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Higher education and rural development in Africa: Building a new institutional framework

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ABSTRACT

To achieve the much needed transformation in higher agricultural education in Africa, Universities have central roles in building an enabling environment. One of such roles that always requires limited attention is that of advocacy for favourable policies. In a contrast where resource attention are short and skills are scarce to service a key sector of the economy (the agricultural sector), the careful shepherding through effective policy decisions that are supportive is Africa's top talent efforts to contribute to socio-economic transformation. Universities in Africa and their stakeholders are increasingly making significant progress with reference to advocacy and engagement with policy-decision makers. This article is premised on messages shared in a Resolution issued at a convening in Kampala, Uganda that addressed the theme "Strengthening Human and Institutional Capacity for Agricultural Development". The convening event was organized in November 2010 by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) as part of activities in the realm of advocacy for higher agricultural education (HAE) in Africa. This event marked a process of engaging policy and decision-makers in efforts to initiate reforms that would revitalize higher education and in particular HAE in Africa and the resolution constituted a key output endorsed by the Ministerial Conference on Higher Education, Finance and Agriculture. The Ministers resolved to address priority issues related to higher education and agricultural development and recognized that human and institutional capacity remains a fundamental and essential component of agricultural development. They agreed that Agricultural development, strategy should give particular attention to the role of higher education, and to facilitating needed changes in higher education policy to address Comprehensive Africa Agriculture Development Programme (CAADP) priority issues. The Ministers committed to respond to these challenges and recognized the need for multistakeholder engagements. They thus, made the following requests

1. We ask for the full support and cooperation of the Comprehensive Africa Agriculture Development Programme;
2. We call upon Vice Chancellors, Rectors, Governing Boards and Senates of our higher education institutions to facilitate and support the calls for action set out in this resolution;
3. We ask Africa's development partners, foundations and private firms and investors to support these efforts and the process of carrying out the actions set out in this resolution."

Key words: Africa, Agriculture, CAADP, Higher agricultural education, reforms

RÉSUMÉ

En Afrique, afin de réaliser la transformation si nécessaire dans l'enseignement supérieur en agriculture en Afrique, les universités ont un rôle central dans la construction un environnement favorable. L'un de ses rôles qui nécessite toujours une attention limitée est celui du plaidoyer pour de bonnes politiques. Dans un contraste où l'apport des ressources est faible et les compétences sont rares pour servir un secteur clé de l'économie (le secteur agricole), le suivi attentionné à travers des décisions politiques efficaces et favorables est l'effort de meilleur talents Africain pour contribuer à la transformation socio-économique. Les Universités en Afrique et leurs partenaires font de plus en plus des progrès significatifs en ce qui concerne le plaidoyer et l'engagement avec la politique des décideurs. Cet article est fondé sur les messages partagés dans une résolution émise lors d'une rencontre tenue à Kampala, Uganda sur le thème "Renforcement des Capacités Humaines et Institutionnelles pour le développement agricole". L'événement de la rencontre était organisé en Novembre 2010 par le Forum Régional des Universités pour le renforcement des Capacités en Agriculture

(RUFORUM) dans le cadre des activités de plaidoiries à l'égard de l'Enseignement Supérieur De l'Agriculture (HAE) en Afrique. Cet évènement a marqué un processus d'engagement des politiques et preneurs de décisions dans les efforts d'initiation de réformes qui pourrait revitaliser l'enseignement supérieur, en particulier le HAE en Afrique et la résolution constituait un résultat clé avalisé par la conférence ministérielle sur l'Enseignement Supérieur, l'Economie et l'Agriculture. Les ministres ont décidé de traiter des questions prioritaires de l'Enseignement Supérieur et du développement agricole et ont reconnu que la capacité humaine et institutionnelle demeure un élément fondamental et primordial du développement agricole. Ils ont convenu que la stratégie de développement agricole devrait donner une attention particulière au rôle de l'Enseignement Supérieur, et de faciliter les changements nécessaires dans les politiques de l'Enseignement Supérieur pour répondre aux questions prioritaires d'un Programme détaillé et complet du Développement de l'Agriculture en Afrique (CAADP). Les ministres se sont engagés pour répondre à ses défis et ont reconnues le besoin des engagements multilatéraux. Ils ont ainsi fait les demandes suivantes :

Alors que nous nous engageons à répondre aux défis susmentionnés avec tous les moyens dont nous disposons :

1. Nous demandons le soutien et la coopération du Programme détaillé et complet du Développement de l'Agriculture en Afrique ;
2. Nous supplions les vices doyens, les recteurs, les Conseils d'Administration et les sénats de nos institutions de l'Enseignement Supérieur de faciliter et de supporter les appels pour les actions énoncées dans cette résolution ;
3. Nous demandons aux partenaires au Développement de l'Afrique, fondations et entreprises privées et les investisseurs d'accompagner ces efforts dans le processus de mise en œuvre des actions énoncées dans cette résolution.

