and sometimes involves installing hub/switch along the way	Most ISP in cities and towns would have a UTP network
Cable: Leased Line through TTCL	Approximately US\$2,000 – 3,000	Starting at US\$350 / month upwards depending on bandwidth plan selected	Most of the country but within the city vicinity of each district HQ	Medium to Good	Medium	Plans start at 128Kbps shared going upwards	None	Technically straightforward, but could take longer as coordination is done through Dsm office	TTCL
Cable: Private Leased Line	Depends on ISP but much lower than that of TTCL	Depends on the service plan selected	Within 2 km of ISP head end	Good	Good	Depends on service plan. Home users would get a shared 64/128Kbps	Not for home users, bigger clients may demand an SLA	Not easy as involves pulling of copper wire from client to ISP head-end	None in Dsm, some local upcountry ISPs like Habari in Arusha

Table 2. Availability of Wireless/Mobile Connectivity in Tanzania

Type of Connectivity	Equipment Cost	Recurrent Cost	Geographic Reach	Reliability	Quality of Service	Bandwidth	Downtime Compensation	Ease of Deployment	Some Providers
Cable: ADSL through Telecoms	Between \$100 and \$200	Starting at \$42 for home connection with limited transfer rate of 0.5GB/month going upwards to \$100/month for 128Kbps shared and unlimited transfer and up to \$500 for higher bandwidth and unlimited transfer	So far in Dsm. Starting soon in Arusha and Mwanza	Good	Good	128Kbps shared up to 512Kbps dedicated	None	Straightforward	TTCL directly as well as raha.com and Africa Online using TTCL infrastructure
Wireless on license free frequencies	Between \$500 and \$3,500	Starting at \$50/month going upwards based on service plan selected	Towns and cities with a local ISP	Varied widely, has potential to be excellent	Varied widely, has potential to be excellent	Home users usually get a shared 128Kbps link, other plans vary based on agreement	Usually none	Quite straightforward	Mostly ALL Upcountry Local ISP
Wireless on licensed frequencies	Between \$500 and \$3,500	Usually a corporate solution starting at \$250/month	Very few towns and cities with a local ISP	Usually good	Usually good	Depends solely on service plan selected	Depends on SLA with corporate customer	Quite straightforward	Very few Upcountry Local ISP
Mobile service (3G, GPRS, CDMA, etc.)	Low – cost of handset \$ >150	So far based on transfer rate. Approximately \$	Currently being deployed in most urban towns	Good	Good	Between 56Kbps to 115Kbps – maybe more on 3G networks	None – this is a pay-as-you-go service. No payments due	Very easy	TTCL, Zantel, Vodacom, Cetei (None have launched officially yet)

Table 3. Availability of Satellite Connectivity (Adapted from Sheriff, 2006)

Type of Connectivity	Equipment Cost	Recurrent Cost	Geographic Reach	Reliability	Quality of Service	Bandwidth	Downtime Compensation	Ease of Deployment	Some Providers
Satellite: C-Band with INTERNATIONAL hub	\$10-12,000	Depends on service plans. Can be as low as \$150/month for home, \$450/month for 128Kbps shared and higher according to bandwidth. These are rates of INTERNATIONAL traffic.	National and beyond	Usually excellent depending on provider	Usually excellent depending on provider	Starts at 128Kbps shared upwards	Usually only for larger purchases with an SLA	Straightforward	SatcoNet, SimbaNet, AFSAT, plus many international providers
Satellite: C-Band with LOCAL hub	\$10-12,000	As above PLUS local traffic can be negotiated as these are not traditional plans offered	National and beyond	Usually excellent depending on provider	Usually excellent depending on provider	Starts at 128Kbps shared upwards	Usually only for larger purchases with an SLA	Straightforward	SatcoNet, SimbaNet
Satellite: Ku-Band with INTERNATIONAL hub	\$1,8003,000	Same as C-Band with INTERNATIONAL Hub (above)	National and beyond	Usually excellent depending on provider	Usually excellent depending on provider	Starts at 128Kbps shared upwards	Usually only for larger purchases with an SLA	Straightforward	SatcoNet, SimbaNet, AFSAT, plus many international providers
Satellite: Ku-Band with LOCAL hub	\$1,8003,000	Same as C-Band with LOCAL Hub (above)	National and beyond	Usually excellent depending on provider	Usually excellent depending on provider	Starts at 128Kbps shared upwards	Usually only for larger purchases with an SLA	Straightforward	SatcoNet, SimbaNet

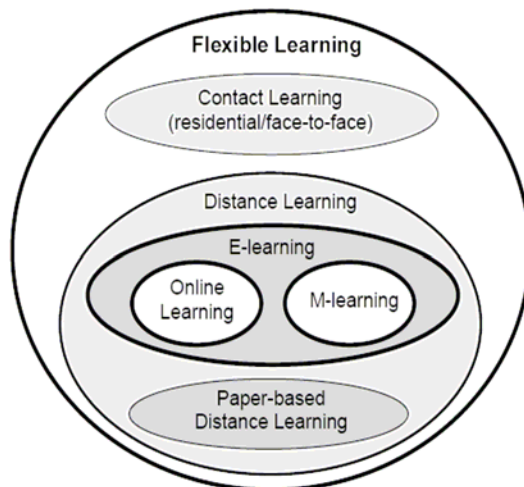


Figure 1. Mode of delivery proposed for ODL and Tech-MODE to suit Tanzania's environment is that of flexible learning as shown by Brown (2003)

5 Institutional and individual capacity on ODL and Tech-MODE

UA has staff with Certificate of Online Education and Training, BSc in Computer Science, BSc Electronics Science and Telecommunications, MSc Computer Science, MSc E-Commerce, BSc Computer Engineering and Information Systems and a large number of lecturers with PhD in agriculture and related fields. Thus, there are enough human resources locally available for setting up a computer networking, development, management and maintenance of e-learning system as well as the development of learning and teaching materials and contents.

There are lecturers, technicians and laboratory assistant competent in agriculture, veterinary medicine, forest and nature conservation, science, continuing education, computer science, pest management, development studies and sustainable rural development¹¹.

Discipline areas of expertise include all areas of agriculture, such as agronomy, soil, food science and home economics, horticulture, agriculture economics and agribusiness, veterinary medicine, forest and nature conservation, science and other subjects such as continuing education, management of information system, computer science, pest management, development studies and sustainable rural development.

At SUA, the status of facilities (infrastructure) and information services in agriculture and agricultural education as outlined by Magesa & Lazaro (2006)¹² is as follows:

¹¹ <http://www.suanet.ac.tz>

¹² <http://sdu.ictp.it/lowbandwidth/program/case-studies/cs6.ppt>

- The Computer Centre manages three computer laboratories (one at the main campus for undergraduate students, one at main campus for postgraduate students and one at Solomon Mahlangu Campus).
- There are more than 500 computers running MS Windows (XP, ME, 2000, etc.) and Fedora core 3.
- More than 200 computers are connected to the Internet.
- The university has an Internet connection using a leased copper wire from an internet service provider (256 kbps downlink and 128 kbps uplink).
- The main campus and the Solomon Mahlangu Campus are connected via a wireless Internet connection.
- The type of network topology at the SUA is an extended star. Its cabling is of fibre backbone, coaxial cable and UTP CAT 5.
- The internet services which are provided to the SUA community are e-mail, file sharing, web hosting, online discussion forum, etc. These services are provided by an e-mail server, a DNS server, a DHCP server, a proxy server, a NAT server, a firewall server and a web server. These servers have been configured to run using the Fedora core 3 and the Redhat enterprise.
- Communication and networking equipments available include a Cisco router 2600 series with hubs, switches, RAD MODEM and a VSAT. Currently, the VSAT is not used and we aim at using it to provide a backup Internet connection, in case there is a problem with the leased copper wire.
- The SUA has more 500 employees and more than 3000 students.

The SUA Computer Centre has a team which is committed to:

- develop and administer e-learning platforms;
- provide instructional design for e-learning content;
- provide ICT literacy training for e-learning communities;
- handle development of multimedia course materials for e-learning purposes.

5.1 Challenges and opportunities for ODL and Tech-MODE

This section describes how the SUA can take a leading role for the implementation of ODL and Tech-MODE, taking into account the strengths, weaknesses, opportunities and threats (SWOT) based on the analysis by the SUA (SUA Investment Guide, 2006)¹³. The SWOT analysis identified issues related to ICT.

Strengths

- A pool of highly trained and competent human resource in agriculture, natural resources management, veterinary science, business and related fields.
- Highly rated in the East and Southern Africa region.
- Favourable institutional policies.
- Adequate land available for investments.

¹³ <http://www.suanet.ac.tz/investment/investment.pdf>

- Basic infrastructure available for attracting investments/outsourcing.
- Basic infrastructure available for training, research, outreach and businesses.
- Basic infrastructure available for ICT development.
- Institutional Strategic Planning.

Weakness

- Inadequate infrastructure.
- Limited ICT facilities.
- Limited use of available land for income generation activities.
- Inability to fully exploit information technology for e-learning, communication and networking as well as data-base creation and management.
- Difficulties in attracting the private sector to collaborate in offering some of the university functions, e.g., training for short courses.

Opportunities

- Core competence in the fields of agriculture, natural resource management and related fields.
- National, regional and global recognition.
- Ready market for most products and services.
- Increasing demand for agribusiness and other demand driven research and training.
- Favourable national and institutional ICT policies.
- The university has Television station (SUA TV) which can be used in ODL and Tech-MODE.

Threats

- Inadequate government and donor support.
- Stiff competition for meagre government resources.
- Speedy globalization and low ability to cope with new paradigm of borderless education.
- HIV/AIDS epidemic and its impact on the workforce to cope.

From the SWOT analysis, it can be seen that with the strengths of having good ICT backbone and opportunities available at SUA in the policies, Tech-MODE can be implemented using low cost ICT. The threats and weaknesses mentioned can be alleviated through a collaboration with other institutions like COL. For example, a collaboration can increase ICT facilities by filling the gap on the equipment required both for distance and lifelong learning. The collaboration will also address the stiff competition of institutions on government resources.

5.2 SUA's partnerships with other national and international organizations

SUA through the Computer Centre is ready to collaborate with any organisation with similar interest in ODL and Tech-MODE. Currently, the Centre collaborates with Soil Water Management Research Group at Sokoine University of Agriculture in projects related to ¹⁴Parched Thirst Computer Simulation Model (www.suanet.ac.tz/cc/PTmodel/).

We are also collaborating¹⁵ with other African universities in African Virtual Open Initiative and Resources project (AVOIR) which developed an open source e-learning system called KEWL.NextGen. The SUA participated in pilot discussion of implementing Distance Learning Material Development and Delivery in the Global Open Agriculture and Food University¹⁶. Furthermore, the OUT uses the SUA as learning centres, and students are taught by the SUA lecturers during vacations. Students also use the SUA library, the classrooms and the science laboratories.

In addition, the SUA has a constituent college, the Moshi University College of Co-operative and Business Studies which offers both face-to-face and distance learning education.

5.3 Future plans with the ODL and Tech-MODE initiative

The Directorate of Computer Centre which has been given the mandate to incorporate ICT into university operations (i.e., research, teaching and consultancy) will have the task of restructuring teaching materials which are in hardcopy so that they fit ICT based distance education. In future, when DE will become operational, there is a challenge of changing the course materials for teaching and research output for outreach programmes into the national language (Swahili).

The authors recommend the establishment of a new unit within the Directorate of Computer Centre which will be responsible for ODL/Tech-MODE. We also recommend the establishment of regional study centres. The unit will have five sub-units:

1. **Instructional design sub-unit:** This will support sound pedagogy in the use of technology in teaching-and-learning. Other functions of this unit will be course writing and writing techniques, developing learning resources, and reviewing and editing existing distance education materials.
2. **ICT literacy sub-unit:** This will train students in computer literacy and the use of applications software.
3. **Digital multimedia sub-unit:** This will provide services to supports the use of digital multimedia such as video in support of teaching and learning.
4. **Materials development sub-unit:** This will be responsible for the development of manuals and simulations to support training.

¹⁴ http://www.nrsp.org.uk/database/project_view.asp?projectID=299

¹⁵ http://ics.uwc.ac.za/index.php?module=cms&action=page&id=documentrepository_38

¹⁶ <http://www.openaguniversity.cgiar.org/Publications/ImplementationPlan.pdf>

5. **Administration sub-unit:** This will be responsible for integrating the new knowledge, maintaining administrative information, evaluating and testing distance education courses as well as administering and monitoring the function of the e-learning platform.

It is also proposed that ODL and Tech-MODE should start with institutes which are in Morogoro region, and later on we can roll to other regions. It has been proposed that the SUA Solomon Mahlangu Campus be the regional learning centre for ODL and Tech-MODE, while the study centres will be the Livestock Training Institute (LITI Morogoro) and the Ukiriguru agricultural college. There is also a need for including the Kilosa community centre. All these proposed areas have some ICT infrastructure, ICT literate lecturers and electronic course materials which should form the basis for further ODL and Tech-MODE implementation.

The functions of the proposed regional learning centre include tutoring and counselling. Also it should provide teaching and learning facilities; organize public lectures, discussion groups, workshops and seminars. In addition, it should disseminate information about ODL and Tech-MODE to different study centres.

The proposed study centres will serve as a focal point for student collaboration in project works, interaction with other students, attending seminars and tutorials, practical work and demonstrations, and for using reference materials. The study centres might be chosen either from existing secondary schools, colleges, institutes or universities, depending on the concentration of the students and the accessibility. The use of existing facilities like schools, colleges, libraries and universities would save some initial cost for project kick off. It is important that each study centre should have staff who will provide counselling and tutoring services to ODL and Tech-MODE students.

