Innovation, Entrepreneurship and Governance for Sustainable Development of Africa’s Agri-food System

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Key messages

1) Africa has the human capital to transform its agricultural sector
2) Growth in urban markets provides new opportunities for enterprise development
3) Investments in science, technology, engineering and math must be increased
4) Bold leadership as well as policies that promote R&D collaboration and provide incentives for partnering with the private sector should be implemented.
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Introduction

The African continent not only has abundant arable land (60% of the world’s untilled land is in Africa) but a rich biodiversity, a knowledgeable human resource base and a long history in agriculture which sustains the informal economy. These assets, plus the growing high-level political leadership and commitment to innovation and transformation, provide a sound foundation for enhancing agricultural output and leapfrogging Africa’s economic development.

The continent is also witnessing growing private-sector interest from both internal and external sources in modernising the agricultural and food sectors to meet the needs of the foreseen massive urbanisation. Meeting this demand will require increased investment in education, research, innovation and public-private partnerships for the creation of new agricultural and food enterprises. This in turn can yield substantial economic returns and employment opportunities from a vibrant agri-food sector. Markets for inputs and services can also expand and drive growth in the non-agricultural sectors.

Yet many factors continue to hinder the emergence of an African Green Revolution, including low investment and productivity, poor infrastructure, limited funding for research, inadequate use of yield-enhancing technologies, weak linkages between agriculture and other sectors, unfavourable policies and regulatory environment, and climate change. Although science, innovation and entrepreneurship are increasingly acknowledged as key forces for change, bold leadership and highly motivated social capital are required to accelerate the agricultural transformation throughout the continent. Redefining the crucial role of the local, regional and international private sectors and the mechanisms for strengthening their partnership with governments and research and academia is now critical.

Innovation systems and economic development

Innovation systems encompass the interactive processes involving key actors in government, academia, industry and civil society to produce, diffuse and use knowledge for societal and economic gain. The key elements of innovation include the generation of a variety of knowledge products and their selection and use in response to the market environment as well as the emergence of strategies for adapting to societal challenges, including climate change.
Economic development is largely a process by which knowledge is applied to convert resources, including natural resources, into goods and services. Conservation of nature’s variety is therefore critical to keeping options open for future development. Adaptive strategies will therefore need to start with improved understanding of the natural resource base. Advances in earth observation and related geospatial science and technology have considerably increased the capacity of society to improve its capabilities for natural resource management. This needs to be accompanied by greater investments in the generation of knowledge associated with natural resources.

Advances in information and communication capabilities will help Africa and international partners to collect, store and exchange knowledge in ways that were not possible before. Sequencing of genomes provides added capacity for selective breeding of crops and livestock suited to diverse ecologies. Technological advancement is helping to augment learning and expand adaptive capabilities.

Adapting to societal challenges – including economic, energy, nutritional and climatic challenges – will require significant upgrading of the society’s knowledge base to allow trends to be identified and responses to be designed. Hence technical education, entrepreneurial activities and product and process diversification are critical to economic development. Promoting prosperity and creating robust economies that can adapt to various challenges and build resilience of the wider society, including farmers, should also be a central concern of African leaders.

**Technological innovation and infrastructure development**

Unlike in the 1950s, when African countries faced enormous technological challenges, the recent phenomenal growth and rapid penetration of modern information and communication technologies have increased access to the world’s pool of scientific and technical knowledge. Relative successes in Rwanda, Ethiopia and Nigeria have demonstrated that there is a clear link between technological innovation, improved farm productivity and income growth and that such linkages operate in Africa and are benefitting smallholder farmers and their families.

Infrastructure investment is critical for stimulating innovation and is one of the areas that can benefit from regional coordination. Indeed, the various regional economic communities (RECs) in Africa are already intensifying efforts to rationalise and coordinate infrastructure investment. A lesson that Africa can learn from other continents is the importance of linking infrastructure investment (especially in key areas such as transportation,
energy, water and telecommunications) to specific agricultural programmes. Even the provision of ‘low-quality’ roads that connect farming communities to markets could contribute significantly to agricultural and rural development. A strategic way to build technical capability is to link training institutions and universities to large-scale infrastructure projects.

