Agriculture
Thematic Futures

Jakkie Cilliers
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In this entry, we describe the context of agricultural production in Africa and how the sector can impact the continent’s development trajectory. We then present an Agricultural Revolution scenario, which shows how farming with a growth mindset can improve agricultural productivity and so benefit Africa’s development outlook.

Summary

• Agricultural production in Africa lags behind that of the rest of the world. Introduction: Why Africa lags The impacts of a history of slavery and colonialism The impact of slavery and colonialism are compounded by poor governance, conflicts The impact of conflict and limited focus on agriculture as a meaningful economic contributor after independence. After independence

• Africa remains the most food-insecure region globally. Food insecurity in Africa This manifests in hunger, malnutrition and low levels of educational attainment, which are well-established markers of underdevelopment. The impact of food insecurity on development progress

• Transforming agriculture in Africa will require access to finance, technology and secure land tenure, Transforming agriculture in Africa rather than ill-considered land redistribution programmes. Zimbabwe: A disastrous experiment Africa can learn valuable lessons from models in China and Brazil. Agricultural reform elsewhere in the world: Lessons for Africa?

• In an Agriculture scenario, The African Agricultural Revolution scenario improved yields, putting more land under irrigation, improving supply chains and increasing per capita caloric consumption result in greater food security because import dependence is reduced. The scenario is expected to have significant economic and development impacts. Impact
Introduction

Africa is yet to have a revolution in agricultural production. Low levels of investment in agriculture, lack of land reform and the continued use of traditional farming methods leave Africa with the lowest agricultural yields in the world. Yet farming is the bedrock of human development and slow progress in this domain, historically and recently, helps to explain poor progress with development in Africa generally.

The Neolithic revolution started more than 12,000 years ago when humans adapted their nomadic hunter-gatherer lifestyles and turned to farming to meet the needs of their growing population. Given the need for water, most settlements were located close to large rivers, such as the Nile, the Euphrates and the Yangtze. Producing food in large quantities required granaries and the domestication of animals for slaughter, transport and work.

Hunter-gatherer societies were constantly on the move in search of food whereas farmers needed to remain close to their fields, had to store food surpluses for winter or feed more animals. With the transition to farming, villages and towns developed close to fields and people started to make pots to preserve foods and developed ways of storing knowledge through symbols and eventually writing. Soon, a division of labour followed. Communities started a barter system of trade, developed rules for property ownership and learnt how to use metal.

With the noteworthy exceptions of the Nile River, modern-day Ethiopia and some parts of West Africa and the Sahel, the agricultural development pathway in Africa followed a somewhat unique trajectory. The continent's high disease burden (discussed in Theme 3) constrained population levels in large parts of the continent even as humanity expanded rapidly elsewhere. It also inhibited the spread of domesticated livestock southwards.

Poor soil quality in most of the continent, with the exception of areas along great rivers such as the Nile and the length of the Great Rift Valley in East and Central Africa, also constrained agricultural development. [1] Free from most diseases, the fertile highlands in northern Tanzania, central Kenya and Ethiopia were the only regions where Africans developed intensive agriculture. [2]

Finally, crop plants in sub-Saharan Africa, such as yams, sorghum and pearl millet, were not as nutrient-rich as wheat, barley, rye, oats, rice and maize, the common staple foods that emerged in the rest of the world, nor were they well suited to the prevailing climatic conditions in southern and eastern regions of the continent. [3] However, the cultivation of African yams in West Africa around 3,000 BCE did allow for larger surpluses to be produced, which eventually set off migration southward and eastward.

Maize, which produces much higher yields than sorghum and millet and was introduced into Africa around 1600, had one major disadvantage: it was not drought resistant. Also, because the continent covered numerous climatic zones from north to south, the richer staple foods prevalent elsewhere could not readily be transplanted across the humid equatorial regions southward.

With farming in sub-Saharan Africa emerging much later than elsewhere, subsequently lower population pressure and hence lower levels of technology, Africa's numerous empires had a relatively short lifespan and collapsed or were forcibly dismantled by outsiders. Even before the Atlantic slave trade, most wars on the continent were fought to capture labour rather than to occupy land to the extent that indigenous African slavery was widespread. [4]

The impact of slavery and colonialism
Collectively, the Arab, European and Transatlantic slave trades, from the mid-7th century to the 19th century, had a devastating impact on the African continent. Slavery meant that African societies remained more dispersed and mobile than others. Farming was challenging in a situation of low population density, lawlessness and violence where people were constantly moving to avoid capture, often avoiding areas that offered easy access such as along larger rivers. Once slaves had been captured and violently removed, it was the young, elderly or disabled who were left behind. In the process, large parts of Africa were denuded of its productive labour force. Farming and herding could therefore not develop in a systematic manner, nor could social, political and economic systems mature to allow for technological and productivity improvements to track development seen in other regions of the world. [5]

Despite the continuous drain of labour formally ending with the abolition of slavery by the mid-19th century, other forced labour schemes under the guise of imperialism and colonialism soon followed. In the decades that followed the Berlin Conference of 1884/1885, where Africa was formally divided between various European states, the continent became an increasingly important source of raw materials to feed the factories in Great Britain, Germany, Belgium, France, Italy, Portugal and Spain, linking and shaping Africa’s agricultural exports to the demands of its colonisers. Imperial economics demanded that commodity exports be supplied at the lowest possible price. As labour costs were the most critical cost consideration, Africans generally received poverty wages.

