

## Global change and the future of African Agriculture: What role for Higher Education?

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### Abstract

Agriculture in sub-Saharan Africa is confronted with multiple dimensions of global change, from the atmospheric to the political and economic, from environmental to the demographic and cultural. Change is continuous, and largely unpredictable. Despite decades of innovative agricultural research and learning, broad, long-lasting impacts on food availability, income and economic development remain elusive. This paper examines some of the main challenges and stresses that confront African agriculture today. Implications for Higher Education are drawn from this analysis. The paper argues that responding effectively to complexity depends on changes in higher education, to promote the application of systems thinking and inter-disciplinary research, more effective collaboration, asking the right questions, building trust in institutions, and fostering innovation.

Key words: Africa, development challenges, Higher Education

### Résumé

L'agriculture en Afrique sub-saharienne est confrontée à de multiples dimensions du changement planétaire, des changements atmosphériques aux changements politiques et économiques, des changements environnementaux aux changements démographiques et culturels. Le changement est continu, et largement imprévisible. Malgré des décennies de recherche agricole innovatrice et d'apprentissage, de larges et durables impacts sur la disponibilité alimentaire, les revenus et le développement économique demeurent insaisissables. Cet article examine des contraintes et défis principaux qui confrontent l'agriculture africaine actuellement. Les implications pour l'enseignement supérieur sont tirées de cette analyse. L'article fait valoir que la réponse efficace à la complexité dépend des changements dans l'enseignement supérieur, afin de promouvoir l'application de la pensée systémique et de la recherche interdisciplinaire, une collaboration plus efficace, en posant les bonnes questions, en développant la confiance dans les institutions, et en favorisant l'innovation.

Mots clés: Afrique, défis du développement, enseignement supérieur

## **Background**

This paper is about the complex and systemic challenges facing African Agriculture and what Higher Education can do that is different or novel to address these challenges more effectively. Agricultural development challenges in Africa are complex and systemic. They include well-researched issues such as stagnation of yields and productivity, land degradation and climate change, poor and inefficient markets and lack of infrastructure, as well as disease burdens, gender and other social inequities, institutional weaknesses, conflicts; the list is long. There are no silver bullets, but much is to be gained from systemic, contextual and scale-sensitive analysis of complexity and change. Such approaches can help to identify systemic bottlenecks and potential entry points that can be tested and modified over time.

Research and education are critical levers for change in agriculture. Studies have shown that investments in agricultural education and research have higher returns than in other sectors (World Bank, 2007). But what type of research, what type of education? There are lessons to be learned from some countries, sectors and regions that are already making progress and leading the way. Rural people are experienced innovators and contributors to livelihood resilience and innovation. The private business sector is innovating in communications, food processing and marketing. Yet the institutions of agricultural research and education, including universities, seem reluctant to lead, to embrace innovation, or to implement reforms, and are lagging in generating new models of socio-economic development and innovation. Old theories of change, including the gradual accumulation of knowledge to influence decision making and the production of graduates to staff stable sectors of the economy and of government are inadequate. African agriculture needs new generations of thinkers, innovators and trained young people capable of responding to the challenges of the 21<sup>st</sup> Century. To train them, higher education needs to change, to promote the application of systems thinking and inter-disciplinary research, more effective collaboration, asking the right questions, building trust in institutions, and fostering innovation.

## **The Multiple Stresses on sub-Saharan Africa's Rural Agricultural and Food Systems**

**Environmental stresses.** High variability in rainfall, low inherent soil fertility, and human, animal and plant diseases present many challenges to the intensification of agriculture as an engine of development in Sub-Saharan Africa. Tackling these challenges has been the major preoccupation of the continent's agricultural scientists, and many of its universities, for the last

60 years. They remain a major preoccupation for academia, government and international assistance, underlined by the persistent failure to stabilise historically declining per capita food production and by growing concerns over land degradation, climate change and rising global food prices.

The impacts of these stresses can be quantified, though such efforts are general and only indicative. Soil degradation has been a concern to farmers, agricultural scientists and policy makers in Africa throughout the 20<sup>th</sup> Century. Estimates of its impacts on yields vary from 2-40% (UNDP, 2012). Some suggest losses to soil nutrient mining as high as \$4 Billion per year, equivalent to \$42 Billion in lost income, resulting in additional commercial food imports of \$20 Billion and a further \$2 Billion of food aid (Sanginga and Woomer, 2009; Bationo *et al.*, 2011). The impacts of increasing human activity on biodiversity and the integrity of ecosystems, particularly those that act as hydrological buffers (water towers, sponges and filters), reservoirs of germplasm and sources of non-agricultural income, are recognised to be increasingly negative for the economy and for human security (e.g. Scholes and Biggs, 2004). Models of the estimated impacts of climate change on agricultural productivity in 2050 suggest reductions to crop yields in marginal dry lands in the order of -20%, possibly as much as -30% (Lobell *et al.*, 2008; Jones and Thornton, 2009). Studies, estimates and modeling do not go much further than telling us what we already know –current practices, land use patterns, and pressures on ecosystems are costly, unsustainable, and unless they are corrected, will result in much lower levels of productivity, with disastrous economic and human consequences.

