



Livestock sector training needs assessment report for East and Central Africa

LIVESTOCK SECTOR TRAINING NEEDS ASSESSMENT REPORT FOR EAST AND CENTRAL AFRICA

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Acronyms

A-AARNET	ASARECA Animal Agriculture Network
ADB	African Development Bank
AEEB	Agricultural Economics Education Board
AERC	African Economic Research Consortium
ARC	The Agricultural Research Corporation
ARRC:	Animal Resources Research Corporation
ASARECA	Association for Strengthening Agriculture Research in East and Central Africa
ASTI	Agricultural Science and Technology Indicators
AU-IBAR	Inter African Bureau for Animal Resources of African Union
BECA	Bioscience East and Central Africa
BIFAD	Board for International Food and Agriculture Development
BIOEARN	East African Regional Programme and Research Network for Biotechnology, Biosafety and Biotechnology Policy Development
BSc	Bachelor of Science
CABI	Commonwealth Agricultural Bureau International
CAPE	Animal Health and Participatory Epidemiology project
CAAS	The College of Agriculture and Aquatic Sciences
CGIAR	Consultative Group on International Agricultural Research
DARHRD	The Department of Agricultural Research and Human Resource Development
DGRST	General Delegation of Scientific and Technical Research
DRD	Department of Research and Development
EARO	Ethiopian Agricultural Research Organization
EARS	Ethiopian Agricultural Research System
EIAR	Ethiopian Institute of Agricultural Research
FA/UNR	Faculté d’Agronomie—Université Nationale du Rwanda
FAO	Food and Agriculture Organisation of the United Nations
GIS	Geographic Information System
GL-CRSP	Global Livestock CRSP
HRDP	Human Resources Development Plan
IAR4D	Integrated Agricultural Research for Development
ICIPE	The International Centre of Insect Physiology and Ecology
ICM	Information and Communication Management
ICT(s)	Information and Communication Technologies
IDR	Institute of Rural Development
IEHA	Initiative to End Hunger in Africa
IFPRI	International Food Policy Research Institute
IGAD	Inter-Governmental Agency for Development
ILRI	International Livestock Research Institute
INRS	Institut National de Recherche Scientifique
IRAZ	Institute of Agronomic and Zootechnic Research
IRST	Institut de Recherche Scientifique et Technologique
ISABU	Institute of Agronomic Sciences of Burundi
ISAR	Institut des Sciences Agronomiques du Rwanda
MAFS	Ministry of Agriculture and Food Security
MSc	Master of Science

NARC	National Agricultural Research Council
NARO	National Agricultural Research Organization
NARS	National Agricultural Research Systems
NEPAD	New Partnership for Africa's Development
ODL	Open Distance Learning
OIE	Office of International Epizootics
PACE	Pan African Programme for the Control of Epizootics
PhD	Doctor of Philosophy
RALEA	Regional Action for Livestock in East Africa
RAIN	Regional Agricultural Information Network
REDSO/ESA	Regional Economic Development Services Office for East and Southern Africa
SPAAR	Special Programme for African Agricultural Research
STI	Scientific and Technical Information
SUA	Sokoine University of Agriculture
TARP	Tanzania Agricultural Research Project
TTTRI	Tsetse and Trypanosomiasis Research Institute

Preface

The recent World Development Report concluded that in the 21st Century, for the agriculture-based countries, agriculture continues to be a fundamental instrument for sustainable development (World Development Report 2008). The lack of capacity has been a major limiting factor in a wide range of development programs and initiatives that have failed in the past.

Research-based capacity building is a core priority of ILRI because of the important role that research plays in economic growth and development as well as in addressing the rapid changes in bio-physical, socio-cultural, technological and the policy environments of the agricultural innovation systems in the developing as well as the developed world. The Association for Strengthening Agricultural Research in Eastern and Central Africa's (ASARECA) Animal Agricultural Research Network (A-AARNET) strives to strengthen the National Agricultural Innovation Systems (NARS) in Eastern and Central Africa Region to conduct livestock research and development. Over the years ASARECA and ILRI have forged a long-term partnership to build the required regional capacity to conduct livestock research within a broader framework—the integrated agricultural research for development (IAR4D).

An effective innovation system in the livestock sector requires a cadre of professionals with a specific skill mix. The changing paradigms and the ongoing transformation processes within the agricultural research and development system are calling for a changed behaviour of the change agents. To be relevant any capacity strengthening activity should be geared towards some specific outcomes. These outcomes are tied to skills and performance levels of the various actors in the innovation system. Capacity strengthening therefore should contribute to the overall performance of individuals, organizations and the society at large and should support the strategic directions of the research for development and the broader developmental goals. As a development input, capacity strengthening is a dynamic phenomenon that must be always present, but should truly reflect the changing conditions and ongoing transformations.

To ensure that the capacity strengthening activities are relevant and dynamic, A-AARNET and ILRI conducted during 2007 a livestock training needs assessment study. The preliminary findings of this study were presented and validated at a multi-stakeholder workshop held in Nyeri, Kenya. This report summarizes the findings of the training needs assessment study and the recommendations of the multi-stakeholder workshop. The overall purpose is to identify common priorities across countries in the region for collective action.

This task would not have been possible without the support and commitment of a number of individuals. We would like to appreciate and acknowledge the contributions made by Drs Mohammed El Habib Ibrahim and Jean Ndikumana, A-AARNET Coordinator, in conducting this study and preparing this report. All organizations and individuals who responded to the survey questionnaire and attended the consultative workshop are recognized for spending their valuable time and for making significant contribution towards this study. The support and continuous encouragement provided by ILRI senior management is also gratefully acknowledged and appreciated.

We recognize that the regional priorities identified in this document need to be complemented with focused national and sub-regional activities. It is our sincere hope that the findings of this study will pave the way for developing and implementing the livestock-related capacity strengthening activities in the ASARECA region. We will make every effort to support the national and regional initiatives in implementing these priorities.

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Author's note

The ASARECA Animal Agricultural Research Network (A-AARNET) and the Capacity Strengthening Unit (CaSt) of ILRI approach capacity strengthening by providing interactive knowledge and information products and services to support livestock R&D in East and Central Africa. Due to limited human resource capacity throughout much of East and Central Africa, National Agricultural Research Systems (NARS) are unable to adequately address issues critical for livestock R&D. NARS will need skills to solve complex problems. Universities in East and Central Africa also suffer from the same problem and have limited ability to train enough researchers in these areas. The changing paradigms for agricultural research for development require strengthening the capacity of other actors such as NGOs, service providers, community-based organizations, policymakers etc.

During the last two decades, A-AARNET provided capacity strengthening to a large number of researchers, university teachers and their support staff. However, the pace of global scientific progress and development of new paradigms created new demand for capacity strengthening. The stakeholders of A-AARNET listed capacity building need assessment as one of the milestones for integrated agricultural research for development (IAR4D). In order to fill this gap in knowledge and skills, A-AARNET in collaboration with ILRI conducted the Training Needs Assessments (TNA) study for countries in East and Central Africa. The TNA study is based on information from primary sources as well as secondary sources. A survey was done using an email questionnaire approach and a stakeholder consultation workshop was held in Kenya to fine tune the survey results and identify the priority training needs.

The outcome of this report will assist A-AARNET and ILRI to base their collaboration on capacity strengthening on the needs of the stakeholders and thus develop a bottom-up strategy. The process is an excellent example for efficient networking to strengthen capacity. A-AARNET is commended for funding this effort and working closely with CaSt to facilitate the process.

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Executive summary

ASARECA and the International Livestock Research Institute (ILRI) forged partnership to build regional capacity for livestock in East and Central Africa. The ASARECA Animal Agricultural Research Network (A-AARNET) strives to strengthen NARS in East and Central Africa region to conduct livestock research. The Capacity Strengthening Unit (CaSt) of ILRI offers opportunities for long- and short-term training for research and development practitioners.

To achieve the above goal, A-AARNET in collaboration with CaSt launched this study to assess the capacity requirements at individual, group, organizational and societal level—a needs assessment study. The objective here is to identify the priority learning and capacity strengthening activities to be facilitated and/or undertaken by the partnership. The study collected information and data in three approaches: (1) surveyed stakeholders using a questionnaire with key informants, (2) used secondary source information and (3) held a stakeholder consultation workshop.

The highest need for trained livestock research staff is in post-conflict countries. For example in Burundi, the sharp decline in ISABU's total number of researchers during the 1990s was relatively more severe for those holding doctorate degrees. A similar conclusion can be stated for Rwanda and Congo.

The stakeholder workshop, the survey and secondary sources revealed the need to build capacity for policy research. The need for capacity strengthening in animal health research was highly stressed. African countries demand building capacity for bioscience research. The establishment of the Biosciences Facility for East and Central Africa (BECA) raised hope for effective capacity strengthening in the skills needed. African institutions and scientists are eager that Africa is not left out.

Capacity strengthening for socio-economic research was given high priority by the stakeholders in many consultations and in this study. Many stakeholder consultations also confirmed the needs for training and retooling staff skills in East and Central African university faculties of agriculture. This will require ILRI's contribution to strengthening the capacity of partner universities in East and Central African countries.

The study recognized the need to strengthen capacity for Information Technologies and Communication (ITC) in East and Central Africa as part of the overall effort for improving research on livestock. Networking for research and capacity strengthening are highly needed for effective delivery and flow of information among the partners. ASARECA nurtures this type of approach.

Research managers stressed as high priority the need to strengthen their skills in strategic planning and priority setting. Specifically, insufficient funding was singled out as an important managerial constraint. There is a need to improve skills in efficient fund raising and maximum utilization of research funds. This will require proficient skills in writing convincing proposals. The challenge is for capacity building organizations to meet this demand and ILRI can play a brokerage role.

Post-graduate training was demanded for specialization in animal breeding, animal nutrition, range management and animal production. Courses were demanded for training in animal nutrition, analysis of feed, development utilization of non-conventional feed resources, forage crop breeding and forage conservation techniques, policy analysis, communication, negotiation, strategic planning, marketing, monitoring and evaluation, team building, resource mobilization, advocacy and leadership skills.

This survey and secondary sources concluded that it is time to engage in e-learning. There are two approaches—the open distance learning approach and the ILRI e-learning approach.

The study led to the following recommendations:

1. ASARECA should strengthen A-AARNET capacity building component.

2. Funds need to be raised for livestock capacity strengthening on a regional basis through strengthening abilities in proposal writing, project management, reporting and public relations skills and management of dynamic databases for grants, grant-giving institutions and local expertise.
3. Livestock research institutions are required to streamline the functioning of capacity strengthening units and link them to collaborate with CaSt in ILRI.
4. A-AARNET and ILRI, in collaboration with partners and advanced research organizations, should develop strategies for capacity strengthening that will train scientists and their support staff deficient in high priority areas as revealed by this study including soft skills as well as technical skills such as animal health, biosciences, socio-economic skills with particular emphasis on marketing, policy research and animal genetic resources.
5. ILRI, being the hub for the BECA and utilizing innovative approaches such as e-learning approaches, should develop strategies for bioscience training to include as high priority post-graduate training, training materials and short specialized courses.
6. ILRI should continue its e-learning platform to produce training resources in various priority topics identified in this study.
7. ILRI should join the distance learning approaches in the region, e.g. the CGIAR Global Open University, the MSc Programme in Economics for East and Central Africa. ILRI should become more engaged in the CG Online Learning Resources.
8. ILRI should work closely with A-AARNET in all aspects of livestock capacity strengthening. It is important that ILRI network with NARS, sister IARCs, the Inter-University Council for East Africa (IUCEA) and other regional organizations, e.g. the Organization for Social Science Research in Eastern and Southern Africa (OSSREA).
9. A-AARNET, ILRI and partner NARS should pursue an aggressive fund raising campaign.
10. A-AARNET and ILRI should continue their efforts in post-graduate training but direct the effort to areas rated as high priority by the stakeholders.

The study identified gaps in capacity for implementation based on A-AARNET priorities. The study, in all of its three approaches to collect data and information, used as background the changing paradigms for Integrated Agricultural Research for Development (IAR4D) and the five priority themes identified by the stakeholders for A-AARNET. Emerging issues (e.g. biotechnology, climate, avian influenza etc.) were taken into consideration in response to the changing global situation.

1 Introduction

Agriculture plays a key role as a source of income for almost 150 million people in East and Central Africa and is a leading sector in most countries. The rural people of sub-Saharan Africa live on diverse agricultural activities among which livestock plays an important role. Livestock accounts for more than 11% of the gross domestic product (GDP) of the countries of the region. However, there is increasing pressure on land while feed resources are also diminishing. This represents a major setback to extensive livestock systems and corrective measures need to be taken.

Livestock keepers in East and Central Africa belong to three major production systems: (i) pastoralists, (ii) smallholder farmers in mixed crop–livestock systems and (iii) landless or urban livestock keepers. These activities cover 60% of the total landmass and most of the remaining 40% is used for agricultural crop production. The total livestock population within ASARECA member countries is estimated at 123 million cattle, 163 million sheep and goats, 4.5 million camels, 5.3 million pigs and 219 million chicken. Most of these livestock are found in rangeland arid/semi-arid and mixed rain-fed arid/semi-arid zones.

The livestock sector in East and Central Africa shows low productivity, and the availability of food of animal origin for human consumption is also low. Projections for the livestock sector in East Africa show a large increase in demand for livestock products, resulting from population growth. Livestock production in East and Central Africa is contributed mainly by traditional systems that mainly rely on indigenous breeds whose overall productivity is generally low. In very few countries, such as Kenya, more productive crossbreeds (European taurine dairy breeds × indigenous *Bos indicus* breeds) are kept in zero grazing or semi-intensive dairy production units.

The total human population of sub-Saharan Africa continues to grow at the current rate of 2.5% with a much higher urban population growth rate of 4.7%. Against these dynamics are massive changes in the consumption of livestock products in Africa. Projected consumption and therefore demand for the various livestock products indicate that the livestock sector is very dynamic and a source of growth in the developing world. Production in East and Central African countries between 1994 and 2002 grew at average annual rates of 2.6% for beef and only 1% for dairy milk. The growth in production has not met increasing demand, which led most East and Central African countries to be net importers of milk, and other dairy products. For example, milk imports during 2002 amounted to almost USD 70.2 million for the region compared with total exports just under USD 1 million. The situation is aggravated by the increasing human population unless appropriate technologies to increase market-oriented livestock production are forthcoming.

Livestock keepers living in arid/semi-arid zones are poor and represent nearly one-fifth of similarly poor people in ASARECA member countries. Perry et al. (2002) reported that cattle were ranked highest in importance to the poor in mixed agropastoral systems of East and Central Africa. The study showed that poultry, particularly chicken, are the most widely kept species by the poor, and also the most numerous. Women in African communities are largely responsible for agricultural work and play important roles in livestock production. They contribute varying but significant levels of the labour required to care for animals depending on the culture and production system.

In the arid and semi-arid lands, pastoralism, which accounts for more than 70% of the total land area, is the only means of food production. These pastoral areas are particularly prone to climate variability and frequent droughts.

A-AARNET (Ndikumana et al. 2000) carried a study to investigate traditional coping mechanisms in pastoral systems of Ethiopia, Kenya, Tanzania and Uganda. It was found that the major coping mechanisms include migration, herd management, grazing reserves and water management. As shown by the study, despite high mortality rates during the crisis periods, pastoralists do not increase sales of livestock.

Wildlife constitute a resource of tremendous economic value in terms of tourism promotion and development of a variety of natural products including game meat. Livestock herders and crop cultivators utilize the land within or close to game parks. This interaction results in problems including predators, livestock diseases, crop destruction and depletion of forage and water.

In the urban and peri-urban zones, livestock production systems and processing plants produce large quantities of waste causing pollution problems. Disposal of poorly-managed waste is exacerbated by poor infrastructure and weak or non-existent regulations.

Africa experienced a decline per capita food production which sent a signal for a need to revitalize agricultural research. Many issues should be addressed to revitalize agricultural research in Africa, including demand-led approaches, accountability, building of critical mass, avoidance of duplication, sustainable financing, and capacity strengthening.

The lack of demonstrable impact from research investments has been raised as a concern by governments, donors and civil society (Opondo et al. 2006). It has been recognized that some 'solutions' remain on the shelves because, although they show technical potential, they are poorly adapted to the complex situations within which they are intended to be adopted.

An ASARECA commissioned study shows the major reform areas dominating the current NARS reform agenda which includes:

- Pluralism in agricultural research: reducing dominance of public institutions and encouraging formation of partnerships and innovation systems
- Decentralization of agricultural research: geographically and decision making
- New funding mechanism that encourage competition for research funds
- Realigning research programs to address and integrate research and development issues to ensure efficient commodity chain value addition
- Establishing stronger innovation systems that will enhance the scaling out/up of successful technologies.

To meet the above requirements, it was found necessary to follow an innovation systems approach to agricultural research for development, which is articulated in the 'Integrated Agricultural Research for Development' (IAR4D) paradigm (Jones 2005). The research will be conducted by multi-institutional and multi-disciplinary pilot learning teams involving concerned stakeholders in all aspects of the production for consumption chain, including market agents and policymakers. Team members will be drawn from a large number and variety of organizations associated with agriculture and rural development, including but not limited to agricultural scientists, NGOs, private companies, farmer-operated enterprises and research foundations. Taking on an innovation system approach means a way of working that take into account the complex dynamics of multiple actors in a fast changing environment. For researchers, this implies a different way of doing research which involves many new partners, concepts and skills. An innovation system is therefore a network of organizations within an economic system that are directly involved in the creation, diffusion and use of scientific and technological knowledge, as well as the organizations responsible for the coordination and support of these processes.

The Integrated Agricultural Research for Development (IAR4D) concept was adopted by the sub-Saharan Africa Challenge Program led and coordinated by FARA. IAR4D carries out research in a demand-driven mode, with impact measured in terms of meeting that demand, rather than in the supply-driven mode that has characterized much agricultural research in the past.

IAR4D projects will involve community members beyond those on the farms or premises where the research is conducted in order to get their intellectual input and to ensure that they are aware of and take ownership of the emerging research products (Jones 2005).