5.4 Available resources, capacity and accessibility

Availability of human and physical resources is a pre-requisite for successful distance education training. Currently, the following resources are available for distance education:

- The SUA Computer Centre with 20 technical and administrative staff. The centre also has servers which can be used for a database server, a web server, a mail server and a file server which can be used for this initiative. It is located in Morogoro region in Tanzania 200 km from Dar-es-Salaam.
- Telecentres¹⁷ and multi-purpose community centres found in many districts, which can be used as learning centres (e.g., Kilosa¹⁸, Sengerema¹⁹, Lugoba²⁰).

¹⁷ <http://community.telecentre.org/en-tc/taxonomy/term/1208>

¹⁸ <http://www.ics.trieste.it/Documents/Downloads/df4339.pdf>

¹⁹ <http://www.sengerema.or.tz/Default.htm>

²⁰ <http://www.lungalugoba.or.tz/>

- Some districts and regions of Tanzania have libraries which could be used as learning centres for ODL and Tech-MODE learners. Also, libraries can be found in universities (like SUA, UDSM, OUT, etc.) which may also be used as learning centres.
- Sharing regional centres and learning centres owned by the OUT. This is possible, if a prior arrangement can be made between the SUA and the OUT. The environment supports this because there is already an MOU between the SUA and the OUT.
- Agricultural colleges like LITI Morogoro, Uyole and Ukiriguru can be used as teaching and learning centres for ODL/Tech-MODE students.

6 Agricultural education at primary and secondary schools

According to Kondoro and Nungu (2006), a project called Tanzania Education Network (TENET) is a national network programme aiming at networking the higher and technical institutions, the teachers training colleges and, the secondary and primary schools in Tanzania. The TENET project is implemented in three phases in institutions namely; technical institutions, the teachers training colleges and the secondary and primary schools. Networking of teacher training colleges has already being done through assistance from SIDA. If all the three phases of TENET project are successfully executed, Tanzania will have the best environment for the incubation and execution of ODL / Tech-MODE for formal agricultural degree and post-graduate education, continuing professional education, lifelong learning for farming communities and agricultural education at primary and secondary schools.

Another benefit of TENET is that it will enable Tanzanians to fully utilise the benefits to be provided by the EASSy project after its completion. Therefore one area which has been identified by the TENET project to simplify connecting technical institutions and secondary and primary schools is through laying the back bone fibre cable throughout the country. Already initial work has started towards accomplishing the goals of TENET. The National ICT Backbone²¹ Network Feasibility study has been announced for companies to tender. In rural areas, where schools lack enough teachers and learning materials, e-learning²² has the potential to fill the gap.

7 Institutional challenges, limitations and weaknesses

Although significant amount of human and physical resources are available in Tanzania, we have challenges that need to be addressed as mentioned below by Sanga & Lwoga (2006):

²¹ <http://www.evd.nl/info/zoeken/showbouwsteen.asp?bstnum=184469>

²² <http://www.spidercenter.org/upl/filer/506.pdf>

- Inadequate funds for acquiring and sustaining the ICT infrastructure and the application technologies.
- Lack of prerequisite skills to manipulate new technology. The implementation of e-Learning programmes also requires skills in content development to repackage existing programmes and also design novel ones.
- Lack of government policies on the role of e-Learning in education and training also poses a big challenge. National ICT policy and SUA ICT policy are enacted for general ICT implementation. There is a need for specific ICT policy for education.
- Low bandwidth in the connectivity and speed of delivery systems in most of higher learning institutions in Africa.
- Maximum use of ²³new technologies such as open source software, free software and wireless connectivity solutions including GSM which has wide coverage in Tanzania.
- Little coverage of electricity which increases the cost of owning ICT infrastructure.

8 The way forward

General recommendations:

- Free and open source e-learning software should be used in higher education to realize the potential benefits of ODL.
- Establishment of shared ICT infrastructure for successful implementation of e-learning strategy. Infrastructure requirement is costly and requires involvement of various stakeholders. Therefore a multisectoral approach involving civil society, private sector and government is important, i.e., public private partnership.
- A mix of face-to-face and online learning & teaching for ODL and Tech-MODE. In future, there is a need to incorporate mobile learning using mobile devices into e-learning platform. This is due to the fact that in rural areas of Tanzania, the numbers of mobile devices outweigh the number of computers. In some rural areas, there is no electricity and this hinders the adoption of using computers for ODL and Tech-MODE.
- Training and capacity building programme should be developed for people in the educational sector, to develop ICT skills, skills on how to develop content for e-learning and how to integrate ICT in the learning environment.
- Course contents that will be developed under this initiative (ODL and Tech-MODE) can be provided without restrictions to copyright laws as in other initiatives such as open course ware (MIT²⁴ course ware). Open course ware is going to benefit large community (Sanga et al., 2006) of agricultural practitioners throughout the world.
- More awareness about ODL and Tech-MODE is needed for the universities and the general community at large, so that there is recognition and accreditation of

²³ http://www.wikieducator.org/ICT4Africa/Country_Report_Tanzania#Table_2:_Selected_ICT_Infrastructure_Statistics

²⁴ <http://ocw.mit.edu/>

distance education certificates, diplomas and degrees like those provided in the traditional face-to-face university education system.

Recommendations for the Forum for Agricultural Research in Africa (FARA) and the Commonwealth of Learning (COL)²⁵:

- FARA and COL should support the establishment of strong links between universities, agricultural research stations and extension offices, and with farmers through telecentres using free and open source e-learning software.
- FARA and COL should facilitate the capacity building of support staff in the development of content and maintenance management systems. They should also help build capacity of end users in their ability to access, contribute and use of scientific and indigenous knowledge.
- FARA and COL should support the establishment of shared ICT infrastructure for successful implementation of e-learning strategies, because infrastructure requirement is costly and requires involvement of various stakeholders.
- FARA and COL should consider supporting the incorporation of mobile devices into e-learning platforms for mobile learning.
- FARA and COL should support packaging and repackaging of huge and rich scientific and indigenous knowledge, which is currently lying on shelves and boxes.

9 Conclusions

To conclude, it is clear that ODL and Tech-MODE promise to provide new learning opportunities which will benefit all the agricultural stakeholders in our country and other countries at large.

Recommendations made in the implementation of Tech-MODE for Ghana by Osei (2006) suit most environments of developing countries (including Tanzania) because of the similarity of institutional and country challenges, limitations and weaknesses. But for ODL and Tech-MODE to be implemented in Tanzania, the following project activities as identified by Osei (2006) must be considered in terms of materials and financial support from governments, donors and the community at large:

- Holding a stakeholders meeting to discuss the roles, and responsibilities, verifying objectives and define activities to be conducted.
- Conducting a participatory needs assessment survey to understand farmers' information needs and their use of relevant media.
- Discussing the use of relevant media, in support of the delivery system.
- Training instructional developers to develop appropriate local content for delivery to target groups.
- Training facilitators in the use of instructional materials.
- Facilitating the broadcast of agricultural programmes and participation of extension officers and farmers in radio and television discussions.

²⁵ <http://www.fara-africa.org/files/FARA%20GA%202005%20proceedings.pdf>

- Facilitating farmer-groups to access agricultural information through radio and audio cassette recorders, Internet forums and discussion groups.
- Facilitating the establishment of more learning centres and telecentres which can be used as access point for agricultural information to the whole community.
- Providing a lifelong learning and ODL to enhance campus-based learning to many students.

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Status and Potential of Technology-Mediated Open and Distance Learning (Tech-MODE) for Agricultural Education in Uganda

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Executive summary

Uganda is well-endowed with natural resources but remains a highly indebted poor country (HIPC) and one of the world's twelve poorest countries characterized by prevalent hunger, malnutrition, low life expectancy (52 yrs), high infant mortality (67/1000) and death rates (13/1000). The economy is predominantly agrarian constituting 82% of the labour force. Poverty is largely attributed to the low human resource capacity in harnessing science and information communications technology (ICT) to overcome the constraints in agricultural production (e.g. drought, pests, diseases, weeds, markets, soil infertility). A study conducted by the International Food and Policy Research Institute (IFPRI) revealed that the greatest reductions in poverty and marginal returns in agricultural production in Uganda came from investments in agricultural research and extension followed by education.

The Inter Academy Council (2004) notes that the next generation of African students must have a strong and holistic science-based training with problem solving and critical thinking skills. In addition, they must possess good communication and inter-personal skills. This is a challenge for which the existing predominantly face-to-face mode of training in Uganda is compelled to face amidst the growing population. Implicitly, the future of agricultural education and research lies in exploiting advances in technology-mediated open and distance learning (Tech-MODE) because of its flexibility, reduced cost and interactive approach for reaching out to a larger population of learners.

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This country report highlights the major ways in which agricultural education is imparted at various levels in Uganda. An attempt has also been made to explore the potential for the use of ICT in agricultural education and training in Uganda. The policy environment surrounding the use of ICT is discussed and the infrastructural, human and policy challenges facing Tech-MODE have been identified. Finally, a few recommendations have been made for strengthening agricultural education to enhance its contribution to livelihoods using Tech-MODE. It is envisaged that the information here will inform the process of nurturing a partnership between the Commonwealth of Learning (COL), the Forum for Agriculture Research in Africa (FARA) and strategic institutions involved in agricultural capacity building in Uganda.

Keywords: Tech-MODE, distance learning, agriculture, Uganda

Principal acronyms

ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
CGIAR	Consultative Group on International Agricultural Research
COL	Commonwealth of Learning
EAC	East African Community
FARA	Forum for Agricultural Research in Africa
GDP	Gross Domestic Product
ICT	Information and Communication Technology(ies)
NAADS	National Agricultural Advisory Services
NARO	National Agricultural Research Organization
NARS	National Agricultural Research Systems
NEPAD	New Partnership for Agricultural Development
ODL	Open and Distance Learning
RAIN	Regional Agricultural Information Network of ASARECA
RUFORUM	Regional Universities Forum
Tech-MODE	Technology-Mediated Open and Distance Education

1 Agriculture in Uganda's economy

Since Uganda's independence, agriculture has been contributing the highest share of the national economy with about 80% in the 1960s. In the years that followed, the agricultural sector experienced negative growth rates due to civil strife, economic mismanagement, the disintegration of public infrastructure and services, a lack of adequate private sector investment and the scarcity of foreign exchange for agricultural inputs. Critical changes occurred between 1986 and 1992 because of the government's economic recovery program introduced in 1987 and structural adjustment policies. The notable changes include liberalisation of the marketing of agricultural produce, abolition of export taxes and removal of other market distortions, establishment of regulatory and promotional agencies for key export crops, dissemination of quality

control and market information. During this time, the agricultural sector experienced a high annual growth rate of 6% from 1992 to 1996.

In recent years, the contribution of agriculture to national economy has declined gradually, being replaced by industrial and tourism sectors. Although the proportion of the population living below the absolute poverty line has declined from 56% in 1992/93 to 35% in 1997/98 and 31% in 2007, household incomes are still low and food security is not guaranteed and about 40% of the population is food insecure (MFPED, 2007). The major reasons for this situation include weak linkages between the research system and the farmer, inadequate extension services that reach only a few farmers, low rates of technology adoption-(> 30%), and only one third of total food production is marketed and 56% of total agricultural GDP is subsistence production for household consumption.

Nevertheless, agriculture is the most important sector of the economy, employing over 80% of the labour force, and contributing 38% of GDP (2006) and 90% of exports. The importance of agriculture for the national economy has been recognised and the Plan for the Modernization of Agriculture (PMA), intended to establish improved agricultural methods and the commercialization of farming, was introduced in 2000. Central to plans to modernise the agricultural sector is the design of a policy and, subsequently, a strategy to cover both the formal and non-formal provision of agricultural education and training. In 2003, a task force was established by the Ministry of Education and Sports (MOES), charged with the development of the policy and strategy.

2 Agricultural training and education in Uganda

The importance of agricultural training and education to the national economy of Uganda is recognised by the government as reflected in the curriculum of education in both the secondary and tertiary institutions. However, the relationship between agricultural training and education, and agricultural development in Uganda is a subject for research. About 67% of Uganda's GDP is contributed by smallholder subsistence farmers engaged in agriculture and largely without formal education. Graduates in agriculture often view their education as the door to exit from the 'poor' farming echelons. Many smallholder farmers make huge sacrifices to support the training and education of their children while instilling in them the spirit of aspiration to be better than them. This begins early before or during primary schooling.

In primary schools, agricultural education is not formal but most traditional schools own farm gardens where pupils participate occasionally in farm activities. In many cases, participation in school gardening is used as a punishment. This is incongruous with the practice in more developed countries like South Africa, where school children actively and joyously do school gardening. Such cases serve as opportunities for exposure and change of mind sets using ICT. The primary targeting could be

pupils but spreads to teachers and parents. Formal education starts at secondary level with agriculture as an optional subject.

In the past, there used to be a number of post-primary farm schools for those who were not able to continue to the secondary level (e.g. Ssesse farm school) but most of them were converted into secondary schools. Secondary schools (lower and higher) are often ill-equipped for preparing students for careers in agriculture. In comparison with other subjects, there are very few books and training materials dedicated to agriculture. Besides, most of the teachers are often not originally trained in agriculture but adapted from other subjects such as biology.

At the tertiary level, there are two kinds of institutions for preparing professionals in agriculture, namely; agricultural colleges and Universities. The agricultural colleges are the equivalent of Community Colleges in the U.S. and they award diplomas and non-diploma certificates in agriculture. Until recently, we have had three agricultural colleges (Bukalasa, Busitema and Arapai). Busitema is gradually being transformed into a University. Graduates trained in colleges are highly skilled and often employed as farm managers, while those not placed serve in the decentralized local governments as extension workers. A few who excel and graduate with upper second or higher diploma classification often sit for a qualifying/mature entrance examination for entry into the university.

