

Placing Agricultural Tertiary Education in the Policy Agenda

A Namanga Ngongi

*President of the Alliance for a Green Revolution in Africa
Nairobi, Kenya*

Abstract

Agriculture is the major source of income, employment and the backbone of the economy in Sub-Saharan Africa. However, African agriculture has generally remained a small-scale, rainfed, low-tech, low-input and low-output enterprise. Human capital is the most important constraint limiting the transformation Africa's agriculture. Africa needs its own scientists in order to drive and sustain a Green Revolution (transformation of agriculture) across the continent. To produce these scientists requires functional, dynamic, relevant and consistent tertiary education institutions. Unfortunately, African universities have been neglected for decades and are now all-to-often non-functional institutions with dilapidated infrastructure, unmotivated staff and poor learning environments. Several donors who made major investments during the 1960s to 1980s to provide training abroad for African scientists exacerbated the decline of African universities. Among the unintended consequences of these investments was little or no funding being available to build infrastructure in African institutions and a significant "brain drain" from among the ranks of Africa's scientific community.

The core functions of almost all universities, whether in Africa or elsewhere, are teaching, research and outreach, for a university to be fully effective these core functions must be closely interlinked and fully funded. If they are, sending students abroad for training becomes much less necessary. The advantages of training scientists in Africa include lower costs, better retention of graduates in the region, relevant instructional focus and context, research projects that provide benefit to the region, and maintenance of the students' institutional and family ties. Recognizing these important advantages, AGRA is currently supporting the advanced training of more than 200 scientists in 14 African universities. Plant breeding, integrated soil fertility management, and applied agricultural economics are among the main disciplines being studied, and AGRA's investments include improving the infrastructure of selected universities as well as the quality and relevance of their curricula. While AGRA's investments in education are a significant help, it is governments that must invest in and support capacity building at all levels, including tertiary education, to produce the scientists and innovators needed to develop new technologies that can solve farmers' problems and increase agricultural productivity.

Introduction

Agriculture in Sub-Saharan Africa (SSA) accounts for about 40% of GDP and 60-80% of employment, and yet SSA is the one region of the world where the food supply situation continues to worsen as population grows. In the rest of the world, food supply has been increasing faster than population for a decade or more. The reverse is true for Sub-Saharan Africa. Sixteen of the 18 most undernourished countries in the world are in Africa (i.e., those with more than 35% of their population undernourished) (FAO, 2005). Sub-Saharan Africa has

one of the highest global hunger indices (von Grebmer *et al.*, 2010), which contributes to high child mortality. This situation is reportedly due to limited government effectiveness and political instability, among other reasons.

As has been the case throughout the world (in Asia, South America and even North America), increasing the productivity of farmers is a prerequisite for economic growth and development. For agriculture to drive economic growth in the agriculturally based countries that typify Sub-Saharan Africa requires a productivity revolution in smallholder farming (World Bank, 2008). New and better-targeted technologies are essential to this process, and a well-developed and well-supported agricultural research system is a precondition not only for the design of these technologies but also for their dissemination and adoption (Beintema, 2004). However, all these changes require well-trained scientists and extension professionals. Sadly, enrollment rates for higher education in Africa are the lowest in the world, with gross enrollment at only 5% of the population compared to 19% for East Asia (Chicago Council on Global Affairs, 2008). Improved farmer productivity through research-generated technologies can only be achieved if governments and donors reverse years of policy neglect and remedy underinvestment in agriculture, starting with investing to generate the human capital needed.

While there was an emphasis during the 1960s to the 1980s on sending the most promising agricultural students abroad for post-graduate training, investments were also made in building an extensive institutional infrastructure across Africa for agricultural education and training. Some 100 public universities were put in place during that period to teach agriculture and natural resources management (World Bank, 2007). Unfortunately, the main focus was on constructing buildings, with less funding made available to establishing strong faculty and curricula. The 1990s and early 2000s saw a serious neglect of agricultural funding by both governments and donors. Donor assistance declined to just 0.7% of the agricultural sector budget by 2004 (World Bank, 2007). However, since then several international and regional initiatives have brought agriculture and technically focused education back into the budgets of African governments and donors.

The Comprehensive Africa Agriculture Development Program (CAADP) that has been endorsed by African Heads of States and governments as a framework for agricultural growth and national food security (NEPAD, 2005) is a very positive step taken by African governments to address food insecurity and poverty issues. 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 through CAADP called for an investment of US\$ 251 billion between 2002 and 2015. The 2002 World Summit on Sustainable Development (WSSD) recognized that education is the driving force for development, and recommended to the UN General Assembly that it declare 2005-2014 the "*Decade of Education for Sustainable Development*". In March 2005, the international Commission for Africa (chaired by British Prime Minister, Tony Blair) recommended higher investments in human resource capacity building linked to agriculture, with a focus on tertiary education in science and technology (World Bank, 2007). Recently, the CIPCAD/GCARD meeting of 2010 recommended integrated strengthening of national capacity building systems as a key milestone to address the challenges discussed during the GCARD and highlighted the role of multi-stakeholder platforms in capacity building and innovation forums.