Policymakers at national and regional levels will also be involved and kept informed of the outcomes of IAR4D projects. This wide scope aims to help spread research benefits to neighbouring communities, and to internalize such benefits in institutions at local, national, and regional levels. This approach will influence the biophysical, socio-economic and institutional aspects of IAR4D at all levels. IAR4D recognizes that it is essential to work across a variety of scales and also requires teams of scientists from many disciplines to work together with farmers and the full range of other stakeholders in highly adaptive ways. The formation of such teams demands institutional flexibility and willingness to change. It also implies a substantial need for capacity building, with funding for team building as a primary element of proposal development and project implementation. It will also require professional facilitation to enable partners from different cultures, dissimilar educational backgrounds, and unequal endowments to collaborate effectively. Research teams from the National Agricultural Research Organization (NARO) reported their experience with implementing IAR4D (Opondo et al. 2006). Empirical data from this study suggest that the challenge for researchers is the operationalization of the new approaches in an organization that still largely functions according to conventional and established routines and institutional beliefs and culture. The development partners especially the non-governmental organizations, the private sector and the new government program of privatizing extension are equally confining themselves to their organizational mandates and approaches. These findings imply that the capacity strengthening thrusts are highly needed for the IAR4D to take root in African agriculture.

The ASARECA Animal Agricultural Research Network (A-AARNET) priority setting process was carried out to define priorities through which the network will contribute to the achievement of the overall goal and strategic objective of ASARECA (A-AARNET 2005). The stakeholders identified as priority 5 themes and 18 sub-themes during the process. The stakeholders also recommended that the research focus is to impact poverty alleviation. The objectives of A-AARNET include the strengthening of NARS in the region to conduct livestock research. It is recommended that all research projects be formulated with an objective of contributing capacity building in the partner institutions.

The International Livestock Research Institute (ILRI) offers opportunities for long- and short-term training for research and development practitioners within the agricultural innovation system, and value chains focusing on livestock related issues. The Capacity Strengthening Unit (CaSt) of ILRI is designed to build and strengthen the scientific knowledge and technical capacity for NARS scientists and technicians in developing countries. In a rapidly changing world, the R&D systems in developing countries confront new and increasingly complex challenges. Over the years, especially the sub-Saharan African countries have seen an enormous erosion of both individual as well as organizational capacity. ASARECA and ILRI forged partnership to build regional capacity for livestock research and central to this effort is A-AARNET–CaSt joint strategy and activities.

A-AARNET and ILRI should collaborate with other organizations in sub-Saharan Africa that deal with capacity strengthening. An example is the Strengthening Capacity in Agricultural Research and Development in Africa (SCARDA). This is a program led by the Forum for Agricultural Research in Africa (FARA) in partnership with the Sub-Regional Organizations (SROs). SCARDA's purpose is to strengthen, through an innovative approach, the human and institutional capacity of African NARS to initiate, design, implement and manage scientific research. The Program is structured into two main components:

1. Strengthening competencies and capacity in agricultural research management.
2. Strengthening the capacity for professional development (of agricultural scientists and extension workers) in research and development.

The first component focuses on improving research management by equipping personnel involved in stewardship of research at all levels, with the needed skills through continuous training, mentoring and short-term attachments to institutions where they can update or gain new special skills. The second component aims to enhance the depth and breadth of skills needed for NARS to conduct quality research that will assure impact to end users. It also aims to generate empirical information on the relationship

between increased investment in strengthening agricultural research capacity and agricultural productivity and profitability.

1.1 Background to the study

The objectives of A-AARNET include the strengthening of NARS in the region to conduct research. One of the main avenues for pursuing this objective is through activities. All research projects are usually formulated with an objective of contributing to capacity building in the partner institutions. For example, projects are often used as a means for post-graduate training. The NARS in the region are very varied in their strengths for livestock research. To remedy this situation, A-AARNET provides greater opportunities to the weak NARS. To achieve this, A-AARNET is keen to find what learning and capacity strengthening activities are needed in the ASARECA region.

The Capacity Strengthening Unit of ILRI is in the process of preparing its strategy and policy. To be effective such a strategy should be based on: broad-based participation and locally driven agenda, building of local capacities, ongoing learning and adaptation, long-term investments and integration of activities at various levels to address complex problems. One of the key activities in the strategy development process is the assessment of the capacity requirements at individual, group, organizational and societal level—a needs assessment study. The objective here is to identify the priority learning and capacity strengthening activities to be facilitated and/or undertaken by ILRI.

Training needs assessment is a tool utilized to identify what learning and capacity strengthening activities should be provided to enhance the productivity, performance and impact of individuals, organizations and the society. A lot of training has been designed without taking the needs of the participants into consideration. Instead, other needs were seen as more important or valid. Sometimes an effort is made to consider training needs, but the information collected is either not complete or based on guessing what is needed. To avoid such pitfalls, A-AARNET and ILRI undertook this structured study to assess training needs for livestock researchers and development agents in East and Central Africa. This report focuses on the outcome of this study on training needs of researchers and development agents in the East and Central Africa region (Burundi, DR Congo, Ethiopia, Kenya, Sudan, Rwanda, Tanzania, and Uganda). ASARECA, ILRI, and A-AARNET were source of information and helped during the information collection.

1.2 Purpose and objectives

The purpose of this training needs assessment is to identify the learning and capacity strengthening needs of the livestock production system of the East and Central Africa region. The study should cover the needs of the individuals, groups, organizations (research, education and civil society) and the society at large. In addition, it should also address the alternative suppliers of such activities, potential key partners as well as the priorities for A-AARNET and ILRI.

The study aim to:

- Collect and synthesize all available relevant secondary information related to the study.
- Collect the relevant primary data needed to complete the assignment.
- Prepare a draft report on the 'learning and capacity strengthening needs of the subregion' by using the primary and secondary information collected. It is also intended to identify the alternative suppliers, strategic partners, as well as the priorities for A-AARNET and ILRI.
- Present the draft report during the regional stakeholder workshop.
- Prepare revised final report based on the comments and additional information generated during the workshop.

1.3 Procedure/methodology

This training needs assessment targeted East and Central Africa and focused on livestock research and development issues. It also focused more on cross-cutting issues rather than on individual institutions. The following approaches were used to collect information:

- Survey stakeholders using a questionnaire prepared by ILRI. The questionnaire was well done and there was no need to change it or add to it. None of those who completed the questionnaire raised an issue about its completeness or ease of use. Response for the questionnaire was obtained from 18 key informants in 8 countries in East and Central Africa (Annex 1).
- Secondary source information was collected from libraries and the internet. Many training needs assessment were done but none on livestock research and development in Africa. But the secondary resources provided valuable information on issues important to this study.
- Livestock training needs assessment stakeholders workshop was held during 3rd to 7th September in Nyeri, Kenya. The workshop was attended by 26 participants from East and Central African countries and representatives from A-AARNET and ILRI (see Annex 2). The objectives of the workshop were:
 1. To share with stakeholders the findings of the livestock training needs assessment study commissioned by A-AARNET
 2. To get additional feedback and input from major stakeholders
 3. To seek consensus on training needs for the priorities of A-AARNET and ILRI
 4. To agree on the way forward.

The context of this exercise is A-AARNET priority themes, consultation report and the vast experience of the workshop participants. ILRI and A-AARNET facilitated the workshop deliberations. The workshop activities can be summarized as follows:

- Introductory presentations were made to throw light on the aim of the study, A-AARNET priorities, ILRI's capacity strengthening strategy approaches and the outcomes of the consultation workshop.
- The introductory presentations were followed by group discussions and presentations on skills needed for changing research paradigms and priority themes of A-AARNET.

The workshop participants analysed livestock training needs assessment in the ASARECA region in two compatible approaches:

- Skills were identified for capacity to handle changing paradigms in agricultural research for development. This approach looked at skills for integrated agricultural research for development (IAR4D), innovation systems perspective, value chain analysis, market orientation and emerging issues, such as biotechnology, ICT, climate change, and avian influenza. The stakeholder groups who will use these skills were: research managers, researchers (this stakeholder comprise NARIs, universities, private researchers and their technicians), trainers, private sector, service providers, community-based organizations (e.g. community services organizations, NGOs, farmers groups, farmers organizations) and policymakers.
- Skills were also identified for A-AARNET priorities which are outlined in the network strategy document. The workshop participants identified the skills for the following five themes (see Appendix 4 for details of themes):
 1. poor livestock productivity
 2. improved access to markets
 3. improving the utilization of innovations to enhance market opportunities
 4. improving value addition in input and output marketing chain
 5. contribution of livestock to sustainability and eco-services.

The information collected from primary/secondary sources and the stakeholder workshop was analysed and then presented in this report. The output includes:

1. Priority skills for livestock capacity in the ASARECA region with focus on A-AARNET priorities and ILRI's capacity strengthening strategy.

2. The prioritized skills are presented in a matrix of changing paradigms for IAR4D and A-AARNET priority themes. The matrix comprised skills and multi-stakeholders operating in IAR4D approaches.
3. Aggregated results for the stakeholders priority needs.

1.4 Outline of the report

The report is composed of the executive summary, introduction and three chapters. Chapter 1 introduces the problem and procedures. Chapter 2 deals with results and analysis. These include previous findings on training needs assessment, survey results on key issues, training needs, alternative suppliers to A-AARNET and ILRI in the region, potential partners for collaboration and opportunities and challenges for capacity strengthening in the region. Chapter 3 presents the key findings, major conclusions and recommendations. It also covers constraints and limitations to the study. The report ends with a bibliography and annexes that give further details.

2 Results and analysis

2.1 Introduction

The study generated information and data that is representative of the training needs for livestock research and development in the East and Central Africa region. Attempts were made to compare, match and sort out information from the two main sources mentioned in section 1.3. This was not an easy task but it was necessary to arrive at clear key findings to prioritize the results and then report them.

2.2 Previous findings on key issues

Many studies were done on status of livestock sector and how this sector in East Africa can be improved. These studies covered various aspects including training needs. This section of the report will deal with findings mostly based on consultation meetings and strategy documents of different institutions. The following key issues will be addressed: policies, animal health, socio-economics, bioscience, ICT, education, funding and networking.

As a region, Africa relies heavily on agriculture and the sector accounts for about 20% of total GDP. Small-scale farmers predominate in a climate of increasing population pressure, food insecurity, low levels of productivity and rapid natural resource degradation. Increasing productivity will require new approaches to agricultural research and development and hence capacity strengthening of staff to accomplish the job.

2.2.1 Policies

Many studies were done on the issue of how policies impact on the livestock sector and capacity needs for policy research. Prominent among these is the Inter-governmental Authority on Development (IGAD) Livestock Policy Initiative. The initiative was done in collaboration with FAO. The initiative covered Eritrea, Djibouti, Ethiopia, Kenya, Somalia, Sudan and Uganda. It was based on the assumption that these countries do not have appropriate livestock policies to guide activities in this sector. Livestock policies in the region tend to be based on poor levels of information and analysis and mostly formulated with little or no involvement of the stakeholders. There is general need to build capacity for:

- policy formulation and tools
- information systems and tools for policy analysis
- raising awareness of the role of livestock in meeting development objectives
- policy negotiation particularly among groups representing the interests of poor livestock keepers.

The primary beneficiaries of the initiative will be policymakers and analysts at the local, national and regional levels. The initiative will liaise closely with NARS, ASARECA, CGIAR network, AU/IBAR, PACE, CAPE and RALEA.

Concern about lack of a long-term vision on what actions are needed to achieve a malnutrition and hunger-free world led IFPRI in collaboration with several national and international institutions to launch an initiative in 1993 on a 2020 vision for food, agriculture and the environment. As part of this initiative, IFPRI developed country-specific initiatives that covered Ethiopia, Kenya, Tanzania and Uganda. The country studies aimed at engaging the countries in a dialogue about food, agriculture and environmental issues within their own policymaking circle. This section will focus only on the research issues and capacity building in policy research for sustainable agricultural development component of the reports. For more details about other issues, readers are referred to the references in the bibliography.

The 2020 Vision Network for Kenya identified three major themes as priority for research:

- Governance and institutional development for agriculture: policy formulation and implementation, institutional development, coordination and linkage and trade policies and competitiveness.
- Agricultural development and the environment: agricultural productivity, technology development and dissemination, sustainable agricultural development and the environment.
- Food security and development: food marketing, storage and distribution, food and nutrition and food production.

The country note for Kenya detailed capacity building in policy research for sustainable agricultural development. It asserted that the main precondition for formulating optimal agricultural policy is the existence of trained policy analysts capable of obtaining quality data. It also depends on the ability of policymakers in adopting findings from policy research. It is therefore necessary to strengthen capacity of policy researchers who can anticipate, define and analyse important policy issues.

The 2020 Vision Network for Ethiopia identified the following themes as priority research:

- Evaluation of veterinary service delivery—their implications for enhancing
- Private-sector participation
- Output marketing and prices
- Input marketing
- Credit markets, risk and investment/saving choices
- Environment: poverty environmental nexus, land degradation, deforestation, agriculture and rural energy and population pressure and the environment.

The country note for Ethiopia stated an objective to strengthen the capacity to design, conduct and implement focused research, strategies and action plans.

The 2020 Vision Network for Tanzania identified the following themes as priority research:

- Agricultural markets and support services: input and output markets and marketing, rural infrastructure, rural financial services
- Agricultural productivity and environmental conservation: dual model production, total factor productivity, land and water conservation
- Legal policy and institutional framework: policy formulation, implementation and monitoring, agricultural legislation and regulation, the role of institutions
- Food security and rural incomes: household and nutritional security, post harvest and value added processing and rural income and employment generation activities.

The country note for Tanzania called for adopting an outward looking approach through defining institutions and focus on capacity building. Therefore it stated capacity assessment of the lead ministries responsible for agricultural development as a researchable topic.

2.2.2 Animal health

Diseases and parasites reduce the productivity of livestock in all agro-ecological zones in East Africa. Epidemic diseases such as Rift Valley fever, contagious bovine pleuro-pneumonia, rinderpest and Newcastle disease, fowl pox and infectious coyza constitute a region-wide risk and can cause high economic loss. Movement of the livestock across the borders contributes to the spread of the diseases. Problems that aggravate the situation include absence of vaccines. Constraints to livestock productivity in East Africa are endemic diseases, mainly vector transmitted, such as trypanosomosis and parasites. Trypanosomosis is the single most important animal disease in the Horn of Africa, as evidenced by the small number of livestock in the tsetse infested subhumid zones. The inability of the countries to control livestock diseases is due to:

- lack of effective functional veterinary services
- lack of diagnostic capacity
- inadequate vaccine production.

Improving animal health services is essential to develop more effective marketing and export systems. At the country level in East Africa, research institutions developed strategies to control livestock diseases. The Kenyan Agricultural Research Institute (KARI) stated in its strategy that animal health component will aim at protecting livestock not only from fatal diseases but also at providing advice for management of infectious and conditions, which reduce the efficiency of production such as sub-clinical mastitis, foot rot and fertility problems. Attention will be given by KARI to traditional livestock disease control/treatment methods (ethno-veterinary knowledge). The centre will carry out research to improve existing vaccines, to develop new ones and to improve diagnostic kits. To accomplish progress in vaccine research and development, it established the Veterinary Vaccine Production Centre in 1990.

The Animal Production and Health Section of FAO/IAEA supports isotope-aided research into methods for improving animal productivity and health in developing countries. Particular emphasis is placed on indigenous and upgraded breeds under traditional management systems. Support is provided through technical projects and training courses. Training is an important component of activities and efforts are made to ensure that training is specific and relevant to the tasks that individuals will perform. This training effort includes fellowships to train at foreign institutes. In addition, regional as well as interregional training courses are held periodically. In animal disease, the focus is on the epidemiological approach to controlling livestock diseases.

Avian flu erupted recently in many countries and reduced poultry productivity tremendously. The principal limiting factor for effective control of the disease in developing countries is inadequate capacity. Without surveillance and rapid diagnosis, a coordinated effort in Africa has proved difficult. In order to facilitate the disease control decision-making process, FAO/OIE encouraged the development of training programs so that laboratory personnel in Africa will be able to:

- use appropriate diagnostic tests
- incorporate results correctly
- adhere to quality assurance.

In response to this need, the Inter African Bureau for Animal Resources of African Union (AU-IBAR), FAO, ILRI, BECA and the Centre for Disease Control (CDC) laboratory in Nairobi explored ways of supporting national and regional veterinary laboratories in Africa to make rapid and early detection of the disease as the crucial step in controlling disease spread. AU-IBAR and ILRI proposed to organize courses during 2006 and 2007. The courses will be more general and basic in nature and will focus on standardized methods of biosafety including use of protective equipment, sample collection and transportation as well as conventional serology and molecular diagnostic tests and handling, packaging and shipping of suspect samples. A more advanced course will be for senior laboratory officers from African countries with capacity to do virus isolation and molecular diagnosis. For East Africa, the venue is ILRI/BECA Nairobi site.

Despite efforts, tsetse-transmitted trypanosomiasis is still a major constraint for livestock agricultural development in sub-Saharan Africa. The main problems in limiting or eliminating the impact of the disease can be listed as follows:

- limited number of drugs available
- parasite resistant strains increased
- reduced capacity of veterinary services in delivering appropriate strategies for use of chemotherapy
- high cost of vector control campaigns
- difficulties in getting participation of local communities.

Due to the transboundary nature of tsetse distribution, a regional approach is needed. Training and capacity building also have to be considered in the planning phase of a field intervention. Recently the AU endorsed a Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC). ADB has shown interest in supporting the interventions through loans and grants to six countries (Burkina Faso, Ethiopia, Ghana, Kenya, Mali and Uganda). In this respect, training continues to provide the essential competence to implement the new tools as they become available.

2.2.3 Biosciences

Emerging developments in biosciences offer promise of new means to address a number of constraints that are limiting productivity and sustainable development in East Africa. In agriculture, this understanding is leading to means to better manipulate and regulate genes, in order to develop improved strains of livestock, better diagnostics and more targeted therapeutics and vaccines. Lack of sufficient number of trained people, suitable laboratory facilities and specialized equipment and technical expertise are constraining the present use of bioscience to address problems. Many African scientists have been trained to MSc and PhD level in various aspects of bioscience. Unfortunately, there are some constraints for many of these scientists in their working effectively as research scientists. Due to this and poor incentives and infrastructure support, most of these scientists continued their careers overseas in North America and Europe—a brain drain dilemma. The situation is compounded by lack of skilled technicians available to operate and maintain specialized equipment and manage bioscience laboratories. ASARECA identified the following priority technical constraints to the application of biotechnology:

- lack of protocols to produce large numbers of quality breeds in a short time frame
- lack of access to isolated genes, novel germplasm and biotechnologies
- lack of new genes/markers and transformation protocol to address production constraints
- inadequate characterization, evaluation and conservation of existing animal germplasm.