University-level agricultural education is probably the most popular for the higher secondary students, of sciences, and, for one reason or the other, fail to qualify for medicine. Often, those admitted do not place agricultural education as their first choice and hold a low interest. The solace comes from the diverse options including Agricultural Economics that guarantees departure from the “gas” in the labs and a “gap” with the soil. There are three public Universities (Makerere, Gulu and Kyambogo) and at least three private Universities that offer a bachelor’s degree in agriculture. Busitema University has been established by the Act of tertiary institutions and is in the process of admitting agriculture students at the bachelor’s level. Currently, only Makerere University offers postgraduate degrees in agriculture in Uganda. Plans are afoot at the Gulu University to begin Master’s degrees.

At Makerere University, agriculture related education is imparted at the Faculty of Agriculture and the School of Education. The School of Education, independent of the Faculty of Agriculture, educates teachers including those that teach agriculture in secondary schools and awards them a B.Sc. in Education. The Faculty of Agriculture trains agricultural professionals in the following programs:

- B.Sc. Agriculture
- B.Sc. Food Science and Technology
- B.Sc. Agricultural Extension Education
- B.Sc. Agricultural Engineering
- B.Sc. Agricultural Land use and Management
- B.Sc. Horticulture
- B. Agribusiness Management

In 2004, the Faculty of Agriculture in Makerere University started a Continuing Agricultural Education Centre (CAEC) located at the Makerere University Agricultural Research Institute, Kabanyolo (MUARIK) with the aim of providing in-service training in agricultural-related subjects for local government staff, private sector and individual farmers. Until recently, the training has largely followed the traditional face-to-face top down teaching with unidirectional flow of knowledge. In 2004, the University adopted the innovation systems perspective and trained an initial batch of 26 staff in personal mastery skills funded by the Rockefeller Foundation and IAR4D competences jointly conducted with the International Centre for Development Oriented Research in Agriculture (ICRA) and the National Agricultural Research Organization (NARO).

A survey conducted by the task force of the National Agricultural Education Strategy (NAES) in 2004 identified the following major challenges facing formal and non-formal agricultural training and education:

- Lack of a coherent policy for agricultural education and training.
- Insufficient funding for agricultural education and training.
- Ineffective institutional framework for the delivery of agricultural education and training.
- Inappropriate curricula and teaching and learning methodologies in agricultural education and training.
- Negative attitudes towards agriculture in general and agricultural education and training in particular.

These findings are in agreement with the Inter Academy Council (2004) which also noted that the graduates produced were lacking in a holistic system and critical thinking problem solving skills and were also ill-prepared to assist farmers in the real world. Clearly then, government commitment provides an environment conducive to promote agricultural education and training. As will be seen later in this case study, already some activities to this effect in the policies are being implemented.

3 Agricultural education and training policies in Uganda

For a long time, the government of Uganda has valued agricultural education and training but had not explicitly expressed its commitment to it. Recently, the government paid particular attention to agricultural training and education. However, efforts have been made to promote agricultural development and some of these developments are implemented through the following government interventions:

Plan for Modernization of Agriculture (PMA, 2000)

The PMA is the country's policy framework for promoting agricultural development largely by moving towards commercialisation. The Plan has the four main goals of:

- creating a framework for rapid economic growth and structural transformation;
- ensuring good governance and security;
- increasing the ability of the poor to raise incomes;
- increasing the quality of life of the poor.

The component of this policy framework responsible for non-formal training is the National Agricultural Advisory Services (NAADS). NAADS is a parastatal of the Government of Uganda designed to develop a demand-driven, client oriented and farmer-led agricultural private service delivery system particularly targeting the women and the poor. The NAADS programme was conceived as a result of the failure of traditional extension approaches to bring about desired productivity and expansion of agriculture, despite costly Government interventions (Master document of the NAADS Task Force and Joint Donor Groups, 2000).

Besides, there is a law, the National Agricultural Research Act, enacted by the Parliament in 2005 to ensure implementation of the National Agricultural Research Systems (NARS) policy, which considers all educational institutions as an integral part. Until recently, training for local farming communities was mainly through the public extension system with an extension officer located at the sub-county level to provide agricultural advice to farmers. Many Non-government Organisations (NGOs) and Community-Based Organizations (CBOs) still play a key role in agricultural extension and education using such approaches as the Farmers Field Schools (FFS) and the Training-and-Visit (T&V) extension.

In October 2003, the Ministry of Education and Sports produced the draft policy on agricultural education, the National Agricultural Education Strategy (Government of Uganda, 2003), which has the following specific objectives:

- Reform the institutional landscape to provide a coherent structure for efficient and effective delivery of formal and non-formal agricultural education and training nationally.
- Re-conceptualise the nature and form of both formal and non-formal agricultural education and training to ensure that the courses offered are relevant to the contemporary individual and societal needs.
- Ensure full participation of all the members of society regardless of gender or disability in formal and non-formal agricultural education and training.
- Raise awareness and improve the status of both the formal and non-formal agricultural education and training at all levels of the education system and in the society at large.
- Ensure adequate supply of well qualified teachers and instructors for formal and non-formal agricultural education and training.
- Establish linkages between providers of agricultural education and training with national research, experience and knowledge base.
- Define and implement an effective quality assurance system in the delivery of formal and non-formal agricultural education and training using both institutional and national mechanisms.

National Agricultural Education Policy (NAEP)

The strategy in this policy is to reform learning and teaching practices to promote agriculture as a business and encourage people to join the agricultural sector. To ensure open participation, issues in the social environment, such as gender, conflicts and security, environment protection and HIV/AIDS will be addressed. An important strategy is capacity building and curriculum review to make agriculture relevant to local problems.

Education Sector Investment Plan

The Ministry of Education and Sports has developed the Education Sector Investment Plan, 2004-2015 and agriculture has been given special attention. A number of interventions related to agricultural education are being implemented by the Ministry of Education and Sports and these include the following:

- A revised primary school curriculum in which agricultural education is viewed as a discrete subject and examinable from 2005.
- Pre- and in-service teacher education programmes in some primary teachers' colleges to improve teaching and learning methodologies.
- Promotion of a practical approach to agricultural education in core primary teachers' colleges and their cluster schools.
- Training programs for specialist teachers of agricultural education to promote the use of locally available teaching and learning materials.
- Incremental provision of equipment and teaching and learning materials for agricultural education and training.
- Introduction of an holistic approach to educational development as recommended in the mid-term review of the Education Sector Investment Plan (ESIP).
- An extensive programme of functional adult literacy.
- Plans to establish 850 community-based polytechnics in which agricultural education and training will be a compulsory field of study.
- Creation of District Agricultural Training and Information Centres (DATICs)
- Introduction of a new approach to the agricultural extension provision through NAADS which seeks to empower farmers to demand services (agricultural education and training) according to their needs through a farmers' forum.
- Decentralization of NARO's services as part of its outreach and partnership initiative to take research, training, information exchange and technology dissemination near to farmers.

4 National ICT and distance education policies

There is no explicit policy specific to agriculture or to education in general, but there has been a series of policy changes to facilitate the increasing use of ICT in education and public administration. It is increasingly accepted that ICT is a change agent of the 20th century and has the potential to fundamentally transform education, governance, commerce and the ability of citizens to participate more in the

development process. The sustainability of high education standards, economic growth and efficiency in operations of both private and public institutions, are dependent on the adoption and effective utilisation of ICT.

Although ICT may have developed earlier in many countries, Africa in general and sub-Saharan Africa in particular, still lags behind other regions in its use in training and education, research and administration. Over time, these technologies have gradually picked up and their use is getting widespread (Stephen and Shin, 2001). Training, research and education in agriculture is increasingly taking advantage of these developments to improve the quality and relevance of agriculture to national economies.

In Uganda, this trend is still emerging and has already taken shape in some institutions such as Makerere University, Uganda Martyr's University and the Uganda Management Institute (UMI). The government has also recognized the importance of ICT and a policy is available to guide the activities. The government has even committed a whole ministry to oversee the implementation of the proposed activities in the National Information and Communication Technology Services and System Policy and Master Plan.

The current policy on ICT and regulatory environment in Uganda dates back to the telecommunications sector policy of 1996, which was operationalised by the Uganda Communications Act, 1997. The policy on ICT developed by the government in 2003 clearly recognises the relevance of ICT in:

- health, education, agriculture, e-government, e-commerce;
- improved delivery of social services, reduction of vulnerability to natural disasters as well as reducing isolation of communities and providing immediate linkage to the modern world;
- improved transparency and governance through availability and use of ICT, introduction of new management and control methods in both public and private sectors facilitating enterprise resource management;
- introduction to the new knowledge-based economy;
- modernisation of the private sector through improved market access, sales, trade and knowledge of business trends;
- facilitation of research and development.

The current status of ICT in Uganda has been influenced by various policies, statutes, laws, acts and regulations. The more relevant ones include the following:

- The Press and Journalist Statute (1995) which extended Article 29(1) (Freedom of Expression) of the Constitution to the print media. It also created the Media Council, the National Institute of Journalists of Uganda and a Disciplinary Committee within the Media Council. The Council is responsible for regulating eligibility for media ownership and requires journalists to register with the National Institute of Journalists of Uganda.
- The Electronic Media Statute (1996) created a licensing system, under the Broadcasting Council, for radio and television stations, cinemas and videotape

rental businesses. The purchase, use, and sale of television sets were also to be subject to licensing by the Council.

- The Communications Act (1997) whose major objective was increasing the penetration and level of telecommunication services in the country through private sector investment rather than government intervention.
- The Rural Communications Development Policy (2001) aimed to provide access to basic communication services within reasonable distance to all people in Uganda.
- National Information and Communications Technology Policy Framework (2002) was prepared to give way to the ICT policy. The aim was to stimulate more participation in the socio-economic-political and other developmental activities, which lead to improved standards of living for the majority of Ugandans and ultimately enhance sustainable national development.
- The Information and Communication Technology Services and Systems: Policy and Master Plan came out of the policy framework and was finalised in 2003. Currently, the government has established a Ministry of ICT, which has the mandate to implement the policy.

5 Status of ICT and Tech-MODE for agricultural education and extension

Most of the agricultural training in Uganda is still predominantly face-to-face with limited use of ICT. Distance learning existed in Makerere University as early as 1953 but the focus centred on in-service training. In 1992, other degree programmes were introduced, which were extended to include graduate and diploma level training. To date, there are a diploma programme, three undergraduate programmes and one postgraduate programme taken under the distance learning arrangement. The course content and instruction is by blended delivery of face-to-face instruction and multimedia (e.g., books, CD, DVD).

A recent development is the USAID-sponsored project “Strengthening Agricultural and Environmental Capacity through Distance Education (SAEC-DE), which involves collaboration between Makerere University, University of Nairobi, University of Florida and International Center for Tropical Agriculture (CIAT) piloting distance education at Masters level for staff in the NARS to access degrees in the north without leaving home institutions. This project uses blended Tech-MODE and multi-media delivered by courier.

The use of ICT in agricultural education and training is yet to be exploited although distance learning is used in various universities and technical colleges. The Faculty of Computing and Information Technology at Makerere University provides the best facilities in Uganda and is the regional referral centre for ICT training, and works closely with the Directorate of Information and Communication Technology Unit of the University. The thrust has increasingly been to transform courses offered face-to-face to e-courses at certificate, graduate and postgraduate

levels using various course management platforms (e.g., KEWL, WebCT, ETUDE and Blackboard). However, the number of students who take these courses is overwhelmingly high compared to the number of computers available with a ratio of computers to students at about 1:40.

The institute has begun expanding its facilities to promote ICT training extensively. The University library has provided the students with Internet kiosks to access the Internet for at least 30 minutes after booking in the morning. This is a good starting point for improving the students' access to the Internet. In addition, it has piloted short training classes beyond midnight to try and overcome these challenges. Efforts to streamline and have a single course management platform are constrained by the binding contracts.

In other public universities such as Mbarara and Gulu, there is access to the Internet but its use for teaching is limited. In Gulu University in particular, academic staff have a common room with only two computers and four Internet ports, where one who has a laptop can access the Internet. However, in the department of computer sciences there are several computers, but their use is restricted to teaching the computer classes. In Kyambogo and Mbarara Universities, the situation is not much different except that the number of offices with the Internet access is more.

Other colleges and technical institutes still have limited access to computers and the Internet with the access restricted to important administrative offices. Martyr's University of Nkozi offers a distance learning combining face-to-face and other multimedia (e.g., books, CDs). Sometimes, the school library has been provided with a few computers but the computer to student ratio is normally too low to allow effective use.

For farmer training and other extension services, the Nakaseke Telecentre is an example of the application and development of ICT to enhance extension services. The Nakaseke Telecentre is part of a chain of five donor supported (UNESCO/IDRC/ITU) telecentre projects initiated in Benin, Mali, Mozambique and Tanzania (Prakash, 2000). The overall objective of the project is to stimulate rural development by facilitating access to information, learning resources and communication technologies by the Nakaseke and Kasangombe communities and support improved medical services through telemedicine. The Nakaseke Multi-Purpose Community Telecentre has introduced new information and communication technologies to this rural area. In three years, the Telecentre has catalysed a number of development activities in the region.

6 Issues affecting introduction and adoption of Tech-MODE

Considering the available infrastructure, current and upcoming policies on ICT locally and regionally, many opportunities are available to promote Tech-MODE as a method of instruction in agriculture. However, several challenges still exist that

may hamper the success in the wider use of Tech-MODE for agricultural education for development. What may be the opportunities and challenges?

