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The future of agriculture in Africa

Boston University The Frederick S. Pardee Center
for the Study of the Longer-Range Future

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The Future of Agriculture in Africa

Julius Gatune Kariuki

Abstract

While agriculture remains central to Africa's economies, its global performance in this sector has lagged. Africa remains a net food importer and continues to suffer from recurrent hunger epidemics. The relatively low rate of African agricultural productivity is caused by many factors, including low levels of technology and land utilization. These factors are compounded by a weak policy environment and land tenure and use issues, as well as problems with post-harvest handling, such as infrastructure weakness, storage, and marketing/transformation issues. But the future of Africa's agriculture is bound to be different, influenced by a host of new drivers including changing demographics and perceptions of agriculture, climate change, growing fear of global food insecurity, and technology innovations. A number of responses have already emerged as a result, indicating new directions: a concerted effort towards green revolution; Africa as a potential solution to future global food crises; increasing interest in African agriculture from the emerging global South; a search for new farming models; and an emerging agro processing industry. These developments are likely to transform African agriculture and indeed Africa itself—though this transformation will depend on the policy environment that arises in response to these new drivers.

ACRONYMNS AND ABBREVIATIONS

ACP-EU: Africa Caribbean Partnership-European Union

AGOA: Africa Growth Opportunity Act

AGRA: Alliance for Green Revolution in Africa

CAADP: Comprehensive Africa Agriculture Development Programme

EPA: Economic Partnership Agreements

FAO: Food and Agriculture Organization

GDP: Gross domestic product

GM: Genetically modified

ICT: Information and communication technologies

ODA: Overseas Development Assistance

OECD: Organization for Economic Cooperation and Development

SADC: South Africa Development Cooperation

WTO: World Trade Organization

INTRODUCTION

Agriculture has been described as the lifeblood of Africa. This industry employs some 70 percent of the workforce and generates, on average, 30 percent of Africa's gross domestic product (GDP)(ECA 2007). Yet, the great paradox is that Africa cannot feed itself. The continent relies heavily on food imports as well as food aid. African calorie consumption levels are also the lowest of any region, making malnutrition a major health concern. Malnutrition has serious human and economic consequences; children do not grow to their full mental and physical potential and adults' productivity is reduced. Arcand (2000, cited in Diao et al. 2007) found that inadequate nutrition reduces the growth rate of GDP per capita in sub-Saharan Africa by between 0.16 and 4.0 percentage points.

Agriculture remains highly underdeveloped in Africa. Not only does the continent have the lowest yield of any global region, but huge tracts of land remain unutilized. Africa has 25 percent of the world's arable land, yet it generates only 10 percent of global agricultural output (Jayaram et al. 2010).

Thus, agriculture has great potential in Africa. Not only can yields be increased, but more land can be cultivated. Currently, much attention is directed toward the capacity of Africa to alleviate the growing insecurity of global food supplies. Indeed, if its agriculture potential were unlocked, Africa would be dramatically different. However, there are many challenges that will need to be overcome. This paper explores the trends that will have a major impact on the future of agriculture in Africa.

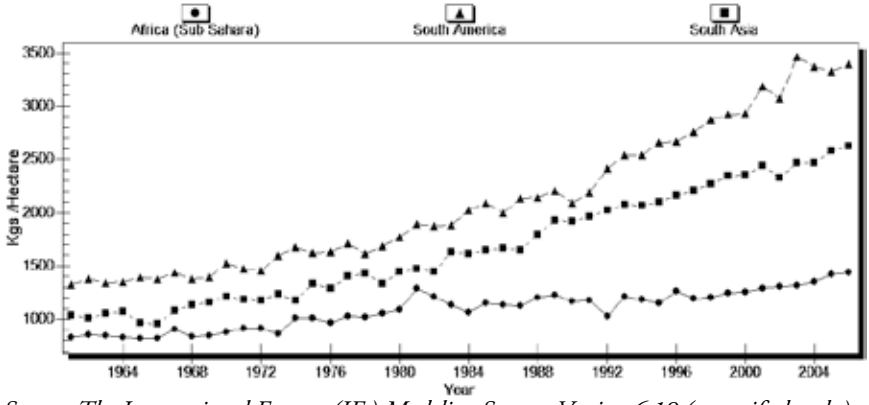
UNDERSTANDING AFRICA'S POOR PERFORMANCE

Low Productivity

Low productivity is the key explanation for the poor performance of African agriculture. For instance, the national yields of maize in Malawi average 1.3 metric tons per hectare (t/ha) in contrast to an average yield of *rain-fed* maize in Iowa in the United States at over 10 t/ha (Denning et al. 2009). In addition, a review of performance of agriculture over the last 50 years shows that Africa has clearly lagged far behind other regions of the world (measured in improving yields, see Figure 1). Yields in Africa only rose by about

72 percent from the 1960s, whereas the other regions were able to increase yields by more than 150 percent. In per capita terms, food production in China has risen by a factor of nearly 3.5, whereas it has fallen in Africa and only recently recovered to the 1961 levels (Godfray et al. 2010).

Figure 1: Agricultural yield over time: Africa versus Latin America versus South Asia
Cereal Yields per Hectare



Source: The International Futures (IFs) Modeling System, Version 6.19 (www.ifs.du.edu)

Part of the reason for low African yields is the low level of technology applied to agricultural products such as better seed, irrigation, and fertilizers (Sachs et al. 2004). Inputs like fertilizers are key drivers of productivity. This is underscored by the recent experience of Malawi as it experienced a reversal of fortunes from a food deficit of 43 percent in 2005, to a 53 percent food surplus in 2007—because of the application of fertilizer (Denning et al. 2009).

Irrigation has further potential to increase agricultural output in Africa. Irrigation increases yields of most crops by between 100 and 400 percent (FAO 2002), yet four percent of the total cultivated land in Africa is under irrigation,[1] compared to 44 percent in China and 26 percent in India (Vince 2010).

The neglect of agronomy research also caused Africa to lose market share in tropical products, where it has natural advantage. This neglect enabled countries in Southeast Asia, such as Malaysia and Indonesia, to capture much of the world market in items such as palm oil. It is instructive to note that palm oil was introduced to Asia from Africa (*The Economist* 2010a).

1. The irrigation potential is estimated 30.3 million ha (UNEP 2006:124).

However, the issue of low productivity is deeper than just technology. Vietnam is the second largest exporter of coffee. The country acquired coffee growing expertise from Kenya, yet productivity for small holders in this African nation is only 250 kilograms (kgs) of coffee per hectare while in Vietnam it is 2,200 kgs per hectare (Nyambura-Mwaura 2010).