In combination, these environmental stresses present formidable challenges to governments, farms and businesses, households and whole ways of life. Natural disasters such as flooding, drought, or typhoons cause massive displacements of people and degradation of the agri-food systems annually. In vulnerable regions and within sections of rural society most vulnerable to these kinds of shocks, people are periodically forced into distress sales of livestock, rural-urban migration, reduction in food consumption, and menial or degrading off-farm work. Whilst these measures help them cope in the short-term (Little *et al.*, 2001; Erikson, 2005) and in some cases increase their chances of remaining in agriculture, they do not add to the financial, human and other capital investments needed in agriculture. Nutrition and health may decline as the quality and/or quantity

of food consumed decline (Westerhoff and Smit, 2009; Quinn *et al.*, 2011). Coping is not necessarily adapting, nor can it enhance resilience.

Society and science have come up with innovative and progressively more sophisticated responses to environmental stresses. Agricultural research has, over the last three decades, contributed more productive, palatable, and stress-resistant crop varieties, hardier livestock breeds, integrated pest management strategies, soil and water conservation and land rehabilitation programmes (e.g. Reij and Steeds, 2003; Osman-Elasha, 2006; Reij *et al.*, 2009), appropriate irrigation equipment (Kay and Brabben, 2000; Majule and Liwenga, 2011), and culturally appropriate participatory approaches to natural resource management and institution strengthening (Evenson and Gollin, 2003; German *et al.*, 2010). Seasonal weather forecasts are increasingly being used to provide crop advisories (ICRISAT, KARI *et al.*, 2010; Mahoo *et al.*, 2011), and to support the deployment of experimental crop and livestock insurance schemes (e.g. Meherette, 2009; ILRI, 2011). The income, food security and livelihood impacts of these technical innovations have been significant on local and occasionally national scales (for example, disease-free tissue-cultured banana plantlets in East Africa). Humanitarian assistance has benefited from technical change such that responses to potential famine situations can, at least in theory, be timelier and better targeted than in the past. Local sourcing of food aid is becoming more common, and can contribute towards strengthening the agricultural economy in non-affected regions<sup>1</sup>. Some timid responses in the direction of local sourcing are taking place with Purchase for Progress by the WFP, an initiative supported by the Canadian Government- (CIDA Food security strategy).

NEPAD (nd) estimates that US\$2.5 billion is spent annually on Africa's agricultural productivity, mostly concentrated in national research and extension programmes. About half of this funding comes from African governments. On average, African countries spend only 0.75% of GDP on agricultural research and development, the majority between 0.2 and 0.5 percent. Only a handful of countries (Ghana, Malawi, Mali, Burkina Faso, Senegal, Niger, Guinea and Ethiopia) has reached the 10% level to which they committed in the Maputo Declaration. The result

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<sup>1</sup>It costs \$812 to buy, ship and distribute 1 ton of maize as food aid from the USA to Africa; \$320 to buy it in Africa and distribute it; and \$135 to support farmers to grow an extra ton of maize (Sanchez, 2009).

**Social Change -  
Demographics,  
Disease,  
Urbanisation**

is massive underinvestment in human capacity development, in proportion to the importance of agriculture to GDP and economic development. Staatz and Dembele (2008) observed that half of 48 countries of Sub-Saharan Africa for which data were available had fewer than 100 scientists (full time equivalent, see also Beintema and Stads, 2004) while 40% of all active agricultural scientists were working in just five countries: Nigeria (2062), Ethiopia (1318), Kenya (1012), South Africa (784) and Ghana (537). Another 25 countries were found to share 20% of the scientific workforce.

The lack of researchers is not limited to national agricultural research institutions alone. In a study of research and development in Sub-Saharan Africa over the period 1971 to 2000, Beintema and Stads (2004) noted that while the share of the higher education sector in the continent's total agricultural research and development capacity increased from 8% in 1971 to 19% in 2000, the individual capacity of many institutions remained low. Over 40% of the 86 agricultural higher education institutions in Nigeria and Sudan, for instance, employed less than 5 researchers in 2000. More recent statistics in the Africa HDR (UNDP, 2012) estimate a total of 9834 staff in the public agricultural research sector. Less than 20% have PhD degrees, and they are ageing rapidly (FARA, 2006).

One of the most important results of this underinvestment is that the continent has far fewer trained scientists than it needs to confront the environmental challenges which its agricultural sector and rural populations face.