6.1 Opportunities

Action Aid has made efforts to empower 26 communities of poor people in Uganda suffering from HIV/AIDS to advance their development using ICT. They concluded that ICT by themselves are not enough to bring about a reduction in poverty. The need of the hour is to mainstream ICT in the development initiatives. According to the study carried out by the International Food and Policy Research Institute (IFPRI), investments in agricultural research and extension as well as generic education had the greatest impacts on poverty and agricultural productivity.

Institutions like Makerere University are at an advanced stage of implementing their ICT action plans. This changing climate creates ample opportunities for the other institutions to support and/or emulate their programmes to fit into a framework at the national level (EAC, Secretariat, 2005).

The ICT trade liberalisation policy in Uganda has proved to be successful and helped the proliferation of the ICT usage in the country. A similar trade strategy with harmonised policies may well be adopted by potential institutions.

Several successful projects at the national level have created an enthusiastic environment for ICT-led initiatives though constraints in funding have hindered their scaling up. A good example is that >1.5 million people possess mobile phones.

There is a moderate growth in the pool of trained ICT personnel in the government offices, including the Ministry of Agriculture, across the region. However there is a problem of retaining these personnel in these departments. Apparently, at least every department has some ICT personnel. This is important because lobbying for promotion of Tech-MODE can have widespread acceptance by the government.

Mobile teledensity is improving at an impressive rate and a wider spectrum of Internet service options is available to the citizens today. The service providers, such as MTN, and Uganda Telecom, and other private individuals, are keen to provide connectivity at a better speed and price in more remote locations than urban hubs.

The presence of a common language of instruction in all institutions, English, makes it advantageous in terms of local expertise and a tradition of higher education. If properly planned, this can be instrumental in promoting inter-university education in the East African region.

Uganda is well-oriented for the strategic strengthening of key organisations to produce necessary trained personnel in ICT at all levels. A sensitised environment

for higher education exists with a number of reputed centres of learning. Networking between institutes nationally proved to be encouraging (e.g., school net Uganda and Uganda Connect with a keen interest in expanding it to the regional level with universities / institutes joining hands in sharing experience, faculties and a credit transfer system. Currently, there are over 20 universities (both public and private) in Uganda. Networking between them and offering courses in ODL can go a long way to alleviate the existing scramble for education resulting from a large number of students.

The National Council for Higher Education, a regulatory agency established by an Act of Parliament to accredit Universities and their academic programmes can play a key role. This can further be developed to cover the East African Community by linking up with the Africa Virtual University, the Kenyatta University and some of the state of the art initiatives in open and distance learning (ODL) like the World Bank's Global Knowledge Gateway Centre at Dar es Salaam through collaborative arrangements with the Inter- University Council of East Africa and The East African Institute of Higher Education Studies and Development (EAIHESD) to serve a wider clientele in the East African Community (EAC) region.

Possibilities could be explored to extend this to the sub-Saharan Africa region (including the Africa University, Zimbabwe) through the Regional Universities Forum (RUFORUM) that links higher education among several Universities and the Regional Agricultural Information Network (RAIN) of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). Linkages can be achieved across Africa through FARA programmes (e.g., RAILS, BASIC, SCARDA, SSA-CP) and New Partnership for Africa's Development (NEPAD) with technical support from COL.

Decentralisation of power in the government to the grassroots levels is emerging as a distinct trend in Uganda and ICT is increasingly being seen as a tool for good governance. Networks of parliamentarians are being established to create a mass awareness among decision-makers and support enabling legislation for the growth of ICT-led development programmes and business environment. In this effort, the government is planning to procure laptops for the legislators at a subsidised price.

Legal reforms are underway that could provide a conducive legal framework for electronic transactions. There is awareness among an increasingly large number of people about the advantages of offering online services.. In fact, the government has established a full ministry to cater to ICT. This ministry is concerned with the implementation of the National ICT policy.

The National Planning authority is committed to operationalising the national ICT Policy and the various ICT Master Plans (e-government, e-commerce, e-health, e-education and e-information).

6.2 Challenges

Power supply is erratic and unstable in rural areas and it demands an added cost of providing alternative source of energy for ICT installations in rural areas. In Uganda, only 4.3% of the households with 2% in rural areas have electricity connections.

Computing facilities are still at the rudimentary stage compared to the large-scale operations required to establish and implement a well-functional distance learning programme. Email is still not used as a regular mode of communication and the overall use of computers is limited to basic application as a word processor. Most of the offices of academic staff are not networked and interconnected through LAN/WAN.

Internet connectivity, even where available, is not accessible to all the staff and this facility is mostly restricted to a few depending on their ICT related job responsibilities. Where available, the bandwidth is a major constraint particularly to real time communication and this has greatly impeded teleconferencing. In Gulu University, for example, only the library is equipped with about 10 computers and students can access the Internet. Even then, the computers are relatively old (Windows 98, 2000 operating systems).

According to a survey by Mega-Tech (Government of Uganda, 2002), combined Teledensity (mobile + fixed) is still low (< 3%). The digital divide is acute in the region with an average 80%-90% telephone/Internet subscribers concentrated in capital/major cities.

Connectivity and bandwidth is a major constraint. Outside the capital cities and a few major towns, there is little Internet penetration, making it a difficult task to deliver government services online in such locations and communities. The awareness about ICT and benefits thereof is low and ICT training cost in such areas is prohibitive. In addition, the cost of bandwidth availability is poor and expensive.

Though partner states have initiated a number of websites for its ministries and parastatals, most of these are not interactive and provide static content. Local contents on the web are scarce and difficult to develop, let alone update.

Different legal provisions regarding electronic governance in general (e.g., Right to Information/Official Secrecy Laws) are still to be harmonised in order to exchange information among the partner institutions. With the emerging regional cooperation in EAC, as reflected in the recently launched Customs Union protocol, an appropriate measure in harmonising information management laws has become necessary.

7 Facilities and resources for implementation of Tech-MODE

Most of the institutions do not have the necessary infrastructure to provide all the desired services electronically to all the students. In all cases, higher bandwidth is a constraint due to lack of funds. Additionally, the power supply is erratic and hardly reaches far away rural areas, making it difficult. Computers are mostly standalone in offices and are not networked. However, some institutions and departments with necessary enthusiasm and access to funds have gone well ahead in networking and providing the intra-office electronic communication.

In most institutions that have the Internet, access is limited to a few individual officers and it is not preferred as a regular mode of communication with most of the official communication still being done in the conventional paper-based system. In fact, some people point out the lack of necessary legal framework (e.g. suitable amendments in the evidence Act) as a hindrance to large-scale use of e-mail as a valid mode of official communication. Another common problem among institutions relates to the space available for the establishment of computer facilities.

Makerere University has made substantive establishments in terms of infrastructure for ICT as can be seen in Table 1.

Table 1. ICT Infrastructure in Makerere University as at July 2007

Project	Amount (USD)	Status
Skills training for end users	600,000	Ongoing
Library information system	300,000	Operational
Academic Records Information System	500,000	Operational
Financial Information system	300,000	Operational
Human Resources Information System	200,000	Operational
Data Network (Backbone)	2,00,000	80% complete
Email and Internet access	350,000	Operational
Computers and LANS	6,600,000	20% funded
Set up of ICT Support Unit	650,000	Phase 1 completed
Total	11,500,000	6,320,000 funded

Source: Makerere University ICT Master Plan 2005-2009.

8 Capacity strengthening needs to support Tech-MODE

Although there are a number of universities and higher technical institutions in the country, there is an overall lack of awareness about ICT among the average student population and many of them do not know how to fit themselves into the new knowledge society. This scenario is acute because most of the staff in the institutions completed their education years ago and now suffer from a fear-psychosis in the fast changing automated office-environment. Therefore, the lack of necessary supporting staff to sustain the initiatives is a major weakness of the existing situation to launch a full-fledged Tech-MODE programme. Opportunities for ICT-related vocational and higher technical training is severely restricted and it is difficult for an average academic staff to update their ICT skills even though most of them have had some kind of basic training in the use of computers (Kwemara and Mayende, 2006).

The budgetary allocation for staff training in ICT is small in comparison to the size of the staff population and the growing need for trained staff to run the Tech-Mode programs efficiently and effectively. Since 2002, the e-Learning department of the Directorate for ICT support (DICTS) at Makerere University has trained over 3,000 university staff and is still conducting an e-learning and Knowledge Environment for Web-based Learning (KEWL) aimed at training Lecturers from different faculties/departments. Platforms such as KEWL provide for interactivity between lecturers and students. They also make learning a two-way process and an interesting practice. Given the establishments and the continuous training of workforce in the university, there is much hope that the future for Tech-MODE in Makerere University seems bright.

9 Collaboration in Tech-MODE for agricultural education and training

Linkages between internal and external institutions are still meagre. As mentioned earlier, the Department of Distance Education in Makerere University offers distance learning but it is important to note that the use of ICT is limited. It is only Uganda Martyr's University that offers the Bachelor of Agriculture degree through the distance mode. Some linkages do exist among institutions. A diploma course is being offered jointly between the Open University of Tanzania and the Department of Distance Education of Makerere University.

A proposed training programme, Alliance for Improvement of Food Security for All (AINFSA), by the Department of Food Science and technology of Makerere University failed to start off after donor-funding failed to materialize. There is still a joint effort between Makerere University and the University of Wisconsin, Madison to develop a diploma programme in Integrated Food and Nutrition. The course is envisaged to adopt both traditional and modern methodology including correspondence, educational television, multimedia systems and Internet-based

systems to ensure cost-effective tapping of top expertise at Makerere University and elsewhere.

The East African Community is another gateway to promote Tech-MODE across member states. Academic institutions should drive towards making policies to introduce ODL programmes at schools and higher education levels offering affordable access to the Internet and multimedia resources. This can be achieved by creating pools at identified centres of excellence in the region. The RUFORUM is a good entry point for such an initiative. These policies should clearly build a knowledge-sharing and collaborative agreement among leading institutions in the region with recognized expertise in the areas of public administration, management, scientific and agricultural research aimed at building a capital of trained human resources for efficiently running e-learning initiatives. A pilot programme in this direction will be undertaken with the existing higher/technical education institutions of partner states drawing up a plan to harmonise standards, curricula and credit transfer options for the region.

The EAC regional e-learning programme on public administration will include a systemic support to the regional cooperation in research and development, exchange of good practices and pedagogical resources, teacher training and development of e-learning content and services. An initial endeavour might be the scaling up of and broadening the coverage of the World Bank's Global Knowledge Gateway based in Dar es Salaam across the partner states (EAC Secretariat, 2005).

So far, the links are more evident at higher levels but there is a need to ramify similar linkages at the lower levels, for example, those between Agricultural Research and Development Centres (ARDS), and NAADS. This can be effected through web-aided interfaces to help farmers access recent information about the technological innovations in different parts of the country to bypass the high costs involved in conventional extension methods. A proposed model illustrated in Figure 1 is based on the linkages which can be developed.

It is important to acknowledge the scarcity of resources for building the entire complex system. Therefore, beginning with a few regional telecentres and expanding at a later period would be acceptable. The following are priority areas for consideration:

- develop a common framework for online learning and distance education among training institutions;
- strengthen mechanisms for communication and coordination of the training community;
- position institutional capacity-building within the external environment (e.g., university partners, educational networks and other learning institutions);
- establish common quality assurance standards for capacity-building, including monitoring and evaluation.

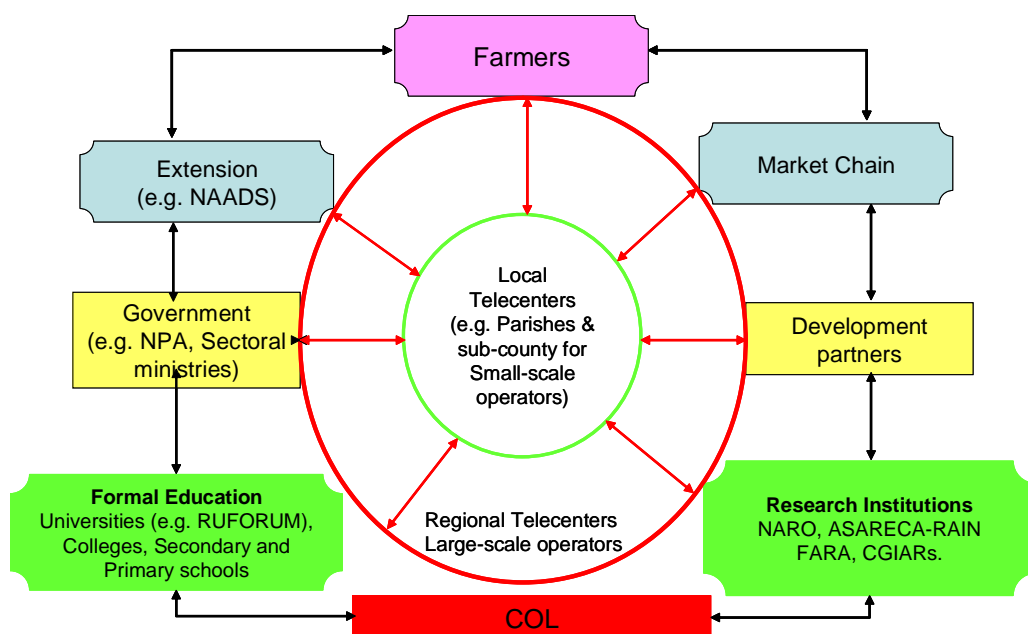


Figure 1. Web-aided stakeholder interfaces for improved training and education

10 Recommendations

Consider the following recommendations:

- Lobby NEPAD for extension of fibre optics marine cable to East Africa.
- Jointly developing courses and learning materials (reusable learning objects) among universities and other higher institutions of learning is a starting point for distance learning.
- Support all universities, technical higher education institutions and at least a few major secondary schools to access the Internet for educational and research purposes preferably over a broadband connection. The secondary-level training in elementary computer techniques is necessary as an induction approach to the e-learning environment.
- Leverage strategic partnerships for DE and online learning to scale up research outputs for increased impacts
- COL to assist in enhancing the effectiveness and efficiency of the African Virtual University to national Universities and other institutions of learning.
- Strengthen the community of practice (training officers) to improve synergies and communication with partners. A broad-based e-learning programme should launch a regional human resources development programme with appropriate structural funds and technical assistance from already established institutions within or from abroad, to provide ICT skills training. This initiative may be based on the proposed virtual university for the EAC.
- Capture synergies to enhance agricultural science and practice by strategically aligning Universities, development partners and relevant CGIAR centres and their resources.