Unutilized Land

Africa has large tracts of idle, arable land. A World Bank/FAO study (ARD 2009) reports that of the 400 million acres that can be used for agriculture, less than 10 percent is currently cultivated. Thus, Africa is the largest underutilized land reserve in the world. The irrigation potential is also largely untapped. For instance, Alexandratos (2005) posits that in Chad, some 5.6 million hectares could be irrigated but today only 7,000 hectares are irrigated. Yet on the surface Chad, being a Sahelian country, would appear to be a land-stressed country.

While the key factors in Africa's low agricultural development are low yield and low land utilization, there are also other underlying challenges that have shaped the agricultural landscape.

These include:

a. **Land tenure**: Most land in Africa is untitled; up to 80 percent of land in Africa is under communal ownership (UNCTAD 2010). This has been seen as an obstacle to increasing agricultural productivity as farmers are unlikely to make necessary investment in the absence of secure rights (Godfray et al. 2010). Failure to resolve this issue has resulted in what de Soto (2000) has referred to as "dead capital," where the poor, lacking property rights, cannot make the capital invested in their property work for them as collateral in debt markets.

b. **Geography**: Africa's geography poses major challenges to agriculture. Africa is located mainly in the tropics, and thus it is at the mercy of erratic and either excessive or inadequate rains, and a high proportion of problematic soils. High incidences of crop and livestock diseases and pests are the other challenges (Sachs et al. 2004).

c. **Land degradation**: Land degradation due to soil erosion and salinity (among other factors) is also a problem. It is estimated that about 30 percent of agricultural land in Africa is already degraded (ECA 2004). For some countries, this degradation has already reached alarming proportions. For example, in Burundi and Rwanda about 70 percent of the land is severely degraded (UNEP 2006:102).

d. **Poor infrastructure**: The lack of roads to connect farmers to markets lowers incentive for farmers to increase productivity. The Commission for Africa Report states that as much as 50 percent of the harvest is lost in many parts of Africa because farmers lack post-harvest storage and are unable to get their goods to the market (Blair 2005). Other infrastructure deficits include credit access and access to market information.

e. **Diseases**: Debilitating diseases such as HIV/AIDS, malaria, tapeworm, and yellow fever limit the productivity of the human labor force on which much of Africa's agriculture depends. HIV/AIDS has also taken a serious toll on many national research and extension programs (Sachs et al. 2001; McMillan and Masters 2003).

f. **Culture/Values**: Some African values and practices have also been harmful. Most pastoralist communities view a large stock of cattle as a mark of prestige, thus encouraging the accumulation of unsustainable herds, resulting in land degradation. The herds are also exposed to increased risks, such as being wiped out in times of draught. Yet, attempts to change lifestyles of pastoralists have failed in the past, partly because such changes require a traumatic socio-cultural transformation of the target communities (Flintan and Tamrat 2002).

EMERGING DRIVERS FOR THE FUTURE OF AGRICULTURE

A number of important trends are emerging that will have a big impact on how agriculture will develop in Africa. These trends include demographic changes, climate change, global demand for agricultural practice, trade liberalization, changing perceptions, and increasing adoption of information and communication technologies (ICTs).

Driver I: Demographic Change

Africa's population rate has risen quickly. The continent is expected to reach 1.2 billion people by 2050. If agricultural performance does not improve dramatically, this growth will put more pressure on food security and worsen the already bad nutrition statistics. Alexandratos (2005) predicts a Malthusian specter[2] for 11 African countries (see Table 1). Currently, these countries have agricultural constraints, yet their populations are projected to grow rapidly in the future. For example, Niger's current population of 12 million is projected to grow to 50 million by 2050, but the arable land has already been over-exploited.

That said, Boserup (1965) argued that population pressure can act as spur to action, and Mauritius could be the poster child for this argument. Mauritius was seen in 1961 as a Malthusian disaster in waiting by James E. Meade, the winner of 1977 Nobel Prize in Economics (Eberstadt 2005).

Table 1: Malthus Specter Countries

Country	Population (Millions)		% Change	Calories per capita		% Change
	2005	2050		2005	2050	
Benin	9.468	24.48	159%	2562	2681	**5%**
Burkina Faso	14.91	41.55	179%	2460	2757	**12%**
Burundi	8.555	24.06	181%	1687	2169	**29%**
Chad	10.94	32.57	198%	2114	2312	**9%**
Congo; DRC	64.18	195.9	205%	1663	2226	**34%**
Ethiopia	78.67	186.2	137%	1948	2763	**42%**
Madagascar	20.71	51.84	150%	2025	2408	**19%**
Mali	15.18	38.36	153%	2192	2607	**19%**
Niger	15.88	48.93	208%	2150	2434	**13%**
Somalia	9.108	22.03	142%	1599	1988	**24%**
Uganda	32.82	90.65	176%	2455	2993	**22%**
Total	**280.4**	**756.6**	**170%**	**2008**	**2534**	**26%**

Note: Alexandratos (2005) points to 11 countries with high population growth rates and highly dependent on agriculture (at least 30 percent of GDP). These countries show prospects of having huge food shortages in the future.

Source: The International Futures (IFs) Modeling System, Version 6.19 (www.ifs.du.edu)

2. Thomas Malthus was a late 18th century Church of England cleric, an originator of the theory about human population—its doubling every 25 years, thus growing at a geometric proportion while food production increases at just an arithmetic rate, and hence population always in danger of outstripping food supply.

Now Mauritius is the star in Africa, enjoying the highest standards of living.[3] And Niger is already rising to the challenge through its own green revolution, with degraded land being reclaimed and trees being replanted, potentially avoiding future disaster (Polgreen 2007).

Urbanization is the other key demographic trend impacting agriculture. Africa is now the fastest urbanizing region, with an existing urban population of 40 percent expected to grow to 53 percent of total population by 2035 (FAO/UNIDO 2010). As a result, agricultural land is being lost to the urban landscape. In Kenya, coffee production has fallen by more than 50 percent due to the loss of coffee estates to real estate development in key growth areas on the outskirts of Nairobi (Nyambura-Mwaura 2010). However, this development may actually lead to the opening of new areas for agriculture like that of the coffee growing region in Kitale, Kenya. Urbanization also allows consolidation of small farms in rural areas to more productive larger units. Further urban growth is a potential benefit to agribusiness and agro-industries because it offers producers and processors access to expanding urban markets and demand for agro-products, especially in processed form (FAO/UNIDO 2010).

Another demographic trend likely to impact agriculture is the youth bulge that dominates Africa's present and future. The youth in Africa are showing little inclination toward farming.