If all these agreements had been fulfilled, then agricultural education would be enjoying more resources than is the case currently.

Strong agricultural education and training systems are necessary for providing the human resources to drive development. Agricultural education and training directly raises agricultural productivity by developing producer capacities and generating human capital for support services (World Bank, 2007). 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). Skills and knowledge are built at the tertiary education level. Most governments and university research systems in Africa are producing only a trickle of new technologies that can be used by farmers (Eicher, 2006). Investments in agricultural education and training enable research, extension and commercial agriculture to generate higher incomes for farmers. Improving tertiary education systems must therefore be high on Sub-Saharan Africa's development agenda. Agricultural education and training was an integral part of the development strategies of countries that grew their agricultural sectors successfully, such as Brazil, India and Malaysia. In 1960, Singapore and the Democratic Republic of Congo had the same GDP, but the Singapore government undertook a mega-program to develop its human capital in support of key industries (such as shipping) and has since developed into a first world country (Anigbugo, 2009). African countries need such concerted efforts in their main industry, i.e., agriculture. Plant breeders, seed scientists, agronomists, soil scientists, food technologists and policy analysts are needed by governments, public and private research centers and agribusinesses to develop, test and disseminate effective technologies. In order to remain relevant, agricultural training needs the support and participation of all major stakeholders, including farmers and the private sector (GCARD Farmer Multi-stakeholder Platform, 2009).

Trained People Needed to Implement CAADP

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. There are only 70 agricultural researchers per million people in Africa, compared to 2,640 in North America and 4,380 in Japan (IFPRI, 2006). The number of agricultural researchers has declined by half in Sub-Saharan Africa over the last 20 years due to limited or non-existent funding of tertiary agricultural education, and more than half of the agricultural researchers working today are due to retire in the next 5 years. Only one in four African researchers holds a Ph.D., compared with nearly two thirds in India (RUFORUM, 2007).

A recent analysis of the capacity required for rice development indicated that to successfully implement only 12 National Rice Development Strategies an additional 400 post-graduates and 11,000 graduate extension staff would be needed (CARD, 2009). It is safe to assume that there will be similar requirements in all 45 Sub-Saharan countries for the development of all their crops, livestock, fisheries and forests. This calls for urgent action to redress Africa's shortfall in high-caliber human capacity in agriculture and natural resource management. Existing human resource capacity in all units of the *Institute des Sciences Agronomique du Rwanda* (ISAR) in Rwanda are 2 Ph.D.s, 25 M.Sc.s and 51 B.Sc.s (SCARDA, 2007). In Mozambique the current number of trained agricultural workers is 488, compared to a target of 5,484 (this includes

diplomas and certificates), and in Ghana the current number of trained workers is 2,135, compared to a target of 6,535 (ITOCA, 2007). These observations reveal that human capacity in the agricultural sector in Africa is very poor. This hinders growth and undermines the foundation for sustainable development. 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, Canning and Clan, 2006).

Status of African Agricultural Institutions and Their Challenges and Needs

The 100 universities with agricultural programs are mandated to provide trained people for agricultural research and development, including the technocrats in agricultural ministries who formulate, guide and develop policies that shape the agricultural sector. They also conduct research on critical issues that feed into national development goals and disseminate technologies to the general public and farming communities to drive development. Frequently mentioned challenges in African tertiary agricultural education include lack of national funding, brain drain due to lack of incentives, limited teaching capacity, and low quality and relevance of education. The challenge today is for tertiary agricultural education institutions to link their programs more effectively to community and industrial development, and also to global issues like climate change, food security, nutrition and health, and poverty reduction.

Critical needs for tertiary agricultural education in Africa include upgrading teaching and learning programs 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.

Africa's human capacity needs in agriculture and natural resource management cannot be met by occasional projects involving a few universities here and there. Comprehensive and inclusive programs are required that are 1) open to all African universities teaching agriculture and natural resources management and 2) that enable them to draw widely on the strengths of their counterparts in advanced universities and African-based international, regional and national agricultural research institutions.

For a long time, universities have focused on training people to work in public sector research, extension and education. However, the public sector no longer has the capacity to absorb new graduates, so training should increasingly focus on producing private sector entrepreneurs. This calls for significant changes in curricula and for lecturers with relevant industry experience. Rebuilding these institutions into centers of excellence will require significant funding, both from governments and donors. Some of the key areas to be funded are discussed briefly below.