Mots clés: Afrique, Agriculture, CAADP, Enseignement Supérieur d'Agriculture, réformes

HIGHER EDUCATION AND INNOVATION IN ECONOMIC RENEWAL: THE CASE OF EUROPE AND NORTH AMERICA

High quality science and innovation are essential to sustainable development. Investments in higher education are central to poverty alleviation and the creation of a prosperous and stable society. This is well recognized by parents throughout the world who often make huge sacrifices to enable their children to gain the education they themselves may not have had. As access to secondary schooling has improved in the developing world, the demand for higher education has increased accordingly. As Zaglul *et al.* (2006) noted, universities and the societies in which they are embedded evolve jointly, involving a continuous process of dialogue and interaction. Today's world of innovation is a network of institutions tied together by flows of knowledge (Sagasti, 2004), with universities as nodes in a global institutional ecology.

Universities in Europe and North America evolved in different ways. In Britain, strongly influenced by the writings of John Cardinal Newman, universities were, in the 19th Century, seen as institutions for the teaching and preservation of knowledge, rather than for the production of knowledge (Cole, 2009). The latter role was assigned to the great scientific societies and independent research institutes. Universities were organized into colleges, where admission was primarily on the basis of family status rather than individual

merit. Each college had its own endowments and facilities, with teaching arranged around periodic tutorials after which students would develop analytic and research papers. France had quality, highly competitive "Elite schools" (*grand écoles*) but which educated few French students and were not principal sites for research activity. The French universities typically specialized in a single area (humanities at the Sorbonne, for example) and competed, rather than collaborated, with the "Elite schools". In both Britain and France, the tradition was that the top institutes were open to the elite. Today, despite significant efforts to broaden access, the top universities in both Britain and France remain (to much of their public) places of learning for the wealthy and privileged (Cole, 2009). In Germany, universities in the 19th Century focused on teaching, rather than research, with teaching arranged around formal lectures, seminars, and practical sessions. But this quickly evolved into German universities contributing directly to major advances in sciences, especially physics, chemistry, and engineering (Cole, 2009).

The new American republic sent its students to study in Britain and Europe. Its early leaders then created their own universities, in part based on either the British or German models. But neither fitted the democratic ideals of the new republic and other locally focused approaches evolved. The Morrill Act of 1862 created the financial base for a system of public higher education

focused on providing widespread access to advanced technical education (Christy and Williamson, 1992). This was the start of the system of land grant colleges which enabled the United States to transform its agricultural industries. The heart of the land grant university was its link to its clients. Initially these universities focused on assisting struggling settlers attempting to make a living on new and unfamiliar soils and difficult environments. But these new universities steadily widened their base to address a comprehensive range of community priorities. The Morrill Act provided the seed; the professors and their students developed the land grant college system into the transformational system that led change in United States agriculture for the following century. Nonetheless, this process of creating higher education Institutions with focus on transformational systems in agriculture has not transplanted successfully in Africa.

In the 20th century, the European universities also evolved, as new universities were created, and the experience from the United States and elsewhere was brought in to improve and adapt the institutions to modern needs. Many of the top European universities today are hubs of innovation, where business and academia work collaboratively to define research priorities, undertake investigations, and provide a range of learning opportunities for students and staff. In the field of agriculture, Wageningen University in the Netherlands provides an outstanding example. The university has a specialist research centre, Wageningen University and Research Centre, with a defined mission “To explore the potential of nature to improve the quality of life”, and a staff of 6,500 professionals. Some 10,000 students from over 100 countries work on issues related to improving access to healthy food and clean living environment. Wageningen UR incorporates the skills of specialised research institutes with the in-house expertise of Wageningen University, with a particular emphasis on collaboration amongst various fields of natural and social sciences, public sector agencies, and private business.

THE AFRICAN HIGHER EDUCATION TRADITION IN AGRICULTURE

With the exception of the Arab universities in North Africa (primarily in Egypt) and the older South African universities, the earliest African universities were largely colonial or post-colonial institutions. As such, they most typically followed the traditions of the former colonial power, which left them poorly linked to their national constituencies. This was particularly the case in agriculture, although recent years have seen some of the leading African universities (Kenyatta University, University of Ghana, Legon, Makerere University, for example) introducing dynamic changes. Eicher (1982) noted that colonial governments gave little attention to

the training of agricultural scientists and managers. By the time of independence of many African colonies in the early 1960s, there was only one college of agriculture in French-speaking tropical Africa. Between 1952 and 1963, only four university graduates in agriculture were trained in francophone Africa and 150 in English-speaking Africa. By 1964, there was a total of three African scientists working in the research stations in the East African countries of Kenya, Uganda and Tanzania.