Another demographic trend likely to impact agriculture is the youth bulge that dominates Africa's present and future. The youth in Africa are showing little inclination toward farming. Côte d'Ivoire and Ghana, the dominant producers of cocoa, are worried about the future of that industry as the youth have failed to show interest in farming, while the current generation of farmers is growing old.

3. Mauritius's miracle has been its realization that without natural resources it would depend on developing human capital to diversify away from agriculture to manufacturing and services. It has moved from dependence on sugar to become a leading textile manufacturer and a banking hub. It also developed solid governance institutions. See www.project-syndicate.org/commentary/stiglitz136/English.

Driver II: Water

On a continental and annual basis, Africa has abundant water resources, but the problem is the high spatial and temporal variability within and between countries and river basins (UN-Water/Africa 2006). For example, Schuol et al. (2008) point out that in Niger, the country-based annual average blue water flow availability is three to eight millimeters per acre, but some sub-basins in the south of the country provide about 10 times more. In many African countries, and in larger countries in general, it is of great importance to analyze water scarcity in a spatially distributed manner on a sub-country level, rather than consider the country as a whole. Even with this variability, the continent overall is seen as dry, with pressing water problems.

Globally, agriculture is the biggest consumer of freshwater, accounting for 71 percent of global withdrawals (WRG 2009). Schuol et al. (2008) state that land use, especially deforestation and irrigation, will exert a strong influence over regional water balance. In the past, deforestation has decreased local *evapotranspiration* and increased surface runoff. Currently, the expansion of irrigated areas has increased this phenomenon.

The future of agriculture in Africa will see both expansion in cultivated land (sometimes resulting in deforestation) and more irrigated areas. Without water productivity increases, water stress will be exacerbated. A recent study by the 2030 Water Resources Group (WRG 2009) predicts that by 2030 (under an average economic growth scenario and if no efficiency gains are assumed), sub-Saharan Africa will see a huge increase in the supply-demand gap. Demand is expected to increase by 283 percent, the highest in any region of the world. Irrigated crops mainly responsible for the withdrawals include maize, sorghum, and millet. Further, the gap will vary widely across the region. South Africa, for instance, will face a 25 percent gap while Tanzania will face a 100 percent gap.

Agricultural water solutions should address both the water challenge and the food challenge. Many solutions to ameliorate the situation have been proposed. The Water Resources Group report (WRG 2009) points to a number of measures to improve agricultural productivity and efficiency. Productivity measures involve increasing yields, mainly through better seeds and fertilizers. Efficiency measures include the use of drip irrigation rather than conventional flooding, which can improve yields by up to 60 percent

while lowering fertilizer use by up to 40 percent. Improving agricultural value chains[4] can also have significant implication on water use. However, the report intentionally states that solutions are very regionally specific.

The efforts to increase productivity of sub-Saharan agriculture is good news, but renewed efforts to increase irrigation areas should focus on more efficient, though more expensive, methods like drip irrigation. Nevertheless, this solution will require significant investment and innovative financing, such as micro-finance solutions, to help small farmers adapt.

Changing farming techniques could also have a significant impact. For example, conservation farming (CF) systems based on non-inversion tillage methods that traditionally have been adopted in humid areas have also been found to increase water productivity in semi-arid and dry sub-humid locations in Ethiopia, Kenya, Tanzania, and Zambia (Rockstrom et al. 2009). The study found water productivity increases ranging from 45000–65000 M3 per ton of maize, and yields rising by between 20 percent and 120 percent. There was a tendency of improved water productivity in drier locations, which can be explained by the water harvesting effect obtained in the CF treatments. Rockstrom et al. (2009) conclude that experiences from East and Southern Africa indicate that for smallholder farmers in savannah agro-ecosystems, CF constitutes a water harvesting strategy. It is thus a non-inversion tillage strategy for in situ moisture conservation. Challenges for the future adoption of CF in sub-Saharan Africa include how to improve farmer awareness of CF benefits, and how to efficiently incorporate green manure cover-crops and manage weeds.

Driver III: Climate Change

Future water challenges will be further complicated by climate change. Most of sub-Saharan Africa depends on rain-fed agriculture and is thus highly vulnerable to changes in weather patterns. The amount of precipitation has decreased in Africa over the years, and droughts are now more regular and

4. An agricultural value chain is the series of activities that occurs from production to market. Agriculture usually starts with a seed, followed by a series of value adding activities until the seed is converted to a product that is sold in the market. So a value chain includes seeds and fertilizers suppliers, farmers input in tilling, transporters, processors, distributors, and retailers. At each stage of a value, opportunities for improving efficiency are always available.

severe (Barrios et al. 2006). Droughts impact many important drivers of agriculture, including water supply, soil erosion, and degradation of fragile lands and ecosystems.

Nicholas Stern's (2007) report on economics of climate change warned that declining crop yields, especially in Africa, could leave hundreds of millions without the ability to produce or purchase sufficient food. Simms et al. (2004, cited in UNEP, 2006: 93) forecast crop yields in SSA falling by 20 percent due to global warming and climate change. William Cline of the Centre of Global Development puts the agricultural loss as high as 50 percent in some parts of Africa (Cline 2007).

Challinor et al. (2007) posit that while farmers in Africa have proved highly adaptable in the past to variations in climate, the key to future adaptability will be access to relevant knowledge and information about climate change. They identify government as an important actor to create institutional and macro-economic conditions that support and facilitate adaptation and resilience to climate change at local, national, and transnational levels.

Driver IV: Growing Global Demand for Agricultural Land

There is growing global concern about the security of the future food supply as the Earth's total population moves towards the 9 billion mark, expected in 2050 (Godfray 2010). This concern is manifest in the current rush to secure agricultural land. The fast growing emerging economies of Asia, especially China and India, will necessitate higher caloric intakes. Increased consumption of meats and dairy products puts even greater pressure on grain prices, as one quarter of grain production is used as animal feed (Blas and England 2008).

Motivated by fear of future food security, some countries are leasing land in Africa to grow their food. For instance, Daewoo Logistics Corp. of South Korea leased half of the arable land in Malagasy, Madagascar (Blas 2008). Countries in the Middle East and Asia are at the forefront of this trend as they envision a future of growing populations and dwindling arable land. With vast unutilized and underutilized land, Africa is seen as a solution to securing the future food supply for these countries.