Chart 1 shows Africa’s terms of trade — the ratio of export prices to import prices — from 1800 to 1940.

![Chart 1: Africa’s terms of trade](image)

In the aftermath of the Berlin Conference (indicated by the grey bar), colonised Africa saw an increase in exports and a deterioration of trade terms, primarily in the form of reduced prices. Effectively, Africa exported more commodities of which the values declined as the terms of trade steadily declined. According to one estimate, by 1940, Africa’s terms of
trade had reverted to the levels it experienced in 1800 as the continent became poorer compared to all other regions. [6]

Elsewhere, the introduction of crops such as peanuts and sesame replaced dietary staples such as millet and sorghum. The result was declining food reserves, chronic malnutrition and famine despite the development of a sizable commercial cash crop system dominated by settler farmers.

In many colonies, settlers often designated large areas terra nullius (unoccupied land) and formal property rights were reserved for settlers and European firms. European settlers steadily established themselves and land was subsequently dispossessed through political measures, most notably the Native Land Act of 1913 in South Africa, which restricted ownership of land by black South Africans in the newly established Union of South Africa to a small portion of the available agricultural land. Much of the rest of the agricultural land not allocated to settlers, here and elsewhere, was given ‘customary’ tenure, meaning it could be used but not owned, and that it was always subject to seizure by the state with the colonists ruling indirectly by co-opting pliable ‘tribal’ leaders who exercised control over the land.

Investment in road and rail infrastructure followed to allow raw materials to be transported from productive areas to the coast, from where products were shipped to Europe. Consequently, the rural and domestic agricultural sector and regional trade were either destroyed or remained economically marginal. In this way, slavery, imperialism and colonialism fundamentally altered the development of agriculture on the continent. It effectively destroyed Africa’s burgeoning trade in food and displaced indigenous crops with commodities beneficial for the industrialising economies in Europe, which undermined food security at home.

After independence

Whereas agriculture is generally considered the mainstay of Africa’s economy, yields per hectare are the lowest globally and improving more slowly than in other regions. Also, because food is cheaper on the international market than domestically and because palates change with income, Africa is becoming more, rather than less, dependent on food imports, despite the continent having millions of hectares of arable land, with massive untapped agricultural potential.

Although African independence brought many political benefits, few accrued to agriculture. With limited exceptions, rural and agricultural development received little resource and budgetary allocation after independence, with leaders instead seeking rapid industrialisation or vanity projects. Most African governments also retained the bifurcated system of land ownership, with customary property rights in so-called tribal lands and formal property rights reserved for a limited few and in some urban areas. Effectively, the urban elites that shared the ethnic orientation of the governing party replaced colonists in state institutions and land ownership. The notion of formalising land ownership gained wider recognition only towards the end of the 20th century, when population growth had significantly complicated efforts at tenure reform.

Substantive yield-enhancing shifts were seen in agriculture elsewhere in the world, including mechanisation and the introduction of new crop varieties and agricultural chemicals in the green revolution of the 1950s and 1960s. However, in Africa the focus was on political rather than economic emancipation. Without tenure reform and being locked into an inequitable supply chain that effectively penalised efforts towards food self-sufficiency and disincentivised domestic value-add to its agricultural commodities, Africa continued to lag behind other regions with regard to agricultural productivity.

By the early 1960s, the Food and Agriculture Organization (FAO) of the United Nations estimated that average yields in Africa were approximately 1.1 tons per hectare, roughly 1.3 tons per hectare below the average for the rest of the world. By 2020, yields in Africa had increased to about 4 tons per hectare, yet were still 3.6 tons below the average of the rest of
Continued low agricultural productivity

Despite isolated success stories (e.g. Ethiopia, Madagascar, Mauritania and Sierra Leone), the agricultural sector in Africa is significantly less productive than in other regions and is likely to remain so into the future. The most recent FAO data (2018) shows that 17 of the 20 countries with the lowest average cereal yields per hectare globally were in Africa. [7] At the same time, only one African country — Egypt — is among the top 12 most productive cereal yields; the next African state on the list, South Africa, is ranked 40th, and here agriculture contributes less than 3% to the gross domestic product (GDP).

The slow progress has been recognised since the mid-1970s, [8] and has remained a topic of transformation concern, with the World Bank noting that Africa has approximately 45% of the global total surface area suitable for sustainable production expansion, and that low labour costs could encourage labour-intensive agricultural production. [9]

The modest increases in agricultural production in Africa since independence were generally the result of increased area under cultivation rather than improved productivity, leading to Africa being described in 2013 as ‘the only developing region in which the percentage of area exceeded growth in yield over the period 1990–2007.’ [10]

Land rotation practices in Africa have traditionally used slash-and-burn techniques, with farmers clearing new lands and leaving the old field fallow for a year or two to recover. Although this worked well while population densities were low, shortages of arable land due to increasing population numbers forced farmers to cultivate the same fields season after season. Rapid population growth and urbanisation in countries such as Kenya and Ethiopia have driven up land prices and swallow some of the best farmland. [11]