The typical route to the creation of an African university was to establish under the mentorship and management of one of the major home universities of the previous colonial power. Expatriate staff would develop the initial curricula and examination processes while local professionals underwent training, most often abroad. The objective was that as these young academics gained their qualifications, they would return to their home university (although as highlighted in Ndullo, 2007, many did not), the expatriate staff and outside mentoring (and support) would be progressively withdrawn, and the new university finally turned over to local management. Analyzing a series of international data, showed that at least a third of African skilled professionals were observed in OECD countries. Of African PhD graduates in the US over the period 1986-1996, almost 40% did not return to the continent (Ndullo, 2007).

The priorities of Africa’s new universities in the sixties were focused on training bachelor level graduates to replace colonial administrators and other professionals (Eicher, 2009). In agriculture, research and outreach remained within Ministries of Agriculture following the colonial tradition, leaving faculties of agriculture often isolated from national priority setting and implementation. Furthermore, the government agricultural research and extension arms often followed the ‘top down’ approaches of the previous administration, albeit with changed emphases and priorities. The majority of farmers, typically poor smallholders, were regarded as ‘backward’. This ignored the reality that for the poor, the struggle for food and survival dominates life. In rural communities, where poverty is typically widespread, there are no surplus resources for investment in improved, more efficient, farming systems, or to start new enterprises which create an additional income stream for the household. Those households unable to adopt change became locked into failing production systems.

Furthermore, the 1960s, when many of the new African universities were established, the conventional wisdom in policy circles was that, by investing in industrialization, the agrarian stage of development could be bypassed. The agricultural sector was

perceived as a low priority backwater. State farms and producer collectives were assumed to generate economies of scale and provide the nucleus around which services such as schools and clinics could be built. Those who sought advice from Western nations used large scale agriculture to generate foreign exchange necessary for infrastructural development. Tanzania, with its disastrous *Ujama'a* programme illustrates the first approach; neighbouring Malawi, with its pervasive malnutrition, high infant mortality, and widespread poverty, illustrates the second.

The state, in either orientation, was seen as the guiding force for development. Farmers were to be led to improved living standards through the actions of a highly interventionist government. Ambitious and far reaching plans were developed on the basis of cheerful assumptions rarely grounded in hard fact. The intellectual bias against smallholder agriculture emanating from the industrial countries severely damaged Africa's agriculture and its capacity to feed itself in the years following independence. In southern Africa particularly, a widespread failure to comprehend the importance of a viable and vigorous smallholder agriculture to Africa, and the discouragement of its evolution, is one of the darkest legacies of the colonial period. The smallholder farmer was to be encouraged out of low productivity agriculture into industry or, as in the case of the Tanzanian *ujama'a* movement, where, in the name of African socialism, smallholder farmers were resettled in new communities which were meant to be self-sustaining and self-reliant.

At university level in Africa, agriculture largely became an orphan discipline. Zimbabwe had no faculty of agriculture until Independence in 1980; the faculty of agriculture in Malawi was a remote marginalized college of the University of Malawi until the recent creation of the Lilongwe University of Agriculture and Natural Resources. Many African faculties of agriculture found themselves caught in a vicious circle of decline. As the demand for tertiary education grew, universities were forced to take on increasing numbers of students without the requisite increase of funding to support the extra students. Practical sessions, field visits, and field attachments were scaled back in order to maintain the basic level of classroom training. Potential students (and their parents) preferred more prestigious fields such as medicine, law, and accountancy. Too many agriculture students had little interest in the field, other than as a means to gaining a degree (Blackie *et al.*, 2009).

By the end of the 20th century, the poor quality of training and underinvestment in facilities was a major constraint on agricultural transformation. The need for a major change in mindset (amongst both graduates

and faculty) and substantial improvement in skills (practical experience, communication and report writing, up to date knowledge) dominated discussions with employers and graduates alike. There was widespread recognition that agriculture university curricula were outdated and students had poor access to up to date literature and research. The pressure on teaching facilities was seriously compromising quality as enrolments continued to rise without concurrent investment in infrastructure.

Agriculture faculties were not seen as centres of innovation, capable of providing a reliable and fertile source of new knowledge (despite plenty of very well educated and competent people at the universities). This was the result of two factors. First, while individuals within agriculture faculties, and, in some cases, whole departments, were carrying out some very innovative and creative work, the university community had largely not embraced rural innovation as core business. Second, and this is related directly to the failure to mainstream innovation for the rural sector, the structure and governance of the universities was poorly suited to serving dispersed and poor rural communities, and interaction with stakeholders was poor. Thus there was (and often remains) poor 'ownership' of the universities by their stakeholders. As a consequence, faculties of agriculture were insufficiently integrated into the national and regional agricultural innovation systems.

THE AFRICAN CHALLENGE IN AGRICULTURAL HIGHER EDUCATION

Eicher and Haggebad (2013), after analysing a range of country studies including Denmark and Nigeria, showed that too few African universities were adequately linked to national and regional priorities and sources of support. In agriculture, this is partly due to the 'orphan' nature of the discipline. It is also an outcome of the 'small country problem'; the continent has some 54 countries, many landlocked. Much of agriculture is in the hands of poor, scattered populations served by inadequate infrastructure for agricultural research, outreach and training. The national institutions serving agriculture often lack the capacity to undertake research and technology transfer on a meaningful scale. In addition, much work undertaken in Africa is lost as a rapid turnover of staff (a consequence of poor working conditions and facilities) destroys institutional memory (Dixon *et al.*, 2016).