This movement is controversial. African nations involved in any land deals are considered likely to "lose" in badly written contracts negotiated under a veil of secrecy (Ryall and Pflanz 2009). The detractors of land leasing also warn that repressive governments may use the demand for land to further remove the poor from their land, as the poor usually have insecure land rights (von Braun and Meinzen-Dick 2009). This fear produced severe backlash in some cases, such as a coup in Madagascar that overthrew the government and cancelled the lease (Redfern 2010). A similar lease between Qatar and Kenya was also cancelled after a spirited campaign by activists. However, the pace of such land leases has quickened, with 45 million hectares acquired in 2009, two-thirds of which was in Africa (Redfern 2010).

Land is also being secured to grow bio-fuel because of concern over the impact of fossil fuels on climate and the uncertain future of fossil fuel supplies. For instance, the European Union seeks to raise the overall share of energy from renewable sources to an average 20 percent by 2020. The high cost of bio-ethanol production in Europe also means that an import strategy would probably be more cost effective in meeting this goal (Johnson and Matsika 2006). Indeed, Europe has started looking toward Africa as the future source for bio-fuels. Already a number of investors are making substantial investments in developing land for bio-fuels. For instance, an Italian investor has secured a concession of 700,000 hectares for growing bio-fuels in Guinea (Ebhardt and van der Westhuizen 2010).

These investments are not welcomed by all. Activists in some areas see them as threatening local food supplies. However, a recent study by Imperial College found that if approached with the proper policies and processes, and with the inclusion of all the various stakeholders, bio-energy is not only compatible with food production but can greatly benefit agriculture in Africa. Bio-energy production can bring investments in land, leading to infrastructure and human resources development that could help unlock Africa's latent potential and positively increase food production overall (Diaz-Chavez et al. 2010).

The emerging agricultural opportunities are also attracting non-conventional investors. Private equity investors eager to identify the next big opportunity are starting to invest in agricultural land. Already 45 private

equity firms plan to invest $2 billion[5] in Africa's agriculture in the next three to five years (Henshaw 2010). Even the now-famous investor Michael Burry, who foresaw the financial crisis of 2007, has started investing in agricultural land (Erlichman and Campbell 2010).

Driver V: Global Trade Liberalization

Trade liberalization is a global mega trend impacting agriculture. Its globalization offers agricultural producers access to larger markets as well as capital for investment. It has the potential to boost Africa's agricultural production. Godfray et al. (2010) argue that trade liberalization is also necessary to balance demand and supply across regions. However, poor countries—especially in Africa—that have little control over the structure of global markets may not see these benefits. For instance, the international agricultural subsidies practiced by most of the OECD countries not only depress international markets, but also weaken local markets in Africa, where imported foodstuffs can be cheaper than what is locally produced. This effect makes farmers in Africa uncompetitive. If agricultural reform were undertaken at the global level, Anderson et al. (2004b) found that agricultural output and the returns to investment from farmland would rise substantially in African countries.

A huge contention in the current Doha Round of WTO negotiations is farm subsidies. How these negotiations conclude will have a substantial impact on agriculture in Africa. Cotton farmers of West Africa stand to benefit as subsidies (mainly from the USA) have depressed world market prices and increased poverty among African cotton farmers (ODI 2008). However, it has been argued that most Africa exports are uncompetitive and only get market access due to preferential treatment (especially by the EU under various preferential agreements, including the Africa Caribbean Partnership–European Union, now Economic Partnership Agreements, and Everything But Arms [EBAs] preferential treatments adopted by WTO, as well as by the USA under the Africa Growth Opportunity Act treaty). OECD donors have committed aid to improve the capacity of African trade, though it is not clear whether the desired results will be seen in Africa, as the donors themselves have vested interests in trade (ODI 2008). It is instructive to note that pressure from

5. All monetary references are in U.S. dollars.

farmers in the donor countries fearing competition from African farmers was one of the key drivers of the fall in Overseas Development Assistance (ODA) support for agriculture (World Bank 2008).

Driver VI: Changing Perceptions of Agriculture

There is a growing global movement by consumers that is shaping how agriculture is practiced. Consumers are becoming more and more concerned about sustainability issues. As a result, the market for organic foods, though still small, has been growing at a much faster rate than the market for conventional foods. This will have important consequences for Africa. On the one hand, organic farming practices are taking place in Africa (more due to inability to buy fertilizers and pesticides) so it is a niche market that can be exploited. The downside of this opportunity, however, is the stringent qualifications and processes required to certify products as "organic." *Certified Organic* means the item was grown according to strict uniform standards that are verified by independent organizations. Certification includes inspections of farm fields and processing facilities, detailed record keeping, and periodic testing of soil and water to ensure that growers and handlers are meeting the set standards.[6] A related movement is the Fair Trade movement, which seeks social justice through paying farmers what is thought to be a fair price to cover the cost of sustainable production and living. Like organic products, products branded under "Fair Trade" also need certification. Unfortunately, most small-scale farmers lack the capacity to obtain these certifications and are unlikely to capture these markets without assistance.

The movement towards sustainable agriculture has also changed perceptions on agricultural research, especially biotechnology. The resistance of Europe to genetically modified crops has had a major impact on adoption of GM technologies in Africa, as the continent seeks to maintain preferential access to markets in Europe. Furthermore, many consumers, environmentalists, and international development campaigners suspect that the biotech companies' real intention is seizing control of food and farming.

6. http://www.organicconsumers.org/ofgu/fair-trade-organic.htm

Farmers will be tied to agribusiness as they become dependent on fertilizers and seeds produced by these companies (Ngugi 2007).

Concern for biodiversity and climate change also will limit the extent to which uncultivated land will be developed (Godfray et al. 2010). In particular, entry into commercial farming organizations will be limited as commercial farmers are becoming more sensitive to global opinion through consumer pressure (as in the case of Unilever and palm oil planters in Indonesia, and Walmart and beef producers in Brazil; see *The Economist* 2010a and *The Economist* 2010b). Given the growing adoption and power of social media in shaping and uniting opinion across the world, perceptions are going to further determine how global commercial agriculture grows. Such concern may mean a shift in commercial agriculture investments to Africa, where there are still vast tracts of land that can be cultivated without having to destroy forests.

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The power of perception in changing the agricultural landscape should never be underestimated. The World Development Report (World Bank 2008) identifies one of the drivers of the fall in ODA support for agriculture in Africa as opposition from environmental groups that viewed agriculture as a contributor to natural resource destruction and environmental pollution.

Driver VII: Market and Technology Innovations

Information and Communication Technologies (ICTs): A major barrier to improving productivity of agriculture is the lack of information and knowledge. Farmers, especially in rural areas, lack information (demand, prices, weather forecasts, etc.) needed to help plan crops, grow their yields, and negotiate prices. That said, development in ICTs has changed the dynamic of gathering information. Through easily accessible cell phones, farmers can now obtain information directly, such as the location of demand and appropriate prices, without middlemen. As mobile banking grows and continues to merge with traditional banking, empowerment of small-scale

farmers, who have traditionally lacked access to credit, will continue to increase (Kinyanjui 2010).