Only those farmland close to urban areas generally had roads good enough for produce to be transported to the market. The lack of paved roads and other infrastructure in prime agricultural areas far from major population centres means that large parts of the available arable land is not used for large-scale production. Closer to population centres, unsustainable cultivation practices in these high-density areas contribute to substantial soil degradation, as average farm sizes shrink and decrease soil fertility. [12]

The impact of conflict

Angola is one of Africa’s most fertile countries and was, before independence in 1975, self-sufficient in all main food crops except wheat. It was the fourth largest coffee producer globally, but successive wars, which lasted until 2002, destroyed much of that. [13] Most of its population fled to urban areas (generally to the capital Luanda). Today, nearly seven out of
ten Angolans reside in urban areas, and there is little infrastructure to connect the capital city to the rest of the country. As a result, Angola ranked close to the bottom (160th of 167 countries globally) on the World Bank’s 2018 Logistics Performance Index. [14]

The Democratic Republic of Congo (DR Congo), host to the largest peacekeeping mission in the world for many years yet still wracked by instability, is ranked at number 143 on the performance index. [15] Despite being the country with the agricultural potential to feed the entire continent, it has not achieved food independence and malnutrition is widespread. With only 10% of its 80 million hectares of arable land cultivated, the country has the potential to become a global agricultural power and the sector provides about 60% of jobs (although most of these only provide for subsistence needs). [16]

However, like Angola, the DR Congo’s agriculture sector has been severely affected by violent conflicts. For example, by 2006, agricultural productivity had fallen to 60% of its level at independence in 1960. [17] Crop yields in the DR Congo are currently estimated at 3.6 tons per hectare and will continue to make the country a net food importer. The current food trade deficit (the difference between the value of exports and imports) of the DR Congo is US$1.5 billion per year and is set to increase over time given the lack of transport infrastructures such as roads and railways, all of which require lengthy and costly investment. [18]

Food insecurity in Africa

Local initiatives to improve agricultural production [19] [20] have not gained widespread traction and Africa remains the most food-insecure region globally. [21]

According to data from FAO, about 256 million Africans faced undernutrition in 2018 and the IFs forecast is that the number will modestly decline to around 200 million by 2043. [22] The impact of a lack of focus on agriculture, climate change, natural resource degradation, rapid population growth, increasing fragility and insecurity, and slow economic growth combine to condemn many Africans to a life of hunger and malnourishment.

Furthermore, those countries in Africa with large agricultural sectors mostly export raw products without adding value. For example:

* Africa produces about 45% of the world's cashew nuts, with 90% of the crop exported for processing overseas but with little benefit to the 2.5 million farmers involved in the industry. The African Cashew Alliance estimates that a 25% increase in raw cashew nut processing in Africa would generate more than US$100 million household income in the sector. As it is, a recent report noted that Tanzania’s farmers ‘get rock-bottom prices and the country imports its own nuts back after processing to meet buoyant domestic demand.’ [23]

Africa also produces 70% of the global total of cocoa, much of that from Ghana and Côte d’Ivoire. Yet Ghana earns only about US$2 billion a year from its colonial-style arrangement with the world’s chocolate manufacturers. In fact, Africa accounts for less than 1% of chocolate exports. Europe, which grows no cocoa of its own, exported US$19.2 billion worth of chocolate in 2016. [24]

However, things have started to change to address such unequal relationships. For example:
• Through the Africa Cocoa Initiative, Côte d’Ivoire overtook The Netherlands as the world’s largest processor of cocoa during the 2014–15 season.

• Ghana is now processing more than a third of its own cocoa.

• In an effort to increase the farm-gate prices to levels high enough to allow small cocoa producers to escape extreme poverty, Ghana and Côte d’Ivoire unilaterally announced that from October 2020, they will be charging a fixed premium of US$400 a ton over the benchmark futures price. [25]

However, government measures to control prices could lead to increased production, in turn driving down the export price and leaving the government to foot the difference. These measures will therefore only succeed with the simultaneous better management and control of domestic production.

Impact of food insecurity on development progress

Hunger, malnutrition and low levels of educational attainment are well-established causes and symptoms of Africa’s underdevelopment. Insufficient access to calories is a driver of undernutrition and stunting and, together with a lack of access to improved water, sanitation and hygiene (WaSH) facilities, can lead to various health problems and subsequent psychosocial and learning challenges (also see Theme 3). [26]

Although sub-Saharan Africa has until recently had a similar number of calories available per capita to South Asia, the region has fallen behind since 2015 and performs significantly poorer than South America (Chart 4).

Given the continent’s massive geographic expanse and diverse climate, agriculture potential and production differs vastly from country to country:

• In 2019, the agricultural sector in West Africa was the largest (at US$184 billion). According to the Current Path forecast, it is expected to experience solid growth, increasing to US$223 billion (21%) by 2043.

• Although agricultural growth in East Africa is expected to be smaller, it will likely be more rapid than what is expected for West Africa.

• At US$30 billion in 2019, the agricultural sector in Southern Africa is the smallest on the continent. Although it too is expected to grow by 21%, it will amount only to US$36 billion by 2043.