Agriculture and agribusiness will play a central role in sustainable development and wealth creation for most countries in Africa. This requires new skills (Figures 1 and 2), together with enabling policies and infrastructure, to build globally competitive agro-food value chains. The absence of such skills is a critical

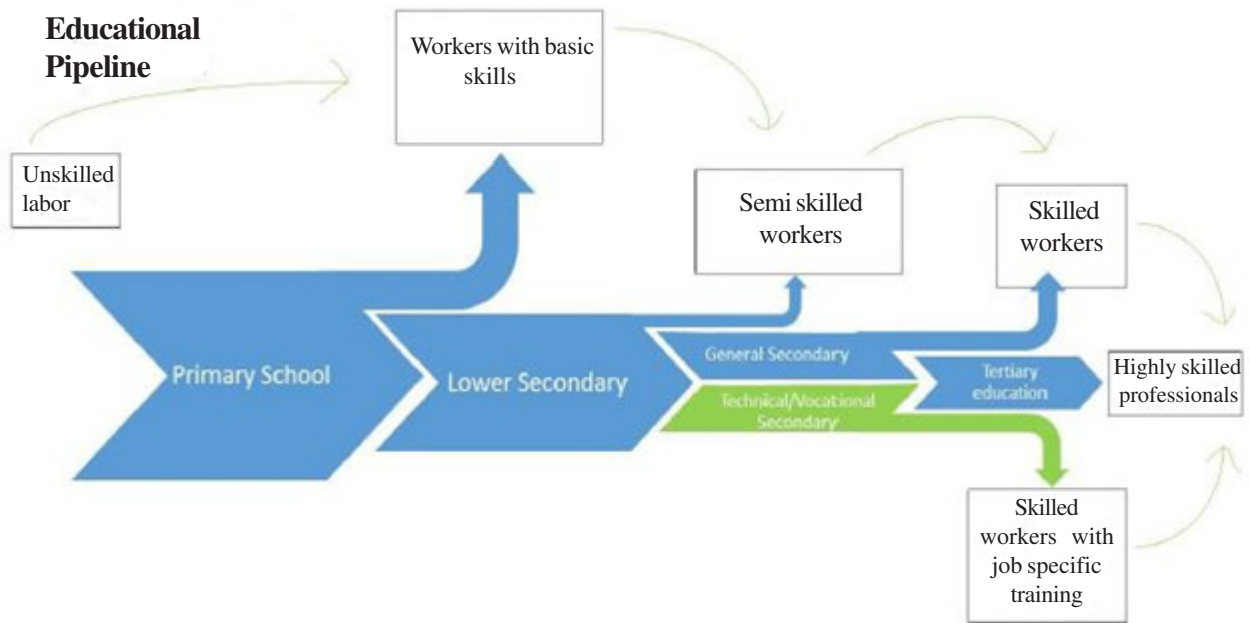


Image Source: InnovATE

Figure 1: Educational pipeline required to equip youth of Africa

The System

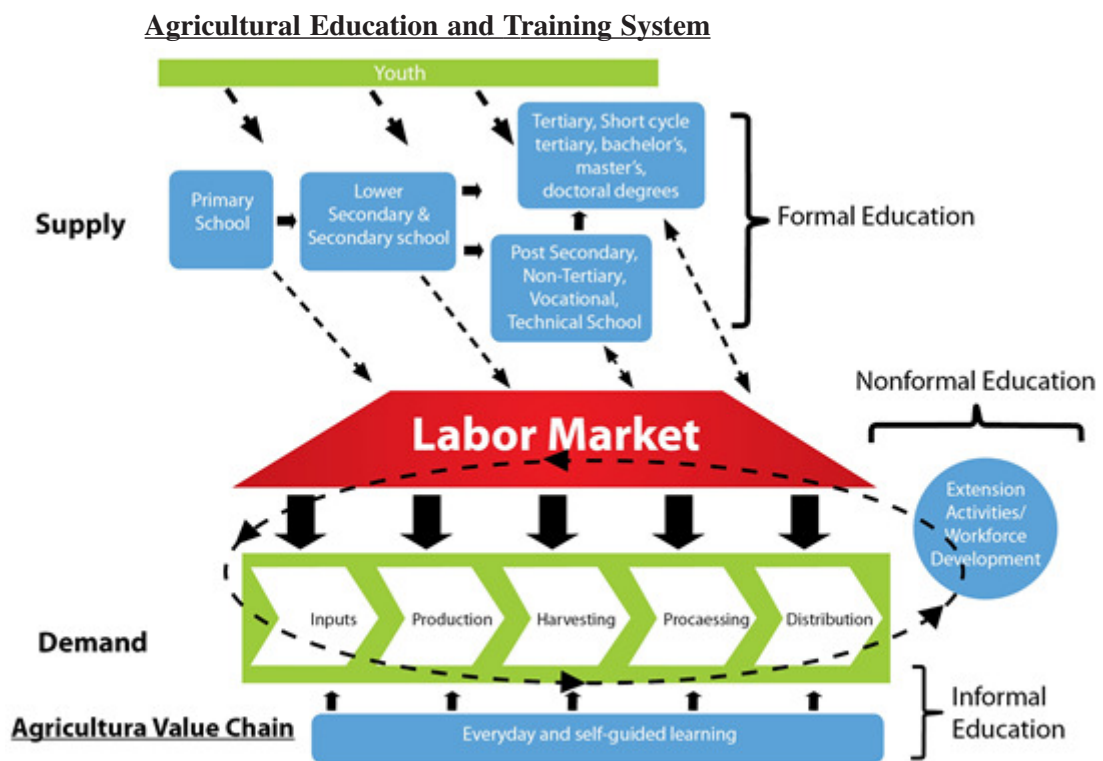


Image Source: InnovATE

Figure 2: Agricultural Education and Training System

constraint in Africa, where there is also an urgent need to modernize food systems to address the food security situation. As world food supplies tighten, Africa's potential to make a significant contribution to

international food security is gaining attention. The starting point for the African Green Revolution is the provision of quality education to the youth of Africa, with an emphasis on what is arguably Africa's most

important business – that of agriculture. This will enable Africa to use its major resource – its youth. Africa's young people are its biggest asset (Bloom *et al.*, 2007). Thus realising Africa's potential will require investments in skills, institutions, and infrastructure in order to capitalise on the job creation and economic growth potential that exists in the agricultural sector on the continent.

FOSTERING DISCOVERY, CREATIVITY AND INNOVATION

The innovative African smallholder

Over the past several hundred years, African smallholders have consistently shown themselves rapid adopters of improved agricultural practices – under favourable conditions. Groundnuts (*Arachis hypogea*), maize (*Zea mays* L.), and beans (*Phaseolous vulgaris*) introduced with the slave trade, spread rapidly throughout the continent to become staples for much of the population. In the late 1960s, Zimbabwe smallholders quickly adopted cotton (*Gossypium hirsutum* L.) which was promoted together with an effective marketing and input supply programme. By 1980, they were producing over 50% of the national crop, and of a better quality than their large scale farming compatriots (Mellor, Delgado, and Blackie, 1986). In Malawi, the introduction of a small 'starter pack' of affordable inputs of maize seed and fertiliser in 1998 enabled smallholders to substantially increase food production and stave off an imminent famine (Levy, 2005). Kenya, with a high value tourist industry, developed a local