- Support capacity building to establish a stable human resource base for propelling ODL in schools and Universities.
- Develop and deliver of modules aligned to the innovations systems through distance learning.
- Work with NAADS and linking with other institutions that work with farmers to improve service delivery by adopting the use of telecentres established at the sub-county level. Institutional participation is possible through specific tasks in the development of teaching materials for farmers and students. There is already a partnership between NARO and Makerere University where NARO staff have provision to teach in the University. This helps in developing and teaching materials that are suited to the local problems.
- Learning facilitators develop teaching materials for farmers and supply them to the telecentres where the extension officers facilitate farmers learning. Information may be developed in electronic media such as PowerPoint presentations, with illustrations and video recordings of field demonstrations.
- Link institutions involved in research through strengthening the efforts of the ASARECA network RAIN.
- Develop a robust framework of an action plan specifically drawn up by a joint committee of major tertiary level institutions and the National Planning Authority at the national level.
- Institutionalise a common quality assurance and standards system for training, education and learning in agriculture using Tech-MODE.

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Introduction and Adoption of Technology-Mediated Open and Distance Education (Tech-MODE) in Agricultural Education and Training in Africa: A Case Study of Zambia

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Executive summary

This country report assesses the potential for introduction and adoption of technology-mediated open and distance education (Tech-MODE) in agricultural education and training in Zambia. It is based on desktop studies and interviews with stakeholders in agricultural education and training. Despite adopting expansionist post-independence educational policies, Zambia has failed to achieve the critical mass of human resources required for sustainable agricultural development because of a variety of factors including inadequate agricultural policies and reduced productivity of vital sectors (mining, agriculture and manufacturing). However, the current agricultural policy (2005-2015) recognizes that achievement of agricultural education and training targets requires strengthening of both formal and non-formal education modes because the formal education system alone cannot meet national training needs. The Government has expressed a strong political will to support open and distance learning (ODL) through education policies that recognize ODL as a complementary mode of education, and an information and communications technology (ICT) policy that seeks to integrate ICT in agricultural education and training.

Zambian institutions have historically provided ODL in non-vocational disciplines, but Tech-MODE in agriculture is a relatively new concept. The concept is complex because it has strong vocational components, requires specialised technological

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methodologies, depends on students' abilities to motivate and manage themselves and requires a front-loaded investment. But the national ICT infrastructure is underdeveloped. Tech-MODE is also time-consuming, expensive to set up and requires efficient administrative support. Furthermore, it is subject to market forces, attracts a more diversified clientele, and requires credible qualifications, institutional accreditation and good practice to compete with class-based systems. These challenges will determine the performance of Tech-MODE in Zambia.

An assessment of existing institutional, human and material resources, previous institutional involvement in ODL and flexibility of institutional facilities and resources concluded that:

- six potential providers of distance education (PDEs) can offer Tech-MODE in agriculture; these include the In-Service Training Trust, Natural Resources Development College, two Zambia Colleges of Agriculture, Katete Centre for Agriculture Marketing and the University of Zambia;
- PDEs need support in re-training human resources, ICT development, market research and the development of a market-centred curriculum, resources for production and delivery of training materials and seed capital to launch Tech-MODE;
- the dual mode of ODL is the most appropriate for PDEs in Zambia;
- bilateral institutional collaboration between PDEs and the Commonwealth of Learning (COL) is an ideal pattern because costs of collaboration increase exponentially as the number of partners increases;
- the front-loaded nature of the costs of distance education favours collaboration between Zambian institutions and COL in the provision of distance education;
- long-term sustainability of distance education delivery depends mainly on the commitment of the Government to develop infrastructure, implement supportive policies and invest in ODL.

This study suggests that there is great potential for introduction and adoption of Tech-MODE in agricultural education and training in Zambia, provided institutional capacities of PDEs are strengthened or developed. It also makes recommendations on how Tech-MODE in agriculture could be introduced and sustained in Zambia.

Principal acronyms

ATI	Agriculture Training Institution
COL	Commonwealth of Learning
DDE	Directorate of Distance Education at UNZA
GDP	Gross Domestic Product
ICT	Information and communications technology
ISTT	In-Service Training Trust
MACO	Ministry of Agriculture and Cooperatives
MAFF	Ministry of Agriculture, Food and Fisheries
MCT	Ministry of Communications and Technology

NRDC	Natural Resources Development College
ODL	Open and Distance Learning
Tech-MODE	Technology-mediated Open and Distance Education
UNZA	University of Zambia
ZCA	Zambia College of Agriculture
ZEGA	Zambia Export Growers Association

1 The framework for Tech-MODE

In 1964, the Zambian government recognized the low levels of educational provision and the consequential under-development of human resources at the time of independence and adopted expansionist post-independence education policies (Mumba, 2002). The Government adopted open and distance learning (ODL) as one of the educational strategies for increasing access to both formal and non-formal education and for improving the quality of education (Lungwangwa, 1999; Mumba, 2002). Since then, the Government, non-governmental organizations and international institutions have invested in ODL to alleviate problems of access, equity and quality in educational provision. However, the Zambian economy has experienced a decline since the mid 1970s due to several reasons *inter alia* the low productivity of the agricultural, mining, and manufacturing sectors. The net effect has been a reduced per capita gross domestic product (GDP) and increased poverty levels are now estimated at over 70% of the population, living on less than US\$ 1 per day (MCT, 2006).

Economic turbulence coupled with a portfolio of austerity measures such as the structural adjustment programme progressively eroded the education system and reduced the living standards of many Zambians (IAS, 1996). The situation has been exacerbated by a turbulent shift to democracy and a free market economy. Therefore, despite the rapid and extensive extension of education and training services provided during the post-independence era, Zambia still experiences problems of limited access to education, a phenomenon that contributes to poverty and general socio-economic underdevelopment (Lungwangwa, 1999; Mumba, 2002). In response, the Government has adopted several strategies including Education for All (1991), Focus on Learning (1992), Educating our Future (1996), and ICT (2007). However, can technology-mediated open and distance education (Tech-MODE) play a role in agricultural education and training in Zambia? How feasible would it be? This country report examines these questions, and recommends the most feasible model(s) for introducing Tech-MODE in Zambia.

2 Economic and political context of agriculture

Zambia is a land-locked nation with a total land area of about 752,600 km² and a population estimated at about 11.7 million, with an average density of about 11 people per km² (World Bank, 2007). The estimated annual population growth rate has declined from 2.0% in 2000 to 1.6% in 2005, due to several reasons, including

successes in family planning programmes, public health problems, and the high incidence of HIV/AIDS.

Historically, the Zambian economy has depended mainly on the mining sector. However, the steady decline in the productivity of the mining sector has resulted in economic decline and erosion of the general standard of living (MCT, 2006). By contrast, the agricultural sector is increasingly assuming a key role in the development of the Zambian economy and will soon become the engine of growth for the next decade and beyond (MAFF, 1999b). The sector employs about 67 to 75% of the total labour force, the second largest source of employment after public administration. Although 50 to 60% of the population derives its livelihood from farming (IAS, 1996; MACO, 2004), the share of agricultural production in GDP has remained between 18 to 20%, contributing about 3 to 5% to export earnings (MACO, 2004). Agricultural GDP growth averaged only 1.5% per annum from 1965 to 1997 and exports for most years were less than 3% (Wichern *et al.*, 1999; MACO, 2004).

Zambia has the best surface and underground water resources in Africa, with many rivers, lakes and dams and 58% of Zambia's total land area is suitable for agriculture. However, only 14% of this land is currently being utilised for agriculture (MACO, 2004). Therefore, Zambia's largely underutilised natural resources could potentially be developed for production of crops, livestock and fish.

There are three categories of farmers in Zambia: small medium and large-scale farmers. The majority, about 800,000 small-scale farmers, have on average 1.5 ha (Francis *et al.*, 1997). They use simple farming tools and techniques, and rely heavily on family labour. The second category includes about 1000 large-scale commercial farmers along the line of rail (Southern, Central, and Lusaka provinces) and in eastern Zambia (Wichern *et al.*, 1999). These farmers use modern technology, hire labour, and produce food and cash crops as well as livestock. This category is characterised by high agricultural production. In between the two categories are 50,000 medium-scale farmers with per capita land size of 5 to 20 ha. These farmers usually use draught power.

Farming in Zambia is predominantly (99%) rain-fed with maize being the staple food and cash crop (MACO, 2004). Other cultivated crops include cotton, tobacco, sorghum, groundnuts and cassava. The livestock sector has declined in the last three decades because of several reasons including poor grazing, diseases, unfavourable macro-economic conditions and poor animal husbandry practices. However, the presence of several large wetlands, lakes and major river systems, combined with the wide diversity of habitats and species, favours the development of a lucrative fishing industry.

Before 1991, the Zambian agricultural policy empowered the Government to control the delivery of agricultural services and, to some extent, direct production of commodities through parastatals, cooperatives and other government-supported institutions (MAFF, 1999b; MACO, 2004). However, in 1992, the Government

embarked on agricultural policy reforms as part of the economic structural adjustment programme (MAFF, 1995a). The main aim of the reforms was to liberalise the agricultural sector and to promote private sector development and participation in the production and distribution of agricultural goods and services. From 1995 to 2001, the Agriculture Sector Investment Program (ASIP), under the then Ministry of Agriculture, Food and Fisheries (MAFF), was the main vehicle for implementation of agricultural policy objectives (MAFF, 1999b). ASIP adopted a holistic approach to provision of improved and sustainable services to the sector by enhancing production through free market development, reduced government involvement in commercial activities and provision of efficient public services.

Despite the enormous potential for high agricultural production, after four decades of experimenting with various economic and agricultural policies, per capita production has generally declined because of unfavourable weather, hostile macro-economic conditions, and untenable sectoral policies (MACO, 2004). Other problems not addressed by previous policy reforms include poor service delivery particularly for small-scale farmers, marketing constraints especially in outlying areas as a result of poor infrastructure notably feeder roads, a void in agricultural finance and credit, weak regulatory framework and poor enforcement of legal framework, unfavourable world and regional markets, and poor accessibility and administration of land in Zambia (Wichern *et al.*, 1999).

Following a review of previous agricultural policies in 2004, the Zambian Government embarked on a policy reform for the decade 2005 – 2015 (MACO, 2004). The overall objective of the new policy is to facilitate and support the development of a sustainable and competitive agricultural sector that ensures food security at national and household levels and maximises the sector's contribution to GDP. The policy addresses specifically the following:

- ensuring national and household food security through an all-year round production and post-harvest management of adequate supplies of basic foodstuffs at competitive costs;
- contributing to sustainable industrial development by providing locally produced agro-based raw materials;
- increasing agricultural exports thereby enhancing the sector's contribution to the National Balance of Payments;
- generating income and employment through increased agricultural production and productivity;
- ensuring that the existing agricultural resource base is maintained and improved upon.

The strategies for attaining these policy objectives include the strengthening and monitoring of the liberalised markets, facilitation of the private sector development, and diversification of agricultural production. The Government also endeavours to develop a science- and technology-led agricultural sector with emphasis on adoption of farming practices that are economically and environmentally sustainable.

The agricultural policy will result in:

- attainment of food security for the majority of households with at least 90 percent of the population being food secure by 2015;
- an increase in agriculture's contribution to total foreign exchange earnings from the current 3-5% to 10-20% by 2015;
- agricultural growth at between 7-10% per annum from 2005 onwards;
- a rise in overall agricultural contribution to GDP from the current 18-20% to 30% by 2015 and thus increasing the share of crops, livestock and fisheries;
- increased incomes of those involved in the agricultural sector.

3 Open and distance learning in Zambia

The Zambian Government recognises education as a key element in national development (MCT, 2006). Shortly after independence, the Government adopted different forms of open and distance learning tailored to specific educational and training needs in the country (Mumba, 2002). The objectives of ODL are to

- provide second-chance education for the dropouts of the formal education system;
- raise the educational level of public servants, teachers and general public;
- provide opportunities for re-entry into the formal and face-to-face education system;
- provide opportunity to gain further qualifications;
- allow people to learn while they work, thereby saving both the employee's and employers' resources;
- provide a relatively inexpensive form of education;
- overcome the shortage of trained teachers and other specialists;
- improve the quality of instruction in educational institutions;
- raise the basic standard of agriculture, health and education in general, which have assumed greater socio-economic importance;

The aim is to increase national literacy level and to develop the human resource to meet national educational and training needs.

Zambian institutions have historically provided ODL at the primary school level (Educational Broadcasting Services, EBS and Community Schools), at the secondary school level (National Correspondence College, NCC), and at the diploma and the undergraduate levels (Directorate of Distance Education, DDE, at the University of Zambia). Other ODL initiatives include in-service training (National In-service Teachers Training College), cooperative education (Zambia Cooperative College), radio farm forums for farmers (Agricultural Extension Services, Ministry of Agriculture and Cooperatives, MACO), broadcasting for literacy (Ministry of Community Development and Social Services), media and non-formal and informal education (Zambia National Broadcasting Corporation, Ministry of Sport, Youth and Child Development, Zambia Information Services). However, the post 2000 era

has seen a proliferation of local and international institutions that have launched the ODL mode from the postgraduate to the grassroots levels.