Aggregate food production in sub-Saharan Africa has increased since the early 1980s, largely driven by the continued expansion of cultivated land (Evenson and Gollin, 2003; Kandji *et al.*, 2006) and not by an increase in its productivity. Population grew by 63% between 1985 and 2003 (FAO, 2006; cited in Staatz and Dembele, 2008) and exceeded the rate of expansion of land, resulting in a reduction in the ratio<sup>2</sup> of cultivated land to agricultural population (Fig. 1). In Zambia for instance, the ratio decreased from 1.367 in the 1960-1969 period to just 0.779 in the 1990-1999 period. Demographic transitions in Europe, Latin America and East Asia have come about as a result of urbanisation, education (particularly for girls), the implementation of effective policies for maternal and reproductive health, and

<sup>2</sup>Land to person ratio = (land cultivated to annual and permanent crops)/(population in agriculture) (Staatz and Dembele, 2008).

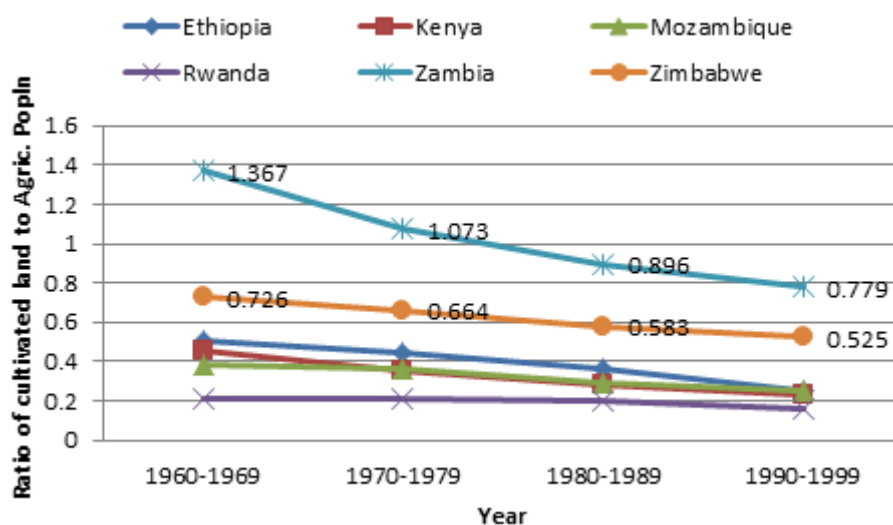


Figure 1. Ratio of cultivated land to agricultural population (Source: Adapted from Staatz and Dembele, 2008).

a host of other social, economic and political changes. Not enough resources have yet been invested in appropriate, viable and affordable programmes and policies, in order to sustain a similar transition in Africa.

For many years, the international community has been concerned that Africa could not feed itself, and seen high population growth as one of the main constraints to greater food security. Yet in a relatively land-rich continent where there has historically been very little external investment in infrastructure and services, more significant in the longer term may be the brake which high fertility, high disease burdens, lack of access and high costs of medical care<sup>3</sup> have put on investment in agriculture by rural people themselves. Investment is significantly reduced by disease, notably HIV/AIDS, Tuberculosis and malaria, through deaths, declines in labour productivity, reduction in on- and off-farm income, and through increased distress sales of livestock and household assets to pay medical bills. HIV/AIDS and Malaria each slow economic growth in African countries by between 0.5 and 1.2% every year (AFDB, 2004). Table 1 illustrates the estimated impact of the HIV/AIDS epidemic on the rural labour force for twelve countries by 2020, compared to what this population would have been using a 1985 baseline. Declines are in the order of 20%. The African Development

<sup>3</sup>Sub-Saharan Africa's health systems are among the weakest in the world. On average, the region has 1 doctor per 5,300 people, less than a seventh of the world average. In Liberia, Malawi, Niger and Tanzania the ratio is 1 doctor per 50,000 or more people (UNDP HDR, pg. 36).

**Table 1. Impacts of HIV/AIDS on agricultural labor force in selected African countries, 1985-2020.**

	Namibia	Botswana	Zimbabwe	Mozambique	S. Africa	Kenya	Malawi	Uganda	Tanzania
HIV Prevalence rate, 2001	22.5	38.8	33.7	13.0	20.1	15.0	15.0	5.0	7.8
Projected loss in agric. Labour to 2020 (%)	-26.0	-23.0	-23.0	-20.0	-20.0	-17.0	-14.0	-14.0	-13.0
Projected number lost (000) to 2020	62.7	58.0	624.5	1,186.0	383.0	1,287.6	439.3	897.0	1,256.6

Source: Coulibaly (2005).

Bank (2004) estimated that household incomes declined by between 50-80% through the loss of the breadwinner to HIV/AIDS. Clearly, investing in access to health care will bring dividends in agricultural productivity and investment.