quality vegetable production capacity in the 1950s. The rehabilitation of previously ecologically declining areas such as Machakos bear testimony to the positive effects of this industry on smallholders with access to markets associated with the expanding tourist industry in Kenya. In 1957, private traders in Kenya began expanding this trade into the export of off-season vegetables, and tropical and temperate fruits. After 1970, this trade expanded steadily as a result of growing demand in Europe, improved technologies and marketing systems for fresh vegetable distribution there, and substantial increases in air-freight space from Nairobi to Europe, a by product of Kenya's booming tourist industry (Tiffen *et al.*, 1994).

One of the major obstacles faced by the poor in the developing world is lack of access to information and to financial services. The widespread growth of mobile phone use, spurred on by low cost handsets and competitive service provision, has opened new options to the rural poor, who respond quickly to appropriate innovation. Through their mobile phones, they can explore commodity and input prices easily, giving them greater power in the market place. New services, such

as Kenya's *M-PESA* money transfer system, allows simple, reliable, and cheap payments to be made by those previously excluded from the banking system. The usability of *M-PESA* has grown to serve some 17 million customers in Kenya and now operates in six other African countries as well as in Asia and Eastern Europe.

The need for significant numbers of skilled change agents to work with African farmers in transforming the agricultural industries of the continent remains. Data from the Zimbabwe cotton industry and other effective interventions to engage smallholders in profitable and productive agricultural systems show that for every researcher, around 8-10 professionals (many in private sector activities such as market development, input supply, and financial services) are required to move a promising research technology from concept to widespread adoption (Blackie, 2016). This gap is widely recognised. African universities are being challenged to produce 'job creators' not 'job seekers', and, in response, entrepreneurship courses are being introduced into degree programmes. This is a useful, but not sufficient, step at helping university graduates gain the competences necessary to establish and build the businesses needed to transform the agricultural industries of the continent.