The potential for distance education in Zambia to contribute to socio-economic development has been widely recognised and several institutions have either launched or are keen launch new ODL programmes. However, the existing capacities of various institutions to offer ODL should be matched against necessary requirements for providing such programmes. Can Tech-MODE play a role in agricultural education and training in Zambia?

4 Agricultural education and training in Zambia

Since independence, in 1964, one of Zambia's major policy objectives has been to develop human resources to meet dynamic needs of the agricultural sector. As a result, the Government has established several institutions, which offer agricultural education and training at the degree, diploma, secondary and primary school levels as well as at grassroots level.

Agricultural training in the country is offered at various institutions including the University of Zambia (degree level), Natural Resources Development College (diploma level), Mpika and Monze Agricultural Colleges (certificate level). Veterinary training is provided at the University of Zambia (degree level) and the Zambia Institute of Animal Health (certificate level). Other institutions such as Kalulushi, Chapula and Kasaka Farm Training Institutes, Palabana Livestock Development Trust and Farm Training Centres provide short-term, demand driven courses. Some training institutions under the Ministry of Science, Technology and Vocational Training also offer courses in Agricultural Mechanics (MACO, 2004).

Co-operatives education and training is provided at the Co-operative College, Katete Centre of Marketing and Co-operatives and Kabulamwanda Co-operative Training Centre. Other training institutions such as the Natural Resources Development College (NRDC), Zambia College of Agriculture (ZCA – Mpika and Monze), the University of Zambia (UNZA) and Copperbelt University (CBU) are encouraged to introduce the co-operatives concept in their training programmes (MACO, 2004).

4.1 Formal university education in agriculture

Established in 1971, the School of Agricultural Sciences at the University of Zambia offers a five-year B.Sc. degree with majors in agricultural economics and extension, animal science, crop science, land management and food science and technology. In 1983, the University opened the School of Veterinary Medicine, which offers a six-year undergraduate degree in Veterinary Medicine to satisfy the need for qualified veterinary personnel in the country. Students, who initially enrol in the School of Natural Sciences, are admitted to the second year of the undergraduate programmes in the two Schools – Agricultural Sciences and

Veterinary Medicine. At the end of the second year, students in the School of Agricultural Sciences choose courses which lead to a B.Sc. degree with one of the five agricultural science majors. A research project and industrial attachments constitute a major component of the undergraduate programmes.

The two schools also offer two-year postgraduate (master's) degrees in veterinary medicine and agricultural sciences (with majors in agronomy and animal sciences). These programmes comprise one-year of taught courses followed by another year of research. The programme in agronomy attracts students from the SADC region.

In 1990, the School of Agricultural Sciences launched an in-service training programme in agriculture to share recent developments with stakeholders in the agricultural sector, including extension and research personnel, farm managers, land use planners, farmers and people in related fields.

4.2 Continuing professional agricultural education

Some of the institutions offering post secondary agricultural education and training leading to diploma and certificate qualifications in different areas of agriculture under the Ministry of Agriculture and Cooperatives are described below.

The Natural Resources Development College (NRDC), established in 1967, offers six three-year Diploma programmes in Agriculture (with majors in animal science, crop science, and agricultural business management), Fisheries, Agricultural Education, Agricultural Engineering, Water Engineering, and Food and Nutrition. NRDC also offers a four-year Diploma in Horticulture in partnership with Zambia Export Growers Association (ZEGA). The NRDC diploma is underwritten by the University of Zambia and its School of Agricultural Sciences is actively involved in curriculum development and quality management through the UNZA-NRDC Professional Committee. The College has a capacity of 300 full-time students.

The two Zambia Colleges of Agriculture (ZCA, Monze and Mpika) offer two-year general certificate programmes in agriculture. Their graduates constitute key front-line agricultural extension workers interfacing with farmers. Other commodity based agricultural training institutions were established to meet the specific needs of the sub-sectors such as the co-operative movement (Co-operatives College 1979), tobacco industry (Popota Tobacco College 1965); the dairy industry (Palabana Dairy Training Institute, 1965); and the horticultural industry (Zambia Horticultural Training Centre 1969). Kalulushi Farm College was established (1963) to train school leavers who would themselves set up farms or work on commercial farms. Two institutions, Katete Centre for Agricultural Marketing and the In-Service Training Trust (ISTT), provide competitive short in-service agricultural training. Their customised courses address dynamic needs of the agricultural sector.

Agricultural education and training institutions in Zambia have not adequately met the dynamic needs of the agricultural sector because:

- previous agricultural policies have lacked clear education and training objectives to meet the needs of changing agricultural landscape;
- declining national budgetary allocations to educational institutions have seriously undermined infrastructural development and flexibility in education service delivery;
- different agricultural institutions administratively belong to different sectors/sub-sectors and thus management of education and delivery of agricultural training programmes has been problematic;
- there has been a disconnect between educational institutions and other sub-sectors of the agricultural industry, resulting in training curricula which are insensitive to the changing overall national agricultural agenda.

Therefore, the current capacity of agricultural training institutions does not match the national capacity building needs of the agricultural sector.

4.3 Life-long learning for farming communities

The majority of farmers, especially in rural areas, are serviced by the national agricultural extension directorate in the Ministry of Agriculture and Cooperatives (MACO) and to a limited extent by NGOs and private organizations. Front-line agricultural staff stationed in rural communities usually conduct residential training for farmers at Farmers' Training Centres (FTC) available in each district in the country. In addition, the National Agricultural Information Services (NAIS) provides non-formal training through television and radio programmes. Programmes such as Rural Notebook, Farmers Notebook, Farm Magazine and the Zambia Radio Farm Forum have reached some of the 800,000 small-scale farmers in the country. Distance learning approaches have complemented the conventional extension initiatives considering the underdeveloped rural infrastructure and understaffed extension department.

4.4 Agricultural education at primary and secondary schools

The formal primary and secondary school curricula contain modules in agricultural sciences. In primary schools, topics in agriculture are taught as a component of environmental science. Many schools, especially in rural areas, have well developed gardens, which equip pupils with basic farming skills. At secondary school level, agriculture is offered as an optional subject and concerned pupils actively participate in School Production Units. As part of the assessment of the subject, students carry out a project on a given topic. In most cases, agriculture science teachers have at least a diploma in agriculture.

5 Current national policies on agricultural education and training

The Zambian Government recognises that the available numbers and loss of trained and experienced agricultural human resources are major factors contributing to unsatisfactory performance of agriculture (MACO, 2004). Despite past and present investments in agricultural training, the existing agriculture training institutions (ATIs) have not met the critical mass of the human resources required for sustainable agricultural development. The recent policy reviews have stressed that training must be relevant, systematic, coordinated and demand driven. They also look for efficient and effective utilisation of trained personnel in both the public and private sector.

The Zambian national agricultural policy (2005-2015) has given ATIs a fresh education and training mandate. The overall objective of the Agricultural and Cooperatives Training Sub-Sector Policy is to produce a critical mass of suitable and adequately trained cadre of people that will meet the needs of both the public and private sectors in a liberalised agricultural sector (MACO, 2004). Specifically, it seeks to strengthen the capacity of the agricultural training institutions, ensure that quality and relevant agricultural training is provided through curriculum reform and development of teaching resources, commercialise or privatise some training institutions and enhance autonomy in some, and institute a mechanism for monitoring and evaluation of agricultural training activities.

The Government's main strategies are to:

- undertake a training needs assessment;
- carry out short and long-term training at technical and professional levels, including farmer training;
- strengthen and carry out a programme of in-service training courses;
- promote agricultural education at both primary and secondary school levels;
- establish income generating ventures as well as cost-sharing mechanisms in local institutions of learning.

Considering that there has been no legal framework for establishment of several of its ATIs, the Government recognises the need to pass legislation through enactment of an Agricultural Training Act.

Agricultural training strategies of other sub-sectors (Crops, Irrigation, Land Husbandry, Farm and Mechanization, Livestock, Fisheries, Agricultural Cooperatives Development, and Agricultural Marketing and Credit Sub-Sectors) of MACO are to:

- build the capacity of members and employees of cooperative societies through the provision of education, training and other support services;
- develop training and education materials that address the needs of co-operative members;

- build capacity of MACO staff at national and field levels in gender analytical skills and techniques;
- facilitate the mainstreaming of gender in ATIs' curricula;
- promote and strengthen farmer groups and farmer field schools as targets for technology transfer;
- facilitate delivery of skills training and technology transfer to small-scale farmers using Farmer Training Institutes at staff level and Farmer Training Centres;
- use electronic and print media as communication tools to support extension information delivery;
- train field staff in farmer friendly extension methodologies;
- produce and distribute training and extension materials/manuals for both farmers and field staff;
- facilitate capacity building among stakeholders in the fisheries sub-sector.

The agricultural policy recognises that achievement of agricultural education and training targets requires strengthening of both formal and non-formal models of education because traditional methods are not adequate by themselves.

6 National ICT and ODL policies in relation to agricultural research, education, training and extension

Agricultural reforms in Zambia have created an enormous need to develop and re-train human resources to meet diverse needs of the agricultural sector. Unfortunately, a predominantly traditional formal educational system cannot meet the human resource needs of a dynamic social and economic development system. Similarly, agricultural education and training has traditionally depended mainly on formal training delivery systems, which have limited capacity to cope with the increasing training needs of sub-sectors in the industry. Therefore, as much as there are demands in the formal educational system, there are considerable training and continuing education needs in agriculture (MCT, 2006). Even with an influx of donor funding, Zambia cannot meet training needs of the changing agricultural landscape using the traditional educational and training methods.

Previous distance learning initiatives in agriculture have greatly complemented the formal educational and training system, especially in rural areas where the poor infrastructure (roads) development and understaffing of the extension sub-sector limit face-to-face sharing of agricultural information. However, the prospects of a sustainable distance learning programme in agriculture cannot be envisioned without considering the critical role of ICT. Therefore, development of agricultural research, education and extension sub-sectors greatly depends on sound ICT and distance educational policies.

6.1 Educational policies

Shortly after independence, Zambia adopted an educational policy aimed at increasing access to both formal and non-formal education and for improving the quality of education (Lungwangwa, 1999; Mumba, 2002). However, almost 45 years after independence, Zambia still experiences problems of limited access to education, a phenomenon that has contributed to poverty and general socio-economic underdevelopment (Lungwangwa, 1999; Mumba, 2002). Despite austerity measures introduced to revamp the Zambian economy, including liberalization of the economy, resources allocated to the education sector have declined, capital investment in the education sector has declined, and the number of qualified teachers in schools reduced. In addition, the number of scholarships for tertiary level education were drastically cut, tuition fees for post-secondary and higher education were instituted and the funding for capacity building in the education sector declined. Other measures introduced included parental contributions to primary and secondary education, and encouraging private education initiatives.

Institutional budgets have failed to keep up with inflation. Although 68% of the Zambian population is literate (World Bank, 2007), 40% of school age children in rural areas, and 20% in urban areas, do not attend school (Mumba, 2002). Thus, these reforms have excluded children and youths from low-income and vulnerable groups of the society.

Previous educational reforms have also created an enormous need to retrain staff in the teaching profession. Unfortunately, inadequate resources preclude development of adequate human resources using the conventional educational system within the required time frame. Alternative strategies are needed to redeploy scarce financial resources if literacy levels are to be increased.

In 1990, Zambia participated in the World Conference on Education for All, which adopted a World Declaration on Education for All and Framework for Action to meet basic learning needs. As a signatory to the declaration, Zambia, like many other countries, has broadened the scope of basic education to include early childhood, primary and non-formal (including literacy for youths and adults) (Mumba, 2002). The Government has, therefore, adopted several policy strategies including Education for All (1991), Focus on Learning (1992), Educating our Future (1996), and ICT (2007) to develop an education system that will meet the socio-economic needs of a developing society. Thus, current educational policies stress that to achieve education provision to a rapidly growing school age population and out of school youths and adults, there is need to expand both formal and informal modes of education delivery, and ICT becomes a handy medium.

6.2 Information communications and technology policy

Underdevelopment of the ICT industry has been a major contributing factor to the poor performance of the national economy (MCT, 2006). The limited capacity of Zambian citizens to actively contribute to, and draw from, the rich ICT-mediated

knowledge and technology reserve has deprived the nation of its much desired social and economic development. The Government recognises that the use of ICTs in education offers an opportunity for a wider process of self-managed change for vulnerable groups, the poor and the marginalised. In Zambia, distance learning has been delivered by physical means including libraries, postal communication and the print media, but these techniques have suffered from limited investment in infrastructure. Radio and TV are also popular media, but TV has limited coverage across the country. Thus, unless the ICT industry is developed, distance education provision will remain an under utilised resource.

Zambia's commitment to ICT development is demonstrated by the approval of the ICT policy in April 2007 and the inclusion of ICT as a priority area in the Fifth National Development Plan (2006-2010). The Government also created the Department of Communications in MCT, to coordinate and oversee the implementation of the policy. The ICT Policy objectives for the education sector are to:

- deploy ICTs at all levels of the Zambian educational system in order to improve and expand access to education, training and research facilities;
- modernise the educational delivery system with the aim of improving the quality of education and training at all levels;
- strengthen the administration and decision-making capacity in the educational system through the deployment of education management information systems;
- promote collaboration of research and development systems within the local industrial set-up to facilitate product development, innovation and delivery of world-class services that can compete on the global market.

The current educational and ICT policies have profound implications for agricultural sector development. The policies, if implemented, will increase the capacities of agricultural sub-sectors (education, research and extension) to deliver services through:

- increased access to information by stakeholders;
- increased literacy levels;
- increased infrastructural development;
- capacity building in ICT;
- use of ICTs to extend agricultural research facilities and increase access to higher education.