Huge social stresses have been placed upon agricultural systems as a result of Africa's incorporation into global economic and political systems. Over the last century, the incorporation of agriculture into commodity and labour markets led to fundamental shifts in the roles and responsibilities of men and women, in their status, economic opportunities, access to information, exposure to infectious disease, and opportunities for self-advancement. The last century saw the marginalisation of women relative to men, with terrible implications for the wellbeing of women and children. Despite enormous attention in academia and in recent years from governments and foreign assistance programmes, gender disparities remain large in most countries. These inequities and accompanying social transitions are far from over. They have fundamental implications for the ways in which agriculture can contribute to societal goals, and merit much higher priority in the continents research and education.

Urban populations are growing faster than rural population throughout much of the continent, mainly through migration, and the continent's urban population is set to double from 300m to 600m between 2010 and 2030 (FAO, 2012). Food production in urban areas is not keeping pace with their growing populations. Re-investment in rural agriculture by migrants is very limited, due to low levels of savings in urban areas. The aspirations of rural youth are outside of agriculture (Future Agricultures; IFAD papers on youth and agriculture). Since the youngest and brightest are the first to migrate, labour and intellectual capital become scarce in rural areas. Without either internal generation or external injection of capital, the agricultural economy fails to grow in ways that could generate ancillary



industries, services and employment. As a result, countries are in a double-bind, with insufficient private and public capital accumulation in agriculture to fuel increased production. There is no concomitant expansion of food production in or close to urban areas to meet growing urban demands (eg. Maxwell, 1999). The agricultural sector is unable to respond effectively to the demands of changing urban diets, so that cities are becoming more dependent on imported food. Economic policy development is largely inadequate as a response.

The rapid spread of mobile phones is contributing to some important cultural shifts and wider access to information, and to changing expectations for personal opportunities and more open, democratic decision making throughout rural Africa. Universities are contributing considerably to technical advancement and to enhanced access to technologies. Less attention appears to be given to the implications of technical change for social change and the impacts on agriculture beyond the more efficient distribution of price information and limited access to banking and insurance services for those who can afford them.

**Conflict.** Insecurity resulting from political conflicts causes major disruptions to crop and livestock production systems across Africa (Fig. 2). Net losses to agricultural production from armed violence in Africa were estimated at \$25bn between 1970 and 1997, equivalent to three-quarters of all aid in the same period (IANSAs *et al.*, 2007). Table 2 estimates the cost of conflicts in 15 countries since independence, resulting in average annual losses of 5.5% of agricultural output. The Angolan war, Nigeria's Biafran war and the Congolese and Sudanese civil wars have each resulted in cumulative losses of over USD 2 billion. Minor conflicts and community conflicts over resources, such as in the Tana Delta in Kenya, in Ethiopia, South Sudan, and northern Uganda have been much more common, and have resulted in significant losses of human lives, displacement of populations, losses in agriculture and degradation of natural resources. The complex linkages between conflicts and natural resources have been documented and have been the subject of much research (Buckles *et al.*, 2001; Wolf, 2007). In the arid and semi-arid range lands of Eastern Africa, conflict regularly inhibits herd mobility – a major drought coping strategy – forcing pastoralists to sell most of their stock at very depressed prices and suffer losses in terms of livestock deaths (see Little *et al.*, 2001).





In 2002 55% of world wide violent conflict took place in sub-Saharan Africa, in 2011 the share had dropped to 24%. Countries emerging from violent conflict have shown some of the most encouraging examples of development gains. Large parts of sub-Saharan Africa have become more peaceful, including West Africa and parts of the Great Lakes. Many peaceful regions have consolidated even in countries with persisting patches of violent conflict.

#### Conflicts as defined by HIIK Conflict Barometer 2011



Source: APP with data from the Conflict Barometer 2011 published by the Heidelberg Institute for International Conflict Research (HIIK).

**Figure 2. Conflict and fragility in Africa, 2011 (Source: APP, cited in Africa progress report, 2012).**

**Table 2. Agricultural losses caused by conflicts in Sub-Saharan Africa.**

Country	Years	Cumulative total loss*	Annual total loss*	Annual total loss as % of agric.	Output
<b>Annual losses per agric. Worker (1999-2001 USD)</b>					
Angola	1976-2002	2,995,303	106,975	15.9	30.06
Burundi	1998-2002	171,967	34,393	5.3	11.13
Chad	1966-1990	636,664	25,467	4.6	12.43
DRC	1996-2001	1,321,311	220,218	7.7	16.78
Liberia	1990-1992	18,162	6,054	4.1	10.48
Mozambique	1964-1974	235,172	21,379	2.5	4.87
	1981-1992	1,181,461	98,455	12.2	16.98
Namibia	1980-1988	39,131	4,348	1.9	17.44
Nigeria	1967-1970	2,150,667	537,667	6.7	35.04
Somalia	1988-1996	275,032	30,559	3.2	14.61
Sudan	1963-1972	690,975	69,098	3.2	16.40
	1983-2003	2,424,773	115,465	3.1	16.85
Uganda	1978-1989	289,271	26,297	0.8	3.61
Average		956,145	99,721	5.49	15.9

\* In thousands of 1999-2001 USD. Source: Rezek and Lukongo (2011).