ASARECA has identified the following areas where additional trained people are required in order to be able to make best use of emerging developments in bioscience in East Africa:

- marker assisted selection as an aid to breeding programs
- genomics as an aid to gene discovery
- plant transformation
- molecular diagnosis
- bioinformatics.

One of the goals of the New Partnership for Africa's Development (NEPAD) is to promote accelerated growth and sustainable development. NEPAD will achieve this through the generation and use of cutting-edge science and technology by African researchers to enable them to develop products aimed at solving African problems. NEPAD is focusing on areas to harness science, one of which is biosciences. Hence NEPAD contributed to the establishment of the Biosciences facility for eastern and central Africa (BECA). The goal of BECA is to support eastern and central African countries to develop and apply bioscience research expertise to produce technologies and help poor farmers. The facilities will be hosted by ILRI in Nairobi, Kenya. BECA first phase is established through a Canadian grant part of which will be used to develop capacity in biosciences amongst African scientists through fellowships and educational and training activities in ways that complement existing programs at national, regional and international levels. The aim is to establish core competencies such as functional genomics and bioinformatics. BECA will help close the disparities in new science and knowledge, skills and technologies currently separating Africa from the rest of world. This will include building greater capacity for managing intellectual property and ensuring safe use of new technologies through science-based regulatory systems.

BECA will work with universities in the region to train young scientists to MSc and PhD levels. This is done by enhancing the work of university laboratories. The close association of BECA with universities will enable academic staff to further their professional development and careers through fellowships and secondments. BECA capacity building can engage in scientific/technical mentoring by senior scientists. It provides opportunities for training to realize the potential of women and young scientists. Training through BECA will focus on biosciences and management skills. The bioscience skills include skills in molecular biology, genetics and breeding, immunology, protein chemistry, pathology, information services, bioinformatics, cell and developmental biology and vaccines. The stakeholder consultation workshop on BECA discussed the inventory of bioscience researchers in East and Central Africa. It was not clear how many scientists were there in the region. They recommended a need for a regional human

resources inventory of available skills in the biosciences in East and Central Africa; in other words a needs assessment study. The study will be used in the design phase to develop a capacity strengthening strategy.

2.2.4 Socio-economics

Livestock and their products contribute 20% to the total value of the agriculture, forestry and fisheries production in developing countries. Hence livestock plays an important role in economic development, particularly as societies evolve from subsistence agriculture into cash-based economies. Animal products constitute about 40% of the total value of agricultural output. The growth markets for livestock products are in the developing regions. Thus to meet the demand for livestock products, improvements in livestock productivity is essential. Animal agriculture can be a positive factor in the long term.

Farmers have often been slow to adopt technologies. However, due to changes such large increases in livestock numbers and grazing pressures, livestock farmers are adopting more intensive systems. The changes are also affecting the relationship between farmers in arable lands and livestock owners in the steppes. Other socio-economic constraints include:

- poor market information and infrastructure
- conflicting land-use rights; shortage and fragmentation of land
- inappropriate price policies
- marketing restrictions
- macro-economic distortions and trade restrictions that have favoured imports
- lack of adequate extension and health services
- inefficient drug distribution.

There is a recognized need to focus on micro-economic issues and support services within the economy in general and the agricultural sector in particular, on which many economies in East and Central Africa depend. There is demand for a new generation of agricultural economists at all levels of the economy and particularly in livestock research. The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) is devoted to enhancing the productivity, value added, and competitiveness of the regional agricultural system to help increase economic growth and improve social welfare while enhancing the quality of the environment in eastern and central Africa. The Eastern and Central Africa Programme for Agricultural Policy Analysis (ECAPAPA) is ASARECA's policy analysis program. ECAPAPA convenes agricultural policy research, analysis, and formulation aimed at facilitating an enabling agricultural policy environment for agricultural transformation. ECAPAPA's overall goal is to promote regional economic growth through application of growth-enhancing agricultural policies and, in the process, to help build a sustainable capacity in the eastern and central Africa to utilize and contribute to agricultural policy research and analysis. To accomplish its objectives and contribute to the overall goal, the Programme has three specific tasks. One of these tasks is capacity building, primarily directed towards the National Agricultural Research Institutes so as to increase their ability to affect policy and to relate their technology development programs to existing policy. The most important work involves developing greater awareness and understanding of policy activities within the NARIs. The goal at this level is to allow the NARIs to both 'tune' and 'tune to' the policy environment in their countries and the region. It is not envisioned to create policy analysts within the NARIs, but rather it should be possible to build sufficient understanding of policy issues and methodologies so that the NARIs can work with and use existing policy analysis capabilities found within the region at universities, private policy units and within government. In response to rural development challenges, ECAPAPA and IFPRI responded to this challenge with a new regional research program. After collaborating for a number of years through the IFPRI Eastern Africa Food Policy Network, the two organizations have launched a program to provide research-based policy options for achieving long-term food security and poverty reduction in eastern and central Africa. The partnership is designed to pursue collaborative projects that explore high-priority research topics. ECAPAPA and

IFPRI are equal partners in project planning, fundraising, and implementation. The collaborative projects are undertaken regionally but implemented at the country level through specially constituted research teams. The program objectives are:

- Identify emerging priorities for regional policy research.
- Convene and support regional policy research initiatives based on those priorities.
- Develop regional and national institutional and human capacities to undertake appropriate food policy research, analysis, training, and outreach.
- Build understanding and consensus among regional and national food policymakers and other stakeholders on policy options for enhancing food security and reducing poverty in the region.
- Catalyse and promote the design and implementation of feasible policy options.

Concerned about the ability of universities in the region to produce sufficient numbers of well-trained agricultural economists, IFPRI 2020 Network for East Africa decided to undertake an assessment of the demand and supply of agricultural economists in the region. The study objectives were to:

- review the existing training programs for their suitability, strengths and weaknesses and indicate areas needing attention
- evaluate the market of agricultural economists
- assess the ability of academic institutions to produce well-trained MSc and PhD agricultural economists
- suggest and evaluate ways to improve agricultural economics training capacity in the region.

A stakeholder workshop was held to discuss the issues and meet the above objectives. The study finds that the quality of teaching in the departments of agricultural economics is constrained by lack of staff and the limited abilities of the existing staff owing to the level and quality of their terminal degrees. This is particularly the case of the graduate training. The poor incentive structure is an important factor. In response to the policy and economic environment, agricultural economics departments are placing emphasis on agri-business. Important tools to training such as access to literature, internet connectivity, analytical software and computer hardware are often limiting. The study notes that improving agricultural economics in the region will call for producing well-trained graduates to satisfy the demand in all aspects, i.e. quantities and qualities. The region could explore how best to benefit from the proposed program by the National Association of Agricultural Economics Administrators (NAAEA) to offer distance education in agricultural and resource economics at MSc and PhD levels. The courses would be computer-based with options for being internet and/or CD-ROM-based depending on accessibility and cost implications. The growth and development of eastern and central Africa, leading to alleviation of poverty, will depend on efficient, equitable and sustainable utilization of the region's natural resources. The region will require the appropriate human resources. Professionals whose skills will range from analysing the implications of changes in trade and macro-economic policy to studying the performance of local markets for agricultural products, services and inputs are most needed. To respond to these needs, initial inquiries managed by the International Food Policy Research Institute (IFPRI), concluded that such investment should:

- strengthen post-graduate education in the region at the MSc level
- feature agricultural economics as its principal disciplinary focus and
- comprise a locally driven collaborative initiative informed by the environment for higher education generally within the region.

In the coming decades, the pool of locally based professionals with the requisite knowledge, skills and experience will be small in relation to the steadily growing demand for their services. Consequently, their formal training must be sufficiently robust and comprehensive in order to remain conversant with a wide range of issues. The stakeholder workshop concluded that it is more appropriate to focus on masters, as opposed to doctoral education. Many of the issues can be analysed by economists with a more general background, who have acquired detailed knowledge of these particular sectors. Nonetheless, more specialized graduate education is equally desirable.

The need to invest in professional development prompted IFPRI in March 2001 to initiate a review of the status of agricultural economics in eastern and southern Africa. A survey was conducted of institutions in the region covering 15 universities, 8 policy research institutes, 5 national agricultural research systems, 2 networks, and 8 agencies in 9 countries. The draft report was discussed at a workshop held in Nairobi October 9 to 10, 2001, which was attended by 30 participants from 8 countries. They concluded that there was a compelling need to strengthen graduate education in agricultural economics within the region. A proposal setting out a detailed, 'bottom-up' planning process was subsequently prepared following consultations with officials and staff of universities in eastern, central and southern Africa. The planning process has addressed this challenge in three ways. First, the Agricultural Economics Education Board (AEEB), comprising representatives of the 16 collaborating departments, has driven it. Secondly, the process has featured regular, informed exchanges on key issues. Thirdly, the ten-month period over which these exchanges have taken place has provided the time and opportunity necessary for nurturing a shared vision and sense of ownership. The planned MSc program has two principal objectives:

- The first is to respond to these needs with a program that conforms to international 'best practices' and also is adapted to the region's specific needs.
- The second is to strengthen the region's capacity to generate skills and knowledge essential to development of agriculture and the rural economy.

The masters program defining features are:

- Demand informed professionals from governments, business communities, and not for profit agencies
- Expanded range of applicants broadened to encompass those in mid-career
- Graduates must be able to adapt analytical approaches to suit the problem at hand, rather than the reverse and thus are exposed to institutional and behavioural economics, offered as a required course to all students
- The program will utilize, with due regard to constraints posed by infrastructure, cost and the subject materials in question, various technologies to enrich learning with reliance on electronic connectivity to provide access to libraries and other knowledge centres
- Create a framework for research
- The program is designed to complement other relevant research and capacity strengthening initiatives
- At present the initiative comprises 16 universities in 12 countries. The program of study is composed of course work and a thesis offered over five semesters. At the beginning, the program will focus on agricultural policy and trade, agricultural and rural development, environment and natural resource management and agribusiness management. IFPRI would serve as the facilitating agency on behalf of the contributing group of donors.

2.2.5 Education

The current decline in per capita food production in Africa signals an urgent need to revitalize agricultural research. Many issues need to be addressed such as demand-led approaches, accountability, building of critical mass, avoidance of duplication, sustainable financing and capacity strengthening. This report will focus in this section on building of critical mass and capacity strengthening. The main institutions building human capacity in agriculture in general and livestock in particular are educational institutions. Therefore a look at the status of this source is important.

USAID conducted an assessment to identify training and capacity building needs for the university faculties of agriculture in Kenya, Tanzania, and Uganda (Annex 3). Proposed interventions will complement the objectives of the Initiative to End Hunger in Africa (IEHA), the Board for International Food and Agriculture Development (BIFAD), and the Regional Economic Development Services Office for East and Southern Africa (REDSO/ESA). There has been significant growth of faculties of agriculture in the region with many of the characteristics and problems that are symptomatic of African higher education in general. The needs for training and retooling in the African university faculties of agriculture are great. Not only have the numbers taking the BSc degrees in various aspects of agriculture greatly increased, but also most faculties have introduced MSc and even PhD degrees. The more senior faculty

have retired or are on extended leaves of absence seeking more remunerative assignments. The burden of teaching/supervision is increasingly being borne by more junior, less experienced faculty, who often only have MSc degrees. There is increased pressure for faculties to be more relevant, to be more engaged with solving national problems, and to produce graduates that meet the changing needs of agribusiness, demand-driven research systems, and privatizing extension services. All this is taking place in the context of declining support for higher education from both national governments and donors.

New Information and Communications Technology (ICT) has the potential to contribute to the upgrading and 'retooling' of faculties of agriculture. However, the team found that access to the new technology is still inadequate. The computers available to faculty members are old and are unable to run the newest software; internet connectivity is very limited, often with only one dial up link in the faculty. However, two of the institutions, the University of Dar es Salaam and Makerere University, are investing, with donor assistance, in a substantial upgrading of the ICT infrastructure which should increase computer usage and improve access to the internet.

The three countries in the assessment are all struggling with the impact of HIV/AIDS on their social systems and the economy. It is affecting faculties of agriculture in several ways: (1) every faculty has both staff and students that are sick or have died from HIV/AIDS; (2) the collaborating partners in the national agriculture system (ministries of agriculture; research institutes) are also losing staff which negatively affects the ability to maintain linkages; (3) farming systems, particularly smallholder agriculture, are changing as a result of the demographic changes in the labour supply; and (4) funding support to universities from national governments is likely to continue to decline as a larger share of the national budget is spent on health care.

2.2.6 Information and Communication Technologies (ICT)

Research efforts in Africa need support of information and communication technologies (ICT). ICT are evolving quickly and many initiatives are in progress. However, human capacities are lagging behind. ASARECA proposed to assess the status of human resources in ICT in the region and therefore its network RAIN conducted an ICT training needs assessment study during 2004. Through visits, interviews, questionnaire surveys, and desk studies, the consultants examined institutional ICT/ICM policies, human resources, and training needs at NARS and related institutions within the ASARECA subregion. The study found the following deficiencies:

- lack of institutional ICT/ICM policies which, in turn, affect human resource policies
- commitment to ICT/ICM by managers
- initiation and execution of ICT/ICM projects
- establishment and management of ICT/ICM units
- deficiencies in access to STI mainly due to lack of skills, poor internet connectivity
- low awareness by management of the need for accessing STI
- deficiencies in skills for managing content, data, and information; disseminating information, communicating; and managing technologies.

The study concluded that training is needed at various competency levels, at short-term, but also at diploma, graduate, and post-graduate levels. The questionnaire survey confirmed the availability of local training resources with respect to content and logistics. The study recommended that RAIN take a lead in ICT capacity strengthening in the ASARECA region. The following are the recommended activities for RAIN:

- Verify NARIs needs for diploma, graduate and post-graduate qualification holders through ASARECA and National Agricultural Information Focal Persons
- Verify training resources that offer the required training at national, regional, and international levels
- Assist in identifying candidates
- Selection criteria: expected contribution for development and dissemination of agricultural technologies, potential for career development, job performance, gender, age

- Assist in identifying funding
- Assist in follow-up and M&E
- Contact potential resource partners for developing ODL in the ASARECA region, for example, African Virtual University (AVU, www.avu.org), Nairobi, CGIAR initiatives, such as the ICT-KM Programme, the Online Learning Resources (OLR) project, the Global Open Agriculture and Food University (GOAFU) initiative, and the Virtual Academy for the Semi-Arid Tropics (VASAT) initiative
- Awareness for policy development.

2.2.7 Networking

One of the issues facing African providers for building capacity is on the effective utilization of networks for building human and institutional capacity. This issue is of importance to ILRI to be addressed when formulating its new training strategy. An example of a network is the African Economics Research Consortium (AERC). The challenge is how to build capacity in livestock research and development and how to retain that capacity in an effort to reach critical mass. Networking involves identifying ways in which the developed capacity communicates to policymakers and conveying the results of research to the ultimate stakeholders. In the case of AERC, efforts are directed to build a network of individuals and institutions that are capable of tackling current problems in research and training with a view to applying research output in the policy context. To keep the network alive many aspects can be emphasized such as:

- clear objectives
- sharing training outputs
- building community of livestock professionals
- create a dissemination strategy (e.g. electronic newsletter).

AERC has a training program that brings together 27 universities in 20 countries in sub-Saharan Africa in a collaborative approach for both Masters and PhD training. This approach rationalizes the use of limited teaching capacity in policy, attains critical mass of students and enforces higher standards for graduate training in economics. Global Livestock CRSP offers another example of capacity building networking. Its goal is to increase food security through collaboration between USA land-grant institutions and national and regional institutions abroad. GL-CRSP is heavily involved in East Africa.

The business plan for BECA made it clear that biosciences is an area where there is a need to establish partnerships with African universities and with internationally renowned research groups to develop systematic capacity building and training programs. Formal relationships with academic bodies will assist in this endeavour. Several national, regional and international programs are also supporting capacity building in biosciences in Africa. These include programs supported by APPIS and ICIPE, ASARECA, BIOEARN, CABI, the CG centres, Rockefeller Foundation, United Nations agencies, the Wellcome Trust, the World Bank as well as several bilateral donors including USAID, that have a large program of research and capacity building activities. Opportunities are being sought by BECA to identify synergies with current programs, and to complement them. An early result of this approach was the conduct of a training course on marker assisted selection in plant breeding jointly sponsored by the CGIAR Generation Challenge Program and BECA in 2004.

2.2.8 Funding

In sub-Saharan Africa, agricultural research has played a crucial role in agricultural production through a sustained supply of improved production technologies. Investment in agricultural research has more or less followed the same trend as the agriculture sector overall. Foreign assistance has played a key role in agricultural research development in all developing countries and particularly in Africa. Funding in the form of loans and grants from international donors accounted for approximately 34% of total research expenditure in sub-Saharan Africa in the early 1960s. African NARS have increasingly relied on foreign funding, reaching about 43% of their total funding in 1991. Despite these huge investments, NARS are still plagued by many deficiencies, in particular as regards institutional development.

The development of well-trained researchers takes time and is costly; therefore, a long implementation period is appropriate for human resources development and institutional development type assistance. However, without an innovative and sustained effort to retain them through salaries, incentives and a proper work environment, massive training of well-qualified scientists can have a detrimental effect on the whole NARS that might become a training ground for other sectors of the economy or of the world market. It is reported that former NARS researchers from the selected countries today may be found in professional and management positions throughout Africa and in international organizations throughout the world. Donors, NGOs and private sector agencies looking for particular skills and appreciating the professional capabilities provided by the various training opportunities frequently seek their expertise.

Although it is still needed, sole reliance on donor funding has proved not to be a long-term solution. A suggested solution might be to diversify domestic sources of funding through the resolute evaluation of all potential sources of funding mechanisms, as already recommended by the FAO/SPAAR/KARI expert consultation in 1993 on funding agricultural research in sub-Saharan Africa. It also requires African resolve, African political leadership and aggressive indigenous resource mobilization.

