TERTIARY AGRICULTURAL TRAINING IN THE 21ST CENTURY: CHALLENGES, NEEDS AND OPPORTUNITIES

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ABSTRACT
In sub-Saharan Africa (SSA), agriculture is the major source of food, income and employment and is considered as the backbone of the economy. However despite the tremendous technological developments in the world, African agriculture has remained small scale, low input, rain-fed and low-tech. Major transformations are needed for agriculture to take its place in driving development. Human capital remains the most important factor for transforming Africa's agriculture. Higher education is increasingly recognized as a critical aspect of the development process, especially with the growing awareness of the role of science, technology and innovation in economic renewal. Critical needs for tertiary agricultural education (TAE) in Africa include upgrading teaching and learning programmes and processes, improving access to locally relevant education materials, breaking down the institutional and programmatic separation of universities and national Agricultural research institutions, systematically upgrading knowledge and skills of researchers and educators, and creating attractive career opportunities for women and youth through agribusiness skills development. The challenge today is for TAE institutions to link their programmes more effectively to community and industrial development and also to global issues like climate change, food security, nutrition and health, and poverty reduction. This would justify the continued investment in TAE. The food and financial crisis is a challenge to Africa's agriculture, but also an opportunity since it has enhanced the interest of national, regional and international policymakers and donors to support more investment in agricultural productivity. This will in turn favor the elaboration of well designed and contextualized tertiary agricultural education which can provide scientific expertise, technical innovations and training in strategic areas of education for rural people, industry and policy makers. Strategic partnerships will need to be established between African and non African training institutions to share experiences on best practices and to scale out innovative capacity strengthening initiatives.

Key words: Tertiary agricultural education, training needs, challenges, opportunities

1.0 INTRODUCTION

Africa's development is in many ways synonymous with the development of its agriculture and related sectors. Agriculture remains the foundation of sub-Saharan Africa (SSA)'s economic activity accounting for 40% of GDP, 15 % of exports and 60-80 % of employment (Diao *et al.,* 2006). About 70% of the African population lives in rural areas and agriculture is a major source of food, employment and income. In SSA, agriculture also contributed a third to economic growth in 1990 – 2005 (World Bank, 2007). However, the agricultural sector is underperforming and 80 % of all Africans are living on a daily income of less than US$ 2 while nearly half struggle to survive on US$ 1 a day or less. As a result, one in every 3 people is malnourished due to lack of access to sufficient food. Increasing the level of farmer productivity is a prerequisite for economic growth and development in African countries. The production growth needed will have to come from improved farm policies, technologies (high quality seeds of improved crop varieties of local staples, improved fertilizer use and integrated soil fertility management technologies) and techniques, including those that address climate change since agricultural land is not increasing. Increasing crop yields has consistently been shown to reduce hunger and increase income among inhabitants of rural areas, where Africa's food shortages are most pronounced. However, for such productivity gains to be achieved, strong agricultural education and training systems are necessary for providing the human resources to drive the change. Under- and post-graduate training to provide high-level scientists and researchers is an essential part of human capacity improvement in Africa (Lindley *et. al*., 1996). The World Bank's Africa Action Plan, clearly points to tertiary education as one of the key drivers of growth to generate the knowledge and skills necessary for sustained growth in SSA. Skills and knowledge economy are built at the tertiary education level. Improving tertiary education systems must therefore be high in SSA's development agenda. Plant breeders, seed scientists, agronomists, soil scientists, food technologists and policy analysts are needed to be in governments, public and private research centers and agribusinesses to develop, review and disseminate generated technologies.

To meet the challenges of agricultural productivity and food security facing Africa today and in the 21st century, Africa must be willing to invest in its human capital for development. There are 70 researchers per million people in Africa compared to North America with 2640 and Japan with 4380 (IFPRI, 2006). The number of agricultural researchers declined by half in SSA in the last 20 years due to poor or no funding of tertiary agricultural education. More than half of the current researchers are due to retire in the next 5 years. Only one in four of the African researchers hold a PhD compared with nearly two thirds in India (RUFORUM, 2007). As a result most governments and university research systems in Africa are producing only a trickle of new technologies that can be used by farmers (Eicher, 2006). To compound this problem, enrolment rates for higher education in Africa are the lowest in the world with gross enrolment at only 5 % compared to 19 % of the population for East Asia (Chicago Council on Global Affairs, 2008). Most donor-funded training programs have relied on awarding African students fellowships to developed-country universities, leaving African universities out of the equation. This has meant no real research and teaching infrastructure improvements in most African universities resulting in obsolete and non-functional equipment. From the early 1990's even these opportunities for overseas study were significantly reduced due to donor focus away from agriculture. This then means that African Universities must

ultimately be responsible for training and replenishing human capital in their respective nations.