Broadcast technologies are also being deployed to gather and disseminate information. For instance, satellite technologies are being employed to find ways to predict disease outbreaks in livestock and take preventive measures accordingly (*The Economist* 2007a and 2007b).

Commodity Exchanges: More sophisticated ICT applications have developed commodity exchanges where farmers can lock in prices and manage risk through forward contracting. Ethiopia has already launched a successful commodity exchange, improving the prices farmers receive (Gabre-Madhin 2007). The Abuja Commodity Exchange in Nigeria, though less successful than Ethiopia's, is already active in local food crops and is now expanding operations to cover cash crops.

Weather Index Insurance: Directly related to the unreliable rainfall distribution is the high risk of reduced or no return on invested capital in rain-fed farming. As long as farmers "live at the mercy of rainfall," extremely low investments in fertilizers, crop varieties, and pest management will continue (Rockstrom et al. 2003). An innovation in insurance, Weather Index Insurance, is now being piloted in various parts of Africa to reduce risk and encourage investments and access to credit. Pilot studies being conducted in Burkina Faso, Ethiopia, Ghana, Mali, Kenya, and Malawi have indicated new ways to design these insurance products. They are still works-in-progress, and more technical and financial resources are needed to improve understanding of how to make such a product work well (Arce 2010).

LOOKING AHEAD

These emerging trends have sparked renewed interest in agriculture. Responses have been directed at strengthening smallholder farming and also in developing commercial farming. The key responses are summarized below.

Response I: Green Revolution Movement

While Africa missed the last green revolution, in the 1960s, the potential for improving yields in Africa remains high. For example, yields of dry land crops such as sorghum, millet, groundnut, and cowpeas could be easily increased by more than 300 percent with appropriate land preparation, timing of planting, and use of pesticides and fertilizers (Jayne et al. 2009). There is currently a renewed effort to start a new green revolution by African governments, philanthropic foundations, and donors. Advances in biotechnology, especially GM crops, are also viewed as potential solutions.

A Renewed Commitment to Agriculture-led Growth: Many governments of the African continent have made new commitments to funding agriculture. The Comprehensive Africa Agriculture Development Programme (CAADP) has committed African countries to pursue economic growth through agriculture-led development. Under CAADP, African countries are expected to allocate at least 10 percent of their national budgets to agriculture. The CAADP approach is based on four pillars:

- *Pillar I:* Extending the area under sustainable land management and reliable water control systems;
- *Pillar II:* Improving rural infrastructure and trade-related capacities for market access;
- *Pillar III:* Increasing food supply, reducing hunger, and improving responses to food emergency crises; and
- *Pillar IV:* Improving agriculture research, and technology dissemination and adoption.

The expected result of CAADP is for Africa to achieve an agricultural GDP growth rate of six percent. An assessment of CAADP implementation in

Ghana finds that it has only marginally improved the way policies are developed and implemented in Ghana (Kolavalli et al. 2010).

Nevertheless, the general renewed interest and funding of agriculture by African governments has shown some good results. Research institutes have developed (or are in the process of developing) scientific breakthroughs that can revolutionize African agriculture. *The Economist* (2007) highlights some success stories, including:

- The first African-engineered maize crop resistant to a devastating virus is undergoing trials.
- South African scientists have developed a fungus that kills locusts, a constant pestilence in Africa, and it is being deployed in Mauritius.
- African scientists are developing a vaccine to stop an infection in sheep that threatens meat exports to the Middle East.

The Alliance for a Green Revolution in Africa (AGRA): The Rockefeller Foundation, the organization behind Asia's green revolution, has partnered with the Bill & Melinda Gates Foundation to promote a green revolution in Africa under the banner Alliance for a Green Revolution in Africa (AGRA). AGRA intends to achieve its goals through a number of initiatives, initially focused on:

- Breeding better crops that are adapted to the variety of local conditions in Africa, with a goal of developing 100 new varieties in five years.
- Training African breeders and agricultural scientists who can spearhead this process in the future.
- Guaranteeing reliable ways to get high-quality, locally adapted seeds into the hands of small farmers, through seed companies, public organizations, community organizations, and a network of 10,000 agro-dealers, (small merchants largely responsible for providing supplies and information to Africa's farmers). [7]

7. See the details of this initiative at http://www.tinyurl.com/betterseeds.

The ultimate goal is that within 20 years, African farmers will *double* or even *triple* their yields and sell the surplus on the market. The AGRA initiative is focusing resources on countries with good agriculture potential, active smallholder farmers, and a strong commitment to agricultural development (AGRA 2009). AGRA reports good progress in meeting its objectives, including:

- Release of 68 crop varieties of cassava, bean, sorghum, and maize; AGRA is also supporting a number of small- and medium-sized companies and cooperatives in doubling their seed production.
- Over 4,400 agro-dealers have been trained in 11 countries.
- Farmers in western Kenya have already increased their maize yields by 115 percent.
- AGRA has advanced over $17 million and leveraged over $160 million in loans to small scale farmers.
- AGRA's market access program has helped farmers increase their farm gate prices by over 30 percent.

Unlocking the Promise of GM Crops: Asia's emphasis on monoculture (rice and wheat) and its possession of easily irrigated lands and good infrastructure, allowed it to benefit from the green revolution of the 1960s. Africa lacked these attributes, since diversity in crops, low levels of irrigation and poor infrastructure are the norm. These factors make the case that GM crops may be the solution in Africa, since crops can be tailored to the more diverse and adverse situations of the continent (Paarlberg 2008). However, integration of GM has been slow in Africa, mainly due to lack of local capacity to lead and inform the debate on many issues surrounding adoption of GM crops, such as food safety and control of genetic material. Europe's negative perceptions of GM crops are very influential in shaping the debate in Africa, especially given the threat of a European ban on African produce if GM crops are widely adopted.

Despite such threats, a few countries are experimenting with the technology. Burkina Faso has planted Bt cotton and is also planning to introduce GM maize. Kenya has introduced a bio-safety law to pave the way for growing

GM crops. South Africa has widely adopted the technological development, growing and even exporting GM products; it is now the eighth biggest adopter of GM crops in the world (Cooke and Downie 2010). Advocates for more widespread adoption of GM crops argue that welfare benefits from GM crops far outweigh even the loss that can result from the closure of EU markets (Anderson and Jackson 2004a). Meanwhile, Glover (2009) states that through the last 10 years of experimenting with GMs, experts conclude that GM technology won't be a major technological fix and can play no more than a small role in addressing the challenges of agricultural development in the global South.