Peacekeeping and the efforts of the African Union, ECOWAS and other regional bodies are reducing the incidence of international conflict in Africa. With increased pressure on scarce land resources, especially well-watered lands, the increasing pace of development of natural resource extraction across the continent, and the additional impacts of climate change on water availability and food security, scope for localised conflict could be much greater. Such conflicts have also affected higher education and research, placing post-conflict countries in dire need of more support. The Regional Universities Forum for Capacity Building in Agriculture's networking role is a partial response to these difficult situations, and such efforts need to be sustained to build capacity in post-conflict countries. But this must go beyond just training of agriculturalists. For more details, see Adipala and Osiru, 2012; Blackie and Kay Muir-Leresche, 2012. It requires a more systematic effort of agricultural recovery and rehabilitation, in raising incomes and food security, creating employment from agriculture, and building resilience of agricultural systems (UNU-IAS, 2004). University training to understand, anticipate or mediate conflicts is still limited in Africa, although the University for Peace in Addis Ababa now has a fellowship programme to begin to address this. RUFORUM's regional PhD programme on drylands, for example, has elements that could be strengthened to take a more systematic perspective on

## **Institutional and Policy Challenges**

agricultural resilience, social change, and conflict management, for example.

Changes in institutions, governance and policies have sometimes brought havoc in terms of the ability of rural people and their agricultural systems to withstand environmental stresses. Brough and Kaimenyi (2004) attribute the failure to cope with drought in the Sahel in the 1970s on the disruption of traditional institutions that guaranteed access to and were responsible for use of common pastures and water points. In Ethiopia, the government's agricultural policies in the years between the famines of 1970s and 1980s resulted in movement of people from their traditional villages into soviet-style communes (Fraser, 2007). This severed them from their traditional pools of social and natural capital, and made them even more vulnerable to drought, with catastrophic results.

Unanticipated policy shifts have been a major threat to the sustainability of agriculture in most countries. In Mimkyemfre, Ghana, the removal of input subsidies in the 1990s reduced the ability of farmers to purchase fertilisers, pesticides and improved seed, leading to poor crops yields (Westerhoff and Smit, 2009). In Nigeria successive governments have frequently reversed policies put in place by their predecessors (Enete and Amusa, 2010), adding to the uncertainties farmers must deal with.

Zambia and Malawi have both instituted input and price subsidies to encourage maize production in recent years. Such measures saved millions of Malawians from starving and restored dignity to the country. From a food deficit country in 2005, Malawi consistently produced above the national maize requirements for more than 5 years in a row, reaching almost one million farmers and increasing maize yields by 50% from 1.4 to 2.1 tons per hectare. The cost to the government rose from \$50 million in 2005/2006 (5.6% of the national budget) to \$285 million in 2008/2009 (16.2%), equivalent to 74% of the Ministry of Agriculture's budget (UNDP, 2012). Whether these subsidies can be sustained remains to be seen – that may depend on the vagaries of donor policies, markets, the weather, and politics. The challenge now is to make such programmes better and more sustainable, by taking an agri-food systems perspective that looks at elements such as overall nutrition (rather than just caloric food-sufficiency), value addition, rehabilitation of soil fertility, and employment creation. Success with so-called "SMART" subsidies are being registered in Ghana, Rwanda

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and Nigeria, and the World Bank has begun to recognise their value.

In other countries, a failure to invest in agriculture by private individuals, private industry or the State are often the result of critical institutional weaknesses, such as unclear land tenure and corruption in lands agencies, inefficient or corrupt marketing boards. The institutional environment, and the policies and interventions that enhance or limit it, still seem to receive inadequate attention in research and education compared to technical matters directly related to production. The ability of farmers and countries to act collectively, to manage natural resources directly, to achieve economies of scale through marketing or management, are limited by the extent to which they can place trust in institutions, governance bodies and legal systems. Only in the last five to ten years, for example, have farmers in Kenya had access to a banking system, Mpesa, that is affordable, accessible and trustworthy. Universities can bring to bear expertise in law, business, economics, governance and political science, ethics, and the humanities to the challenge of building an enabling institutional environment.

A regional institutional landscape is beginning to take shape that emphasises collective action, regional trade, economies of scale, synergies and networking. It comprises the regional economic communities such as COMESA, the EAC and ECOWAS, and a host of supportive regional organisations, in research (FARA, ASARECA, CORAF, RUFORUM, AGRA). Regional policies for agriculture, such as CAADP, are emanating from a process of continual engagement and dialogue between these bodies, national governments, private sector and foreign donors. And national governments such as Ethiopia, with its Agricultural Transformation Agency, Rwanda and Uganda, have put in place parastatals to focus on transformation of national agri-food systems. We need universities to engage with these agencies, to support, inform, challenge and provide the necessary social audit functions of their efforts.