On the other hand, too much of Africa's talent is being wasted. Many (if not most) African children attend schools that are poorly resourced and where teaching is poor. The students that achieve university entrance qualification standards rarely come from such schools; a common problem in the developing world. In Costa Rica, EARTH University was created in 1990 to reach out to such potential students. EARTH University is a non-profit, private, international university dedicated to contributing to the sustainable development of the tropics through education in the agricultural sciences and natural resource management. Its objective is, through innovative academic, research and outreach programmes, to develop the new designers and implementers of solutions that promote improvements in the quality of life of the inhabitants of the humid tropics. EARTH specifically seeks out promising young people of limited resources from remote and marginalised regions who show potential as future agents of change. An extensive system of scholarships (some 80% of its annual intake of over 100 students receive some level of support) enables students who would not normally have access to tertiary education to enter the institution (Zaglul *et al.*, 2006).

The programme is demanding but focused. It is a four year undergraduate degree aimed at developing the mindsets of effective agents of change. Leadership, identification with the inhabitants of the region, a

concern for conservation of the natural resources of the tropics, an entrepreneurial spirit and the skills and commitment for life-long learning are considered attributes of greater importance than the retention of information (Zaglul *et al.*, 2006). The study programme is based on the principles of experiential learning, where the individual student learns for him or herself how to integrate theory and practice. There are extended periods of ‘hands on’ learning where students first work on EARTH’s 3,300-hectare farm gradually enhancing their husbandry and management skills. They then move on to specialize with practical exercises in their areas of interest before, in their third year, working with smallholders directly (both individual farmers and community groups). Finally (and this is an essential requirement for graduation) all students participate in the three-year long Entrepreneurial Projects Programme. Here they learn, in groups of 5 or 6, how to develop and sustain a productive enterprise which are seen by EARTH’s leaders as a powerful means of creating new sources of employment and improving income distribution in rural communities of the developing world, as well as to slowing the migration from rural to urban areas.

TOWARDS THE GREAT AFRICAN UNIVERSITY

Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), a network of African faculties of agriculture, has enabled faculties of agriculture to start the process of creating truly African universities. Through a system of carefully monitored research grants to staff in network participating faculties, universities are building a focused series of research projects, with strong emphasis on a value chain approach and key commodities and systems. Key criteria include proper problem identification and the use of appropriate research methods. The participation of relevant stakeholders, particularly civil society and the private sector organizations, is encouraged. RUFORUM’s Annual Report for 2014/15 reported a total of 55 research projects supporting training and research for 112 field-based MSc students (Egeru *et al.*, 2015). The 2014 RUFORUM Tracer study showed that graduates stayed in their home countries or on the continent, and typically gained employment within six months of graduation.

Moock (2015), notes the potential of building a strong human capital development infrastructure and harnessing gains from innovation in the research process by the creation of, and investment in, scientific networks. Fundamental to this strategy are “strong” universities building economies of scale and scope and reaching out to “weaker” institutions. But, while networking on a wide scale brings the economies of scale and specialization, the network overall has to be

of a size that its members recognize and respect. Without a strong belief in the necessary mutual obligations of cooperation, trust, and collaboration, networks can easily degenerate into ineffective discussion forums.

Faculties of agriculture have a real opportunity to play a significant role in creating the new African university. Agricultural development policy in Africa is increasingly informed by the use of “agricultural innovation systems” (AIS) to understand how societies generate, exchange, and use knowledge and information (Michelsen *et al.*, 2003). The AIS framework claims to embrace the influences of market forces, the impacts of organizational learning and behavioural change, non-market institutions, and public policy processes. In the conventional agricultural knowledge transfer model (which has its roots in the top down colonial period of much of the region), information flows from the informed and educated science and development specialists down to farmers and field workers. In simple terms, the poor, many of whom are farmers, are told what to do by experts. In a development of this thinking based on learning and a review of experience, the AIS conceptualisation is a more complex process-based systems approach, in which all individuals and organizations in the system continually learn and innovate. It is a system to which all contribute knowledge and which relies on the efficient transfer of information throughout the system in a non-hierarchical manner.

The phrase “business unusual”, which has been adopted by many of the agricultural research and outreach agencies in Africa, is intended to encourage the needed changes in organizational cultures, networks, and linkages among innovation agents which are required in an effective AIS. Importantly (and again to simplify), the poor, along with other actors, contribute directly applying their knowledge and skills to the solutions to their problems. A strong network of faculties of agriculture, fully integrated into the national and regional research and development communities is a core component of a functional AIS. The agricultural graduate from these faculties has the skills, mindsets, and knowledge to address a development agenda that is market-led and knowledge-intensive directly and efficiently. In the new paradigm, smallholders are the innovators of the desperately sought after African Green Revolution.

At the policy level, there is evidence of support for this change in emphasis. The 2003 Jinja Consensus called for the creation of a new African agricultural university to build a different cadre of agricultural graduates who will go on to become entrepreneurs and wealth-creators rather than cogs in the wheels of

existing public agricultural education, research, and extension organizations. University education would be grounded in student-centred learning styles in which instructors would facilitate rather than direct the learning process. Graduates would be armed not only with market-oriented skills, but also with a new standard of morals, ethics, and awareness. So there is potentially a receptive environment for modernizing initiatives within the sphere of African agricultural education and training. This requires more than simply curriculum change – it requires the explicit recognition by universities of their massively changed role within an AIS.