Funding of tertiary agricultural institutions to improve quality – Most universities in Africa receive very little support from their national governments. The funding they do receive usually covers undergraduate programs with very little support for post-graduate students. The budgets for universities are usually bundled with those supporting primary, secondary and tertiary education. MacGregor (2006) stated that although enrollments in Sub-Saharan Africa

tripled from 1991 to 2005, public funding eroded, declining from an average of US\$ 6,800 per student to just US\$ 981 in 25 years for 33 countries. The negative impacts of this radical increase in student numbers without funding support were made worse by lack of attention to quality assurance and labor market needs, governance issues and lack of accountability. Moreover, students in most public universities in Africa pay next to no fees. A World Bank report (2006) found that only 20 out of 47 countries in Sub-Saharan Africa 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 (Materu, 2006). This lack of understanding by national governments of the importance of tertiary education to reducing poverty prevents making institutional funding a national priority.

Total gross domestic research and development expenditures in Sub-Saharan Africa average US\$ 3,992 million per year, compared to US\$ 573,964 million in high-income countries (IFPRI, 2006). 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 prioritizing 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 national and regional development strategies. This can only come about if universities have management and leadership capacity focusing on development. Eicher (2006) highlighted the need to mobilize 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 research, and encourage private enterprises to participate in the financing of technological innovations and research.

Funding to improve relevance and produce market-ready graduates – The lack of adequate funding for tertiary institutions fosters a lack of autonomy to make decisions and limits flexibility to adapt to labor market demands, resulting in graduates with weak skills who often do not meet job market needs. It also hampers efforts by multiple stakeholders to review curricula. Relevance can be achieved by ensuring that institutions of higher education play a developmental role by establishing linkages with private and public agricultural agencies and farming communities. Rivera (2006) also recommended 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.

Funding to improve human capacity to train – Most African universities are not operating at full capacity for generating the human resources needed for 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. MacGregor (2006) also stated that graduate students comprise a shrinking portion of total enrollments, reducing the next

generation of tertiary 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, and heavy teaching loads resulting from declining staff-student ratios, deficient personnel management and lack of research opportunities makes staff retention and recruitment difficult.

University authorities need to innovate in the allocation of opportunities and advantages to 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 organizational competitiveness. Review of workloads and staff audits should be done in order to ensure equal work for equal pay.

Funding to strengthen 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. Most universities in Sub-Saharan Africa cannot provide even basic grants for research for their staff to use and are dependent on donors and, by extension, their agendas. This has resulted in institutions with very little money to conduct research, much less to consult widely in the development of research that addresses the critical problems facing farmers and industry. Agricultural production is increasingly integrated in value chains with input/supply and marketing linkages that require wider competencies to deal, not only with technical issues, but also with complex and nonlinear partners engaged in innovation, development, production and marketing. If lecturers do not have the competencies needed to conduct research aimed at these issues, how can they train students? Different sources of knowledge are needed to deal with these challenges that require dense networks of connections (World Bank, 2006). Interactions between educators, students, private sector and local communities will enrich curricula content and produce more practical graduates and more relevant research. To compound all these, Africa is still faced with challenges of connectivity, information availability in the right format, cost and quality and this seriously affects research quality.

Funding to improve the quality of graduates – There is a need for high quality graduates. This can be achieved by devising strategies to tap existing pools of world-class knowledge, such as among international partners, the Diaspora, and in the private sector, so as to better align tertiary education outputs to present and future needs of the labor market. 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. Research should not only be scientifically good but must also as much as possible meet the real needs of key growth sectors.

High-quality graduates can be developed through high-quality training that requires regular curricular reviews and revisions to provide critical skills for the changing agricultural sector. Existing curricula often lack dynamism and practicality, and fail to inspire and engage learners. There is a serious need for continual improvement of curricula to make it not only more robust and relevant, but also responsive to the agricultural needs of the economy. Private and public sector representatives on curriculum committees are needed to ensure institutions meet industry requirements and expectations.

Access to relevant, good-quality literature can also improve the quality of graduates. Unfortunately over 90% of all agricultural textbooks used are produced elsewhere and are used by academics and students, usually without regard to context. There is a need to at least produce advanced teaching materials based on local knowledge and technologies and to put into context instructional materials brought in from abroad. Courses focused on basic principles can make good use of externally produced teaching materials, but applied courses need to be developed locally to ensure relevance.

Experiential learning approaches are needed in order to ensure that newly acquired skills are suitably applied and benefit the individual as well as the institution (von Kauffmann, 2006). Practical experiences, such as field trips and mentoring programs, are important to attract students and allow them to experience real-life situations, thereby preparing them to work. Some universities in Sub-Saharan Africa provide internships in which students spend a stipulated amount of time working for an agribusiness enterprise (either private or public). This activity is monitored to make sure students complete their involvement. At the 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. Most AGRA education and training programs are linked to public and CGIAR center research programs, enabling students to conduct their theses research and/or practical exercises under the guidance of experienced scientists.