Education and training is a strategic priority if we are to achieve food security, eradicate malnutrition and poverty and spur development in rural Africa. Well designed and targeted tertiary agricultural education (TAE) can provide scientific expertise, technical innovations and training in strategic areas of science and technology that can improve rural people's livelihoods, industry and policy makers. Recent research findings indicate that expanding tertiary education may promote faster technological catch-up and improve a country's ability to maximize its economic output (Bloom *et al.,* 2006). Currently SSA has close to 100 universities teaching agriculture and natural resource sciences. However, the visibility of these universities and their programmes is marred by the fact that their impact on agricultural development is unclear. Agricultural education in its current form is poorly targeted and structured to deliver on such an ambitious programme.

2.0 CHALLENGES FACING AFRICAN TERTIARY AGRICULTURAL EDUCATION

African tertiary agricultural training institutions were initially meant to simply raise human resources to meet public sector needs. This has long petered off and many graduates end up jobless because the industries which would have absorbed them are not yet developed, or if they are available, are non-functional. The graduating students are not prepared to establish their own businesses. Neither are there adequate support systems, financial or otherwise, to enable self-employment. Frequently mentioned challenges in African tertiary agricultural education include lack of national funding, brain drain due to lack of incentives, weak teaching capacity and quality and relevance of education. However, the world globalisation has internationalised higher education and put more pressure on the weaknesses that urgently need to be addressed if Africa is to achieve the MDG targets by 2015. A few are described briefly in the next section. However, they are all interlinked.

2.1 Lack of Funding

Most universities in Africa receive very little support from their national governments. This usually covers undergraduate programs with very little support for postgraduate students. The budgets for universities are usually included with general education budget that includes primary, secondary and tertiary education. MacGregor (2008) stated that although enrolments in SSA tripled from 1991 to 2005, public funding did not keep up from an average US$ 6,800 to just $ 981 in 25 years for 33 countries. The negative impacts of this radical increase in student numbers without corresponding funding support were made worse by lack of attention to quality assurance and labor market needs, governance issues and lack of accountability.

The lack of adequate funding for tertiary institutions fosters lack of autonomy to make decisions and flexibility to adapt to labour market demands resulting in graduates with weak skills who often do not meet the job market needs. This is however, part of a bigger problem of lack of understanding by the governments on the role of education and training

in reducing poverty. A World Bank report of 2006 found that only 20 countries in SSA out of 47, mention tertiary education in their national development strategies and only 3 national development strategies reviewed out of 31 indicated tertiary education as a priority for reducing poverty, 2 planned to increase funding while 6 planned to decrease funding. This lack of understanding by national governments means institutional funding is not even a national priority. The challenge for tertiary agricultural education community is to improve packaging and articulation of arguments in support of tertiary education in a manner that demonstrates impact to the economic development and well-being of citizens (Materu, 2008).

2.2 Low and Weak Human Capital

Most universities are not operating at full capacity for generating the human resources needed for development (Temu *et al.,* 2004). Existing human resource capacity in all units of the *Institute des Sciences Agronomique du Rwanda* ISAR in Rwanda are 2 PhD's, 25 MSc's and 51 BSc's (SCARDA, 2007). In Mozambique, the current agriculture trained workers are 488 compared to a target of 5484 and in Ghana current workers number 2135 compared to a target of 6535 (ITOCA, 2007). The observations reveal that the landscape of human capacity in Africa is very low but consistently variable, and requires detailed analysis of national-level needs in both the public and private sectors. This situation hinders growth and undermines the foundation for sustainable development.

African agricultural universities are short of trained faculty with 30-70 % of the required posts not filled in part because of low wages and poor working conditions. Trained faculty is in short supply also because the universities have so few graduates at MSc and PhD levels (von Kauffmann, 2006). MacGregor (2008) also stated that graduate students comprise a shrinking portion of total enrolments, reducing the next generation of tertiary level instructors and researchers. These trends make it difficult to provide relevant knowledge and core skills needed for competitiveness and growth. Insufficient attention to professional development, inadequate salaries, heavy teaching loads resulting from declining staff to student ratios, deficient personnel in management and lack of research opportunities makes staff retention and recruitment difficult.