2.3 Survey results

2.3.1 Key research management issues

Research management seems to be overburdened with responsibilities which a few claim leads to imbalanced life style. Managers, who are mostly researchers moving up the rank, find it difficult to conduct any research due to heavy responsibilities. The majority of respondents pointed the need to strengthen their skills in strategic planning and priority setting. Insufficient funding was singled as an important managerial constraint. There is a need to improve skills in efficient and maximum utilization of research funds. Other issues raised, but to a minor level, include skills needed for writing research proposals, projects, management of biosafety and intellectual property rights, monitoring and evaluation, and impact assessment.

2.3.2 Key research issues

a. Animal production

Nutrition and feeds were rated by all as high priority. The subject includes inadequate feeds, forage seeds, forage resources, pasture development, and feed supplementation. Socio-economics research received also high rating. Issues here covered poverty reduction, production economics, marketing, land tenure and infrastructure. Genetic improvement also was considered high priority regional research. In this, field research was deemed necessary for reproductive efficiency, characterization of livestock genetic resources and breed improvement. Animal productivity was seen as an important research issue. In the improvement of basic animal husbandry, livestock products were seen as issues that need researching. Commercialization and agro-processing was given medium priority. Inadequate human capacity to effectively handle animal production research and the need to train specialists and technical staff was also stressed by respondents from countries recovering from war conflicts.

b. Animal health

High priority and emphasis was given to the prevention and control of diseases of animal and public health. The list includes the following diseases:

- zoonotic diseases
- infectious and non infectious diseases
- vector and vector borne diseases

- tick-borne diseases
- eradication of tuberculosis
- Foot-and-Mouth-Disease
- African swine fever
- bovine brucellosis tuberculosis
- typanosomiasis
- avian flu

Other priorities stressed by the respondents focus on disease control packages and delivery systems. These include:

- inadequate diagnostic tools for surveillance and control of major livestock diseases and pests
- limited disease diagnostic capacity (laboratory)
- strengthening disease surveillance and diagnostic capabilities of veterinary institutes and regional veterinary laboratories
- epidemiological knowledge of livestock diseases and local veterinary public health problems.

Equally stressed was the issue of drugs and their use. The main issues were:

- inappropriate use of unprescribed drugs
- inappropriate policies leading to high cost of drug and disease control packages
- inappropriate packages that increase the cost of drug and disease control packages for smallholder livestock producers
- non-existence of animal pharmaceutical infrastructures
- lack of veterinary products quality control.

Other issues of minor importance include:

- use of qualified veterinary personnel to attend to cases
- high needs in specialized training of field technicians diagnosis
- climatic changes
- use of properly formulated feeds
- livestock certification and export promotion
- establishing animal health information systems
- factors of disease transmission in the country
- transboundary diseases and prevalence of disease and geographical distribution.

c. Policy/institutions

The respondents listed an array of policy and institutional issues but no major areas came out as stressed by a majority. The following are the issues listed by all:

- poor enforcement of existing policies
- lack of policies on sale of unfit products, e.g. adulterated milk
- developing viable farmers organizations and institutions
- internal constitution of feeds (home made) that are not nutritionally balanced, inappropriate grazing management practices and no improvement of natural pastures
- policy for conservation and utilization of indigenous genetic resources; lack of appropriate breeding policies and availability of improved breeds
- research and documentation of animal breeding policy
- lack of appropriate information and market access; agricultural credit
- high cost of proven feed conservation technologies
- inadequate supply of appropriate processing technologies for small-scale producers and processors
- inappropriate policies and institutional setup for drug quality control and the provision of veterinary services
- lack of national coordination in animal production and health activities (including research)
- non-existence of national training policy beyond the field technician level
- farm management
- migration of rural population.

d. Marketing and trade

The focus on marketing was lack of marketing research *per se*. It was stressed that marketing research should cover the following:

- livestock and livestock product marketing
- feed marketing
- lack of innovative marketing strategies through value addition to livestock and livestock products
- inadequate capacity for market research for value added outputs
- lack of appropriate post harvest technologies for perishable livestock products in input/output markets
- research on factors limiting export of animal products in SSA
- lack of marketing information
- cost of feed
- pricing and price regulation
- cost of transport.

Second in importance to the above issues come trade issues such as:

- factors affecting trade of animals and animal products
- developing sustainable market linkages for farmers and other market agents in dairy value chains (organizational and institutional issues) as well as addressing technological issues.

Minor issues in socio-economic area include:

- poor farmers' organizations leading to low farm gate prices in output markets
- lack of dairy transformation and conservation systems.

e. Other issues of interest

The respondents mentioned the following with no clear aggregation for any of the issues:

- poor road networks
- unpromising partnerships with farmers
- animal traction
- fishery
- apiculture
- remote sensing and GIS
- initiation of agro-pastoral and pastoral institute
- developing veterinary public health infrastructures
- producing veterinary public health educational materials and electronic access to science-based current information
- supporting libraries of higher institute in order to access scientific journal free of charge or less price
- diseases at interface between wildlife and domestic animals.

Since no stress was given to any of these issues, it is safe to assume that these issues represent more importance at the country level than regional need. ILRI can further probe into these issues at the network meetings and workshops. It is suggested that ILRI build a database for national experts working in livestock various disciplines. The database will be a pool of experts who can contribute to workshops and capacity strengthening activities in the countries or the region.

2.4 Training needs

2.4.1 Research management training

The respondents stressed the need for improving capacity for research management. Managers stress training their staff for PhD level in management fields and at the same time develop on-the-job training opportunities. The following were mentioned as management components that need training:

- research planning
- project and project cycle was found most important. Training in this area should include project monitoring and evaluation, developing logical frames and proposal writing
- team (e.g. multidisciplinary research teams) management
- change management
- human resource management
- public relations.

On a minor note, managers are interested in transfer of technology, farming systems research, leadership issues.

2.4.2 Technical training

The survey simulated the respondents to come with a long list for additional scientific and technical knowledge that is required in addressing research issues mentioned in this section.

2.4.3 The following is a list that summarizes the responses:

- Post-graduate level: Animal breeding, animal nutrition, range management, animal production
- Undergraduate level: Animal science, animal production and range management
- Addressing challenges of on-farm research
- Strategies for initiation of policy changes
- Strategies for effective dissemination of research results
- Information communication technology
- Good production practices, good manufacturing/hygienic practices (HACCP etc.), products standards and quality, food safety and traceability, quality assessment issues, food safety issues, quality control to monitor use of alternate substitutes to meet a specific ingredient to supply same nutrition requirement
- Issues of international trade
- Research for pro-poor farmers
- Research for crop and livestock production system
- Research for conservation utilization of indigenous genetic resources
- In AI proper research to ensure that one gets the right calf for the semen used (genetic)
- Develop appropriate processing technologies for enhanced value of livestock product
- Bioinformatics, scientific knowledge on biotechnology, molecular biology and biotechnology skills
- Skilled laboratory technician, laboratory engineering research, laboratory organization, scientific knowledge in laboratory technology
- Animal nutrition, analysis of feed, nutrition and breeding, development utilization of non-conventional feed resources, forage crop breeding and forage conservation techniques.

2.4.4 Additional skills

In the recent past, a number of changes have occurred in the agricultural research and development (R&D) arena. Given these changes, some additional 'soft skills' are needed to be an effective manager/researcher/trainer. The survey respondents rated a given array of the skills. Summary of the results is shown in Table 1.

Planning and priority setting, participatory research methods, monitoring, evaluation and impact assessment were rated highest in importance (90–100%). Skills following in importance include strategic planning, intellectual property rights policy, and interaction of crop–livestock–water, innovation systems perspective and implication to R&D (80% of the respondents). Skills that rated medium in importance (by 70% of respondents) include implementation and assessment of networks and partnerships. Most of the remaining skills received lower ratings.

Table 1. *Summary of research skill gaps as seen by the survey respondents*

Skill areas	Degree of importance* (EI, MI, NI)
1. Participatory research methods	EI (81%) MI (19%)
2. Leadership and decision making	EI (54%) MI (46%)
3. Strategic planning	EI (81%) MI (19%)
4. Intellectual property rights policy	EI M (81%) MI (19%)
5. Negotiation and conflict resolution skills	EI (27%) MI (73%)
6. Facilitation skills	EI (27%) MI (63%)
7. Design, implementation and assessment of networks and partnerships	EI (73%) MI (27%)
8. Monitoring, evaluation and impact assessment	EI (90%) MI (10%)
9. Planning and priority setting	EI (91%) MI (9%)
10. Climate change: Implications and adaptation strategies	EI (36%) MI (64%)
11. Poverty, vulnerability and risk analysis	EI (55%) MI (36%) NI (9%)
12. Value chain analysis, market orientations and implications to R&D	EI (36%) MI (64%)
13. Innovation systems perspective and implication to R&D	EI (81%) MI (19%)
14. Interaction of crop–livestock–water	EI (81%) MI (19%)
15. Gender analysis	EI (27%) MI (73%)
16. Sustainable use of animal genetic resources	EI (63%) MI (37%)
17. Gene bank management	EI (36%) MI (64%)
18. Convincing proposal writing	EI (45%) MI (45%) NI (10%)
19. Scientific writing	EI (27%) MI (63%) NI (10%)
20. Effective communication	EI (54%) MI (36%) NI (10%)

* Extremely Important (EI), Moderately Important (MI) and Not Important (NI).

2.5 Training needs assessment stakeholders workshop results

The changing R&D paradigms calls for the joint development of capacities with a broad range of stakeholders—governmental organizations, non-governmental organizations, civil society organizations, private sector, supply providers, farmers and their organizations and consumers. The workshop participants worked in groups to identify the skills that are needed by the broad range of stakeholders in East and Central Africa. They also identified skills needed for effective livestock research in ASARECA countries, the gaps where training is needed and the priorities for A-AARNET and its hub ILRI. The focus was on changing paradigms in AR4D and priority research themes of A-AARNET. The two are inseparable but each will be presented separately for ease of clarity. The final section will present aggregated findings.

2.5.1 Changing paradigms in agricultural research for development

The framework of A-AARNET for the period 2005–10 specifies the need to strengthen the regional and national capacity for IAR4D in animal agricultural systems. With this goal in mind, workshop participants discussed in groups the skills needed by the various stakeholders. They did these deliberations in the context that paradigms are changing in AR4D. Consideration was given to the entry of new stakeholders, technologies and market forces, which when combined with new economic and demographic pressures, prompted the search for more innovative and less linear approaches.

The results are presented in Tables 2, 3, 4, 5 and 6 in matrices showing needed training skills for the various stakeholders involved in AR4D. The matrix presented changing paradigms to include IAR4D, innovation systems perspective, market orientation, value chain analysis and impact orientation. Workshop participants also looked into emerging issues of concern to their region. The results for stakeholders in need of training for various skills in biotechnology, avian influenza and climate change are presented in Tables 7, 8 and 9. Table 10 shows aggregated soft skills across stakeholders that need training input.

Integrated agricultural research for development

The paradigm IAR4D is an effective mode to enhance capacity to innovate in the face of rapidly changing conditions. It features a broad agenda that addresses a chain of interactions, from natural resource management to production systems, markets and policies. Table 2 presents the skills that are needed for IAR4D and the gaps where training is needed for the various stakeholders. As can be seen from the table, the two stakeholders that need training in most skills are the research managers and the researchers. Research managers need many skills for which the module content may vary in depth of coverage. Soft skills include team building, leadership, corporate governance and entrepreneurship. Technical skills include communication, institutional building and strategic planning. They need to be aware of other skills such as quality assurance, resource mobilization and IPR management. Researchers need training in communication, data handling, policy analysis, marketing and project management including monitoring and evaluation. Since the integrated approach calls for the efforts of all stakeholders in various stages during development, needs to train in various skills were identified for the other stakeholders. The private sector agents and the trainers come next in terms of stress for training.

Table 2. *Changing paradigms in agricultural research and development: Integrated agricultural research for development*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
Team building	☑		☑			☑	
Quality assurance	☑						
Resource mobilization	☑					☑	
Leadership	☑						
Communication	☑	☑	☑		☑		
Entrepreneurship	☑			☑			
Systems conceptualization	☑	☑					
Data handling		☑	☑				
Policy analysis		☑	☑				☑
Institutional development	☑						
Strategic planning	☑			☑			
Corporate governance	☑			☑			
Marketing		☑		☑	☑		
IPR management	☑						
Project monitoring and evaluation		☑					
Risk analysis				☑			
Group dynamics						☑	
Advocacy				☑		☑	

Innovation systems perspective

An innovation system incorporates a broad range of activities, actors, policies and contexts. Innovation capacity includes a combination of scientific, entrepreneurial, managerial and other skills and knowledge. It requires partnerships, alliances and networks linking different sources of knowledge and different areas of social, economic and policy activities. Table 3 shows the skills needed for the gaps where training is needed for various stakeholders.

As can be seen in the table, research managers, researchers and trainers require training in many skills in this paradigm. As by the nature of the paradigm, all stakeholders require skills with varying intensity. Research managers require training in leadership, team building, entrepreneurship, systems conceptualization and negotiation. They also need to be technically trained in strategic planning and to be aware of IPR management. To be effective contributors, researchers in the innovation systems paradigm need training in proposal writing, communication, data handling, value chain analysis and

indigenous knowledge evaluation and bio-prospecting. The researchers need soft skills in critical and creative thinking. To contribute to this paradigm, trainers need training in skills for proposal writing, participatory research methods, value chain analysis, marketing and communication. Private sector agencies will need to train their staff in product cycle management and risk analysis. Staff in the private sector also need entrepreneurial skills and risk management skills.

Table 3. *Changing paradigms in agricultural research and development: Innovation systems perspective*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
Team building	☑					☑	
Quality assurance	☑						
Resource mobilization							
Leadership	☑						
Communication		☑	☑		☑		
Proposal writing		☑	☑				
Entrepreneurship	☑			☑			
IPR management	☑						
Systems conceptualization	☑						
Data handling		☑					
Institutional development	☑						
Policy analysis							☑
Institutional development							
Strategic planning	☑						
Participatory research methods			☑				
Negotiation and partnership	☑						
Corporate governance							
Marketing			☑				
Product cycle management				☑			
Value chain analysis		☑	☑				
International rules and regulations (OIE)				☑			
Risk analysis				☑	☑		
Group dynamics							
Advocacy						☑	
Critical creative thinking		☑					
ITK evaluation and bio-prospecting		☑					

Market orientation

The market orientation paradigm, as a change paradigm, encourages farmers to produce what they can market rather than market what they can produce. All stakeholders work towards enhancing the ability of poor farmers to conduct livestock research that links technology development to market opportunities. Against this background, the workshop participants listed skills needed for market-oriented livestock research in ASARECA countries. Table 4 lists the skills needed for market-oriented livestock research and specified the training needs for various stakeholders. Researchers, trainers and managers are in most need of training. The private sector staff and community-based organizations also need training in a few skills. Even though service providers and policymakers deal with market-oriented research, the participants find them trained in what they need. As the table shows, researchers need training in simulation modelling, ICT, econometric methods and project monitoring, evaluation and impact assessment. Managers need to be aware of IPR management, policy analysis and project management. They will also need training in strategic planning.

Table 4. *Changing paradigms in agricultural research and development: Market orientation*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
Team building							
Leadership							
Negotiation and partnership			☑				
IPR management	☑			☑			
Simulation modelling		☑	☑				
Policy analysis	☑			☑			
Strategic planning	☑						
Marketing						☑	
Project monitoring, evaluation and impact assessment	☑	☑	☑				
ICT		☑					
Group dynamics						☑	
Econometric methods		☑					

Impact orientation

Agricultural research in Africa represents a long lasting search for a paradigm for the development of national agricultural research systems that has the expected impact on farmers' livelihoods (Byerlee 1998). The lack of demonstrable impact from research investments has been raised as a concern by governments, donors and civil society alike and is leading to a reduced budget allocation and to emergence of alternative funding mechanisms such as the competitive grants schemes. To achieve this goal, it is necessary to determine the required knowledge, skills, and resources to conduct effective M&E, including impact assessment; and develop implementation and institutionalization strategies for a comprehensive M&E system. M&E contributes to the empowerment of all stakeholders because it promotes active participation and involvement in all phases. With this background in mind, the workshop participants identified skills needed for effective impact orientation research. Table 5 presents the skills identified by the participants as requisite for impact orientation research by the various stakeholders involved in AR4D. Training is needed for many skills for researchers, private sector staff, trainers and research managers. Researchers would require training in project monitoring and evaluation, environmental impact assessment, policy analysis, simulation modelling and ICT. In the same way, trainers require skill improvement in monitoring and evaluation to include impact assessment. The private sector is involved in impact assessment and hence they need skills in product cycle management, negotiation and conflict resolution and business. The participants find that the knowledge possessed by community-based organizations and policymakers is enough to allow them to partner in impact oriented research and there is no need for further training.

Table 5. *Changing paradigms in agricultural research and development: Impact orientation*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
Communication							
Business				☑			
Data handling		☑					
Policy analysis	☑						
Simulation modelling		☑					
Product cycle management				☑			
Project monitoring, evaluation and impact assessment		☑	☑				
ICT		☑					
Socio-economic analysis			☑				
Negotiation and conflict resolution	☑			☑	☑		
Environmental impact assessment		☑					

Value chain analysis

The development of food chains, value addition and competitiveness of agricultural production are priorities in the region that call for new partnerships and alliances since other actors also influence knowledge and innovation. They require approaches that combine science with the development and adaptation of technology and link up to comprehensive commercial strategies. Improvements in productivity, competitiveness and markets will be broad based, meaning they will cover the whole spectrum of the value chain, not focusing only on producers but also considering all the actors and issues through to consumption, including smallholders and pastoralists. The workshop participants listed the skills needed by the stakeholders to address the value chain analysis paradigm (Table 6). All stakeholders were identified in need of skills for value chain analysis. The private sector staff and community-based staff were among the neediest. Researchers need training in strategic planning, participatory research methods and econometric methods. The private sector staff and service providers will need training in marketing, product cycle management. Community-based organizations need training in many skills for value chain analysis such as resource mobilization, group dynamics, credit management and negotiation skills.