The pedestrian improvement in agricultural productivity in Africa amidst rapid population growth contributes to the slow rate of poverty reduction, although relatively high levels of inequality also contribute. Changing dietary preferences also contribute to food insecurity in that African countries import ever-larger quantities of food every year.

In 2019, Africa’s annual agricultural trade deficit stood at roughly US$64 billion per annum. The Current Path forecast is that it will increase almost fourfold, to about US$276 billion, by 2030 and then again more than double, to approximately US$652 billion, by 2043.
Chart 5 shows the agricultural trade deficit for the five African regions in a stacked area graph. It indicates that much of the increase will come from West and Central Africa, although all regions will experience deteriorating agricultural trade deficits long into the future. In the Current Path forecast, Africa could be importing more than a third of its food requirements by 2040, which leaves the continent extremely vulnerable to fluctuations in food prices.

**Transforming agriculture in Africa**

The potential of property rights to unlock capital and development remains largely unrealised in Africa:

- An estimated 90% of rural land in Africa is not formally documented.
- Just 4% of African countries have mapped and titled the private land in their capital cities.
- Less than 20% of occupied land in sub-Saharan Africa is registered; the rest is undocumented, informally administered and thus vulnerable to land grabbing and expropriation without adequate compensation. [27]
- Up to 60% of national land in sub-Saharan Africa is held under customary or traditional forms of land ownership.

Well-meaning reformers have often neglected the myriad other factors affecting whether titles are useful or not, such as custom, other laws and the capacity of the state to enforce people's legal property rights, and have generally underestimated the ability of vested interests, such as traditional leaders and urban elites, to obstruct reform. [28]

Generally, agricultural reform needs to start by unlocking access to credit that will enable farmers to invest towards higher productivity. With few exceptions, agriculture in Africa generally has low levels of technological advancement, seen in limited irrigation, low levels of mechanisation (as labour is cheap and farmers lack capital) and limited (or no) use of fertiliser. All of these require access to credit. The continent also sees limited use of genetically modified seeds, which are more resilient to disease, slow progress with organic farming, and limited cultivation of indigenous crops that are better suited to the continent.

Credit requires secure and transferable ownership of land, pointing to the need to formalise, regulate and modernise land ownership. Without clarity on ownership, farmers cannot access finance, transfer land or protect themselves against encroachment. [29]

Peruvian economist Hernando de Soto [30] noted that farmers inevitably remain poor if they are unable to leverage their resources and assets to create wealth. Legally protected property rights is the key source of the developed world's prosperity, he argued, and the lack thereof is the reason why many nations remain mired in poverty by the ‘tragedy of the commons’, where their unregistered assets can be stolen by powerful interests, hurting individuals and broader economic development.

In fact, a comprehensive ‘land grab’ is evident across Africa, particularly in the Nile River basin, which covers an area of 3.18 million square kilometres (from Uganda to Egypt). Companies from several developed nations have acquired fertile Nile-irrigated land for growing food crops, flower, tobacco and biofuels, rearing livestock and logging trees. Most of these deals are agricultural leases and forest concessions. Although some have brought positive benefits to local economies, in most cases the local people suffer because governments prioritise foreign investment and export earnings above the pursuit of local livelihoods.
The World Bank has separately found ‘little evidence of a relationship between increased commercialisation and improved nutritional status.’ [31] Low- and lower middle-income African countries should ideally produce food for domestic consumption before pursuing cash crops for the export market, it argues. To capitalise on the benefits of having an educated and healthy labour force, governments need an unwavering emphasis on achieving food security. Only then should agriculture be pursued to unlock the opportunities to earn foreign exchange.

Zimbabwe: A disastrous experiment

Africa’s own leadership is often responsible for land grab at an even larger scale. Zimbabwe's disastrous land redistribution programme (1992 to 2010), which eventually destroyed its most productive sector, illustrates the importance of security of ownership that is able to unlock land as a bankable asset and the implications of land expropriation without due process.

Rhodesia, present-day Zimbabwe's predecessor, unilaterally declared independence in 1965. By that time most of the high-potential agricultural land had been seized and was farmed by white settlers. At the time that Rhodesia declared itself a republic, a few years after independence, the vast majority of the black population had been relegated to so-called tribal trust lands, generally in the lowlands, areas which were significantly less productive and often disease ridden.

After a violent struggle that involved liberation forces operating from a number of neighbouring countries, Zimbabwe was eventually born in 1979. The Zimbabwe African National Union-Patriotic Front, led by Robert Mugabe, subsequently won the first elections in 1980 and embarked upon a land reform programme that steadily became more chaotic and violent.

Between 1960 and 1990, Zimbabwe exported about 10% more food than it consumed and consistently outproduced China on a per capita basis. But production per capita dropped rapidly in the early 1990s (Chart 6). Although agricultural production recovered somewhat later in that decade, it has never regained previous levels of production.

In the early 2000s, Mugabe evicted more than 4,000 white commercial farmers from their land. Later his party embarked upon centralised ‘command agriculture’, which dealt a further blow to Zimbabwe’s agricultural sector. [32] By 2010, yields per hectare in Zimbabwe were below the levels seen at the time of its Unilateral Declaration of Independence in 1965 although, due to the expansion of land under cultivation, total production was significantly higher.