Thus, agricultural development depends on supportive educational and ICT policies.

7 Potential issues affecting the introduction and adoption of Tech-MODE for agricultural education and training

In Zambia, introduction and adoption of Tech-MODE for agricultural education and training may be a promising and feasible option of alleviating problems of access, equity and quality in education provision. However, there are many potential issues to be considered, if Tech-MODE is to be successfully adopted widely.

Most of the current distance education programmes in Zambia have a limited component of field or laboratory activities. Agriculture is perceived as a difficult subject to teach through distance learning to people in need of vocational training (Coote, 2002). Even with careful curriculum development, some face-to-face or 'hands on' are still required. Where distance agricultural education and training have succeeded, it is offered at the postgraduate level. Some providers organise day schools, weekend workshops, practical home experimental kits, local organisation or field visits, laboratory work, etc. for on-the-job practical training.

Many parts of Zambia are not connected to the national electricity grid and telecommunication systems. The cost of satellite access prescribes wireless technology as the only pragmatic and affordable option. Although most rural communities in Zambia can access radio programmes, internet, intranet and TV facilities are accessible mainly in urban and peri-urban areas. While the Government has approved the ICT, educational and agricultural policies that favour ODL, the existing infrastructure is still rudimentary.

For many people, introduction and adoption of Tech-MODE in the agricultural sector would represent a cultural shift from the present passive and dependent culture of learning to more self-sustained study and enquiry by students. This shift is difficult to internalise because most of the resources which people are used to are associated with the conventional educational system. The challenge is how to provide distance learning resources with an impact equivalent to that derived from formal agricultural education. Development of resources takes time, expertise and financial resources. Even in situations where an institution uses imported materials, adaptation of such materials to the local conditions can be costly.

The success of distance education will depend on the environment in which it is delivered. While rural communities need the opportunities Tech-MODE can provide, social problems, such as alcoholism, poverty, diseases, crime, unemployment, greatly undermine the positive attributes of the educational programmes. Management education and training is also a pressing need in several organizations. Employers should be keen to provide material and local support (coaching and mentoring) and on-the-job training in agricultural practical skills.

Distance agricultural education for the youth is likely to be more challenging than that for adults. Any model used for young learners, therefore, must ensure:

- well organised learning materials to suit the age group;
- careful selection of media and print;
- adequate local support for the learner and parents;
- thorough induction and clarification of roles for pupils, parents, teachers and supporting staff;
- speedy feedback on student questions and assignments;
- relevant curriculum to retain the interest of rural children and parents.

A successful ODL programme should adequately address the above requirements.

In Zambia, there is very limited experience of distance education in agriculture. A major challenge to adoption of Tech-MODE is the expertise needed to develop the agricultural learning materials and the resources to accomplish the task. There are few qualified agricultural teaching and training staff with expertise in distance education (Robinson, 1995). Therefore, there is a need to train teachers and trainers to equip them with skills and the level of expertise required to identify what kind of media to use, under what circumstances, and for which learners. So far, professional development of trainers is rudimentary.

The cost of developing distance education is a critical factor in promoting Tech-MODE. Contrary to the popular notion that distance education is cost-effective, it may be costly depending on the number of learners, mix of communication technology, media and learning materials, degree of learner support, salaries and employment conditions, production standards, institutional working practices and overhead costs (Billham and Gilmour, 1995). This educational approach is time consuming, expensive to set up and requires efficient administrative support.

Distance education is subject to market forces. Institutions need to consider the concepts of added-value and customer services as they apply in other fields (Billham and Gilmour, 1995). The challenge is that an average distance learner tends to be older, more mature, more experienced and potentially more demanding than an average full-time student. The service provider will, therefore, need a whole range of strategies to keep the distance learner satisfied, motivated and fulfilled.

The qualification and institutional accreditation tend to motivate students. Many students are keen to acquire qualifications from a reputable and well-established institution. The distance learner must be convinced that an institution will offer a qualification that is equivalent to that awarded under a formal educational environment. It is also imperative that quality management and assurance mechanisms are enshrined in distance learning programmes.

In short, a distance agricultural education and training programme can only succeed if there is a perception of good practice, based on quality of teaching

materials, clear course goals and objectives, media options, course administration, student support systems, assessment and feedback, calibre of tutors, local tutorial and practical support, study guidelines, flexibility of the programme and training needs assessment (Billham and Gilmour, 1995).

With a background of under-funding, Zambian institutions should demonstrate that good practice is a description of their course delivery. As the nation considers introducing and adopting Tech-MODE agricultural education and training, the challenges mentioned earlier should be ably addressed.

8 Facilities and resources for the implementation of Tech-MODE

Agricultural sub-sectors (education, research and extension) and other agro-based industries have inherent capacities to deliver distance education and training. The research sub-sector has research sites, libraries, laboratories, ICT (internet, intranet and telephone), seminar rooms, and access to farmers' fields. ATIs have teaching facilities (laboratories, libraries, classrooms, farms) and ICT facilities. The agricultural extension sub-sector has access to TV and radio facilities, Farmers' Training Centre, farmer field schools, and farm demonstrations. Agro-based organizations have a wide range of facilities including laboratories, ICTs (Internet, intranet, video-conference and telephones), conference rooms, commercial farms, processing plants, farm machinery, greenhouses and several other facilities.

Most of these institutions have hosted research and industrial attachments and would, therefore, serve as demonstration and research facilities for distance education programmes. It must be stressed that, although institutions have been under-funded over years resulting in underdeveloped infrastructure, some of the institutions have attempted to build up their capacities to the extent that they have either launched or are about to launch distance education programmes. Whatever the case, these institutions need recapitalisation if they are to offer quality programmes.

Zambia has invested substantially in human resource development for several years and has a high calibre of staff in most branches of agriculture. However, the nation has also experienced a high turnover of agricultural staff. Recognising the need to maintain a critical mass of human resources, the Government in its National Agricultural Policy (2004) outlines several measures aimed at training and retaining agricultural staff in the agricultural sector.

The Government and its international development partners are the main sources of funding for agricultural education and training in Zambia. Recent agricultural policies have also encouraged institutions to commercialise some of their activities in order to increase the funding resource base to sustain their programmes.

8.1 Institutions and facilities

Table 1 shows facilities at selected agricultural education and training institutions.

Table 1. *Facilities at selected agricultural institutions*

Institution	Facilities
University of Zambia	
1 School of Agriculture	Lecture rooms, laboratories, greenhouses, office accommodation for staff, research farm, access to agricultural research station fields, library, access to meteorological station, computers and internet, access to national radio and TV facility, telephone and fax, overhead projectors and VCR.
2 School of Veterinary Medicine	Lecture rooms, laboratories, animal clinic, farm, kennels, office accommodation, access to national animal research facilities, library, computers and internet, access to national radio and TV facilities, telephone and fax, overhead projectors and VCR. The University has a Directorate of Distance Education (DDE) and is an authorised internet service provider. Its computer networks are linked to the regional branches of DDE and tutors can interact with distance learners in their regions.
Natural Resources Development College (NRDC), Lusaka	Lecture rooms, office accommodation, library, laboratories, model village structure, commercial farm, ranch, access to green houses, orchard, engineering workshops, student accommodation, meteorological station, access to national radio and TV facilities, computer laboratory, telephone and fax, overhead projectors and VCR.
In-Service Training Trust (ISTT), Lusaka	Seminar and break away rooms, resource centre, office accommodation, participant accommodation, access to farms, research stations and farmers' fields, access to national TV and radio facilities, computer and internet, telephone and fax, overhead projectors and VCR.
Zambia Colleges of Agriculture (ZCA) at Monze and Mpika	Lecture rooms, office accommodation, library, laboratories, commercial farm, ranch, orchard, engineering workshops, student accommodation, meteorological station, access to national radio and TV facilities, video facilities, telephone and fax facility, overhead projectors and VCR.
Katete Centre for Agricultural Marketing (KCAM)	Lecture rooms, office accommodation, library, laboratories, commercial farm, ranch, orchard, engineering workshops, student accommodation, access to national radio and TV facilities, video facilities, telephone and fax, overhead projectors, VCR and access to regional marketing facilities.

All education institutions have basic facilities including office accommodation, lecture rooms, laboratories, libraries, and basic audio-visual aids. However, smaller Colleges such as Zambia Colleges of Agriculture (ZCAs) and Katete Centre for Agriculture Marketing (KCAM) lack computers and internet facilities. The range of facilities at an institution depends on the nature of programmes and the level of education and training they provide. The University of Zambia, which offers undergraduate and postgraduate programmes, has generally better infrastructure than colleges, while the ISTT has facilities designed to provide in-service training. The common feature of all institutions is that they are designed mainly for on-campus education or training. However, they would be very useful for residential schools, weekend workshops, or for other components of distance education for students based in areas close to the institutions. These facilities can be developed to provide quality ODL programmes in agriculture.

8.2 Status of individual and institutional capabilities for Tech-MODE

Although there is no specific distance education policy, the establishment of the Distance Education Unit in the Ministry of Education, production of the Government Distance Education Strategy Paper, approval of the ICT policy in 2007, and agricultural policy reforms strongly favour the adoption of Tech-MODE. It is important to stress that traditional distance education programmes have heavily relied on the print media, radio, and to a lesser extent TV facilities. However, the development of Tech-MODE in the long-term will depend on the development of a national infrastructure (telecommunications, roads, electricity grid, roads), especially in rural areas, which are still adversely affected by the digital divide.

Assessment of the existing institutional, material and human resources in selected agricultural and training institutions suggests that there is a capacity for introducing and implementing Tech-MODE programmes in agriculture. However, there is need to build the institutional capacities to ensure that Tech-MODE is sustainable in the long-term. The ability of an institution to provide ODL depends on human, material and institutional resources.

This section provides a brief assessment of the status of individual and institutional capabilities for introduction of Tech-MODE in Zambia.

In-Service Training Trust (ISTT)

The ISTT provides in-service training in agriculture and related fields. The Trust has a qualified team of subject matter specialists in agriculture. This team has been instrumental in the development, testing, and editing of distance education materials in selected fields of agriculture. ISTT has provided ODL programmes in collaboration with COL and other institutions in Lesotho, Mozambique, Namibia, Tanzania and Uganda and local institutions including DDE at the University of Zambia, Katete Centre for Agriculture Marketing, and ZCA Monze.

With an 80-bed capacity, ISTT is capable to hosting residential schools for distance learners. Within its institutional Strategic Plan, ISTT intends to offer a dual mode of training because it already has access to ICT infrastructure such as computers, internet and phones. In addition, the institution has human resources to manage ODL. It also has a resource centre, spacious seminar rooms, and good audio-visual aids. The Trust is a self-financing institution. Therefore, ISTT holds great potential for providing Tech-MODE in agriculture.

Natural Resources Development College (NRDC)

NRDC is an established diploma awarding institution with well-trained human resources and basic infrastructure to potentially offer distance education programmes. With its affiliation to the University of Zambia, quality management and assurance, and assessment schemes are consistent with guidelines given by the University of Zambia. The College has a library, a commercial farm, computers and phones to basically support ODL. Being a training institution under the Ministry of Agriculture, it can easily access the national radio and TV facilities. NRDC is funded by the Government although the current agricultural policy encourages institutions to commercialise some of its activities to supplement government funding. Although it has no history of offering ODL, it is about to launch an ODL diploma programme in agriculture. Therefore, introducing and adopting Tech-MODE fits squarely in its strategic plan.

Zambia College of Agriculture Monze

The college has experience in running ODL programmes and has a curriculum that is regulated according to MACO Cooperative and training sub-sector. The college has a library, a training farm and basic building infrastructure. Although, it currently has no access to computers and the internet, its experienced lecturers have maximised the use of the print media, and have some experience in training distance learners. The college is government-funded, but it is also encouraged to generate additional resources through commercialisation of some of its activities.

Zambia College of Agriculture Mpika

The Zambia College of Agriculture at Mpika has never offered any formal distance education programme. However, it is currently working with Copperbelt University to develop an ODL diploma programme in agroforestry. The College has a library, training farm, and basic building infrastructure for on-campus agricultural education and training. Although it currently has no access to computers and the internet, the lecturers have vast experience of teaching agricultural courses using the print media. The current initiative to introduce ODL programmes is a major incentive for improving its institutional capabilities and for adopting distance education in agriculture. In addition to government grants, the college is commercialising some of its activities to generate additional resources for its programmes.

Katete Centre for Agriculture Marketing

The Centre is an experienced open and distance education provider with access to a community radio station. It has good infrastructure, a library and has well-trained and experienced lecturers who have trained distance learners. Although the Centre has computers and phones, it has no access to the internet. The Centre plans to develop an ODL diploma programme in agricultural marketing.

University of Zambia

The two Schools, Agricultural Sciences and Veterinary Medicine, at the University of Zambia have great potential to offer distance education at undergraduate and postgraduate levels because they have

- well-trained lecturers and administrative staff who could easily be re-trained to offer distance education;
- basic infrastructure (laboratories, greenhouses, a research farm and clinic) and access to computers, telephones, TV and radio facilities;
- established quality management and assurance systems, education monitoring and evaluation systems and student support systems;
- collaborative links with other agro-based organisations.

Although agricultural and veterinary programmes have large components of ‘hands on’ requirements, they can draw lessons from the DDE within the University which are offering distance education.

DDE is electronically connected to its regional centres and as such is able to interact with its distant learners through the internet. The two Schools – Agricultural Sciences and Veterinary Medicine – could effectively utilise this facility to launch their ODL programmes in agriculture. Thus, the University can develop its capacity to offer Tech-MODE in agriculture.