Will the Green Revolution Happen This Time Round? Ejeta (2010) posits that the international aid community drives agricultural research in Africa. Accordingly, such research has been highly susceptible to frequent paradigm shifts generated by these foreign agencies. These shifts have led to a series of failed starts and little progress. It is not clear whether the renewed momentum for green revolution, this time driven by philanthropists, will be maintained before priorities shift.

Even if the current momentum is maintained, it may not be enough. A green revolution will take more than research in better seeds and better market infrastructure. The key is the integration of small-scale farmers, which is more of a mindset change than anything else. Vince (2010) documents a case in Uganda, where one inspired farmer has a thriving farm through adopting green revolution technologies amid the shriveled farms of his neighbors, who do not take advantage of the same opportunities. More research into social issues surrounding the adoption of technology is required to better understand the issues surrounding technology diffusion and adoption.

Response II: Looking to the Global South

China: China's increasing engagement with Africa for minerals and oil has also been accompanied by increasing involvement in agriculture. China has called for a leap in Africa's agricultural output through infusion of Chinese agricultural characteristics that have been very successful in transforming China. It has proposed a raft of plans to translate this vision to African soil.

Its measures include rural farmer education, establishing modern farming demonstration centers, better quality seeds, and new technology in farming machinery as well as soil improvement techniques (VPPS 2010). Since 2004, China has sent more than 900 agricultural experts and technicians to Africa to train 4,200 agricultural management officials and technicians, and it has constructed 14 demonstration centers for agricultural technology (China.org.cn 2010). Some of the emerging results show great promise. In Guinea, a Chinese demonstration farm has managed to achieve average yields of 10 tons per hectare compared to 1.5 tons in surrounding farms (Yanshuo 2010).

The interest of China in African agriculture is considered a model that African countries can follow. China is relying on trial and error, rather than the direct importation of foreign paradigms that tend to dominate Africa's agricultural policy.

China's investment in Mozambique underscores the seriousness of China's intentions. Through a series of agreements, China has pledged $800 million to modernize Mozambique's agricultural infrastructure and has financed the building of dams and canals to bring water to arable land (Rubinstein 2010).

The interest of China in African agriculture is considered a model that African countries can follow. China is relying on trial and error, rather than the direct importation of foreign paradigms that tend to dominate Africa's agricultural policy. This decision has been touted as a good model that can succeed when coupled with strong political will on the part of African nations to establish secure land rights and stimulate private initiative (Fan, Nestorova, and Olofinbiyi 2010).

In addition, observers note that China's interest in developing Africa's agriculture stems from practical considerations related to its desire to secure future food supplies (Gill et al. 2007). The Chinese understand that if agricultural production increases, it will have a substantial food supply. This is especially important as Chinese imports grow, partly due to more wealthy populations consuming more and diversified calories, as well as China itself reaching the limits of its food production capacity.

Brazil: Brazil is one of the greatest success stories in global agriculture. From 1960 to 2005, Brazil's agricultural productivity grew on average two percent a year, outpacing countries like China (1.8 percent), India (1.5 percent), Argentina (1.5 percent), Canada (0.8 percent) and the US (0.8 percent). This growth established Brazil as a leading agricultural country (Freemantle and Stevens 2010). The success of Brazil can be attributed to research that successfully opened new lands to agriculture and improved yields (*The Economist* 2010c). Brazil, like most of Africa, is a tropical country. For that reason, it can offer the best lessons as Africa seeks to improve agriculture. Incidentally, a key driver of improved beef output in Brazil was a grass imported from Africa and then improved by the Brazilian agriculture research agency, Embrapa (further demonstrating the potential of knowledge sharing—see *The Economist,* 2010c).

Such knowledge sharing is beginning to occur. Brazil recently signed an agreement with African countries, the Africa-Brazil Agriculture Innovation Marketplace, to enhance knowledge and technology transfer and stimulate policy dialogue (Bafana 2010). Brazil has already extended its technical expertise through Embrapa to several African countries, including Ghana, Mozambique, Mali, Angola, and Kenya (Freemantle and Stevens 2010).

Freemantle and Stevens (2010) argue that this is motivated by Brazil's desire to develop Africa's agricultural markets. African countries can buy its well-developed technologies, especially in the area of bio-fuels production, and also bolster the market for its ethanol-run cars. By diffusing bio-fuels technologies to Africa, Brazil will also achieve its dream of making bio-fuels a global commodity.

Response III: Search For New Farming Models

Africa's poor soils and poor climate favor crops that require heavy pre-harvest investment (irrigation or preparation). Clark (2010) reports that in Zambia, it costs $10,000 per hectare to turn bush into farmland. The cost is even higher where irrigation is needed. For example, it is estimated that to put a hectare of land under irrigation requires an investment of between $2,300 and $3,400 (USD) for small-scale farmers and between $18,000 and $25,000 for large-scale schemes (Flintan and Tamrat 2002). Indeed,

Jayaram, Riese, and Sanghvi (2010) estimate that Africa will require additional annual investments of $50 billion to unlock its agricultural potential.

Commercial Farming: It is unlikely that small-scale farmers, who are already poor, will be able to bring the vast underutilized lands into production or put more land under irrigation. This positions commercial/large-scale agriculture as an attractive option. The success of Brazil, especially in bringing new lands into farming, relied on highly mechanized commercial farms (*The Economist,* 2010c). There are significant benefits to having commercial farms. Coffee estates (plantations) in Kenya, for instance, represent around only 12 percent of land used for coffee growth, but produce 40 percent of the harvest (Nyambura-Mwaura 2010). Furthermore, to capture all the important export markets, it is only commercial farms that have the capability to meet the stringent requirements that many export markets hold, in particular phytosanitary standards and other requirements imposed by retailers (Poulton et al. 2008).

However, avenues for commercial farming are limited, as there are few internal African resources to set up such farms. This underscores the need for attracting foreign investments and skills to the agricultural sector. In this regard, South African farmers have been offered land for agriculture in Angola and Uganda, and the government is also in talks with the Democratic Republic of Congo, Zambia, and Southern Sudan (Derby 2009). Similarly, Nigeria has welcomed commercial farmers expelled from Zimbabwe to set up commercial farms (BBC 2004).