Agricultural production in Zimbabwe seems to be on a terminal decline. Despite Emmerson Mnangagwa initially appearing to embark on a different approach after deposing Mugabe in a military coup in November 2017, he soon reverted to the same policies that had brought disaster in the first place. By 2019, Zimbabwe was importing close to 22% of its total food demand. When Mnangagwa half-heartedly sought to reverse course in 2020, fewer than 300 white commercial farmers (mostly dairy farmers) were estimated to be left in the country. Much of the land violently acquired had, in the meanwhile, been handed to party officials. Ham-fisted efforts at land and agricultural reform in Zimbabwe have therefore accentuated poverty.

A different approach in Zimbabwe would have yielded very different outcomes.

The World Bank finds that agricultural markets regularly fail African farmers, generally because ‘the pattern of market failures is general and structural, and not related to the head-of-household’s gender, or to geographic characteristics such
as distance to roads or to large population centres.’ [33] African farms are less productive because farmers are chronically unable to access the finances (or credit) that would allow them to purchase critical inputs that could improve yields, such as fertiliser and seed.

### Agricultural reform elsewhere in the world: Lessons for Africa?

The first 20 years of China's agricultural revolution, which improved productivity on smallholder farms through institutional incentivisation, access to better seeds and better farming practices, holds many lessons for Africa.

In the 1970s and 1980s, Deng Xiaoping used the household responsibility approach to transform the domestic agricultural sector in China. The reforms contracted individual households instead of collectives to farm. With this new responsibility and various other market-related reforms, productivity improved in the order of 20% above collective era output. [34]

Average yield nearly tripled between 1970 and 2013 and was a catalyst in the economic growth enjoyed by the country during those decades. The available calories per person increased by nearly 70% and there were fewer than 2 million malnourished children in 2015, compared with the more than 22 million in 1987.

The African experience is that different families farm small patches of land, relying on unproductive, often traditional, practices. This is similar to the situation in China several decades ago. By working with the individual farmer and focusing on improved smallholder productivity, China transformed its agricultural sector and fed its rapidly growing population. Today, electronic land-use transfer systems contribute to continued productivity, with farmers being able to lease their land to others, creating larger and potentially more productive farms. [35]

Brazil also enjoyed rapid improvements in agricultural production in the decade between 2000 and 2010. Although the country has traditionally been a net food exporter, it has improved that position by nearly seven percentage points. Between 1981 and 2016, Brazil more than doubled average cereal yields, despite the size of the land under cultivation only increasing by about 6%.

Brazil's agricultural sector has grown in absolute terms and diversified but, like China, only achieved that progress once it had graduated to an upper middle-income status. Today, Brazil is the world's largest exporter of both sugar and coffee, second only to the United States in soybean exports, and third to the United States and Argentina in maize exports. [36] The genetic tailoring of seeds and plants had an essential role in these changes.

Brazil is now at a stage in development where it is moving beyond agricultural production for food security. The country exported approximately 12% more food than it consumed in 2018 and has begun to embrace a ‘forest, agriculture and livestock integration’ approach to farming that is widely acknowledged to have benefits for both agricultural production and environmental sustainability. [37] But it is achieving many of these goals at the much greater cost of environmental degradation, as farmland steadily encroaches on the vast Amazon forests that serve as an important global carbon sink.

### Access to technology and finance can change agriculture in Africa

Agricultural production per capita is declining steadily throughout sub-Saharan Africa. At the same time, South America sustains high production after an impressive decade-long sprint to improve productivity and China’s yields per capita.
continue to rise. As a result, sub-Saharan Africa is condemned to food insecurity and an expensive agricultural trade deficit without a revolution in agriculture.

Rather than replacing farm workers, of which there is an abundant supply on the African continent, agricultural technologies will likely help farmers reduce inputs such as herbicides, pesticides and fertilisers through greater precision in their application. Devices such as drones can also help to inspect fields and monitor herd animals. [38] In its 2019 report on the state of climatic conditions in Africa, the World Meteorological Association notes that solar-powered micro-irrigation has the potential not only to offset carbon emissions but also to increase farm-level incomes five to ten times, improve yields by up to 300% and reduce water usage by up to 90. [39]

Mobile technology can alleviate many of the bottlenecks in Africa’s smallholder agricultural credit system and enable farmers to access farming inputs at lower costs. For example:

- In Kenya, the company FarmDrive [40] uses machine learning and various data sources to unlock access to credit for smallholder farmers. Once the exact location of the smallholder farm is confirmed, [41] often with reference to a known reference point such as the location of a nearby primary school, the system accesses geospatial information to determine soil quality, weather conditions and market accessibility, and then uses an algorithm to determine a credit score. The associated decision-making tool enables financial institutions to develop small-scale agriculture loan products. In this way, modern technology facilitates a process through which smallholder farmers can access capital to purchase critical farming inputs such as seed, fertiliser and implements that could increase yields and revenues.