More explicit recognition of the impact of government policies on the successful development of an AIS at national and regional levels is needed at the political level. Dorward *et al.*, 2008, describe the challenge of the “price/productivity tightrope”. The elements of the tightrope are: producers need high returns from investment in new technologies in order to provide them with incentives to invest in productivity increasing technologies; and poor consumers need low prices for food security, for welfare, and to raise real incomes to drive and support growth. Far sighted, long term, and carefully implemented policies to support the transformation of the agricultural sector are needed to complement programmes to alleviate the immediate impacts of food insecurity.

The need for change at African universities is reinforced by the rapid change that is taking place on the continent. It is the fastest urbanizing region in the world. Largely as an outcome of advances in modern sanitation, childhood mortality rates have fallen sharply, creating a substantial cohort of young people entering the labour market. The demographic dividend created by increased child survival in Africa can be captured to transform the lives of the poor of the continent, and a productive agriculture will be essential to this change. In 2010, agriculture and agribusiness in sub-Saharan Africa represented a US\$313 billion industry but this is a fraction of its potential. AgBiz, a South African business think tank, estimates the potential to be around US\$1 trillion by 2030. Realising this potential can be jumpstarted through the development of agro-industries that create jobs and broadbased income and welfare gains. Successful agribusiness investments in turn stimulate agricultural growth through the development of new markets and a vibrant input supply sector (Rodrik, 2014). A study from Princeton University provides further evidence for this potential. The study recognises that the future economic growth in Africa will be from making smallholder farming commercial, supported by initiatives in communications, IT, transport and logistics, finance, distribution, health and education.

There are several steps which can accelerate the transformation of African universities from institutes perceived as removed from the national priorities to sites of knowledge and innovation serving both the private sector and government. The core principle is ensuring that fair access to the university resources of knowledge and learning are made accessible to the poor and disadvantaged, but motivated and committed potential students.

The first step for African faculties of agriculture is to build and sustain their networks to extend best practice across universities and to mobilise the substantial resources needed to support research, outreach, and student learning and scholarships. This will reduce unit costs while reinforcing quality standards. The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) has a strong base on which to build this essential resource mobilization effort.

The second step is for the universities to reach out actively to smallholder groups, and to small and medium sized businesses, learning from the EARTH University and other models. Student attachments need a formal structure, with proper feedback and follow up between universities and industry. Attachments should be formally and collaboratively assessed by both the universities and industry (Blackie *et al.*, 2009). There are useful examples of such exercises being implemented in Africa. The African Leadership Academy started in 2004 as an academy targeting 16 - 19 year olds from throughout Africa who would not normally gain entry to a university. It provides them with needed skills in leadership and entrepreneurship. Students develop business plans in their first year, and then go on to implementation for the remainder of their training. The programme is heavily oversubscribed, indicating the level of unsatisfied demand for quality, practical tertiary education in Africa. Asehi University, a private, non-profit liberal arts college located in Ghana, offers a four-year bachelors programme with majors in Business Administration, Management Information Systems, Computer Science, Electrical and Electronic Engineering, Computer Engineering and Mechanical Engineering. It was founded by Patrick Awuah in 2002 and within 5 years had gained recognition as a leading university in Ghana. Zaglul *et al.* (2006) cite the University for Development Studies in the northern region of Ghana founded in 1992. The university was explicitly required to work directly with communities in Northern Ghana with emphases on agricultural sciences, medical and health sciences, and integrated development studies. It is a multi-campus institution, with facilities located throughout northern Ghana, the poorest region of the country and one which faces significant natural resource degradation (Zaglul *et al.*, 2006). Teaching is practice-oriented, and community-

based, and the curricula emphasised community entry, community dialogue, extension and practical tools of inquiry.

The third step is to widen the entry process by providing young people, who show a clear commitment to, and vocation for, rural development, and who come from disadvantaged areas to gain the opportunity for advanced study. Motivation and commitment become core attributes in the selection process. This will involve a drastic, but not impossible, change to the manner in which students are selected; together with well-designed experiential learning processes which enable the bright, motivated, but poorly educated, student to move quickly and securely into tertiary education. In Zimbabwe after independence, the government correctly made the policy decision to merge the extension service which served the large scale farmers with the separate service dealing with smallholders. But this created a problem for many of the experienced and competent smallholder extension workers who did not have degrees. The lack of a degree meant their route to promotion was severely curtailed. A project funded by the Rockefeller Foundation Agricultural Sciences Division, using distance learning expertise from London University (combined with skillful local tutoring) enabled the agriculture diploma holders of the smallholder extension service to gain degrees (and thus, be eligible for promotion under the criteria of the merged department). This was achieved while still undertaking their usual duties. The graduates were reported as being amongst the best the London distance learning programme had ever produced.