Hybrid Models—Nucleus Farms: Small-scale holders dominate the African agricultural landscape with 85 percent of farms operating on less than two hectares (Jayaram, Riese and Sanghvi 2010). Smallholder farming has many disadvantages such as fragmented production, and inability to mechanize and achieve economies of scale. However, given the preponderance of small-scale farming, any farming model that fails to put small holders at the centre is doomed to fail.

Both the small-scale and commercial farming models have proven successful. China's agrarian revolution has been achieved on the back of small-scale farmers (Fan, Nestorova, and Olofinbiyi 2010). On the other hand, Brazil's

successes in agriculture were achieved through the commercial farming model. With characteristics of both Brazil and China in terms of numerous small scale farmers and also huge tracts of uncultivated land, Africa can learn from both countries' experiences.

A hybrid model that incorporates both practices is beneficial. The presence of commercial farms benefits small-scale farmers as they can utilize the infrastructure (roads and irrigation), supply systems (seeds and fertilizers), and distribution systems that commercial farms develop. The symbiotic relationship is best demonstrated by the fact that in Zimbabwe, without the presence of commercial farmers, small-scale, farmers' productivity has dropped from 1.5mt/hectare to 0.5 mt/hectare (IRIN 2008). A McKinsey study (Jayaram, Riese and Sanghvi 2010) identifies the ideal for African agriculture as a nucleus farm model, where 50-hectare farms are operated by sophisticated farmers who also help surrounding small-scale farmers to become more productive through diffusion of knowledge and sharing of systems.

Public-Private Partnerships: Public-private partnerships may also be good models for developing commercial farms. In this case, governments, as major landowners, would contribute land and maybe loan guarantees, while the private sector contributes expertise and capital. This arrangement is likely to be less politically sensitive than land leases, especially if the investor is a foreign entity (the perception of "land grabs" can be allayed). Some examples of this type of arrangement are starting to emerge. Senegal has announced plans to cooperate with Brazil and India to launch bio-fuel production through public-private partnerships. Brazil will provide scientific and technological expertise, Indian entrepreneurs will supply the capital, and Senegal will offer land and labor (Freemantle and Stevens 2010).

Response IV: Agricultural Diversification

There is a shift from traditional export crops such as tea and coffee to higher value crops, horticulture (especially flowers), and fruits (especially in Eastern and Southern Africa, see MGI 2010). Kenya has been particularly successful in the exports of flowers and other horticulture crops. The Ethiopian government is very keen to emulate Kenya's example; it is offering a five-year tax holiday and duty-free import of machinery for an investor wishing to

develop flower farms (Henshaw 2006). However, due to stringent requirements and the scale required to supply the export market with high-value crops, few small-scale farmers can participate in this transition.

Another trend involves efforts to capture the growing niche market for organic products. Small-scale farmers have the skill and experience to capture this market, given the right training and necessary infrastructure. Already, nearly 5,000 farmers in Burkina Faso, Cameroon, Ghana, Senegal, and Sierra Leone are exporting organically grown produce to Europe after gaining organic and fair-trade certification with help from the Food and Agriculture Organization (FAO). The program focuses on all stages of production, from planting and harvesting to packaging and promotion. Potential benefits are huge. For instance, a total of 30 small-scale pineapple farmers in Ghana saw sales grow from 26 tons to more than 115 tons after gaining their organic certification (Stearns 2010). For small-scale farmers seeking to export to Europe, the organic product market is the ideal path because the scale required for the conventional export markets is too large (Poulton et al. 2008).[8]

Already, nearly 5,000 farmers in Burkina Faso, Cameroon, Ghana, Senegal, and Sierra Leone are exporting organically-grown produce to Europe after gaining organic and fair-trade certification with help from the Food and Agriculture Organization (FAO).

AGRICULTURE AS A VEHICLE FOR TRANSFORMATION IN AFRICA

Agriculture, therefore, has the potential to transform the economies of Africa by improving incomes and thus consumption, as well as providing a pathway to establishing manufacturing industries. A McKinsey study (MGI 2010) estimates that Africa has the potential to increase the value of annual agricultural output from the current $280 billion to around $880 billion by 2030. This increase requires steps to increase yield, open new land, and the shift to higher value crops like fruits and vegetables. Agricultural output will also spur growth in related industries. The report states that agribusiness

8. For instance, the entire cotton crop for some countries like Ghana can only supply a medium-sized ginnery in China (p. 27).

and agro-processing could generate a further $35 billion and $239 billion, respectively, for African countries.

Current global conditions are favorable for supporting an economic transformation strategy built around agriculture. The growing demand for food and bio-fuels, and continued demand for tropical products, provide important foundations for building an industrial base. Good candidates for building an industrial base include food processing, wood processing, leather processing, textiles and bio-fuels. For instance, most wood from Africa is exported as logs that are used for high-value furniture. But Africa's contribution to the global trade of tropical forest woods stands at around one percent, as compared to South East Asia's at 83 percent. Also, Africa spent $4.4 billion to import wood products in 2007 (Mbella 2010). Other post-harvest losses could be as high as 30 percent in cereals, 50 percent in roots and tubers, and up to 70 percent in fruits and vegetables. Food processing can cut these losses, with the added advantage adding value to commodities and creating employment (FAO/UNIDO 2010). A more detailed analysis follows that discusses the potential for bio-fuels to help transform economies in Africa.

Bio-Fuels

The nascent bio-fuels industry provides a potentially good example of how an industrialization strategy can be built. Bio-fuel crops have great potential in Africa, as the climate is suited to growing some of the more promising varieties. For instance, bio-fuel production from sugarcane in Mozambique is considered profitable without subsidies as world oil prices rise above $70 per barrel (Econergy, 2008). Yet of Mozambique's 30 million hectares of arable land, only one-sixth is currently cultivated. Cassava and sweet sorghum are the other good candidates for ethanol production in Africa. For production of biodiesel, Jatropha and Palm oil are the crops well suited to certain regions in Africa.

Sugarcane production is especially promising. The whole of Southern Africa's potential for bio-ethanol production is best demonstrated by comparing India and the SADC group of countries in terms of sugarcane production.

Table 2: SADC vs India

Country Region	Population (Millions)	Total Area (Million Ha)	% Area Cultivated	Area Under Sugarcane (1000 ha)	Production (1000 Tons)	Yield (Tons per Ha)
SADC	271	964	5.5%	696	45,557	65
India	1,169	297	57.1%	4,608	281,600	61
Proportion (SADC to India)	**0.23**	**3.2**	**0.10**	**0.15**	**0.16**	**1.0**

Source: Johnson and Matsika, 2006 (Original data FAOSTAT)

While SADC has only 23 percent of the population of India, it has three times the land area. Most of the SADC land area, while of high agricultural potential, remains uncultivated. The total area under sugarcane in India is only 15 percent. In terms of productivity, SADC has higher yields and, furthermore, southern Africa has the ideal conditions to produce sugar yields that are twice the world average for sucrose production from cane (Poulton et al. 2008). Thus, the potential for the region as sugar and bio-fuels giant is huge. Brazil and Thailand have transformed their countries on the back of sugar production underscoring the wasted potential in Southern Africa.