The primary source of wealth is practical and effective application of human capital. As a source of livelihood, Africa's agriculture has invested considerably in training at various levels, from vocational to postgraduate education. However, many of the graduates do not get employed because their knowledge and skills fail to meet the requirements of the workplace. Studies commissioned by ANAFE (1999, 2005) and UNEP (2004) showed that despite the fact that TAE programmes in Africa are relatively young, many of them have moved quickly to specialize in several areas such as Entomology, Horticulture, Food Science, Home Economics, Beekeeping, among others. Graduates produced under this system are not able to relate well with one another. UNEP (2004) found that only 5 % of the universities in Africa had evolved to address the inter-disciplinary nature of agriculture and environment. The thrust to specialize has been so strong that highly specialized professionals being produced lack in the broader understanding of agricultural business within the context of natural resource management and conservation. A study by Ocholla *et al.* (2009) also indicated typical skills employers perceive fresh graduates lack to include, farmer training skills, implementation of adaptive

or on-farm demonstrations or trials, financial and project management, agricultural value chain addition skills and business start-up advisory entrepreneurial skills. A wide perception amongst employers is that agricultural graduates are weak in terms of problem analysis and solution skills. A new range of competencies such as adaptability, team work, communication skills and the motivation for continual learning have also become critical. Tertiary institutions are therefore challenged to adjust their program structures, curricula, teaching and learning methods to adapt to these new demands. Greater attention therefore has to be focused on quality.

2.3 Weak Research and Innovation

Much of the research that takes place at African universities is of an academic nature and pays little attention to the utility of results. The training curricula of the majority of African Higher Education institutions still focuses only on theory and are divorced from production and development needs. The fact that agricultural production is increasingly integrated in value chains with input/supply and marketing linkages require wider competencies in dealing not only with technical issues, but also with complex and nonlinear partners engaged in innovation, development, production and marketing (World Bank, 2006). The context of agriculture is continuously evolving. New regulations, consumer preferences, competitors, pests and diseases, climate change and human health problems such as HIV/AIDS are some of the changes that agricultural systems must face. Different sources of knowledge are needed to deal with these challenges which require networks (World Bank, 2006). TAE institutions often have a narrow and academic understanding of the practical world that shapes development policies and economic growth. In 2005, FARA commissioned an assessment of National Agricultural Research Centers in SSA to identify major areas of weaknesses and recommend corrective strategies. The study identified human and institutional capacity for designing, implementing and managing scientific research as the most important weakness.

The problem of educator isolation could be addressed through a scheme that opens up TAE institutions to a deliberate tapping of knowledge and experiences from outside the academia. Interactions between educators, students, private sector and local communities will enrich curricula content and produce more practical graduates and more relevant research.

A scoping study done by FARA (2005) also indicated that there is not enough capacity to form strong multi-institutional partnerships between NARS, universities, extension agencies, farmers' organisations, private enterprise and other groups that are essential to bring about the required change.

Africa is still faced with challenges of Internet connectivity, information availability in the right format, cost and quality and this seriously affects research quality.

2.4 Lack of Integration

Agricultural development is viewed independently from closely related resource sectors such as forestry, water management, energy and environment. Thus, agricultural practices purely geared at productivity become less sustainable due to nutrient mining leading to land degradation and desertification. Creative strategies are needed for elaborating practical mechanisms that bring TAE into closer, more productive relationships with other

closely related sectors of agriculture, natural resource management, land-use and industry. This will bring about sharing of comparative advantages of different actors and institutions to reduce transaction costs, achieve economies of scale, exploit complementarities, and realise innovation synergies. Lack of coordination between the different branches of agriculture has resulted in silos, with limited synergy or complementarities.

2.4 Inappropriate Teaching Materials

Much of SSA relies on imported scientific knowledge and technologies to fuel its development. This is in spite of Africa's enormous wealth of local knowledge in agriculture and natural resources (Temu *et al.,* 2007). The latter is locked within specific cultures, social groups, or institutions and as a result, the knowledge has failed to find access into learning systems in order for it to reinforce scientific knowledge. The integration of local knowledge into agricultural programmes remains limited or even non-existent. As a result a huge gap exists between what is being taught in agriculture and actual practices, especially by small-scale farmers.