- In Ghana, Kenya and Uganda, more than 20 000 farmers have access to affordable insurance contracts (such as against crop failure or the loss of expensive breeding stock) via their smartphones, using blockchain technology. The system uses high-resolution satellite images to detect rainfall and plant growth data and offers advice on what, when and where to plant as well as directing farmers to suitable packaging and distribution centres. [42]

- The World Food Programme’s Rural Resilience Initiative (R4) is also helping to implement innovations in finance and insurance to increase food and income security and reduce the climate-related farming risks. Their efforts reached more than 57 000 farmers in Ethiopia, Senegal, Malawi, Zambia and Kenya in 2018. [43]

Over the last decade, the Alliance for a Green Revolution in Africa (AGRA) has invested hundreds of millions of dollars in improved seeds and has doubled maize yields in the 18 countries where they work [44] (although detractors are opposed to these green revolution programmes, [45] calling them efforts to promote industrial agriculture).

These examples reflect some of many emerging African solutions that can help the continent’s estimated 50 million smallholder farmers change a traditional farming mindset to one focused on practising agriculture as a business. However, a lack of access to electricity in rural areas and low Internet penetration are major obstacles to applying modern technology in agriculture (also see Theme 7).

Improving soil fertility is another important aspect of improved agricultural production. The use of fertilisers, whether organic or human-made, has greatly boosted yields. Usage in Africa is generally lower than elsewhere in the world despite the soil being poorer than in most other continents. [46] With the limited use of fertiliser soil fertility depletion generally continues unabated. The challenge is that both the manufacturing and application of fertilisers (generally in the form of ammonia as nitrogen supplement) has a heavy carbon emissions toll. [47]

The reason for low fertiliser use in Africa is that prices are far more expensive than elsewhere in the world because the continent generally imports fertiliser instead of manufacturing it. Although the delivered cost at the port is similar to that for other importing countries, the cost of distribution in Africa is higher, reflecting the continent’s poor transport infrastructure, the lack of competition and inappropriate regulations. [48]
Despite a strong lobby against more intensive fertiliser use, various efforts are now underway to increase production of fertilisers on the continent. For example:

- The Indorama Eleme public-private fertiliser plant, which was completed in 2016, intends to turn Nigeria from a large fertiliser importer to a self-sufficient producer and eventually a net exporter. [49]

- Morocco’s OCP Group, which holds 75% of the world’s phosphate reserves (an essential ingredient for phosphate-based fertilisers), has announced plans for a US$1 billion industrial investment in fertiliser plants in Nigeria while constructing a massive plant in Dire Dawa in eastern Ethiopia, at an estimated cost of US$3.7 billion. [50]

The African Agricultural Revolution scenario

Boosting farmers’ income helps stimulate general demand for goods and services in rural areas, which results in the establishment of new enterprises and contributes to the broader process of structural economic transformation and diversification. [51] This will hold even as most of the continent’s intense agriculture occurs at the periphery of urban centres, i.e. closer to the market, given the denser network of roads and access to markets here compared with the generally low road density in rural areas across much of Africa.

In this section we model an Agricultural Revolution scenario using four variables within the IFs forecasting platform. Each intervention initialises from individual country data, and the improvements are benchmarked to ambitious rates of progress in countries at similar levels of development. Generally, the magnitude of the interventions is more significant in most sub-Saharan African countries, which have lower current agricultural productivity and more potential than North Africa.

The four sets of variables are as follows and the underlying logic to their key outcomes and eventual impacts is summarised in Chart 7:

- **Direct improvement on yields**: Fundamental to this intervention is improved tenure security and transferability of ownership to unlock finance. Many African countries have recently started to overhaul communal land rights, creating something of a middle ground between individual freehold and the colonial customary model. Modern technology, such as aerial photography and digital platforms, can support the documentation of land and resource rights. The result is progress on land administration at a reasonable cost and is being pursued in countries as diverse as Ethiopia, Rwanda, Côte d’Ivoire, Ghana, Benin, Burkina Faso and Tanzania. [52] Rapid adoption of fertilisers, growing high-yield variants, improved water management and cultivating more appropriate indigenous crops are all potent yield multipliers. [53]

- **Amount of land equipped for irrigation that is being irrigated**: As the stock of land currently under irrigation in most African countries is meagre, this set of interventions comes off a shallow base. Just over 6% of cultivated land in Africa is under irrigation, compared with the global average of 21%. Therefore, the vast majority of cropland is dependent on good rainfall, which is increasingly irregular owing to the impact of climate change and desertification, to which Africa is particularly susceptible. Excluding South Africa, Africa also has the world’s lowest water storage capacity: 43 m$^3$ per person compared with 6 150 m$^3$ per person in North America. (South Africa’s storage capacity is 750 m$^3$ per person.) As a result, much of the continent has little ability to control water flow and conserve it during periods of abundance for use during periods of scarcity.
• **Improved food supply chains:** Whereas the average loss and waste of agricultural produce in the rest of the world is roughly 14%, it is calculated at 24% in Africa and up to 30% in West Africa. Unlike in Europe and North America, where food reaches the consumer but is then discarded or wasted, almost a third of the food loss in Africa happens in the production stage. Better storage and infrastructure would help reduce losses, but more detailed data on the supply chain would also help. Modern technology can also play a big role here as, according to FAO, one-third of the world’s food — approximately 1.3 billion tons and worth US$1.2 trillion a year — is wasted. [54] Technology can help track inventory and reduce food waste along the distribution chain. One African example is InspiraFarms, which produces affordable, energy-efficient cold storage and processing equipment for on- or off-grid use. [55] The combination of reduced post-production losses together with increased yields can increase the availability of food for local consumption and export (or at least reduced import dependency).