The potential benefits of sugarcane are best demonstrated by a proposed 30,000-hectare bio-fuel development project in Angola. The farm will have its own processing plant and produce 280,000 tons of sugar plus 3,000 cubic meters of ethanol from the cane residue. In addition, the leftover fibrous remains from the cane, along with the leaves and waste heat from the sugar processing, will be used to produce 217 megawatts of electricity a year (Redvers 2009).

The market for bio-fuels also goes beyond exports. With the right polices local markets can also be expanded. The potential is clearly demonstrated by Brazil, where about 50 percent of cars run on ethanol. Flexi-fuel vehicle technology is now well developed, and with proper tax incentives the supply of these types of vehicles in Africa can be expanded, thus creating a vibrant local market for bio-fuels. Bio-fuels can also be used to power electric generators, making electricity more accessible, especially in rural areas. Domestic

markets can be further expanded through adoption of bio-fuels for cooking (Utria 2004). This is a significant market as the majority of African households use wood and charcoal for cooking.

In addition, bio-fuels can be an important base for industrial development. Not only do they generate exports, they also generate electric power that can be used to fuel other industrialization activities. Some African countries are already looking towards bio-fuels to transform their economies. Nigeria aims to produce cassava ethanol worth over $150 million every year, once it establishes a suitable infrastructure. This includes the construction of 15 ethanol plants with assistance from Brazil (Sielhorst, Molenaar and Offermans 2008).

While bio-fuel may show great potential, there are obstacles that will need to be overcome. An analysis of possible future expansion in production and trade of bio-ethanol in the SADC region by Johnson and Matsika (2006) points to a number of factors that will be keys for success:

I. The scale of production will have to be significantly greater, as the current factory sizes are too small to result in a market large enough for competitive export.

II. Improvements and capacity expansions of the distribution and transportation infrastructure in the region will be needed to facilitate significant expansions in trade.

III. Since land transport costs are much higher than shipment by sea (for exports) the location of facilities will be crucial for cost reduction—it may be desirable to locate distilleries near ports and ship feedstock to the distilleries.

The analysis concludes that coordination among SADC partners will become important if optimization of production and market sectors is to be achieved. This will mean accelerating the pace of economic integration within SADC, so that trade in allied industries is improved equally.

Poulton et al. (2008) surmise that to develop African agro-based industry, major advantages in either the agro-ecological environment or labor costs

are needed to offset the generally high costs of capital, transport, land production and marketing, as well as generally weak institutions.

POLICY WILL BE KEY

The key tension that African governments face is how to balance between ensuring that farmers get a price for their produce that will induce increased investment and at the same time ensuring food prices are affordable for the majority of the population. This policy environment is complicated by the need to strike a balance between food crops and bio-fuels crops; the need to grow food for local consumption versus the demand for land leases to grow food for foreign consumption; and the balance between the interests of small-scale farmers versus the interests of commercial farmers.

Unlocking the potential of agriculture in Africa, both as source of livelihood and as a basis for industrialization, will require policy interventions to spur the needed investments. ARD (2009) has suggested interventions including:

- Continued macro-economic reform, including removing export taxes on agricultural exports and hastening regional integration to streamline cross-border trade;
- Reforming land policy to enable secure transferable rights so that land can move to those who can use it most productively (requires building institutions and equitable enforcement structures);
- Public investments to boost agricultural research, education and extension services (along with investment in needed infrastructures including transportation, irrigation, energy, and logistics);
- Improve business climate to induce private sector investment;
- Strengthen market institutions to make them more efficient and less risky. Offer those critical services that the private sector is unwilling to provide;
- Strengthen state capacity in marketing and business development services and forge partnerships among public, private, and civil society actors.

WHAT IS THE FUTURE?

The powerful trends and concerted responses outlined here show signs of the changing African agricultural landscape. It is not clear what the final model will be or who will be the winners and the losers of future development. A scenario where a green revolution targets small-scale farmers is likely to reduce poverty, but not necessarily result in large-scale economic transformation. Likewise, a scenario where foreign land leases dominate agriculture may result in some transformation of the economy, but may come with the huge cost of African political instability.

Though governance is still not very strong, more governments are accountable, and civil society is more active in curbing the excess of poor governance. Therefore, it is likely that when new land is opened up for agriculture, the rights of the poor will be protected. Also, as foreign interests look to Africa's agriculture to secure global food security, they are likely to adopt models that will incorporate local people in the production systems in order to secure the license they need to operate.

The more desirable scenario is where the forces gathering will be harnessed to transform Africa using agro-processing as the launch pad into manufacturing. This is a real possibility given the interest shown by investors in agricultural land. Contracts that bundle land concession with processing mandates will go a long way in launching Africa to a better future.

CONCLUSION

Looking ahead, the world is facing an increasingly uncertain future in terms of food security. Food insecurity and the price of agricultural land, as well as inflation, are causing global anxiety, and as a result some governments are taking bold action to secure future food supplies. Africa, although it has a perennial food security problem, is increasingly seen as the region that has the greatest potential to ease the concerns for future global food security. This is mainly due to low yields and vast amounts of arable land that remain unutilized.

Efforts to increase yields through a new green revolution are underway; African governments have made a commitment to invest 10 percent of their

budgets in agriculture and donors are also stepping in. FDI is also starting to flow into agriculture as countries lease land to secure their future food supplies and private investors look for better returns.

The path for Africa is not yet clear. Brazil and China are two examples of how agriculture can be developed. Brazil is now the biggest producer of ethanol and a world leader in agricultural exports using commercial farming approach. China has managed to move hundreds of millions out of poverty through rural development focused on improving small-scale agriculture. Africa's characteristics will require a model that is a mix of Brazil and China. The scale of resources can best be harnessed by encouraging commercial farming and, in this context, land leases by other countries should be welcomed. However, ways should be sought to harness the resources and knowledge of commercial farms to assist small-scale farms so that they can benefit from the knowledge, skills, and infrastructure that comes with commercial operations.

A policy framework that balances food production with industrial agricultural production (e.g., bio-fuels), that is sensitive to local food supply as well as international demands, and that balances the competing interest of small-scale and commercial farmers will be key.

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