Nonetheless, it should be recognised that investing in infrastructure has high up-front costs. Making large investments ahead of demand poses a wide range of management and political risks, especially if the human and institutional capacity is not readily available. African countries have to think and act creatively when seeking funding for infrastructure development programmes and determine how best to mobilise the requisite human resources. Countries such as Senegal, for example, have been using the military to support the development and maintenance of infrastructure commissioned through large-scale investments. They have put in place a clear management structure, which operates in a manner that reduces the chance of corrupt practices or political mischief. The bottom line is that the engineering capabilities of African militaries can be harnessed to lay the foundation of economic security through infrastructure projects that also support agriculture-led innovation and enterprise development.

Technological innovation can help overcome some of the constraints facing African farmers. For example, research has shown that applying physical analytics – a groundbreaking technology – to irrigation of perennial crops can improve water-use efficiency by up to 20%, freeing up water for other uses. There are numerous cases to illustrate the ingenious and innovative ways that African farmers are overcoming resource constraints to improve agricultural productivity and livelihoods. The enabling policy environment in some countries is contributing to the acceptance of new and improved technology options e.g. biotechnology.

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**Traditional knowledge, crops and livestock**

Traditional knowledge has become increasingly relevant to strengthening Africa’s agricultural innovation systems. Traditional knowledge, though neglected during the colonial era, is now increasingly valued, recognised as effective and considered a powerful tool to encourage farmers and community members in the use of new technologies or in adapting them to suit their needs. Traditional practices are being revived by the scientific and academic communities and integrated in their research programmes. They are also seen as avenues for new product development by the private sector and as having commercial value.
Advances in science are also casting new light on the innovation potential of indigenous and traditional niche crops and livestock, especially in the creation of new and improved varieties that are resilient to climate change and important for improving nutrition in sub-Saharan Africa (SSA). The African research community, collectively and in partnership with other researchers and the private sector from the North and the South, are building on the genetic makeup of indigenous species to produce higher-yielding, nutrient-dense, drought-resistant and heat-tolerant varieties. Niche crops, e.g. dark green leafy vegetables rich in vitamin A, medicinal plants and lost, neglected and underutilised crops such as millet and sorghum, are providing new market opportunities, including nutrient-dense food, nutraceuticals, pharmaceuticals and bio-herbicides.

Determining the optimal time for sowing or transplanting crops depends on knowledge of optimal planting conditions and reliable long-range (multi-month) weather forecasts. Expertise in data analytics and crop and weather modelling are needed, together with long-term accurate weather data. The island of Brunei is hoping to lead the way in this field by using data analytics and weather modelling to increase its domestic rice production by 60%. Models will help farmers adjust their agricultural operations to climatic conditions, maximising their use of inputs and increasing yields. Other countries that have adopted this approach have experienced a 15% improvement in yields translated into significant revenue savings.

Africa has to expand its food processing sector and this will require increased access to capital for infrastructural development. Changes are needed in national and regional policy and regulatory frameworks, including the updating and enforcement of standards for facilities and products. Individuals and companies must be able to access capital more easily to invest in the research, product development, equipment, facility design/upgrading and training necessary to support a diverse, modern agro-food industry. Improving supply chains and adding value to fresh produce, especially indigenous varieties, will give Africa a comparative advantage on domestic, regional and international markets and at the same time curb imports of some commodities.

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**Human capital, educational revival and agricultural renewal**

The current gaps in educational achievement and the lack of basic infrastructure, including laboratories, in many African schools are an opportunity for governments to adopt more community-driven models that prioritise education in a holistic way. This will improve community involvement, child achievement, agricultural production and the standards
of living for rural populations. No new agricultural technology, however
cutting edge and effective, can improve the situation if people are unable
to access and use it. Farmers need to have the capacity to understand new
technologies and the system must meet their needs and empower them.
Since most farmers in Africa are women, an important component of the
system will be to include women in all parts of the process: education,
capacity building and technology innovation.

Acknowledging that agriculture is both a valued traditional lifestyle as well
as a driver of economic growth therefore requires changes to educational
programming: sustainable agri-food systems are knowledge intensive.
Encouraging basic education – both primary and secondary – and
eschewing fundamental reforms in existing tertiary learning institutions,
especially universities and research institutes, will go a long way towards
achieving these goals. Closer links must be forged between governments,
the private sector, including farmers, and universities and research
institutes.