• **Increased per capita caloric consumption:** Increasing individual energy intake from 2 600 calories per person per day in 2019 to 2 900 calories per person per day in 2043 is done to ensure that the increase in agricultural production is partly consumed domestically and does not benefit only exports (where it can earn valuable foreign exchange). The 2043 value is about 150 calories higher than the Current Path forecast.

### Agriculture 7

In the Agricultural scenario, Africa’s average crop yields improve by 50% by 2043 compared with the Current Path forecast (see Chart 8). The scenario represents an 83% improvement from 2019 levels by 2043 (with an average yield, across crop types, of 7.2 tons per hectare). These improvements are particularly potent for East Africa, where yields are set to increase by 74% relative to the Current Path forecast by 2043, while West and Southern Africa could achieve yield improvements of 43–50%. Even the comparatively modest interventions in North Africa could cause yields to increase by about 12%. Yields in Central Africa in 2043 are 60% higher than the Current Path forecast for that year. [56]

The interventions increase land under irrigation in Africa by approximately 7.6 million hectares by 2043 (Chart 10). This is a 55% improvement compared with the Current Path forecast for that year. The largest increase is in East Africa, where it almost doubles, coming off a low base.

Because of the large increase in available food, the scenario increases the total amount of agricultural waste. However, as a share of production, food loss and waste would decline dramatically. In the Current Path forecast, loss and waste would climb from about 23.6% in 2019 to about 27% of production by 2043. In the Agricultural Revolution scenario, rates decline to approximately 19% by 2033, and maintain a slight downward trend beyond 2043 (Chart 11).

### Impact
The impact of the Agricultural Revolution scenario is impressive. By 2043, Africa will produce a total of 703 million metric tons of additional food (crops, meat and fish), which is 1,549 million metric tons more than the Current Path forecast for 2043. With increased domestic food production, Africa’s agricultural import bill can be US$327 billion lower in 2043 than would otherwise have been the case.

The increase in available food energy (calories) reduces the number of children suffering from malnourishment by more than 2.4 million in 2043. Thus, from 2024 to 2043, a cumulative number of 44 million fewer children suffer from malnourishment, accompanied by a reduction in stunting. The scenario also reduces infant mortality by almost two children per 1,000 live births under one year of age. Bear in mind that more than 43 million births occurred in Africa in 2019 and that the Current Path forecast is for almost 55 million in 2043. Although infant mortality declines, almost a million fewer children will be born in Africa in the Agriculture scenario than in the Current Path, as health improves and parents generally opt for fewer children.

Chart 12 presents Africa’s growing food dependence over time in the Current Path forecast, including demand for crops, meat and fish. In 2019, the continent imported 11% of its agricultural demand, consisting of staple foods such as rice and maize, which are cheaper to procure on the international market than domestically. In the Current Path forecast, net agriculture food import dependence reaches 35% by 2043, whereas the Agriculture scenario reduces the continent’s food insecurity to only 8% by 2043.

The averages conceal huge differences between countries and regions (Chart 13). Countries that achieve the most spectacular increases in production volumes (Nigeria, Tanzania, Ethiopia and the DR Congo) are well known for their agricultural potential whereas arid and small island states gain the least. Nigeria, for example, would see an increase from just under 300 million metric tons of agricultural products in 2043 in the Current Path forecast to over 400 million metric tons in the Agriculture scenario.

One of the continent’s most agriculturally productive countries, Egypt, is already close to its full agricultural potential and thus was not included in interventions under this scenario. In fact, given the imminent water crisis, Egypt’s agriculture production volumes fall somewhat under this scenario, as does Djibouti’s, although marginally.

The Agriculture Revolution scenario has significant developmental and economic impacts (Chart 14): [57]

- By 2043, the Agriculture scenario is expected to reduce the number of extremely poor Africans (using US$1.90 as a benchmark) to 358 million instead of 468 million people. This represents 16% of the total population compared with 21% in the Current Path forecast for that year, half of whom are expected to come from West (38 million) and Central Africa (32 million).

- Low-income countries with high agricultural potential, particularly Madagascar and the DR Congo do particularly well. Extreme poverty in the DR Congo is expected to reduce by almost 26 million people in 2043 (to 56 million), which will be equivalent to only 33% of its population by then.

- Levels of poverty are expected to be 28% in 2030 instead of 31%, reflecting the extent to which Africa is set to miss the SDG target of eliminating extreme poverty.
By 2043, Africa’s total economy is expected to be US$562 billion larger (using MER) than in the Current Path forecast. The Agriculture scenario is expected to increase the average GDP per person (in PPP) in Africa by US$338 in 2043 — more than a 5% improvement on the Current Path figure forecast for that year. Regional breakdowns suggest that:

- because of its smaller agricultural sector, North Africa will benefit least, improving its GDP per capita by only 2%, although this still represents an increase of US$256 in GDP per person.

- proportionally, East Africa will benefit most (equivalent to US$401).

- West Africa will benefit most in absolute terms (by US$454).

- GDP per capita in Central Africa will be US$271 more in 2043 than in the Current Path forecast.