Too much emphasis is placed on the adoption of modern technologies, some of which are inappropriate for small scale farmers. It is common to find learning materials that emphasize exotic animal and crop management systems based on outdated and/or out of reach technologies (economically), and further compounded by instructors whose capacity is limited by lack of familiarity with local circumstances and therefore cannot draw examples or case studies from the local environment. Few countries (e.g., Ethiopia, South Africa and Sudan) can boast of having strong local inputs into the agriculture and natural resources learning materials. Experience from elsewhere indicate that a change in the learning systems, in terms of relevance of content and quality of delivery influences many other areas like policy, strategies and practice. Therefore improving the quality of educators, learning resources and the whole education system (including faculty attitudes) becomes a fundamental prerequisite.

3.0 TERTIARY AGRICULTURAL EDUCATION NEEDS IN A FAST CHANGING GLOBALISED WORLD

Africa's human capacity needs in agriculture and natural resource management cannot be met by the occasional projects involving a few universities here and there. It requires comprehensive inclusive programmes that are open to all African universities that are teaching agriculture and natural resources management and which enables them to draw widely on the strengths of their counterparts in advanced universities and the African-based international, regional and national agricultural research institutions. This unfortunately is quite costly.

There is a need to appreciate TAE's potential role in promoting innovation, and growth for Africa's agriculture. Creative strategies are needed for elaborating practical mechanisms that bring TAE into closer, more productive relationships with other closely related sectors of agriculture, natural resource management and land-use. This will bring about sharing of comparative advantages of different actors and institutions to reduce transaction costs, achieve economies of scale, exploit complementarities, and realise innovation synergies. A few of these needs are highlighted briefly in the next section.

3.1 African Governments Need to Increase Funding to Tertiary Agricultural Institutions

National commitments should be made to higher education through adequate budgetary allocation. African governments should allocate more resources (at least 20 % of national budgets) to education in accordance with the letter of the African Union Plan for the Second Decade of Education in Africa, while prioritising the sub-sector (Strategic orientation for higher education in Africa, 2009). Governments need to rethink the role of tertiary education in capacity building for the attainment of Millennium Development Goals and new development visions and give it a proper place in the national and regional development strategy. This can only come about if universities have management and leadership capacity focusing on development. Governments need to review the funding frameworks for tertiary education and link funding levels to inputs and outputs. Eicher (2006) also highlighted the need to mobilise and sustain greater political support for continuous investment in agricultural education and training, design incentives that attract and retain trained professionals, explore alternative cost-effective training modalities (such as sandwich programs with foreign universities) and invest in graduate programs to strengthen agricultural education training research. There is also a need to define a competitive system to finance the research, and incite private enterprises to participate in the financing of technological innovations and research. There is a need to promote research and development and reward innovative research and development activities especially those that target development problems indigenous to Africa.

3.2 Improve Quality of Graduates Produced

Institutions need to prioritise the production of those skills and areas of research that will promote a mix of dynamic and competitive industries. Public universities can therefore consolidate and boost quantity, by reinvigorating research and solidifying graduate programs. This can be achieved by upgrading teaching and learning programs and processes.

There is a need for greater educational relevance and higher quality graduates. This can be achieved by devising or formulating strategies to tap existing pools of world class knowledge and forge effective linkages with the private sector so as to better align tertiary education outputs to present and future needs of the labor market especially in the leading sectors of growth. Research should not only be scientifically good but must as much as possible meet real needs of key growth sectors.

3.3 Training of Trainers

Creating attractive career opportunities for academics are critical through agribusiness skills development, information and communication technologies for education (ICT for ED) in order to develop and support implementation of distance learning. Ongoing training for academic professionals is required to update and expand their skills and knowledge.

There is also a need to encourage authorities to innovate in the allocation of opportunities and advantages to the teachers and researchers in the scientific and technological sectors. Universities need to adopt a human resources management approach in which labor is considered the most valued asset to be nurtured, motivated, and

supported to enhance organisational competitiveness. Review of workloads and staff audits should be done in order to ensure equal work for equal pay.

3.4 Curricular Review and Development

Institutions are struggling with curricula that are often obsolete, outdated and lack local relevance. Existing curriculum often lacks dynamism, practicality and fails to inspire and engage learners. There is a serious need for continual improvement of curricular to make it not only more robust, relevant but responsive to the agricultural needs of the economy. Private and public sector representatives to curriculum communities are needed to ensure institutions meet industry requirements and expectations. Much of SSA relies on imported scientific knowledge and technologies to fuel its development. This is in spite of Africa's enormous wealth of local knowledge in agriculture and natural resources as highlighted before.