In many developed countries, such as Germany, the Netherlands and
USA, it has been shown that these close linkages lead to continuous
innovation in product and services, and increased productivity and process
efficiencies. A better understanding of the network relationship, as well as
clustering of enterprises and actors in Africa, is critical. It also calls for all
levels of education – primary, secondary and tertiary – as well as for
research, teaching, extension and commercialisation to be more closely
integrated.

**Agriculture and entrepreneurship**

Another important component that needs to be better exploited on the
continent is the potential that entrepreneurship has for spurring
innovation, steering innovation processes and propelling the creation of an
enabling environment for sustaining innovation systems. One such
example has been the success of the New Rice for Africa (NERICA),
where the private sector was able to convince the government to adopt new
policies. This resulted in more economic opportunities, attracted more
self-organised entrepreneurs and completed a ‘healthy’ cycle of economic
and technological improvement thereby bringing much relief to the people
in terms of access to an important staple. The groundbreaking research
which led to innovation in rice production was spear-headed by an African
scientist, Professor Monty Jones, who had access to quality laboratory
infrastructure and adequate resources for the pioneering research work.

Despite strong growth in the private seed sector in Africa over the last
decade, most of Africa’s millions of small-scale farmers lack easy access to
The creation of a vibrant seed sector and food processing enterprises could help African farmers retain a higher portion of the profits from the fruits of their labour.

affordable high quality seeds. Africa commands less than 2% of the billion dollar international seed market. Policies and regulations on seeds currently differ across African countries, limiting opportunities for research, trade and collaboration. However, efforts are under way to develop regional trading blocs in the seed industry. The Southern African Development Community (SADC), for example, has developed enabling policies that allow companies to move seeds and breeding materials across national borders, register varieties more easily and market their products regionally. A parallel initiative is ongoing in the Eastern African region as well. These regional efforts have to be replicated across Africa.

The creation of a vibrant seed sector and food processing enterprises could help African farmers retain a higher portion of the profits from the fruits of their labour. This inevitably puts the focus on addressing the challenges of: instituting and enforcing intellectual property rights regimes and sanitary standards and phytosanitary measures; management of transboundary resources such as water bodies and forests; building the necessary infrastructure; promotion of joint research; and monitoring of key commitments of member states, particularly the one on earmarking 10% of the national budget for the agricultural sector and 1% for research and higher education.

Governance in complex environments

Promoting a growth-oriented agenda will entail adjustments in the structure and functions of government. More fundamentally, issues related to science, technology and innovation will need to be addressed in an integrated way at the highest level. Bringing science and innovation to the centre of Africa’s economic renewal will require more than just political commitment; it will take executive leadership. This requires Heads of State to take on the role of ‘concept champions’.

So far, most African countries have not sufficiently developed national policies that demonstrate a sense of focus to help channel emerging technologies into strategies for dealing with poverty alleviation, wealth creation and sustainable agricultural-led socio-economic development. There are signs of hope though: The New Partnership for Africa’s Development (NEPAD) Ministerial Forum on Science, Technology and Engineering for economic growth is playing a key role in raising awareness among Africa’s leaders.

Food and nutrition security issues are being addressed through Africa’s RECs and so far regional policies and programmes have been developed which allow member states to work together. The Economic Community of West African States (ECOWAS) and the Common Market for Eastern
and Southern Africa (COMESA) are building, for example, on the Comprehensive Africa Agricultural Development Programme (CAADP), which celebrated its tenth anniversary in 2014 and is now gaining momentum. The RECs are elaborating regional compacts to guide member states in formulating and implementing their national CAADP compacts. So far the results reinforce the need for regional approaches to agricultural development.

The leadership being provided by the African Union Commission and the NEPAD Agency and the supporting commitments enunciated in the African Union’s Agenda 2063: The Africa we Want and Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods are pointing the way forward for continental action and coalescing the national, sub-regional and regional agencies to act in concert to support policy harmonisation and mobilise investments for increased agricultural outputs.

Agricultural innovation will take place in an even more complex and uncertain world in which leaders and other actors will have to anticipate developments (e.g. intensive crop breeding; switch in livestock breeding; developing migration corridors to facilitate ecosystem integrity etc.) and consumer needs for products and services will have to be projected. A 2°C increase in temperature will reduce annual income per capita in both Africa and South-east Asia by 4–5% relative to high-income countries. SSA is likely to be the worst hit because of its fragile ecosystems. With nearly 75% of its surfaces being dry land or desert, this part of the world is highly vulnerable to droughts. While traditional agriculture had its own way of coping with such trends through migration, insecurity and instability in many parts of Africa makes such movement increasingly hazardous. Long-term responses to the complexity in transforming agri-food systems will require political, social and technical changes. Political turmoil adds to the complexity and this has implications for governance, especially in fragile states.