Table 6. *Changing paradigms in agricultural research and development: Value chain analysis*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
Leadership and change management	☑						
Strategic planning		☑		☑			
Participatory research methods		☑					
Resource mobilization						☑☑	
Econometric method		☑		☑			
Negotiation and partnership management			☑		☑	☑	
Marketing research				☑			
Credit management						☑	
Product cycle management				☑	☑		
Group dynamics						☑	

Emerging issues

The workshop participants deliberated on only three emerging issues: Avian influenza, biotechnology and climate change. The issues are discussed in the context of their effect on IAR4D. Tables 7, 8 and 9 list the outcome of workshop deliberations.

Avian influenza

The participants listed several skills needed for avian influenza research (Table 7). Training is mostly needed for researchers and trainers. Researchers and trainers need skill training on epidemiology, control strategy, etiology, diagnostic and simulation modelling. In addition to this, the researchers need training on GIS and econometric methods. The community-based organizations need training on biosafety and the managers need to be aware about control strategies.

Biotechnology

A long list of skills was listed for effective research in biotechnology from the subregion perspective (Table 8). The stakeholders targeted for training are managers, researchers, the private sector and community-based organizations. It was surprising that the workshop participants do not see any need for trainers. Managers will need training on strategic planning, IPR management, change management, negotiation, communication and poverty analysis skills. The private sector staff needs training in the science and art of biotechnology research skills. They also need training in standards and regulations,

risk and biosafety management and bio-ethics. Researchers are considered self sufficient in most skills but need training in IPR management, change management and negotiation skills. Community-based organizations need skill training on strategic planning, policy analysis, advocacy and environmental impact assessment.

Table 7. *Emerging issues in agricultural research and development: Avian influenza*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
Epidemiology		☑	☑				
Economic impact							
Control strategy	☑	☑	☑				
Etiology		☑	☑				
Diagnostic		☑	☑				
Econometric		☑					
GIS		☑					
Simulation modelling		☑	☑				
OIE standards and regulations							
Biosafety						☑	
Surveillance							

Table 8. *Emerging issues in agricultural research and development: Biotechnology*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
Strategic planning	☑						
IPR management	☑	☑					
Epidemiology							
Science and art of biotechnology				☑			
Standards and regulations				☑			
Risk and biosafety management				☑			
Bioethics				☑		☑	
Strategic planning							
Change management	☑	☑					
Negotiation and partnership management	☑	☑					
Policy analysis						☑	
Communication	☑						
Advocacy						☑	
Negotiation and conflict resolution							
Poverty and vulnerability	☑						
Environmental impact assessment						☑	

Climate change

A long list was also developed for effective research on climate change in the context of IAR4D (Table 9). Training was demanded for researchers, research managers and community-based organizations. To a lesser degree, training is needed for trainers and service providers. Researchers need training in skills for research on GIS, simulation modelling, science of green house gas emission, ICT and econometric methods. Community-based organizations and service providers need training in skills for trade policies and mitigation strategies.

Table 9. *Emerging issues in agricultural research and development: Climate change*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
GIS		☑	☑				
Simulation modelling		☑					
ITK evaluation and application, bio-prospecting		☑	☑				
ICT		☑					
Econometric method		☑					
Science of green house gas emission		☑					
Awareness							
Environmental policy	☑						
Poverty analysis	☑						
Strategic planning							
Trade policies	☑			☑	☑	☑	
Attribution							
Mitigation strategies					☑	☑	
Advocacy						☑	

Soft skills aggregated across stakeholders

The sections above illustrate training needs by the stakeholders for skills in the various issues of IAR4D. It is clear that the stakeholders may have specific skill requirements but they also share the need for many skills. To elucidate this fact, an attempt was made at aggregating needed skills across the various issues for each stakeholder. Table 10 lists the soft skills requiring capacity strengthening by each stakeholder.

The stakeholder workshop identified managerial skills for research managers. These included leadership skills such as supervision, mentoring, fund raising, planning and policy analysis. Soft skills identified for researchers focused on the need to manage research projects. These skills include proposal writing, project monitoring, evaluation and impact assessment. Researchers would also need training in technical skills such as data handling, indigenous knowledge, GIS and quality assurance. Trainers would benefit from training on similar skills as researchers. The private sector and service provision staff need training in skills mainly business oriented. These include entrepreneurial skills such as product cycle management, customer care, intellectual property rights, trade policies and marketing. Community-based organization agents require training in skills usually needed to manage non-governmental organizations. These skills focus on advocacy, environmental impact assessment, biosafety, bio-ethics, negotiations and conflict resolution.

Even though each group of stakeholders requires specific skills, as stated in the above paragraph, there are skills which cut across all categories. It is evident that communication and networking skills are needed by most categories. Planning and policy analysis skills come second in rating. At a lower priority the workshop participants rated leadership, monitoring, evaluation, and impact assessment and information technologies.

Table 10. *Aggregated soft skills needed by stakeholders*

Stakeholder	Needed skills
Research managers	Leadership and change management (supervision, mentoring, fund raising, planning) Communication Networking Team building (negotiations and partnership management), systems conceptual, institutional development Policy analysis IPR management Poverty, vulnerability and risks quality assurance
Researchers	Communication facilitation Data handling and processing Information and communication technologies Socio-cultural orientation Proposal writing Networking Quality assurance Planning and decision making Project monitoring, evaluation and impact analysis Simulation modelling ITK evaluation and application/bio-prospecting GIS
Trainers	Planning and decision making Socio-cultural orientation Communication Proposal writing Networking Negotiations and partnership management Project monitoring, evaluation and impact analysis Econometric method Simulation modelling GIS
Private sector	Entrepreneurship (business product cycle management, risk analysis and management customer care services corporate governance) International rules and regulations (OIE) Networking Communication Research methods Policy analysis Intellectual property rights management Strategic planning Marketing (development and promotion, quality assurance, risk analysis)
Service providers	Facilitation (negotiations, partnership, mitigation strategies) Communication Product cycle management Risk analysis and management Policy analysis Research methods Marketing methods Information and communication technology Trade policies and international conventions Project monitoring, evaluation and impact analysis Econometric methods
CSO	Advocacy Team building Networking Communication Trade policies and international conventions Environmental impact assessment Biosafety, bio-ethics Resource mobilization Negotiation and conflict resolution
Policymakers	Policy analysis

2.5.2 Training needs of ASARECA Livestock Network (A-AARNET)

The purpose of A-AARNET is to contribute to the ASARECA by addressing the animal agricultural sector. To enhance the capacity of animal scientists in the ASARECA region, A-AARNET finds it is important to identify gaps/weaknesses in capacity for implementation of its agenda in areas such as:

- AR4D for all partners
- Economic analysis, processing to enable R4D on competitiveness, value addition
- M&E; impact assessment; scaling up.

To achieve the above objectives, the workshop participants worked using previously identified priorities for livestock to determine training needs identified for ASARECA region. Tables 11, 12, 13, 14 and 15 present the skills identified for themes and sub-themes (see Annex 4 for list of themes and sub-themes). The matrices in the tables list skills in each sub-theme and the skill training needed for each stakeholder.

Needs for priority theme 1

Priority theme 1 deals with poor livestock productivity and has four sub-themes. Table 11 lists all skills identified by the workshop participants for satisfactory implementation of livestock research in priority theme 1. All stakeholders need training but the highest priority is for the researchers and trainers.

Table 11. Training needs for priority research themes in A-AARNET: Theme 1 poor livestock productivity

Themes	Research managers	Researchers	Trainers	Private sector	Service providers	CO* Policy makers
1.1.Enhancing utilization of animal genetic resources						
Breed characterization, identification and registration		☑	☑			
Conservation and utilization of livestock biodiversity						☑
Biotechnology		☑	☑			
Breeding		☑				
ICT/GIS		☑				
1.2. Improving utilization of feed and water resources						
Formulation of quality feeds			☑	☑	☑	☑
Feeds resources assessment		☑	☑	☑	☑	☑
Water management and policies				☑	☑	☑
Dissemination of technologies		☑	☑		☑	☑
ICT		☑	☑		☑	
1.3. Improving animal health through disease control and prevention strategies						
Epidemiology		☑			☑	
Prophylactic and preventive strategies	☑		☑			
Diagnostic methods of diseases		☑	☑			
Assessment of veterinary input access			☑		☑	
Disease control policies				☑		☑
1.4 Improving packaging and dissemination of technologies						
ICT/GIS		☑	☑		☑	
Innovative knowledge		☑	☑	☑	☑	☑
M&E	☑	☑		☑	☑	☑
Writing skills		☑	☑		☑	
Dissemination tools			☑		☑	
Curriculum development skill			☑			

* CO: Community organizations (community-based organizations, community service organizations, non-governmental organizations, farmer organizations, farmer groups).

Sub-theme 1.1

The researchers and trainers need to be trained in sub-theme 1 on biotechnology, breed characterization, identification and registration. Researchers need training in breeding, ICT and GIS. It is necessary for community-based organizations to receive training in conservation and utilization of livestock biodiversity.

Sub-theme 1.2

The participants find that improving utilization of feed and water resources require training for skills for all the stakeholders. Only the managers and policymakers are exemption.

Sub-theme 1.3

Skills training in sub-theme 3 are needed by all except stakeholders in the community-based organizations. Trainers need skills training for prophylactic and preventive strategies, diagnostic methods and assessment of veterinary input access. Researchers need skill training for epidemiology and diagnostic methods. Managers need to be aware of prophylactic and preventive strategies.

Sub-theme 1.4

In sub-theme 4, skill training is needed most for trainers, researchers and service providers. All three stakeholders need training on ICT, GIS, innovative knowledge and writing skills. Monitoring and evaluation training is needed by managers, researchers, the private sector and service providers.

Needs for priority theme 2

Priority theme 2 deals with improved access to markets and has eight sub-themes. Table 12 lists all skills identified by the workshop participants for satisfactory implementation livestock research in priority theme 2. All stakeholders need training but the highest priority is for the researchers and trainers.

Table 12. Training needs for priority research themes in A-AARNET: Theme 2 improved access to markets

Themes	Research managers	Researchers	Trainers	Private sector	Service providers	CO*	Policy-makers
2.1. Identification and characterization of niche market							
Participatory research		☑	☑				
Econometric		☑	☑				
Market research		☑	☑		☑		
Consumers demand studies		☑	☑				
GIS		☑					
Standard		☑					
Team building	☑						
Resource mobilization	☑						
Negotiation skills	☑						☑
Standards and regulation			☑	☑			
2.2. Identification and agreement on appropriate standards in the ECA region that affect market access							
ICT skills							
Trade agreement and protocol			☑	☑			
Negotiation skills	☑						☑
Conflict resolution							☑
Institutional development							☑
Standards and regulations			☑	☑			

Themes	Research managers	Researchers	Trainers	Private sector	Service providers	CO*	Policy-makers
2.3. Strengthening farmers' organizational capacity and bargaining power in the input–output markets							
Negotiation skills	☑			☑	☑		
Conflict resolution			☑	☑	☑		
Institutional building					☑		
Livelihood analysis		☑					
Institutional development				☑			
Market analysis		☑					
ICT							
Communication and knowledge sharing of products		☑					
2.4 Taxation policies and their impacts on trade							
Tax and tariff analysis		☑	☑				
Monetary policy analysis		☑					
Trade agreements			☑	☑			
Negotiations and partnership management	☑			☑			☑
2.5 Policy analysis to promote private and civil sector investments in infrastructure and services development in market access							
Policy analysis							☑
Risk analysis		☑	☑	☑	☑		
Market research		☑			☑		
Negotiations and partnership management	☑						
Advocacy							☑
Conflict resolution							☑
2.6 Developing strategies to enhance access to market information							
Communication and knowledge sharing products	☑				☑		
Negotiations and partnership management	☑						
Monitoring and evaluation			☑				
2.7 Addressing instruments and institutional arrangements that weaken the ability to bear market risks							
Group dynamics and management			☑				
Risk analysis		☑					
Negotiation skills	☑				☑		☑
Conflict resolution	☑		☑	☑			☑
Institutional development					☑		☑
2.8 Improving efficiency of input and output markets							
Group dynamics and management			☑				
Communication skills		☑					☑
Market research		☑			☑		
Econometrics		☑					
Negotiation skills	☑						
Conflict resolution							☑
Institutional development							
Partnership							☑

* CO: Community organizations (community-based organizations, community service organizations, non-governmental organizations, farmer organizations, farmer groups).

Sub-theme 2.1

Sub-theme 2.1 deals with identification and characterization of niche market. Skills training in this sub-theme are highly needed by researchers, trainers and research managers. Researchers and trainers need training in participatory research, econometric methods, market research and consumer demand studies. In addition, researchers need training on GIS and standards. Managers require training on team building, resource mobilization and negotiation skills.

Sub-theme 2.2

Sub-theme 2.2 deals with identification and agreement on appropriate standards in the East and Central Africa region that affect market access. The participants recognized the need for training in very few skills. Most of the training was demanded for the community-based organizations. Skills needing training for this stakeholder are negotiation, conflict resolution and standards and regulations. No demand for training was stated for researchers, policymakers and services providers.

Sub-theme 2.3

Sub-theme 2.3 deals with strengthening farmers' organizational capacity and bargaining power in the input–output markets. Training for skills was demanded for researchers, the private sector and service providers. Researchers will be trained on livelihood analysis, market analysis and communication and knowledge sharing skills. The private sector staff and service providers will need training on negotiation and conflict resolution skills.

Sub-theme 2.4

Sub-theme 2.4 deals with taxation policies and their impacts on trade. Skill training was identified mainly for researchers, trainers and the private sector staff. Training was needed for tax and tariff analysis, monetary policy analysis, trade agreements and negotiation skills. Managers and community-based organizations need training on negotiation skills.

Sub-theme 2.5

Sub-theme 2.5 deals with policy analysis to promote private and civil sector investments in infrastructure and services development in market access. Even though training is demanded for all stakeholders, very few skills were identified for training. It is assumed that the stakeholders are knowledgeable in most of the skills in this sub-theme.

Sub-theme 2.6

Sub-theme 2.6 deals with developing strategies to enhance access to market orientation. Very few skills were identified for this sub-theme and few among these were earmarked as needed for training. Research managers need training on communication and negotiation skills.

Sub-theme 2.7

Sub-theme 2.7 deals with addressing instruments and institutional arrangements that weaken the ability to bear market risks. Training was demanded for research managers, private sector staff and community-based organizations. The skills needed for training include negotiation, conflict resolution and institutional development.

Sub-theme 2.8

Sub-theme 2.8 deals with improving efficiency of input and output markets. Training was demanded for researchers and community-based organizations. Researchers need training in communication skills, market research and econometric methods. Community-based organizations need training in communication, conflict resolution and partnership.

Needs for priority theme 3

Priority theme 3 deals with improving the utilization of innovations to enhance market opportunities. It has two sub-themes for which the workshop participants listed needed skills to accomplish its objectives.

Table 13 lists all skills identified by the workshop participants for satisfactory implementation of livestock research in priority theme 3.

Table 13. *Training needs for priority research themes in A-AARNET: Theme 3 improving the utilization of innovations to enhance market opportunities*

Themes	Research managers	Researchers	Trainers	Private sector	Service providers	CO*	Policy-makers
3.1. Assessment of demand for market-based innovations							
Commodity chain analysis		☑	☑	☑			
Price analysis		☑	☑	☑			
ICT		☑	☑	☑		☑	
Promotional activities			☑	☑	☑		
3.2. Improving adoption of appropriate innovations that enhance market opportunities							
ICT		☑	☑		☑		
Writing skills		☑					
Promotional activities			☑	☑	☑		
Price analysis		☑	☑	☑			

* CO: Community organizations (community-based organizations, community service organizations, non-governmental organizations, farmer organizations, farmer groups).

Sub-theme 1

Sub-theme 1 deals with assessment of demand for market-based innovations. Training was needed for researchers, trainers and the private sector. The focus on skills was for commodity chain analysis, price analysis, ICT and promotional activities.

Sub-theme 2

Sub-theme 2 deals with improving adoption of appropriate innovations that enhance market opportunities. Researchers, trainers and the private sector needed skill training in ICT, price analysis. Trainers, service providers and the private sector need training in promotional activities skills.

Needs for priority theme 4

Priority theme 4, which has 2 sub-themes, deals with improving value addition in input and output marketing chain. The workshop participants listed a large number of skills required to implement research in this theme. It reflects the complexity of the goal of value chain analysis. Table 14 lists all skills identified by the workshop participants for satisfactory implementation of livestock research in priority theme 4.

Sub-theme 1

Sub-theme 1 deals with innovative marketing strategies for value addition. All the stakeholders need extensive training in all the skills listed for this sub-theme. Since it will be overwhelming to develop modules for each skill, it is suggested that training suppliers regroup the skills in sub-headings. It is clear from the table that researchers, trainers and the private sector staff need extensive training followed in intensity by research managers, community-based organizations and service providers.

Sub-theme 2

Sub-theme 2 deals with improved efficiency and value addition in input and output market chain through policy and institution arrangements. All skills, as perceived by workshop participants, needed to accomplish this task are listed in Table 14. Most training is needed by research managers and service

providers. Research managers and service providers need training in communication, organizational skills and institutional development. The content orientation may differ for the two stakeholders.

Table 14. Training needs for priority research themes in A-AARNET: Theme 4 improving value addition in input and output marketing chain

Themes	Research managers	Researchers	Trainers	Private sector	Service providers	CO*	Policy-makers
4.1. Innovative marketing strategies and technologies for value additions							
Strategic planning and decision making	☑			☑			
Value chain analysis		☑	☑	☑	☑		
Problem analysis/needs assessment		☑	☑				
Processing technologies		☑		☑	☑		
International standards and regulations				☑	☑	☑	
IPR management	☑			☑	☑		
Market analysis		☑	☑				
Econometrics							
Communication	☑	☑	☑		☑	☑	
Leadership	☑						
Critical and lateral thinking	☑	☑	☑				☑
Entrepreneurship and business				☑	☑		
Quality assurance (products)			☑	☑			
Organizational skills	☑			☑	☑	☑	
Post harvest technologies		☑	☑	☑	☑	☑	
Monitoring and evaluation	☑						
Information management	☑			☑			
Policy research		☑	☑			☑	☑
Qualitative data processing		☑	☑			☑	
Risk analysis		☑	☑	☑	☑		
4.2. Improved efficiency and VA in input and output market chain through policy and institution arrangements							
IPR management	☑			☑			
Communication	☑				☑		
Leadership	☑						
Critical and lateral thinking	☑				☑		
Organizational skills	☑				☑	☑	
Monitoring and evaluation						☑	
Information management							
Policy research	☑						☑
Qualitative data processing							
Networking					☑	☑	
Advocacy and lobbying				☑		☑	☑
Institutional development	☑				☑		

* CO: Community organizations (community-based organizations, community service organizations, non-governmental organizations, farmer organizations, farmer groups).