## **Economic Change**

Africa has seen an extraordinary rebound in economic growth over the past decade. Some of the world's fastest growing economies are in Africa, and they have expanded even during the ongoing uncertainty in the global economy: Kenya continued to grow at 4.5%, Rwanda above 8%, and Ethiopia above 10% in 2011 (Africa Economic Outlook, 2012). This has brought a

much-needed reduction in poverty in the region and a renewed sense of optimism about its future. (UNDP, 2012). Much needed investments in transport infrastructure will undoubtedly have a positive impact on farming<sup>4</sup>. However, to date the agricultural sector is barely participating in this growth, indeed its contribution to growth is declining. More importantly, growth is not yet translating into a transformation of agriculture, nor a significant reduction in rural poverty, undernutrition, or food insecurity.

How can the pace with which agriculture benefits, and the reach of these changes be increased? Investment in the infrastructure that agriculture needs, beyond roads, is happening in some countries where there is a determined effort by government, such as Ethiopia, Ghana and Rwanda. International programmes such as AGRA are focusing on understanding and strengthening input markets. Value chain development is a major focus for a number of governments, international agencies and non-government organisations. To date, investments on the kind of scale necessary to bring about transformation of the food system seem to be dominated by foreign private or sovereign wealth investors, to meet the food and bio-fuel needs of countries outside of Africa, and are resulting in growing concern and opposition where they exclude or marginalise local populations.

Research and higher education have a vital role to play, in finding ways to translate and sustain such growth in the agricultural sector, in ways that benefit the 70% of the poor who depend on agriculture for livelihood. Increasing attention is being dedicated to the business environment, capacity development for business administration, and towards financial and other services that will contribute towards agricultural development. Bringing cheap, accessible and flexible energy sources to rural areas is a pivotal challenge in all of this, and universities are the obvious source of ideas and innovation. Agro-processing, collective action on marketing, information systems, credit for women, and a host of other critical areas desperately need more attention.

The majority of attention on agriculture within research and Higher Education on the continent is focused on the first set of challenges outlined above, those that deal directly with the agronomic, environmental and biotic stresses on production.

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<sup>4</sup> A study of 15 villages in Ethiopia found that access to all-weather roads was associated with an average 16% increase in household consumption and a 7% decrease in poverty (UNDP, 2012, 35).

Social change, the institutional environment, issues such as the rule of law and management of conflict, and the relationship between growth in other sectors of the economy and agriculture are paid rather less attention outside of faculties of social science and humanities, and are not well integrated into agricultural and rural development teaching, learning and practice.

Yet such generalisations are really beside the point. We need universities to produce graduates that are capable, alone or as part of multi-disciplinary teams, of considering and integrating whichever of these challenges, or others, are relevant to a given context and moment. In the following section, we examine how such an agenda might be advanced.

**Moving Forward in  
Higher Education:  
How to pull all this  
together to overcome  
systematic challenges  
and bottlenecks**

**Train people to build resilient rural systems.** Systems-thinking seems to have gone out of fashion in agricultural and rural development discourse. To the extent that this reflects how people are being trained, and the relevance of research to the challenges facing African economies and societies, this is unfortunate and needs to be corrected. Learning to apply the skills of systems-thinking is critical to making a difference amidst all this complexity, to identify entry points where changes in a system are most likely to bring about the desired results (Meadows, 1999), to be able to recognise where the potential impacts of technical change are limited by higher-level system constraints, such as weak markets, to identify systemic bottlenecks to change, and to prioritise policy and other changes that can influence the direction in which a system is changing. For example, land tenure and property rights remain contested in many areas, and are a major deterrent to investment, capitalisation and management, whether public or private, individual or through collective action. Systems-thinking also helps to identify key gaps in technical training, such as agro-processing in humid environments, business development, hydro-geology, outreach and communications, para-legal and financial services, mobile telephony applications, agricultural advisory services, or cooperative enterprise development.

Significant benefits of re-adopting such an approach would flow to agricultural productivity, because it would unlock human and financial capital that is currently diverted to deal with the other challenges listed above. Bezner-Kerr and colleagues (2007) work in Malawi demonstrates this elegantly. It would require a reversal in some of the current biases in research, towards areas that are currently neglected such as livestock production

(Ocholla and Onyancha, 2006), climate science, nutrition, policy assessment, and agricultural engineering.