3.5 Improve Linkages

There is a need for tertiary agriculture education in Africa to foster and establish meaningful institutional linkages with national and global information networks, reducing academic isolation and enabling the institutions to grow. The need for greater educational relevance and higher quality has been reported by Lindley *et al.* (1996). Relevance can be achieved by ensuring that institutions of higher learning play a developmental role by establishing linkages with relevant private and public agricultural agencies and farming communities. Rivera (2006) also recommended including intensifying linkage-building efforts as a key reform to improve relevance of agricultural education. Greater understanding is specifically needed of how alternative strategies and selective approaches might shift agricultural education and training into closer, more productive relationships with other actors in the agricultural sector and wider economy.

3.6 Increased Experiential and /or Practical Learning Methods

Experiential learning approaches are needed in order to ensure that newly acquired skills are applied suitably and benefit the individual as well as the institution (von Kauffmann, 2006). Practical experiences such as field trips and mentorship programs are important to attract students and allow them to experience real life situations thereby preparing them to work. Some universities in SSA have internships where the student spends a stipulated amount of time in the curricula working for an agribusiness outfit, either private or public. This activity can be monitored to ensure the students complete involvement. At post-graduate level, students can be attached to national and private research institutes to conduct their research and/or add components of on-farm research.

3.7 Improving Access to Locally Relevant Education Materials

Over 90% of all agricultural text books used are produced elsewhere and are used by academics and students usually without contextualisation. There is a need to at least produce advanced teaching materials based on local knowledge and technologies and putting into context the materials produced in developed countries. The basic principle courses can use materials produced in developed countries but all applied courses need to be developed locally for relevance.

4.0 OPPORTUNITIES

4.1 Right Policies

Africa is responding to its agricultural development challenges with a new approach articulated in the Comprehensive Africa Agricultural Development Program (CAADP) which has been endorsed by African Heads of States and governments as a framework for agricultural growth, food and national security (NEPAD, 2005). The African Heads of State meeting in Maputo in 2003 endorsed an increase in public investment in agricultural development to 10 % of their national budgets. NEPAD has identified agriculture as the engine for Africa's economic development and set out a programme for this in the CAADP which calls for an investment of US$ 251 billion between 2002 and 2015. The World Summit on Sustainable Development (WSSD) held in 2002 recognized that education is the driving force for development, and recommended to the UN General Assembly to declare 2005-2014 the "*Decade of Education for sustainable Development*". If all these agreements are followed then agricultural education would be more resourced than it currently is.

4.2 Effective Regional Networks and Renewed Interest By Donors in Agriculture

There are some effective regional agricultural education networks available such as RUFORUM and ANAFE that can roll-out curriculum review and development (Rudebjer *et al.,* 2005); teaching materials development; Post-graduate research support addressing real farmer problems; Establishing of farmer learning resource centers used for effective teaching and extension support to farmers; Training of trainers; and other success stories enabling learning together and sharing information. These need to be strengthened to deliver more on relevant education across the sub-continent.

4.3 Open Educational Resources

Open Educational Resources (OER) are teaching and learning materials that are freely available for anyone to use, reuse, adapt and share for teaching, learning and research (Bomba, 2009). OER can exist as smaller, stand-alone resources that can be mixed and combined to form larger pieces of content or as larger course modules or full courses. OER can also include simulations, labs, collections, journals, and tools. These materials are considered open if they are released under an open license such as a Creative Commons license.

The benefits of OER include; opportunity to improve content and curriculum quality due to abundance of choice, reducing the time and cost of curricula development by building on the work of others, organizational and personal development opportunities associated with participation, engage many parts of the agricultural community and bring to life the curriculum by making it more practical, relevant and inclusive. There is increased interest and engagement in the agricultural sector with RUFORUM (the Regional University for Capacity Building in Africa) and OER Africa, among others taking a leadership role. A number of US universities including Cornell, Michigan State and others are also working on these opportunities.

4.4 Large Pool of African Diaspora

African governments and agricultural education training institutions must view the Diaspora as a resource, not a loss and learn from them. This happened in China and India. There must be deliberate strategies to engage the Diaspora in education and training.

4.5 New Tools

New tools such as molecular techniques and global communications can be used to upscale technologies and review curricular. Write-shops can be used to develop relevant teaching materials by African scientists for Africa.

5.0 CONCLUSIONS

The challenges for tertiary agricultural training in sub-Saharan Africa are daunting. Africa needs to make concerted efforts that appropriate capacity is developed in our tertiary agricultural education institutions. The challenges facing tertiary agricultural education training can easily be surmounted by embracing the opportunities that are currently available. Central to the opportunities is application of effective networking. However, governments need to follow up on their commitments with effective support to tertiary agricultural education.

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