Needs for theme 5

Priority theme 5 deals with contribution of livestock to sustainability and eco-services. It has two sub-themes. Table 15 lists all skills identified by the workshop participants for satisfactory implementation of livestock research in priority theme 5.

Table 15. Training needs for priority research themes in A-AARNET: Theme 5 contribution of livestock to sustainability and eco-services

Themes	Research managers	Researchers	Trainers	Private sector	Service providers	CO*	Policy-makers
5.1. Strategies for adaptation and coping with climate and social-induced crises and shocks							
Early warning systems analysis/GIS		☑	☑				
Disaster preparedness and management					☑		
Relief management					☑		☑
Rangeland management	☑		☑				
Ethnography	☑		☑				
Conflict management					☑		☑
Environmental economics							
Environmental impact assessment	☑		☑				
Socio-economic analysis	☑		☑				
Advocacy and lobbying							☑
Networking				☑			
5.2. Enhanced productivity to increase benefits while conserving ecosystems							
Early warning systems analysis/GIS		☑	☑				
Rangeland management	☑		☑	☑			☑
Environmental economics	☑		☑				
Environmental impact assessment	☑		☑		☑		
Socio-economic analysis	☑		☑				
Livestock–environment interaction	☑		☑				
Natural resource conservation	☑		☑	☑	☑		☑
Wild life management	☑		☑				
Production systems	☑		☑		☑		
Risk mitigation				☑	☑		☑
Moisture conservation techniques	☑		☑		☑		

* CO: Community organizations (community-based organizations, community service organizations, non-governmental organizations, farmer organizations, farmer groups).

Sub-theme 1

Workshop participants listed all the skills needed to operate for sub-theme 1. The focus of needed training is for researchers and trainers. Less intensity is noted for service providers and community-based organizations. Researchers and trainers need training in GIS, early warning systems analysis, rangeland management, ethnography, environmental impact assessment, socio-economic analysis. The service providers' staff need training on disaster preparedness and management, relief management and conflict management skills.

Sub-theme 2

Sub-theme 2 deals with enhanced productivity to increase the benefits while conserving ecosystems. Similar to sub-theme 1, a large list of skills was identified for this sub-theme. Also the focus here is on training researchers, trainers and service providers. Researchers and trainers demand training for all skills except risk mitigation. On the other hand, service providers and the private sector demand less skill training and training will focus on environmental impact assessment, natural resource conservation and risk mitigation.

2.5.3 Aggregated training needs

In sections 2.4.1 and 2.4.2 the results were presented listing skills for various priority themes or changing paradigms. The stress was on the needs of the stakeholders. In this section the focus will be on prioritizing

skills across the stakeholders. Table 16 presents aggregated skills for changing paradigms. Skills that were most frequently demanded include: policy analysis, communication, negotiations, strategic planning, marketing, project monitoring and evaluation, team building and resource mobilization. The method used to aggregate the skills is counting the number of times a skill is needed by all the stakeholders. The problem with this approach is that the stakeholders may differ in the intensity in which the skill or scope of training is needed. For example, managers may need only awareness training whereas researchers and trainers may need in-depth coverage.

Table 16. *Aggregated skills for changing paradigm by stakeholder*

Skills	Research managers	Researchers	Trainers	Private sector	Service providers	CSO	Policy-makers
Policy analysis	☑☑	☑	☑	☑			☑☑
Communication	☑	☑☑	☑☑		☑☑		
Negotiations/partnership	☑☑☑		☑☑	☑	☑☑	☑	
Strategic planning	☑☑☑	☑		☑☑			
Marketing		☑	☑	☑☑	☑	☑	
Project monitoring and evaluation	☑	☑☑☑	☑☑				
Team building	☑☑		☑			☑☑	
Resource mobilization	☑					☑☑☑☑	
Entrepreneurship	☑☑			☑☑			
Data handling		☑☑☑	☑				
IPR management	☑☑☑			☑			
Product cycle management		☑		☑☑	☑		
Quality assurance	☑☑						
Leadership	☑☑☑						
Systems conceptualization	☑☑	☑					
Risk analysis				☑☑	☑		
Group dynamics						☑☑☑	
Simulation modelling		☑☑	☑				
Econometric method		☑☑		☑			
Institutional development	☑☑						
Corporate governance	☑			☑			
ICT		☑☑					
Advocacy				☑		☑	
Proposal writing		☑	☑				
Participatory research		☑	☑				
Value chain analysis		☑	☑				
International rules (OIE)				☑			
Socio-economic analysis			☑				
Environmental impact assessment		☑					
Business				☑			

It was found not possible to use the same approach above to aggregate skills for A-AARNET priority themes as the tables are too complex. This is because the skills in each sub-theme are specific to that sub-theme. But an attempt was made to count the number of times the skill was listed in all of the sub-themes (Table 17). Negotiation rated highest among the soft skills followed by institutional building, conflict resolution and communication. Other soft skills came low in the rating scheme. Market research and ICT rated highest among technical skills. GIS, monitoring and evaluation and risk analysis were rated moderately. It was surprising that many of the important technical skills, e.g. biotechnology, breeding, feeding, disease control, were rated low using this technique. This finding does not agree with findings from secondary sources or the survey. Since the findings in the latter approaches were identified through consultation workshops, it is advisable to adopt the results of the survey and secondary sources.

Table 17. *Skills aggregation for A-AARNET priority themes*

Skills	Frequency of occurrence in sub-themes
Negotiation	8
Market research	7
ICT	6
Institutional building	6
Communication, conflict resolution	5
GIS, monitoring and evaluation, risk analysis	4
Policy analysis, econometric methods, standard and regulation	3
Advocacy	3
Water management and policies, dissemination of technologies, trade agreement and protocol, group dynamics and management, price analysis, qualitative data processing, early warning systems analysis, rangeland management, environmental economics, environmental impact assessment	2
Leadership, writing skills, critical and lateral thinking, organizational skills, networking, information management, promotional activities, IPR management	2
Breed characterization, identification and registration, conservation and utilization of livestock, biodiversity, biotechnology, breeding, formulation of quality feeds, feeds resources assessment, epidemiology, prophylactic and preventive strategies, diagnostic methods of diseases, assessment of veterinary input access, disease control policies, econometrics, participatory research, consumers demand studies, livelihood analysis, tax and tariff analysis, monetary policy analysis, commodity chain analysis, value chain analysis, assessment, processing technologies, quality assurance (products), post harvest technologies, disaster preparedness and management, relief management, ethnography, livestock–environment interaction, natural resource conservation, wild life management, production systems	1
Innovative knowledge, curriculum development skill, team building, resource mobilization, strategic planning and decision-making, partnership, conflict management, problem analysis, entrepreneurship and business	1

2.6 Alternative supplier in the region

Demand for strengthening capacity for livestock research and development is met by many institutions and projects nationally, regionally and internationally. ILRI is meeting this demand through its Capacity Strengthening Unit (CaSt) by offering various training activities and training materials. In some instances CaSt does this in collaboration with other institutions. This section will deal with capacity strengthening efforts by suppliers alternative to ILRI at the national, regional and global levels.

National suppliers

Many national institutions offer capacity building on livestock research, natural resource management and environment. Table 18 lists national institutes in East Africa that offer livestock training and education.

Regional suppliers

Many regional institutions, networks or projects offer capacity building on livestock research, natural resource management and environment. Table 19 lists regional institutes in East Africa that offer livestock training and education.

Table 18. *List of national institutes that supply livestock training in East Africa*

Institution	Capacity strengthening efforts	Target audience
Tegemeo Institute http://www.tegemeo.org	Tegemeo is widely recognized as the centre of excellence in agricultural policy research and analysis in Kenya. Its objectives are to conduct policy-relevant research in agriculture and strengthen capacity that contributes to improved generation, demand and application of policy research. The institute has a fellowship program on policy for MSc and PhD degrees in collaboration with universities in USA and Europe	Kenyan researchers
Agricultural Technology and Information Response Initiative (ATIRI) KARI, P.O. Box 57811 Nairobi, Kenya Fax 254 583344	The Kenya Agricultural Research Institute has formulated ATIRI, whose main goal is to work with partners to meet farmers' information and technology demands. Capacity building within partner organizations (community-based organizations, Government of Kenya extension staff and farmers) is also an objective of the ATIRI	Kenyan community-based organizations, Government of Kenya extension staff and farmers

Table 19. *Regional institutions in East Africa offering livestock capacity building*

Institution	Capacity strengthening efforts	Target audience
The Inter-University Council for East Africa (IUCEA) http://www.iucea.org/	The Inter-University Council for East Africa (IUCEA) is a regional inter-governmental organization established in 1980 by the three East African Partner States (Kenya, Tanzania, and Uganda) with the aim of facilitating contact between the universities of East Africa, providing a forum for discussion on a wide range of academic and other matters relating to higher education, and helping maintain high and comparable academic standards. The IUCEA membership currently stands at 47 public and private universities and university colleges distributed within the three East African countries of Kenya, Tanzania and Uganda. IUCEA offers through the Robert McNamara/EADB PhD Graduate Scholarship in Development Studies	Staff in universities in Kenya, Uganda and Tanzania
FARM AFRICA	FARM-Africa is an international non-governmental organization that aims to reduce poverty in eastern and South Africa. Farm-Africa has training and advisory units in Ethiopia, Kenya, Tanzania, Uganda	Local government bodies, NGOs, farmers and herders, and the private sector
The Organization for Social Science Research in Eastern and Southern Africa (OSSREA) http://www.ossrea.net/	The Organization for Social Science Research in Eastern and Southern Africa (OSSREA) is a regional membership-based and donor-supported research and capacity-building organization whose mission is to promote dialogue and interaction between researchers and policymakers in eastern and southern Africa with a view to enhancing the impact of research on policymaking and development planning. Its headquarters is based in Addis Ababa, Ethiopia. OSSREA offers training on social science methodology. The training focuses on emerging thinking in social science research, ethical issues in social science research, mainstreaming gender and environmental issues, developing research proposals, choosing study approaches and designs, planning and managing social science research and writing a research report	Social scientists

Institution	Capacity strengthening efforts	Target audience
The Pan African Veterinary Vaccine Centre (PANVAC)	The Pan African Veterinary Vaccine Center (PANVAC) was launched in March 2004 as a specialized agency within the Department of Rural Economy and Agriculture of the African Union Commission. It is founded on the belief that, with respect to the major vaccine preventable infectious diseases, the health of livestock in Africa can be drastically improved by the use of good quality vaccines and good diagnostics. The training program was pursued under a UNDP-funded project in various forms: workshops, in-service training, fellowship training and assignment of experts to the national laboratories as well as assignment of trainees to PANVAC laboratories	National laboratories as well as assignment of trainees to PANVAC laboratories
The African Economic Research Consortium (AERC) http://www.aercafrica.org	The mandate of AERC is threefold: enhancing the capacity of locally based researchers to conduct policy-relevant economic inquiry; promoting retention of such capacity; and encouraging its application in the policy context. The training program augments the pool of potential researchers, policy analysts and policymakers through collaborative study programs at Masters and PhD levels, along with direct support to universities participating in the network	Consortium member researchers from Africa
Biosciences Eastern Central Africa (BECA) www.biosciencesafrica.org	BECA offers: Fellowships for scientists, with special emphasis on women scientists, young scientists and those from post-conflict countries Co-supervision of thesis related research Conduct short courses and workshops Seminar series Suitable accommodation and child care facilities for visiting women scientists	African scientists

Global suppliers

Globally many institutions offer livestock training and training materials. Since the number of institutions offering livestock training globally is very large, a selected list is given in Table 20.

Table 20. *A selected list of institutions offering livestock training globally*

Institution	Capacity strengthening efforts	Target audience
International Food Policy Institute (IFPRI) www.ifpri.org	IFPRI's capacity strengthening program collaborates with partners to generate new knowledge and strengthen individual and institutional capacity in food and agricultural innovation systems. Three key initiatives that use distance learning to achieve these aims: Global Open Food and Agriculture University Center for Agricultural Research Management and Policy Learning for Eastern Africa The Virtual Learning Room To enhance regional and local efforts in capacity strengthening, IFPRI's L&CS Program identifies and collaborates with regional networks. IFPRI publishes a capacity strengthening newsletter	NARS and policymakers

Institution	Capacity strengthening efforts	Target audience
International Centre for Agricultural Research in Dry Areas (ICARDA) http://www.icarda.org/Training_opp.htm	The centre offers a wide variety of training activities to suit group and individual needs such as degree and non-degree training and long- and short-term courses. Participants in ICARDA's training program are offered the opportunity to work with a team of international scientists in the classroom, laboratory and field. The centre courses cover the following topics: molecular characterization of small ruminants, integrated crop and livestock production and design and analysis of experiments	NARS in Sudan, Ethiopia and Eritrea
World Agroforestry Centre www.icraf.org	World Agroforestry Centre's Global Training Unit is located in Nairobi, Kenya. The centre strengthens capacity in agroforestry research and development through training and education. It offers: Short training courses Learning resources Individual training opportunity Support to tertiary education training Online learning resources Training support and research	NARS
Pastoral and Environmental Network in the Horn of Africa (PENHA)	The Pastoral and Environmental Network in the Horn of Africa (PENHA) is an international NGO led and inspired by Africans, mostly from the Horn Region. Its headquarters is in London but it has established offices in Uganda, Eritrea, Sudan and Ethiopia	PENHA offers capacity building, training and education delivery for pastoralist communities with consideration of gender equality. It also provides training to relevant local NGOs and community-based organizations, line ministries etc. to improve the effectiveness of service delivery for pastoralist communities
The Global Livestock CRSP http://glcrsp.ucdavis.edu/	The Global Livestock CRSP, a USA program, built on the structural strengths of US land-grant universities and collaborative partnerships with international organizations, has four characteristics: 1) Collaboration with US land-grant universities; 2) International training; 3) Long-term scientific relationships; 4) Program cost-effectiveness. One of its objectives: To strengthen the ability of institutions in developing countries to identify problems in livestock production and develop appropriate solutions	Livestock researchers and educators
BASIS Research Program, University of Wisconsin-Madison Department of Agricultural and Applied Economics http://www.basis.wisc.edu/	The BASIS Research Program on poverty, inequality and development is dedicated to understanding the poverty and income distribution dynamics of rural economies and to crafting creative policies and programs that broaden the base of economic growth and offer sustainable pathways from rural poverty. BASIS collaborates on postgraduate training and short courses	Livestock researchers and PhD students

Institution	Capacity strengthening efforts	Target audience
The African Centre for Technology Studies (ACTS) http://www.acts.or.ke	ACTS is a Nairobi-based international intergovernmental science, technology and environmental policy think-tank that generates and disseminates new knowledge through policy analysis, capacity building and outreach. The centre strives to rationalize scientific and technological information to enable African countries make effective policy choices for improved living standards. ACTS works with partners and networks including academic and research institutions, national governments, UN bodies, regional and international processes and NGOs. ACTS' research and capacity building activities are organized in five programmatic areas: Biodiversity and environmental governance; Energy and water security; Agriculture and food security; Cross-cutting issues; and Science and technology literacy. Its members include the Governments of Kenya, Malawi, Malta, Uganda and Ghana, as well as the World Agroforestry Centre (ICRAF) and the Third World Academy of Sciences (TWAS)	
Livestock in Tropical Farming Systems http://www.ansci.cornell.edu/courses/as400/main.html	Cornell University offers to students, instructors and professionals in developed and developing countries a portfolio of educational materials about Livestock in Tropical Farming Systems on a set of 3 CD-ROMs. Resource materials are thematically organized and richly photographically illustrated in a web-style format. Users are helped to explore hierarchies of binding constraints on productivity and economic returns in complex tropical systems with livestock	African livestock post-graduate students
CGIAR Online learning Resources http://ariadne.cs.kuleuven.be/cgmoodle/	'CGIAR learning objects' repository in collaboration with several CG Centres. This was a World Bank funded pilot project and the repository can be found at http://learning.cgiar.org . It is linked to a Learning Management System called Moodle and this versatile framework enables centres to produce and maintain online courses	NARS and universities

2.7 Potential partners for collaboration

The survey revealed many partners that the respondents see as potential partners in their country/region, deliver courses addressing the gaps mentioned in section 2.5. The following is the list summarizing the response:

- Uganda: Uganda Management Institute, Makerere University, NARO
- African Institute for Capacity Development
- Tanzania: Sokoine University of Agriculture, ESAMI Tanzania
- Kenya: Feed manufacturers, Kenya KVA, Kenya Ministry of Livestock, Kenya Ministry of Agriculture, NGOs
- Ethiopia: Ethiopian Management Institute, Addis Ababa University, Haremaya University, Ethiopian Civil Service College
- Sudan: Agricultural Research Corporation, Animal Resources Research Corporation and Central Veterinary Laboratories
- Burundi: ISABU scientists after a consolidated training
- Rwanda: RARDA (Rwanda Animal Resources Development Authority), NUR (National University of Rwanda), ISAR (Rwanda Agricultural Science Institute)
- Democratic Republic of Congo: Faculty of Agriculture

2.8 Opportunities and challenges for capacity strengthening in the region

This section of the report focuses on the opportunities that give added value to capacity strengthening. Information is drawn from the survey and the literature. The rationale for these topics can be:

- availability of new technologies, e.g. digital technologies, biotechnology etc.
- their cost effectiveness
- offering innovative ways for capacity strengthening.

2.8.1 E-learning

The revolutionary change which is taking place in information and communication technologies (ICTs), has dramatic effects on the way universities and research institutions carry out their functions of teaching, learning and research, particularly on the creation, dissemination and application of knowledge. These developments pose unprecedented challenges to higher education institutions in developing countries particularly in Africa.