We know a lot about how to support the development of enabling environments for resilient agriculture and rural development (see Table 3 for a summary). By training people to think systemically, whatever their disciplinary speciality, universities can foster the development of a myriad of innovative approaches that will help rural people to cope with the range of complex and mutually reinforcing stresses we have discussed above. For example, university researchers from Malawi and Canada are working with health and nutrition experts used the ecosystem approach to human health (Lebel, 2003) to reduce malnutrition amongst three thousand families in northern Malawi, and improve soil fertility, through the introduction of legumes into diets and cropping systems, education and outreach programmes (Bezner-Kerr *et al.*, 2007). Infant health and malnutrition became an effective entry point into building resilience in the farming system. Potentially, their approach could help Malawi to make its subsidies smarter on a massive scale, through improved fertiliser use efficiency. That would require putting nutrition ahead of growth as a goal of the agricultural system (cf Meadows, 1999).

**Train and support people to work collaboratively.** When we look at the world through a systems lens, we quickly realise that we need to work across disciplines and across organisations in order to address real-world challenges. Trans-disciplinary and interdisciplinary learning have their challenges, often because of the institutional barriers to this kind of work. Professional recognition and advancement comes mostly through specialisation in academic disciplines. If we need researchers to work collaboratively to address the continent's pressing challenges, then we need incentives and rewards for achievements in line with the nature of the task in hand, and in addition to those of academic advancement that come with publication. Examples of such incentives are endowed chairs in applied research, funding and prizes offered for addressing a specific problem and professional recognition for leadership in interdisciplinary research and mentoring.

Working with decision makers, research users and professionals from non-academic organisations requires that graduates and researchers acquire skills in communication, empathy and listening, and become practiced at working in non-academic



approaches to problem solving. Those funding research projects or designing graduate and sandwich/co-op programmes can build opportunities for learning collaboratively into these. For example, university researchers funded under the Climate Change Adaptation in Africa programme in Tanzania and Malawi engaged local-level decision makers in discussions about their research agenda at an early stage of their work, leading to changes in district budgets and water management in support of strengthening farmers' adaptive capacity (Majule *et al.*, 2011). The recently launched UniBRAIN initiative provides opportunities for collaboration between universities, research institutions and the private sector (FARA, 2012). The Women in African Agriculture Award has supported women scientists to take leadership roles in agricultural research in the continent.

These programs have facilitated increased exchange of information between agricultural practitioners, policy makers, researchers and students. Universities can do much more to engage potential users of research and knowledge from private and public organisations in discussion, dialogue, and in the testing of innovations. Intended and unintended outcomes and consequences of regional and national agricultural policies and institutional changes should be a major focus of policy analysis and advice. An area of real opportunity for Universities is in the independent monitoring of policy impacts, where they could play a key role to evaluate and help re-formulate policy options. Well-funded research Chairs encourage collaboration across disciplines and organisations, to promote systems thinking, and to attract funding. UNESCO's Interdisciplinary Chairs programme in the 1990s developed innovative PhD programmes. At the University of Curitiba in Brazil, students had to contribute to addressing a systemic challenge defined jointly, such as the impacts of flooding in low-lying coastal settlements, each from their disciplinary expertise. Canada's research councils and IDRC fund an International Research Chairs Initiative "to build healthier, more equitable, and more prosperous societies in low and middle income countries through strengthening the research capabilities of universities" (IDRC/CRC, 2007). African agriculture could benefit enormously if universities were to establish research chairs that promoted interdisciplinary systems thinking and applied collaborative research, in fields such as:

- Health and nutrition in agri-food systems
- Agri-business and entrepreneurship
- Innovation for sustainable rural systems
- Enabling institutions and policies
- Climate Change Adaptation and resilience

Research funders can play a key role in all this by funding programmes designed deliberately to encourage collaborative research. An example is the Rural Territorial Development Programme led by the Latin American Centre for Sustainable Rural Development (RIMISP). This is a joint research and training programme of Think Tanks and Universities, which set out to explain why rural development has been so heterogeneous on the continent (RIMISP, 2012). By combining analysis of economic growth, social inclusion and environmental trends, the programme has helped to uncover the ways in which policies are mediated by social and economic forces, local context and culture, and to shape thinking on the need for place-based policies as part of national and regional economic development strategies. Another example is a new initiative of DFID and IDRC, the Global Adaptation Research programme, which will fund consortia of universities and research institutes to address adaptation gaps in hotspots of climate change impact in Africa and South Asia. Collaborative research, across disciplines and organisations, is likely to become increasingly attractive to large donors looking to reduce administrative and management costs, and to address big questions and global challenges.

**Build the capacity to ask the right questions.** In the preceding points, we have argued that universities need to train people that can think and analyse from a systems perspective, and work collaboratively across disciplines whilst developing their technical and problem solving skills. Training people to understand uncertainty and risk, and the implications for decision making and investment, should be basic to a range of disciplines, from civil engineering to social policy.