Smart decisions need to be taken urgently to secure human and ecosystem resilience in the face of long-term pressures. A state-of-the-art systems approach to problem solving will need to fuse monitoring, modelling, simulation, forecasting, forward planning and experimentation to confront the emerging and projected scenarios. Meeting the multiple challenges facing efforts to expand prosperity will require greater investment in the generation and diffusion of new knowledge and technologies and a society that is able to learn and adapt quickly.

Governing in complex environments requires high-level coordination to ensure that all the key functions of government are focused on advancing
innovation. Governing agricultural transformation with a focus on innovation and entrepreneurship gives African leaders the opportunity to build up the capacity necessary to become innovative states and surpass the limits of the entrepreneurial state, which is usually focused on promoting global competitiveness. An innovative nation state has the added challenge of addressing inclusive growth and sustainable development.

Policy-makers should be aiming at innovation systems approaches that shift economies towards low-carbon, fuel efficient and multiple product and diverse pathways. The essence of traditional agriculture will change and social and technological innovation will increasingly be recognised as key aspects of adaptation and transformation. Governments will need to give increasing priority to science and innovation as part of their economic developmental strategies. Traditional governance practices such as participation will need to be complemented by additional measures that enhance social capital. The importance of innovation will need to be reflected in economic governance strategies at all levels. Approaches need to be integrated into global governance strategies, especially the adoption of technology-oriented agreements. Innovation-oriented approaches will need to also focus on expanding the adaptive capacity of society, construction of robust infrastructure, enhancement of human capabilities and promotion of entrepreneurship. Fundamentally, the ability to innovate will possibly be the greatest test of our capacity for social learning. Regional integration will provide greater flexibility and geographical space for such learning processes. The promotion of local innovation will contribute to the emergence of sustainable, well-integrated agri-food systems that can withstand shocks and deliver socio-economic development.

While science and innovation have been the key forces behind agricultural growth in particular, and economic transformation in general, key and bold leadership is required by heads of states and heads of government. They need to recognise the real value of sustainable agriculture and rural development and the untapped economic potential of the entire agri-food system with its multiple opportunities for the provision of a range of goods and services. Sustainable agriculture must be recognised and valued as a knowledge-intensive productive sector, which has to expand beyond the informal private economy.

**Conclusion**

Agricultural innovation has the potential to transform African agriculture but only if strong structures are put in place to create and disseminate critical best practices and technological breakthroughs. In much of Africa,
linkages between farmers, fishermen, firms, universities, schools and research and training centres could be much stronger.

Although new telecommunications technologies such as mobile phones have the potential to strengthen linkages, it is important not to lose sight of the fact that geography will continue to matter, regardless of new forms of communications. Local, national and regional authorities must carefully assess where agri-food and other industrial clusters may prove most successful and must lay out clear plans for cluster development. Clusters need to be nurtured and throughout the process, public and private institutions must work cooperatively.

The private sector, foundations and philanthropists must be willing to transfer knowledge and make funding and even personnel available in the early stages of cluster development. Governments must provide the enabling policy and regulatory framework. But for innovation to be mainstreamed in all facets of the socio-economic growth and development agenda in Africa, the public sector should further support interactions, collective action and broader public-private partnership programmes.

Country studies have suggested that from a public sector perspective, improvements in policy design, governance and implementation and in the enabling environment will be most effective when combined with activities to strengthen innovation capacity of actors in the agricultural innovations systems. Success stories in which synergies were created by combining market-based and knowledge-based interactions and strong links within and beyond the value chain point to an innovation strategy that is holistic in nature and that focuses on, in particular, strengthening the interactions between key public and private and civil society actors work best.
About CTA

The Technical Centre for Agricultural and Rural Cooperation (CTA) is a joint international institution of the African, Caribbean and Pacific (ACP) Group of States and the European Union (EU). Its mission is to advance food and nutritional security, increase prosperity and encourage sound natural resource management in ACP countries. It provides access to information and knowledge, facilitates policy dialogue and strengthens the capacity of agricultural and rural development institutions and communities.

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For more information on CTA, visit www.cta.int

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