8.3 Government support and potential available to implement Tech-MODE in collaboration with COL

Successful introduction and adoption of Tech-MODE in Zambia depends, to a larger extent, on Government policies in the agricultural, education, and communication sectors. Current policies strongly emphasise on communication infrastructural and ICT development, increased use of ICT in education and training, human resource development in the agricultural sector, development of a knowledge-based society. Other issues include restructuring of education and training institutions to strengthen ODL, capacity building, strengthening, retaining skilled human resources, and increasing the portfolio of funding to the agricultural sector. These aspects of Government policies provide a foundation for introduction and adoption of Tech-MODE in agriculture.

Although Zambia does not have a formally articulated policy to guide the distance education mode, the Government’s initiative to establish a distance education unit

in the Ministry of Education and to produce a publicly accepted formal Government strategy for distance education clearly demonstrates its commitment to enhanced education delivery through ODL. The establishment of NCC and Open Secondary Schools (Siaciwena, 1994), DDE at the University of Zambia, National Agricultural Information Services in MACO and several other sector-specific ODL programmes strongly suggests that the Government is committed to the development of distance education. In addition, the Government's commitment to the following is an incentive to the development of distance education:

- education through Education for All (1991), Focus on Learning (1992), Educating our Future (1996), Education for Better Future;
- ICT development by approval of the ICT Policy (MCT, 2006);
- the Agricultural Policy (MCT, 2004).

The educational and agricultural reforms, high turnover of agricultural staff, underfunding of the sectors, supportive Government strategies and the need to develop a knowledge-based society, have collectively generated acute training needs and there will be continuing need for education in the long-term. With 30% of school age children in Zambia not attending school (Lungwangwa, 1999), tuition fees and limited places in tertiary institutions, and with 70% of the population living on less than US\$1 per day (World Bank, 2007), the distance education mode is becoming increasingly attractive. In Zambia, there is a literate and educated population as potential students and conventionally well-qualified staff capable of delivering distance education, if re-trained.

Although Zambian institutions have not offered agriculture by distance education, there is experience of distance education in non-vocational disciplines and models from other countries to draw on that can inform the start-up phase of Tech-MODE. Association with international distance education institutions has assisted some Zambian institutions to participate in joint ODL programmes. In addition, there is willingness of development partners to fund the introduction of ODL approaches as part of development projects and explicit political will in several sectoral policy and strategy documents. Therefore, current educational needs can be associated with different benefits associated with ODL, including providing in-service training to agricultural staff, delivering on-job training to employees, tertiary education and supporting agricultural training for farmers.

9 Identification of capacity strengthening needs to support the implementation of Tech-MODE

The decline in the Zambian economy over the years has undermined the institutional, material and human capacity building capabilities of most potential Tech-MODE providers. The situation has been further compounded by limited experience of ODL in agriculture. Therefore, to successfully introduce and adopt Tech-MODE in agriculture, there is a need to:

- develop human resources in the use of information and communication technologies for teaching, administration and delivery of materials;
- strengthen institutions through provision of hardware, software and technical assistance;
- train teachers and trainers in production and use of educational materials.

However, capacity building and strengthening approaches should be sustainable in the long-term.

Before Tech-MODE is introduced, the PDEs need to constitute technical teams to:

- examine current ICT capacities, human resources and programme needs to ensure efficient deployment of resources;
- engage strategic planners to assist PDEs to concretise plans to incorporate or increase the use ICTs in distance education and training;
- plan and test satellite services;
- develop web-portal and train human resources in the use of ODL management software;
- examine the use of distributed printing for distance education.

Development of the ODL mode should also include building and strengthening the capabilities of teacher education institutions and that of primary and secondary schools to provide distance education in agriculture. It must be stressed that efforts to introduce Tech-MODE should embrace capacity building at all levels of the education and training systems.

10 Potential and issues for effective collaboration with COL

According to Truelove (1998), the general principles of distance education are:

- teacher and students are separated by physical distance;
- lesson materials are prepared in a structured, sequential order for study by students on their own;
- media are used sometimes in conjunction with face-to-face communication for the exchange of learning materials;
- the presence of an educational system.

Effective implementation of distance learning requires appropriate facilities and resources. Existing agricultural education and training institutions have curricula, instructional materials, instructional media, assessment schemes, student support systems, staff training, training management systems and ICT that have been designed mainly for formal education. However, due to under-funding, the capabilities of these institutions to provide quality education and training have been undermined and hence have failed to satisfy the human resource demands of the national economy. Therefore, although Zambia already has a tradition of distance education, very few institutions have inherent capacities to provide ODL.

Successful implementation of Tech-Mode for agricultural education requires well-trained human resources, including teachers, trainers, administrators, mentors, extension officers, ICT experts and others depending on the nature of the programme. However, there are very few Zambians who have been specifically trained in distance agricultural education. Several institutions, which intend to launch ODL programmes in agriculture, have to retrain their staff in the use of ODL techniques, administration, ICT and development of learning materials.

Zambia has an underdeveloped ICT industry for several reasons including due to under-developed infrastructure, limited investment in ICT and under-funding of institutions. Most of the agricultural institutions have limited or no access to ICT facilities and therefore their application in teaching, administration and developing training materials is limited. Such institutions need resources to either upgrade or introduce ICT in their training programmes.

Limited resources have hindered effective market research to enable institutions to design curricula that respond to the needs of the industry. Involvement of stakeholders in curriculum development has been problematic due to inadequate resources. Development of marketable education and training programmes will require institutions to consistently review their curriculum based on current training needs analyses.

One deterrent for introducing distance learning is that it requires considerable up-front investment to train staff, design curriculum, prepare materials and acquire selected technology (Saint, 1999). This front-loaded expenditure pattern suggests that the tertiary distance education projects are ideal candidates for international development assistance. COL can contribute to the seed capital and technical support to launch the programme over the initial phase of 4 to 5 years, ensuring that the programme is sustainable in the long-term. Zambian agricultural education and training institutions could greatly benefit from collaboration with COL. The most important areas of collaboration are curriculum development, development of instructional materials, telecommunications and technology, development of information services, training, and continuing professional education. Recent agricultural policies, which emphasise on distance agricultural education and training, suggest that that financial resource may increase due to:

- increase in budgetary allocations;
- income generating activities of the ATIs;
- donor funding;
- income likely to accrue from delivery of ODL;
- organisations sponsoring on-job training.

The ability of the institutions to mobilise financial resources will greatly determine the success of the programme.

10.1 Institutions and organisations to be involved and criteria for their selection

For an organisation to offer distance education, it must be legally established under the jurisdiction of the Ministry of Education or Ministry of Agriculture and Cooperatives. It should demonstrate that it has potential to effectively manage distance education with appropriate infrastructural facilities and adequately trained and experienced personnel. Educational standards should be comparable to class-based system complying with standards for academic and professional qualifications. The potential distance education provider must have qualified teachers, trainers and support staff. In addition, the institution should have:

- an educational system with adequate distance education technologies and sufficient integration of education media to ensure distance learners receive good educational services and pursue self-directed learning of high quality;
- a measurement, monitoring and evaluation system to ensure effective evaluation of learning achievement with quality comparable to class-based systems;
- an efficient checking and control system to ensure students learn, take examinations and carry out academic assignments by developing examination management for summative and formative evaluation;
- an appropriate quality assurance system comprising curriculum administration, instructional and research resources, student support system and market-directed training;
- an effective and appropriate internal quality assurance system according to external quality assessment system.

Although most Zambian institutions do not exactly match the criteria above, PDEs include the In-Service Training Trust, Natural Resources Development College, Zambia Colleges of Agriculture at Monze and Mpika, Katete Centre for Agriculture Marketing and the University of Zambia. These institutions are capable of providing distance education because they:

- offered a distance education course, either in partnership with other institutions or solely;
- are about to launch a distance education qualification programme;
- exhibited flexibility in their education or training programmes.

Distance education programmes for rural communities are designed according to conditions set by MACO.

10.2 Mechanism for the introduction of Tech-MODE

Most of the ATIs in Zambia that offer distance agricultural education and training are already providing education using conventional methods, thus the dual mode of education provision seems appropriate. Dual mode approaches that make use of existing academic staff and facilities reduce competition for scarce resources often associated with establishment of new institutions and erode staff resistance by

offering opportunities for direct staff participation (Saint, 1999). Likewise, common admissions policies for residential and distance education students and the awarding of a single qualification based on common standards will do much to offset the notion that distance education is of inferior status.

Institutions such as ISTT, the University of Zambia, NRDC and ZCA should safely adopt this ODL mode. They can involve all or some of their departments in distance education provision. The dual model allows the institution to build on its existing capacity. However, depending on available resources and facilities, the institution can either develop its own ODL materials or import materials and adapt them to suit the local conditions. If conditions and resources permit, institutions should develop their own training materials.

10.3 Pattern of collaboration with COL

Establishment of a distance education capability in Zambia requires both subject expertise and distance learning expertise. Most agricultural education and training institutions in Zambia have very little experience of distance agricultural education although they have provided on-campus education and training. Issues related to agricultural distance education are different from non-technical education and could not be easily explained by text, especially if students do not come from a technical society.

Bilateral institutional collaboration with COL is an ideal pattern. Daniel (1987) indicates that costs of collaboration (both monetary and non-monetary) are exponentially, rather than linearly, related to the number of partners. Considering that the agricultural sector is based on diversified agro-ecological conditions and unique socio-economic factors, the distance education programme should be jointly developed by the potential distance education provider and COL. Only in exceptional cases should external consultants be brought in to develop the capability of the PDEs in production or delivery of distance education.

10.4 Strategies for strengthening capacities for Tech-MODE

To build the capacity of agricultural education and training institutions to deliver Tech-MODE in Zambia, there is a need to:

- constitute teams to examine ICT facilities, use of print media, human resources, and programme needs;
- concretise plans to incorporate or strengthen ICTs in distance education delivery;
- secure resources for programming of piloting, dissemination and staff training;
- train academic, administrative and technical personnel in the use of ICTs for teaching, administration and delivery of learning materials;
- provide hardware, software, technical assistance and train personnel to maintain the ICT facilities;

- establish partnerships and collaborative networks to effectively utilise limited resources and create economies of scale.

The Zambian Government must fully support Tech-MODE in agriculture through implementation of agricultural, education, and communication policies and strategies that directly or indirectly support the delivery of ODL by agricultural education and training establishments. The Government should also take responsibility for mobilising stakeholders in ODL and facilitate the implementation of programmes through establishment of professional bodies.

11 Conclusions

An assessment of the potential for introduction and adoption of Tech-MODE in agriculture in Zambia concludes that:

- despite its efforts to expand the formal and non-formal education systems in the post-independence era, the Zambian Government has not yet developed a critical mass of skilled human resources to meet the dynamic needs of social and economic development, probably due to declining productivity of vital industries (agriculture, manufacturing, and mining), economic mismanagement and inappropriate policies;
- realising that the formal education system cannot meet all the human resource needs and national literacy demands, current education, agricultural and communication policies and strategies strongly emphasise on ODL as an education model that should complement the formal education system;
- although ODL in non-vocational disciplines is not alien to Zambians, Tech-MODE in agriculture is a relatively new concept;
- agricultural institutions with inherent capacities to provide formal education and/or non-formal education can be upgraded to offer Tech-MODE in agriculture;
- although the Government has expressed a strong political will to build the capacity of ATIs to deliver formal and non-formal education and training, it does not have adequate resources to accommodate all the requirements of these education models.

These findings clearly demonstrate that there is a great potential for the introduction and adoption of Tech-MODE in agricultural education and training in Zambia. However, long-term sustainability of distance education delivery depends mainly on the commitment of the Government to develop communication, education, and agricultural infrastructure. The front-loaded nature of costs of distance education favours collaboration between Zambian institutions and COL in the provision of distance education.

12 Recommendations

The study, therefore, recommends that COL should constitute a team of experts from COL, PDEs and stakeholders (public, private and voluntary sectors) to:

- conduct a training needs assessment and characterise individuals, groups and organizations, including key stakeholders in the agricultural sector.
- develop mechanisms for active participation of stakeholders in curriculum development which ensures that the Tech-MODE programme is market-oriented.
- evaluate the existing formal and non-formal education and training systems (infrastructure, ICT, curriculum, training materials and aids, human resources, funding mechanisms, quality assurance, accreditation and other programme needs of PDEs) to determine which components of the systems are directly transferable to ODL and those that must be developed.
- facilitate the development of institutional, human, and material resources to meet the requirements of Tech-MODE. The overall objective should be to develop human resources in the use of ICT for teaching, administration and delivery of materials; strengthen institutions through provision of hardware, software and technical assistance, and to re-train teachers in ODL methodologies, production and use of educational materials and assessment techniques. It should also develop long-term plans for strengthening or integration of ICTs in distance agricultural education and training.
- assess the existing market and cost the Tech-MODE programme to develop a sustainable cost-sharing mechanism and to ascertain the economic and logistical viability of the programme. This will guide COL and PDEs to secure resources for programming, dissemination of materials and training.
- suggest how PDEs can introduce and adopt the dual mode of Tech-MODE delivery.
- identify or facilitate the establishment of an independent professional body that should oversee the delivery of Tech-MODE in agriculture.
- suggest how the COL will work with the Zambian Government, which has an obligation to support most PDEs through direct funding, policies and strategies, infrastructure development, commercialisation of training activities, capacity building and retention of trained staff, and to solicit funding for ODL.
- suggest how bilateral collaboration between COL and PDEs could be established and maintained.

Apart from the existing formal education system, a few ATIs are either delivering, or about to launch, ODL programmes in agriculture using basic media techniques. Considering that Zambia has a tradition of distance learning in non-vocational, and to a limited extent, vocational disciplines, the approach to introduction of Tech-MODE should be to build on the existing structures. Where local expertise is available, the programme should extensively use it to deliver Tech-MODE in agriculture.

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