The relationships between research and policy implementation need to be improved. Universities need to train people that are capable of designing, implementing, monitoring and modifying policies as systemic experiments, to encourage learning by doing throughout policy processes (e.g. PEP, 2012). Intended and unintended outcomes and consequences of regional and national agricultural policies and institutional changes should be a major focus of policy analysis and advice.

Understanding how to learn from others' successes and failures, and to identify what experiences from elsewhere are and are not relevant to one's own situation are key skills that need to be built.

**Build Trust in institutions.** Lack of trust in the institutions that govern agriculture and rural living is pervasive, and is a major brake on investment in agriculture and the creation of attractive employment opportunities for rural youth. Weak markets, collusion, inefficient, corrupt and ineffective judicial systems, and dysfunctional land registries all undercut the rates of return on investment in rural livelihood systems. As Table 3 demonstrates, local-level institutions are instrumental in the management and restoration of the natural resource base upon which agriculture depends. However, these institutions are today disappearing or being neglected. There is need for universities to develop and advise on programs to strengthen local-level (traditional) and informal institutions common-pool resource management, livestock and range management. Universities could also contribute to the development and coordination of more effective collective action on poor access to input and produce markets.

Universities and institutes of higher learning can build the capacity to identify where institutions are failing, and what improvements or reforms would enhance their functioning. But perhaps more importantly, universities have the human capital necessary to demonstrate the cumulative impacts of institutional failures, and to command the attention of government and society in proposing reforms and improvements. There is also a need to identify areas where local institutions are absent, or eroding, such as in the realm of collective action for the rehabilitation of natural resources, common pool resource management, and cooperative economic activities, and devise ways to evaluate, strengthen and support them.

**Educate people to foster rural innovation systems.** Not enough students in agriculture and rural development are being given an education relevant to the challenges faced by the continents farmers and rural societies. A recent FAO report sums up the situation:

“...there is a pressing need for institutions to strengthen links with rural society so as to play a full part in the development efforts of their region or community. Agricultural universities

and colleges also need to have closer links with current national research in applied fields. At all levels, there is a need for a critical review of subject-matter content and a judicious replanning of courses to fit employment opportunities and to address the problems and issues of sustainable agricultural production and rural development. Priority attention should be given to upgrading teaching skills and methods with an emphasis on practical, field-oriented student training” (FAO, 2003).

Well functioning, efficient and relevant educational systems are a prerequisite for sustained agricultural production and economic development (FAO, 2003). New models are emerging, such as the African Rural University (ARU) in Kibaale district of western Uganda. Inaugurated in 2011, ARU is the first African university dedicated to training women, building strong female leaders for careers in agriculture. The local community is a partner in their training, contributing to define priorities on which they will focus, and benefiting through better food security, nutrition, incomes, women’s leadership and education (Juma, 2012).

Currently, most universities produce graduates that want jobs. Africa needs graduates capable of creating jobs, by becoming entrepreneurs. Universities need to prepare graduates to be innovators, technology developers, marketers and market researchers and entrepreneurs. Agribusinesses offer tremendous opportunity for youth employment as many aspects of the agribusiness chain remain untapped. Practical skills in areas such as communication, post-harvest handling and storage and business development and management are needed. And research is needed on ways to foster the emergence and deepening of rural innovation systems. Already in the last few years we have seen a boom in innovations building on information and communications technologies, in countries such as Kenya, Ghana and South Africa. How can this environment be developed further? One way would be to rethink post-secondary education, to provide students with key principles in relevant disciplines (agronomy, economics, ecology, computing, nutrition, engineering) and then on-the-job learning experiences where they are able to experiment in the application and combination of those principles, all the time being encourage to think systemically and innovate. We need to find ways to develop technical expertise and industry-relevant expertise, alongside learning and experimentation, within and across disciplines.

## Conclusion

Despite multiple challenges on agriculture, there is increasing optimism that Africa is poised to develop its agriculture in ways that are appropriate to its social, environmental, economic and political circumstances. Experience on this continent and elsewhere demonstrates that it is possible to identify systemic entry points, levers, ways of fostering positive change and promoting adaptation that contribute to building resilience of rural economies, agrarian societies, and food systems. Sometimes it will require putting other issues first, in order to have indirect, but highly significant impacts on agricultural production, innovation and development. The region's Universities and institutes of higher education are increasingly aware of and beginning to respond to these challenges and this paper is a preliminary attempt to identify ways in which this can develop further.

Ocholla and Onyancha (2006) note that it is the continent's universities, with the highest levels of collaborative research in the region, that are best placed amongst the continent's learning and training centres to foster the systemic and collaborative work needed to address these challenges, and to unlock the potential of Africa's rich heritage and diversity of rural societies, cultures and agricultural systems. The real challenge is to harness their inherent potential to the right kinds of training and learning, to unleash a wave of economic, technical, institutional and informational innovations.

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