The fourth step in making tertiary education more accessible to poor students, involves paying attention to attracting young women into higher education. Women comprise a small minority of agricultural students, and are inadequately represented at all levels of the agricultural industries (except as active farmers where they are over 50% of the workforce). There is considerable demand for female agriculturalists to play a full role in the future development of the industry. As customs and traditions often mean that women farmers communicate more easily with female advisors and specialists, there is a clear need for greater numbers of suitably trained female professional agriculturalists.

While gender issues are widely accepted and many agricultural specialists are fully attuned to gender sensitivity, an understanding of how to mainstream gender issues and, importantly, to engage fully women at all levels of agricultural development is less evident. The data show there are important obstacles to increasing the numbers of women agricultural graduates. Probably the most important one is the poor teaching of science to girls in school. Girls are not

encouraged to study science subjects and, for those that do, the standard of training is often inadequate. For female 'high fliers' in science at school level, careers in the health sector look more attractive and remunerative than those in agriculture (and recall that information on agricultural careers at school is typically poor in any event). For those with more modest school leaving qualifications, the favoured options are often the 'caring' disciplines such as food science, midwifery, nursing, or home economics. Very often these skills are acquired at diploma level and, if the women go on to further studies, it will not be in agriculture. But this does not mean that there are a useful number of female diploma holders in science related subjects who could, with attractive programmes, take further qualifications in agriculture. Enlightened and focused programmes, such as those introduced by Sokoine University of Agriculture in Tanzania, can substantially increase female enrolments in agricultural education (Blackie *et al.*, 2009). Broadening access will go some way to providing career opportunities for women (who are often disadvantaged in education) to enter university level education.

The final, but by no means the least important, step in the transformation of African universities is to learn from, enhance, and institutionalise the experiential learning initiatives pioneered by EARTH University, Asehi University and others. As Zaglul *et al.* (2006) note, experiential learning focuses on the process rather than content, making it particularly well suited to the complex and dynamic world of agriculture and rural development. The learner, not the teacher or the discipline, is the focus of experiential learning. Theory and 'real world' practice are combined to give the student tools for investigation as well as the confidence to explore and think widely in problem solving. This provides a fertile soil in which to develop the university as a knowledge enterprise where innovation, individuation, and adaptation are central. Innovation generates the ideas, products, and processes from academic research. Individuation fits these new ideas into specific contexts while adaptation means the university is constantly (and speedily) learning from its own, and others', programmes (Crow and Dabars, 2015).

CONCLUDING REMARKS

This paper outlines a step-wise learning approach to filling a widely recognised gap in the tertiary educational system serving the agricultural industries in Africa. The potential for addressing the food insecurity of Africa is considerable. The initiative will be highly demanded as it will attract students previously arbitrarily excluded from advanced educational opportunities. It is demanding, and is not cheap - but the alternatives

are no less costly. The record of short run attempts to deal with food insecurity in Africa have led to policies which largely focus on various combinations of inputs subsidies, output price subsidies for farmers and for consumers, and social protection to raise the incomes of the poor. The subsidy of input costs has gained considerable momentum by recent actions by the Malawi Government. However, this comes at a major cost to other sectors of the economy (plus other inefficiencies) (SOAS, 2008). However, generalised subsidies of this type have a negligible impact on poverty as the principal beneficiaries are those who already purchase inputs. The costs to government can quickly spiral out of control since the government does not control the international price of inputs, the exchange rate or input demand. Subsidized inputs create major incentives for cross-border smuggling. Uncertainty regarding government intentions seriously disrupts trade as importers and farmers wait to see the magnitude of the subsidy before placing orders (Conroy *et al.*, 2006).

The transformation of agriculture in Africa will require quality African professionals working across the relevant scientific disciplines and within the private and public sectors. A higher education system that addresses effectively the development challenges of the continent must be put in place today to create the innovators of tomorrow. Today the demand for higher education on the continent far exceeds current capacity of the sector to train. The postgraduate sector is particularly weak, with too few universities producing the talent required to support knowledge generation and research. There is a shortage of suitably qualified and experienced teachers which impinges on both the quality of courses offered and the availability of mentoring for young graduates. Too many of the most talented African professionals leave for overseas institutions, frustrated by the lack of resources and support at home.

In competitive and knowledge-intensive agricultural economies, capacity building includes, in addition to the acquisition of technical skills, institution strengthening, the improvement of inter- or intra-organizational structures, and the imparting of entrepreneurial competencies and business acumen necessary to develop vision and strategies. The emphasis must be on doing and accomplishing, not just on training and learning (Moock, 2015). Universities have a central role in building an enabling environment for such change to come about. In a continent where resources are short and skills are scarce, the careful shepherding, through effective networking and collaborations, of African's top talent into prestigious African research institutes, universities, and think tanks is an essential strategy. Young people

can be attracted to such institutes to work with the best professionals and to build their own skills, experience, and competences.

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