ICT is seen as having the potential to upgrade the training offerings available to researchers/students, to make available on-line journals and research findings; and to facilitate research collaboration both within Africa and between African institutions and institutions in the US and Europe. However, the reality falls considerably short of the vision. Therefore e-learning is an opportunity and challenge to ILRI and its partners. Two forms of e-learning will be focused on in this report: open distance learning by education institutions in East Africa and ILRI's platform for e-learning.

Open distance learning/education

Distance education is formal instruction conducted at a distance by a teacher who plans, guides, and evaluates the learning process. Nearly every country in the world makes use of distance education programs. Distance education increasingly uses combinations of different communication technologies to enhance the abilities of teachers and students to communicate with each other. To date, distance education is making use of computer conferencing on the World Wide Web, where teachers and students present text, pictures, audio, and occasionally video. As the technology improves, educational capabilities increase correspondingly. The emergence of inexpensive computer technology and mass storage media, including optical videodiscs and compact disks has given instructional technologists better tools with which to work. Compact disks (the CD-ROM) are used to store large amounts of data, such as encyclopedias or motion pictures. At new interactive delivery stations with computers and CD-ROM, or videodiscs, a student who is interested in a particular topic can first view an electronic encyclopedia, then watch a film on the subject or look at related topics at the touch of a button. These learning stations combine the advantages of reference materials, still pictures, motion pictures, television, and computer-aided instruction. With even newer technologies now being developed such learning stations will eventually be commonplace in homes for both entertainment and educational purposes. Distance education has created a major shift in how educators and students think about teaching and learning. By allowing students to learn in more convenient locations and often at more convenient times, distance education opens educational opportunity to previously unreached populations. It also enables more people to extend the period of their education from a limited number of schooling years to a lifelong learning process. In addition, it changes power and authority relationships between teachers and learners, often encouraging more equal and open communication than in conventional educational settings. Because distance education enables institutions to reach students all over the world, learners gain increased opportunities to experience other cultures while enriching their educational experience.

Currently, developing countries are experiencing a significant capacity constraint despite the Tertiary Education Formal Classroom programs in respective national universities. It is observed that this gap

between *capacity* and *need* must be addressed if the advances made thus far in agriculture-led poverty reduction in the developing world are to continue, and if chronic and transitory food insecurities are to be eradicated in the region.

Looking at the situation in East Africa, the situation in two institutions can be cited. The University of Dar es Salaam and Makerere University are in the process of significantly up-grading their infrastructure with donor assistance. USDM will have three fiber optic backbone networks that will link computers throughout the university and the internet linkage will be upgraded. Makerere University has been quite successful in enlisting donor support for developing infrastructure. The African Development Bank will fund the networking of the main campus. USAID, through the Leland Initiative, is financing the installation of a wireless backbone; and NORAD is providing USD 11 million grant for ICT-activities. Makerere University's second strategic plan identifies five priority areas for the application of information and communications technology including implementing specific ICT-based applications for teaching and research. In 2002, it began implementing an on-line component for 10 campus-based courses in political science, gender studies, and sociology.

The World Bank, through its Global Development Learning Network, also has training facilities with good connectivity and video conferencing capability in Kampala, (located at the Uganda Management Institute) and Dar es Salaam (Institute of Financial Management). These facilities, which are used by the Bank for in-country training programs, are available to other institutions on a fee basis and could be potentially used for distance education programs by the universities.

Access, however, is only one component of distance learning. The second component—design of the course materials and local support for learners—is often overlooked in discussions that focus on access and connectivity. There is a difference between providing a delivery mechanism and enabling the creation of appropriate learning experiences. Good distance-learning will require courses with material that is specific to Africa and uses learning modalities that are adapted to African preferences. It will also require on-site student support, a component that is often missing or poorly thought out in many distance-learning initiatives.

There is enormous potential for the new technologies to contribute to the upgrading of research and teaching in Africa. But at this point, designing good distance learning opportunities will require realistic assessments of the situation within individual faculties of agriculture. The status of universities in East Africa is shown in Table 21 .

The American Agricultural Economics Association (AAEA) has been for some time considering developing some distance learning modules on different subject areas pertaining to agricultural economics. If the steering committee of the Collaborative Masc. Program in Agricultural and Applied Economics feels that some modules could be used in their program, then the team would be supportive of a small amount of money being given to support this. Given current inadequacies of electronic connectivity in some of the region's faculties of agriculture, the team believes that using CDs would be a more appropriate mode of distance learning in the immediate future.

Another distance learning initiative that could be considered is the Master's of Agricultural Business at Kansas State University. This attracts individuals from different parts of the world although to date, not from Africa. The potential exists for adapting some of the modules in CD format for use in the region. This could be done at relatively little cost, but such an initiative should be adapted in partnership with knowledgeable individuals in the region.

The Consultative Group on International Agricultural Research (CGIAR) considers that distance learning as a means could effectively improve the skills of developing country students and professionals but it requires that proper assessment is made. The gaps include both the Open Distance Learning (ODL) as an *issue* and the stakeholder administrative and operative *management* structures as the other. The fact

that this is already not happening means that a *gap* exists between what is and what should be. It is observed that this gap between *capacity* and *need* must be addressed if the advances made thus far in agriculture-led poverty reduction in the developing world are to continue, and if chronic and transitory food insecurities are to be eradicated in the region.

Table 21. *Status of distance education in East Africa universities*

Faculty of Agriculture	Status of distance education
University of Nairobi	The University is a member of the KENET system that links the universities in Kenya and improves their connectivity. However, this has not led to improved access in the Faculty of Agriculture to date. Computers are old and cannot run the new software; access to the internet is extremely limited with only one (slow) dial-up connection in the Dean's office. There is no networking of computers in the faculty of agriculture
Egerton University	Access to computers and internet connection is limited. The University of Massachusetts is implementing a project to build computer labs for the faculty of Social Sciences and to develop an internet cafe/business centre. This has not resulted in increased internet access for the Faculty of Agriculture to date
Moi University	The Faculty has limited internet connectivity and does not have a distance-learning program
Jomo Kenyatta University of Agriculture	The university is in the process of installing internet connectivity, but it was noted that such a facility would still be inadequate for distance learning. The library has a CD-based literature support from the TEEAL Program, whose implementation is supported by the FORUM program
University of Dar es Salaam	With the help of NORAD, the Faculty is developing a distance-learning curriculum and is looking into bandwidth issues. Further assistance is needed in curriculum development for various courses, interactive pedagogical techniques, and infrastructure development for course delivery
Sokoine University of Agriculture	The Faculty is exploring a distance-learning program with Wye College of the UK. Limited connectivity and computer resources are an issue
Makerere University	Connectivity for the entire university will be substantially improved through an ICT development project funded by a consortium of donors. The Faculty has a facility for distance learning and offers limited distance learning to districts. However, assistance is required in pedagogy for distance education delivery. Excellent facilities for distance education including video conferencing capacity are available at the nearby Uganda Management Institute that can be used on a fee-basis

The CGIAR conducted a training needs assessment (Akundabwenil 2004) on distance education and the stock of recent training needs assessments (TNAs) conducted by CGIAR centres and similar research organizations on postgraduate education in agriculture, natural resources, and food security in Africa. Its two objectives were:

1. To take stock of recent TNAs on post-graduate education in agriculture, natural resources, and food security in Africa
2. To prepare a comprehensive synthesis of their findings and suggest a way forward.

The TNA study concluded that the Consultative Group on International Agricultural Research (CGIAR), with its human and physical assets, has a tremendous opportunity to establish a Global Open Food and Agriculture University that would effectively train students and professionals from developing countries via ODL. The most strategic entry point in this undertaking is to initiate programs at a post-graduate level, in particular, the Masters of Science (MSc) degree. It is important to work at the MSc level because the MSc capacity in east and southern Africa still remains very low in proportion to the number of students who matriculate from the undergraduate level. Also, the current pool of MSc graduates is insufficient for large doctoral (PhD) programs. As a mitigation measure (especially in the areas of farming, hunger, poverty, and natural resources), ODL offers opportunities for increasing the capacity of LDC postgraduates. However, many traditional LDC universities do not offer such programs. A Global Open Food and Agriculture University would be a way to address the LDC postgraduate capacity constraint.

With a desire to formally engage partners in realizing the Global Open Food and Agriculture University, the CGIAR brought together partners from developing and developed country universities, university associations, distance learning institutions, and donors for a one-day dialogue on August 26, 2004. The stakeholders at this dialogue supported this CGIAR Program and are eager for it to be implemented, although with caution. It was agreed that the program will take a step-by-step approach in its implementation and will take into consideration the issues raised during the dialogue which include the following:

- Accessibility of students and universities (professors) to information and communication
- Adequate and available information and communication technology (ICT)
- Need for library support
- An approach for maximizing the impact of CGIAR knowledge through this Program
- Production of high-quality agricultural graduates exceeding market demand
- Need to strengthen undergraduate education as its quality has an impact on graduate education
- Lack of qualified academic staff and
- High financing requirements.

It was concluded that the Global Open Agriculture and Food University can make a difference in solving food insecurity and poverty through increasing the quality and quantity of postgraduate education. Educating the next generation of agricultural researchers, policy advisors, and university professors will provide a solid basis for implementing sustainable technologies and policies.

ILRI's learning platform

ILRI provides animal science training to livestock researchers in NARS at various stages of their career development. One entry point is to facilitate the learning environment at universities while the researcher is training for higher degrees (MSc or PhD). In most cases, knowledge and information on animal science available to university teachers that supervise the graduate students are outdated. One of the factors leading to this is the lack of financial resources available to libraries in developing countries. Training resources available commercially are developed to suit developed country situations and it may be misleading to use them to educate students in developing countries. ILRI's approach leads to sustainable learning environments by ensuring that universities and research institutions periodically receive products with the most up to date knowledge. To meet this objective, ILRI developed training resources which can be defined as interactive electronic knowledge and information products that provide, in an integrated manner, resources to teachers and trainers. ILRI produces training resources on CD-ROM and web-based media.

ILRI in collaboration with SLU (Swedish University of Agricultural Sciences) launched the project called Capacity Building for Sustainable Use of Animal Genetic Resources in Developing Countries. The main objectives are to strengthen subject knowledge and skills, as well as teaching and communication skills, of university and NARS animal scientists teaching or supervising BSc, MSc and PhD students in developing countries. The project includes the following components: introductory core texts in five different modules (covering animal breeding topics, as well as teaching methods), lecture handouts on a variety of topics, computerized exercises, case studies relevant to the different regions, breeds database etc. The training resource will continuously be improved in further releases.

ILRI also has a project on 'Biometrics and Research Methods Teaching Resource'. The resource is to enhance effective teaching of and training in biometry through teaching guides, interactive, illuminating real-life case studies and other teaching materials. It is built around six proposed teaching guides that take the reader through the research process. These are: research strategy, study design, data management, exploration and description, statistical modelling and reporting. The Teaching Resource also includes other teaching material provided from University of Reading, ICRAF, University of Kwazulu-Natal and Massey University, New Zealand. The teaching resource contains 13 case studies drawn from research conducted in Ethiopia, Kenya, Swaziland, Uganda and Zambia. The case studies go through

different parts of the research process as set out in the teaching guides, and illustrate how methods of design and analysis are applied to the examples described. Four short videos have also been produced that demonstrate how arable and animal experiments are laid out and illustrate other aspects of research methodology in the field. A fifth video shows a consultation between a biometrician and a client. Each case study has its own data set(s) and study questions and has been designed around the statistical software GenStat. A 'Discovery' version of GenStat, free to users in sub-Saharan Africa, is distributed alongside this teaching resource.

ILRI produced the training resources in animal genetics and biometrics after extensive consultation with the stakeholders in African countries. Both were published in CD-ROM and web-based format. The impact of these training resources is not yet studied or reported. The material can be basis for content in e-learning or distance learning courses. Therefore ILRI has an important opportunity in its hand. The e-learning platform in ILRI is a product of collaboration among CaSt, Information Service Unit and scientists in ILRI, universities and researchers in Africa.

2.8.2 Biosciences

Advances in the biosciences promise powerful new ways of improving crop and livestock productivity, and minimizing threats to human health and to the environment. The challenge is to mobilize new scientific advances for Africa's development, to reduce poverty and create wealth in sustainable and equitable ways. Many problems constraining Africa's development require solutions specifically tailored to unique local, national, and regional circumstances. Some solutions may be developed from existing knowledge and adaptation of available technologies. Many, however, require new knowledge, new discoveries and endogenous innovation—by Africans, for Africa. Many opportunities present themselves to achieve the goal of using biosciences but there are also many constraints. One of these constraints is the lack of sufficient, suitably trained scientists, who are able to have a career path as scientists in Africa. Many opportunities in the form of biosciences hub, initiatives and projects present themselves for capacity strengthening. Table 22 summarizes the opportunities for capacity strengthening in biosciences.

There is a challenge for ILRI and its partners in East Africa to join these initiatives. NARS in East and Central Africa vary in their need and capacity for biosciences. Few institutes, for example, KARI and EIAR, are ready to make use of the opportunities in Table 10. To illustrate the concept, I will detail the KARI and EIAR cases. Other institutes in East Africa will be similar to one or the other examples.

KARI case

Biotechnology in Kenya is taking place within the context of an established agricultural R&D system. The main modern biotechnology program and policy-related initiatives include:

- Transgenic sweet potato for virus resistance, a collaborative public-private research project involving Kenya Agricultural Research Institute (KARI), Monsanto, Agricultural Biotechnology for Sustainable Productivity (ABSP) project, International Service for Acquisition of Agbiotech Applications (ISAAA) and Michigan State University (MSU).
- The Insect Resistant Maize for Africa (IRMA) project, a *Bt* Maize project involving public and private partnerships among KARI, CIMMYT, Novartis (now, Syngenta), Foundation for Sustainable Development and Rockefeller Foundation.

While conceding that these initiatives contributed to the technical and legal capacity of national institutions such as KARI and placed them on the technology-frontier, some critics were concerned about the threat of weakening public research. In particular, they observed that the use of proprietary technology threatened to replace free exchange of knowledge and undermine the public goods produced through national research programs. Furthermore, much of the effort was confined to capacity building

for transgenic sweet potato and *Bt* Maize research at the national level, and not extended to the local level.

Table 22. *Opportunities for capacity strengthening in biosciences in Africa*

Bioscience opportunity	Capacity strengthening component
National Programs on Biosciences and Biotechnology	High level political support, national policies and strategies, in support of specific research programs and projects are in operation in several countries, for example, in Ethiopia, Kenya, Rwanda, Tanzania and Uganda. These programs are supported by national resources as well as receiving external support from bilateral donors and multilateral agencies including UN agencies and the World Bank
Biosciences Eastern and Central Africa (BeCA)	Biosciences Eastern and Central Africa (BECA) consists of a hub located on the campus of the International Livestock Research Institute (ILRI) in Nairobi, Kenya, that will provide a common biosciences research platform, research-related services and capacity building and training opportunities. Capacity building is a major goal of all program activities of BECA. It provides opportunities to increase the capacity of institutions and individuals. Bioscience training and leadership training opportunities target African scientists and technicians, particularly youth and women; and a specific fund to enhance the role of women in bioscience research
USAID Biotechnology Initiative	The initiatives include a regional biotechnology and biosafety program in East and Central Africa, biosafety regulatory training in southern Africa, public awareness of biotechnology through the region, development and distribution of livestock vaccines developed from biotechnology, and testing of genetically engineered crops in Kenya and South Africa. The regional-based training focuses on scientific risk assessment, access to information, risk management strategies, and genetic techniques
BIO-EARN	The mission of the BIO-EARN Programme is to build capacity in biotechnology in Ethiopia, Kenya, Tanzania and Uganda and promote appropriate research and related policies. It promotes sharing of experts and facilities amongst institutions and training of scientists. In its first two phases, BIOEARN trained approximately 20 African graduate students to PhD level, in cooperation with Swedish universities. In its next phase, it aims to develop and support regional research projects in agricultural biotechnology and environmental biotechnology. http://www.bio-earn.org
Future harvest research institutes with livestock bioscience component:	CIAT conducts international research on forages. http://www.ciat.cgiar.org
International Center for Tropical Agriculture (CIAT)	ILRI's research focuses on livestock diseases in developing regions of Africa, Asia and Latin America and the Caribbean. http://www.ilri.org/
International Livestock Research Institute (ILRI)	
Program for Biosafety Systems (PBS)	PBS is a partnership program for biosafety capacity development. PBS supports partner countries as they develop the policy and legal framework, administrative procedures, technically qualified personnel and outreach mechanisms integral to their national biosafety systems. PBS work emphasizes sound science-based decision-making and research, while also addressing socio-economic considerations. http://www.ifpri.org/themes/pbs/pbs.htm
UNEP/GEF Biosafety Projects	The objectives of the GEF Initial Strategy on Biosafety are: to assist with national biosafety frameworks; to promote information sharing and collaboration, especially at the regional and subregional level; and to promote collaboration with other organizations to assist capacity-building for the CBD Biosafety Protocol. http://www.unep.ch/biosafety/about.htm

It was clear to KARI that it should focus and define its objectives for comprehensive strategic research in modern biotechnology to benefit resource-poor smallholders. Equally important is the effective communication and implementation of the development strategy with the relevant scientists and stakeholders. To this end, the management of modern biotechnology research initiatives in Kenya often seeks to strengthen the country's legal, scientific and management capacities. This requires strong scientific knowledge and linkages in technology generation, which were undeveloped in traditional biotechnology innovations.

The problem of building capacity is exacerbated by the deficiency of both quantity and quality of personnel in the relevant disciplines of modern biotechnology. In particular, the government and research institutions do not have specific training strategies for building national capacity in biotechnology, IPRs and biosafety regulations. Rather the research institutions have incorporated their training needs within the framework of individual research projects/programs (KARI Training Masterplan 1997). With increasing proprietary knowledge, the public research sector can only access the technology and the relevant human resource capacity training through collaboration with the private sector and donor funding. Some respondents pointed out that the approach was limited to a few scientists and short courses. There is thus limited contribution to the long-term strategy for achieving a critical mass of human resources needed to effectively engage in modern biotechnology. The country is currently facing a crisis of training and retaining scientists. The few scientists that are highly trained leave the country for better career opportunities in Europe, North America and southern Africa. For instance, Kenya's national newspaper, the Daily Nation, reported recently that 1 out of 14 scientists who had qualified with PhD in molecular biology and genomics was still in the country by the end of 2001. This may be attributable to under-utilization of existing capacity as a result of poor scientific infrastructure. Much of the deficiency in modern biotechnology capacity is also related to intensification of science and costs. Therefore, effort is still needed to develop agricultural biotechnology strategies that work with diverse social groups and their particular constraints, and not against or around them.