Roles of Governments and Donors

All the needs highlighted above need significant funding, both from governments and donors. Governments must take ownership of their institutions and support them financially for both infrastructure development and student loans and grants up to the Ph.D. level. Some governments support undergraduate learning only, but this support should be expanded to include the highest levels to ensure innovative, relevant technology development. 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 non-functional equipment. From the early 1990s, these opportunities for overseas study were significantly reduced due to donors shifting their focus away from agriculture. Although the tides have changed, with commitments from African governments and donors pledging to increase support to agriculture, these have not yet paid off. Most donor support is time bound and supports mainly student fellowships and very little or no infrastructure improvement, whereas governments have been known to provide grants and/or loans to support infrastructure development, including buildings and equipment.

Training post-graduate students in Africa builds local capacity and infrastructure for training students, provides solutions in student theses to African problems, is cheaper and ensures better retention of people in local institutions in their home countries. This then means that African universities must ultimately be responsible for training and replenishing human capital in their respective nations, and governments must bear the brunt of funding relevant training.

Governments and universities can be partners, with universities providing some services to governments. Creating the right policy environment requires that countries have sufficient internal capacity to identify and analyze key policy constraints, and universities could be a powerful resource for governments in terms of identifying, formulating, implementing and evaluating policies. The result of such collaboration could be more informed decisions on critical issues that directly impact food production and hunger. The differences between policy makers in the north and south are huge, the key ones being education levels and exposure to various technologies. Tertiary Institutions could train B.Sc., M.Sc. and Ph.D. students in critical fields of agriculture and improve their abilities to identify key issues amenable to policy solutions, provide useful evidence for and against different courses of action, raise awareness, and monitor and evaluate policy changes.

The ideal situation is for universities to have Center's of Research, such as the Food and Agriculture Policy Research Institute (FAPRI) at the Universities of Missouri and Iowa in the USA. FAPRI uses comprehensive data and computer modeling systems to analyze the complex economic interrelationships of the food and agriculture industry and prepares baseline projections each year for the US agricultural sector and international commodity markets. The institute helps determine effective risk management tools for crop and livestock producers, and analyzes how government policy affects risk management strategies. FAPRI briefs staff members of the US Senate and House Agriculture Committees on projections for US and world agricultural markets. It also increases the public's understanding of agricultural trade-related issues, for example, those involving the European Union, China and India. This could be done in Africa, too, as one institute at the University of Pretoria in South Africa – the Bureau for Food and Agricultural Policy – conducts policy analyses for a large number of companies and institutions. It was started in 2004 with a multidisciplinary team of 32 people and with partners from within South Africa and the USA (Kirsten, 2009)

African Universities must be at the forefront of innovation for agricultural and socio-economic development:

- Developing knowledge that can be translated into action;
- Providing evidence that can assist policy makers to make the right decisions for the nations; and
- Analyzing and reviewing policies to assist governments to maintain a responsive and dynamic agriculture sector.

To do this they have to be well funded by their governments.

Action and Investment Plans

Recognizing that, in their present state, Sub-Saharan Africa's tertiary agricultural training institutions cannot produce the required human and institutional capacity, AGRA and FARA initiated a process for achieving a consensus on what needs to be done to reduce the human and institutional capacity deficit and how the necessary actions and investments should be advanced. The ultimate purpose of this initiative is the development of an action and investment plan that will be used by national governments, development agencies,

foundations, tertiary agricultural and natural resource institutions, government agencies, Regional Economic Communities, and Sub-Regional Organizations to identify where each can make the most effective contribution to the collective goal of building sufficient human and institutional capacity that is fit-for-purpose in 21st century African agriculture.

To make improvements on a large scale it is necessary to first know what is already being done and where the most urgent gaps are, and second to have a plan to which all the capacity strengthening providers and investors can commit in order to maximize the positive impact of the sum of their contributions.

The first step will be accomplished by the development of a comprehensive interactive framework for capturing current capacity building initiatives with feed-forward and feedback loops to inform and constantly update the priorities for investment in strengthening capacity to build capacity in agriculture and natural resources.

The second step will be achieved by developing an Africa-wide action and investment plan for responding to the identified priorities. However, the process of developing an investment plan of that magnitude and complexity must be based on a business plan that sets out the goals, objectives, methodologies, timelines and costs of developing such a continent-wide plan.

A third step is also needed, i.e., to secure funding from governments and donors. This may require increasing the staffing of regional universities or centers of excellence for M.Sc. and Ph.D. training, rather than each country seeking national facilities that cannot be sustained.

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