ElAR case

The Ethiopian Institute of Agricultural Research (ElAR) published its strategy directions (ElAR 2007). ElAR offers an example where there is resolve to get into biosciences, modest infrastructure and funding. Ethiopia has lagged behind its neighbours in terms of investing on research and development on modern agricultural technologies such as biotechnology. Accelerated efforts shall be needed to build both material and human capacities in this area. Efforts that began in recent years to establish biotechnology laboratories at Holetta, Jimma, Melkassa, and Debre Zeit shall be sped up.

Biotechnology research in ElAR has immediate, medium, and long-term objectives. The immediate task here is to use biotechnology for rapid multiplication of planting materials (tissue culture), embryo transfer, disease diagnosis, and production of disease-free seedlings, and identification of microbial strains for microbial fertilizer production. Medium-term objectives include genetic fingerprinting of high priority indigenous crops such as tea, coffee and *enset*, and conservation. Research into cutting-edge science shall be considered in the long-term, once national biosafety regulations are in place. Currently the Biotechnology Research program at ElAR has three projects. These are Plant Biotechnology Research, Animal Biotechnology Research, and Microbial Biotechnology Research, ranked in that order. The ElAR strategy recognizes that there is a need for a demand-driven and merit-based human resources development, with a particular emphasis on biotechnology.

3 Key conclusions and recommendations

3.1 Introduction

The study reviewed large amount of literature on needs assessment and capacity strengthening approaches in East and Central Africa. Most institutions in East and Central Africa responded to the questionnaire and attended the stakeholder consultation workshop. The key findings are based on information obtained from the secondary sources, the survey questionnaire and the consultation workshop. The key findings were used to make conclusions and recommendation for future actions.

3.2 Key findings

In East and Central Africa, the human resources for livestock research vary by country. The highest need for trained livestock research staff is in post-conflict countries. For example, in Burundi, the sharp decline in ISABU's total number of researchers during the 1990s was relatively more severe for those holding doctorate degrees. A similar conclusion can be stated for Rwanda and Congo. The survey conducted by ILRI revealed that training is needed in all other countries in East and Central Africa. Many stakeholder workshops and surveys during the last decade confirm this finding.

The survey, stakeholder workshop and secondary sources revealed the need to build capacity for policy research. Specific policy topics to be addressed by capacity strengthening efforts include policy formulation and tools, awareness raising and policy negotiation.

The need for capacity strengthening in animal health research was highly stressed. The principal limiting factor for effective control of the disease in developing countries is inadequate capacity. Without surveillance and rapid diagnosis, a coordinated effort in Africa has proved difficult. Thus the need for training programs so that laboratory personnel in Africa will be able to use appropriate diagnostic tests, incorporate results correctly and adhere to quality assurance. Priority was placed high for capacity strengthening on the prevention and control of diseases of animal and public health such as zoonotic diseases, infectious and non-infectious diseases, vector and vector borne diseases, tick-borne diseases, eradication of tuberculosis, Foot-and-Mouth-Disease, African swine fever, bovine brucellosis, tuberculosis, trypanosomiasis and avian flu. Need was expressed to address the issue of drug availability, use and cost.

Emerging developments in biosciences offer promise of new means to address a number of constraints. Even though African countries vary in their capacity for biosciences research, the stakeholders in East Africa and their regional and international partners established the Biosciences Facility for East and Central Africa (BECA). Training through BECA will focus on biosciences and management skills. This is in line with the outcome of the survey conducted for this study. High priority was given to training for skills in biotechnology and laboratory management. The respondents listed bio-informatics, scientific knowledge on biotechnology, molecular biology and biotechnology skills. In addition the list included training of skilled laboratory technicians, laboratory engineering research, laboratory organization and scientific knowledge in laboratory technology.

The secondary sources, outcome of the survey and stakeholder workshop recognized a need to focus on socio-economic issues. Strengthening post-graduate education in the region at the MSc level was one suggested approach. For this purpose an initiative for an MSc program was established. Among the socio-economic issues, the survey and stakeholder workshop revealed that capacity strengthening for marketing research is high priority. The focus on marketing was lack of marketing research *per se*. It was stressed that marketing research should cover livestock and livestock product marketing, feed marketing, innovative marketing strategies through value addition to livestock and livestock products and appropriate post harvest technologies and marketing information.

Many stakeholder consultations confirmed the needs for training and retooling in the African university faculties of agriculture. Not only have the numbers taking the BSc degrees in various aspects of agriculture greatly increased, but also most faculties have introduced MSc and even PhD degrees. Initiatives were established by funding institutions to meet the capacity needs of educational institutions in East and Central Africa. The result of the survey stresses collaboration between ILRI and the universities in the region. This will require ILRI's contribution to strengthening the capacity of partner universities.

Secondary resources and the stakeholder workshop revealed a gap in information and communication. ASARECA initiated the RAIN network to deal with this gap. The needs assessment study by RAIN revealed many gaps in information and communication and outlined the steps to strengthen capacity in this area. The survey also recognized the need to strengthen capacity for ITC in East and Central Africa as part of the overall effort for improving research on livestock.

Survey results as well as secondary sources revealed that one of the issues facing African providers for building capacity is on the design and implementation of an effective network for building human and institutional capacity. Many research networks are operating in East and Central Africa. These networks provide training to its members. Very few networks exist for capacity strengthening. During the 1990s the International Agricultural Research Centres (IARCs) operating in Africa created, in collaboration with NARS, a training network with the objective of streamlining capacity strengthening and as a hub for collaboration. The effort failed and a new thrust is needed at least for livestock research capacity. The survey results revealed a desire by the respondents for institutions in their country and the region to collaborate with ILRI. This is a great pool for effective collaboration/networking.

The development of well-trained researchers takes time and is costly. Funding was given priority in the secondary resources and the result was confirmed by the stakeholder workshop. Results from the survey and stakeholder workshop revealed the need to strengthen skills in strategic planning and priority setting. Specifically, insufficient funding was singled out as an important managerial constraint. There is a need to improve skills in efficient and maximum utilization of research funds. Skills in writing convincing proposal were rated as needed (90% of respondents rated high and medium).

The respondents stressed the need for training in management. Respondents stressed training for post-graduate degrees in management fields and at the same time develop on-the-job training opportunities. ILRI does have the comparative advantage for this type of capacity strengthening. The challenge is for ILRI and other capacity building organizations to broker this demand.

The survey results produced a list of areas that need trained researchers. Post-graduate training was demanded for the specialization in animal breeding, animal nutrition, range management and animal production. Since the survey covered capacity strengthening in general, the respondents indicated high need for undergraduate level education in animal science, animal production and range management.

The survey revealed the need for training in animal nutrition, analysis of feed, development utilization of non-conventional feed resources, forage crop breeding and forage conservation techniques.

Advancement in information and communication technologies prompted stakeholders in East Africa to plan to use this frontier in training and education. Two forms of e-learning, mainly open distance learning by education institutions in East Africa and ILRI's platform for e-learning, were covered in this report. The consensus for the demand of this mode of delivery was endorsed by many stakeholders. The survey did not cover this area. An outcome of this approach may be the establishment of the Global Open Food and Agriculture University by the CGIAR and its partners. ILRI already forged partners in Europe, Africa and Asia for its training resources platform.

The stakeholder workshop identified the need to train on soft skills such as team building, negotiation, institutional building, conflict resolution and advocacy skills. Most important is the agreement of the

findings of the three approaches (secondary resources, survey and stakeholder consultation workshop) with the new changing paradigm drives. The interaction among the facilitators and workshop participants was useful in discussing in detail aspects of integrated research for development, innovation systems, market orientation, impact orientation, value chain analysis and many emerging issues.

3.3 Major conclusions

The training needs assessment clearly reveals the need to strengthen capacity for livestock research in East and Central Africa. There are many providers and opportunities for these providers to collaborate and form a consortium. The need to strengthen livestock research capacity is for all countries in the region but highest for staff in post-conflict countries. The NARS in the region are very varied in their strengths for livestock research. A-AARNET (2005) recognized these facts and strives to target the weak NARS by helping them to become competitive. The survey, stakeholder consultation workshop and secondary sources revealed the need to build capacity for policy research. Specific policy topics to be addressed by capacity strengthening efforts include policy formulation and tools, awareness raising and policy negotiation.

The need for capacity strengthening in animal health research was high priority. African countries demand building capacity for bioscience research. The establishment of Biosciences Facility for East and Central Africa (BECA) raised hope for effective capacity strengthening in the skills needed. African institutions and scientists are eager that Africa is not left out.

Capacity strengthening for socio-economic research was given high priority by the stakeholders in many consultations and in this study. Many stakeholder consultations also confirmed the needs for training and retooling the African university faculties of agriculture; this came as high priority. This will require ILRI's contribution to strengthening the capacity of partner universities.

Studies by ASARECA's RAIN network revealed many gaps in information and communication and outlined the steps to strengthen capacity in this area. The survey also recognized the need to strengthen capacity for ITC in East and Central Africa as part of the overall effort for improving research on livestock.

Networking for research and capacity strengthening are highly needed for effective delivery and flow of information among the partners. ASARECA nurtures this type of approach.

The need to strengthen their skills in strategic planning and priority setting was stressed. Specifically, insufficient funding was singled out as an important managerial constraint. There is a need to improve skills in efficient fund raising and maximum utilization of research funds. This will require proficient skills in writing convincing proposals.

Training managers to do a better job was stressed as high priority. The challenge is for ILRI to broker other capacity building organizations to meet this demand.

Post-graduate training was demanded for the specialization in animal breeding, animal nutrition, range management and animal production. A-AARNET (2005) indicated in its strategy that one major opportunity is to use the projects as a means for postgraduate training. Courses were demanded for training in animal nutrition, analysis of feed, development utilization of non-conventional feed resources, forage crop breeding and forage conservation techniques

This survey and secondary sources concluded that it is time to engage in e-learning. There are two approaches, mainly, the open distance learning approach and the ILRI e-learning approach.

The stakeholder consultation workshop was instrumental to confirm findings from the survey and secondary resources. It was an opportunity to identify priority livestock training needs for A-AARNET

based on its priority themes. Many new needed skills were identified by the stakeholder workshop. Prominent among these are team building, negotiation, institutional building, conflict resolution and advocacy skills.

3.4 Recommendations

General recommendations for the East and Central Africa region

Collaboration

Strengthening livestock research capacity in the region for cross-cutting skill gaps is best done through regional consortia. It is recommended that ASARECA strengthen A-AARNET capacity building component. Partners in the consortium can be ILRI, NARS, NGOs and the private sector. This collaboration through network should be innovative in its approaches and make use of advances in ITC technologies.

Funding capacity strengthening

Funding for capacity strengthening is scarce from national budgets. It is recommended that funds are raised for livestock capacity strengthening on a regional basis through strengthening abilities in proposal writing, project management, reporting and public relations skills and management of dynamic databases for grants, grant-giving institutions and local expertise. It will also take innovative ways for raising funds locally, e.g. KARI's experience in raising funds. This can be a job for the consortium in recommendation 1.

Management of capacity strengthening

Even though livestock research institutions, and development institutions recognize the need for capacity strengthening, little effort is taken to mitigate this deficiency. It is recommended that livestock research institutions streamline the functioning of capacity strengthening units and link them to collaborate with CaSt in ILRI. This would require staffing these units and training the staff in management skills such as fund raising, database management, reporting and presentation.

Specific recommendations for A-AARNET and ILRI

Livestock capacity strengthening

The study revealed high priority training needs in livestock research. It is recommended that A-AARNET and ILRI, in collaboration with partners and advanced research organizations, develop strategies for capacity strengthening that will train scientists and their support staff deficient in high priority areas as revealed by this study including soft skills as well as technical skills such as animal health, biosciences, socio-economic skills with particular emphasis on marketing, policy research and animal genetic resources.

Biosciences

Sub-Saharan Africa as a whole, and East and Central Africa in particular, confirmed the need for training on bioscience skills for scientists and support staff. It is recommended that ILRI, being the hub for the BECA and utilizing innovative approaches such as e-learning approaches, develop strategies for bioscience training to include as high priority post-graduate training, training materials and short specialized courses. Collaboration is vital and cost-effective.

E-Learning

Advancement in ICT makes it possible to effectively deliver training using the new technologies.

- It is recommended that ILRI continues its e-learning platform to produce training resources in various priority topics identified in this study. ILRI's experience in the Animal Genetics Training Resource and the Biometric Training Resource is very valuable to use in expanding this effort. Products from this effort are valuable material for other e-learning platforms. Demand driven and collaboration should be the guiding principles in this approach. Most important is the excellent collaboration within ILRI among CaSt, information and research themes.
- It is recommended that ILRI joins the distance learning approaches in the region, e.g. the CGIAR Global Open University, the MSc Programme in Economics for East and Central Africa. ILRI's best contribution to these approaches would be the e-learning platform skills and products.
- It is recommended that ILRI becomes more engaged in the CG Online Learning Resources. More of its training materials/resources to be placed in this hub.

Networking

It is recommended that ILRI work closely with A-AARNET in all aspects of livestock capacity strengthening. It is important that ILRI network with NARS, sister IARCs, The Inter-University Council for East Africa (IUCEA) and other regional organizations, e.g. The Organization for Social Science Research in Eastern and Southern Africa (OSSREA).

Fund raising

Funding for capacity strengthening in most CGIAR centres including ILRI diminished. It is recommended that ILRI pursue an aggressive fund raising campaign for capacity strengthening. Collaboration in this effort will strengthen the effort. A new paradigm shift in this area is needed, e.g. NARS contributions, marketing approaches etc.

Post-graduate training

Post-graduate training for livestock scientists and managers is high priority as per the key findings in this study. It is recommended that A-AARNET and ILRI continue their efforts in post-graduate training but direct the effort to areas rated as high priority by the stakeholders. Collaboration with universities in the region and developed countries is key to this recommendation. Joining others to build a consortium of suppliers will be useful.

3.5 Limitations of the study

ILRI and ASARECA are commended for conducting this training needs assessment. Further consultation and refining of this study will lead to sound training strategy based on the needs of the stakeholders. It is an approach that corrected the old paradigm of top-down delivery characterized of early CGIAR efforts. Having stated this fact, the study has the following limitations:

- The questionnaire survey was excellent in its content but it was not easy to deliver to the clients to complete. To accomplish the task quickly email was used. Other means of delivery are very slow in the region. Participants were asked to complete the questionnaire and send it as an attachment. Many hurdles were experienced such as:
 - email failures
 - questionnaire fatigue on the part of the participants.
- The secondary sources and questionnaire are not enough to get a clear picture of what is happening in the region. It would have been more effective to visit various institutions and interview the clients. Many of the projects cited in the secondary sources might have been outdated by new approaches that were not published yet.

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Annexes

Annex 1 List of institutions and staff that completed the survey questionnaire

Respondent	Institute
Dr Seyoum Bediye	Ethiopian Institute of Agricultural Research P.O. Box 2003, Addis Ababa, Ethiopia
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Annex 3 Human resources status in faculties of agriculture in Kenya, Uganda and Tanzania

University	Capacity development needs	
Faculty of Agriculture	Staff development	Training for technicians
University of Nairobi	There is a need for re-training staff in new and specialized areas. These include econometrics, biometrics, and GIS technology. Short courses delivered in the region are preferred, rather than long-term degree training	Technical support personnel lack skills for handling modern research and training equipment. Skills improvement and retooling is required in instrumentation and equipment maintenance and on GIS technology
Egerton University	The Faculty identified the following areas as critical for short courses for staff retooling: dry land farm management; biometry; and proposal writing. Long-term training is particularly needed in the departments of Food Science and Agricultural Economics	
Moi University	The Faculty is in dire need of qualified staff in all its departments	
Jomo Kenyatta University, Faculty of Agriculture and Technology	There is a need for short courses in biometrics. There is a need to support attachment staff in advanced laboratories	
University of Dar es Salaam/ Faculty of Science	Support for short courses for faculty skills development in biotechnology. Development of new courses to produce graduates with the skills demanded by industry. Retooling of teachers through in-service training. Training in proposal writing as part of the retooling of staff already in employment	Short courses for the re-training of technical staff in laboratory and analytical techniques
Sokoine University of Agriculture	The Faculty has a critical shortage of research and teaching staff in horticulture, food technology and agricultural economics. It was noted that these professionals are in high demand	In the private sector and the university had difficulties retaining staff
Makerere University	Priority training needs are agricultural economics and agribusiness, horticulture and retooling of staff in new area of technology utilization, and new pedagogical methods. Biometrics: The Department of Crop Science plans to develop and offer short courses on Applied Statistics in Agricultural Research and Pesticide Application and needs assistance in course development	

Annex 4 A-AARNET's themes and sub-themes

Themes	Sub-themes
1. Poor livestock productivity	1.1. Enhancing utilization of animal genetic resources 1.2. Improving utilization of feed and water resources 1.3. Improving animal health through disease control and prevention strategies 1.4. Improving packaging and dissemination of technologies
2. Improved access to markets	2.1. Identification and characterization of niche markets 2.2. Identification and agreement on appropriate standards and regulations in the ECA region that affect market access 2.3. Strengthening farmers' organizational capacity and bargaining power in the input/output markets 2.4. Taxation policies and their impacts on markets 2.5. Policy analysis to promote private and civil sector investments in infrastructure and services development to enhance market access 2.6. Developing strategies to enhance access to market information 2.7. Addressing instruments and institutional arrangements that weaken ability to bear market risks 2.8. Improving efficiency of input/output markets
3. Improving the utilization of innovations to enhance market opportunities	3.1. Assessment of demand for market-based innovations 3.2. Improving adoption of appropriate innovations that enhance market opportunities
4. Improving value addition in input and output marketing chain	4.1. Innovative marketing strategies and technologies for value addition 4.2. Improved efficiency and value addition in input and output market chains through policy and institutional arrangements
5. Contribution of livestock to sustainability and eco-services	5.1. Strategies for adaptation and coping with climate and social-induced crises and shocks 5.2. Enhanced productivity to increase benefits while conserving ecosystems

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