The contribution of agriculture as a portion of an economy generally declines as countries graduate from low- to middle- and eventually high-income status. For example, in Africa’s 23 low-income countries, the agricultural sector contributed about 28% to GDP in 2019, about 17% in the 23 lower middle-income countries and about 3% in the six upper middle-income countries. [58] By 2043, these portions will likely have declined to 9%, 7% and 2% for low-, lower middle- and upper middle-income Africa respectively.

Chart 15 shows the average size of the agricultural sector as a percentage of GDP for the two most affected income groups, accounting for 46 of Africa’s 54 countries. The Agriculture scenario would increase the value of the sector by four and two percentage points for low and lower middle-income Africa, equivalent to an increase of US$108 billion and US$162 billion, respectively.

A different expression of the same metric is that in the Agriculture scenario, the sector would contribute 11% of the economy of Central Africa by 2043 (down from 17% in 2019), compared with a more rapid decline to 8% in the Current Path forecast. In addition, the economy of Central Africa will be significantly larger than in the Current Path.

Although the agricultural sector in Southern Africa shows the second least impressive growth in absolute size, the sector already represented only 4% of GDP in 2019, significantly smaller than in other regions. Instead of being US$36 billion in 2043 (as expected in the Current Path forecast), it would be US$52 billion in the Agriculture scenario.

Chart 16 shows the expected change in the size of the agricultural sector in the Agriculture scenario relative to the Current Path forecast for each of the five African regions by 2043. The differences are:

- US$16 billion in Southern Africa

- US$24 billion in North Africa

- US$39 billion in Central Africa

- US$90 billion in East Africa
In 2019, the agricultural sector was the largest, as a percentage of GDP, in East Africa (28%) compared with only 4.4% in Southern Africa. Thus, over time West and East Africa emerge as the food baskets of Africa.

However, these improvements are not a given, as they would depend on factors such as the amount of water available for irrigation, the effect of carbon fertilisation due to climate change on crop growth, as well as the impact of new cultivars and genetically modified plants that are more temperature tolerant. [59]

More than half of Africa’s labour force is engaged in the agricultural sector. But like in China, the agricultural sector in Africa is steadily losing its productive, working-age population as young men and women migrate to cities in pursuit of improved livelihoods. The Agriculture scenario accelerates the rate at which employment in the sector declines even as productivity improves and total output increases. However, jobs will be created downstream in the much larger agri-processing sector by lowering the costs of raw materials. Productivity improvements could come from upgrading value-chain activities such as logistics, input services, storage and other off-farm activities all of which will require improved connectivity and basic infrastructure. [60] Thus, as Africa moves up the agricultural value chain, growth in the sector will expand employment opportunities in downstream agri-processing, with much of that in urban centres.

Conclusion: Aiming at food security and growth

Investment and prioritisation of Africa’s massive agricultural production have never been attractive enough for Africa’s leaders or international partners to unlock its potential.

Europe is often blamed for Africa’s lack of access to its agricultural market. Yet African leaders fail to recognise the need to focus comprehensively on the production of staple foodstuffs for domestic consumption, advancing regional rather than international trade in agriculture, investing in agriculture research, advancing rural property rights, in schooling for agriculture and generally focusing attention on rural poverty rather than on urban elites. [61] If African countries were to prioritise growing staple foods while actively encouraging intensive smallholder farming and sustainable practices, they could increase rural incomes and reduce poverty and eventually open up the potential of agribusiness and large-scale exports that earn foreign exchange. The much-needed Agriculture scenario modelled here will reduce Africa’s agricultural import dependence, improve food security and contribute to growth.

Raising agricultural productivity serves as a foundation for broader sustained economic development. Eventually, agriculture ‘is central to securing foreign exchange earnings that can allow for the expansion of imports, thereby fuelling investment and growth.’[62]

Clearly, there is much that Africa can do to improve agriculture, even as it inevitably declines as a share of national economies. To this end, the Alliance for a Green Revolution in Africa calls for a holistic land management strategy that includes raising the organic matter, moisture retention and other forms of soil rehabilitation in addition to using inorganic fertilisers. In South Africa, for example, primary agriculture contributes only about 3% to GDP, yet it provides food security on the back of a highly productive private agricultural sector and significant agri-processing industry. As a result, the country had a secure food supply system when it went into a six-month lockdown in March 2020 to curb the spread of COVID-19, while many other countries on the continent suffered.
The impact of climate change on agricultural yields in Africa is a big uncertainty. A recent long-term forecast by our group on the future of five Sahel countries (Mali, Niger, Burkina Faso, Chad and Mauritania) highlighted the impact climate change has already had and will continue to have in this region. The Intergovernmental Panel on Climate Change soberly notes that the Sahel, where agriculture accounts for more than 75% of total employment, has 'experienced the most substantial and sustained decline in rainfall recorded anywhere in the world within the period of instrumental measurements.' [63]

Theme 14 examines the impact of climate change on Africa's future. It varies across the continent, given changes in temperature and rainfall and the increased variability of weather with many more extreme events such as floods, tornadoes and droughts. The IFs forecasting platform includes some of these effects in its agriculture yield forecast but may underestimate the impact. There are significant uncertainties, particularly the potential for technology to increase agricultural production — not through the traditional route of expanding land under cultivation, but through more precise farming and more sustainable farming methods. Eventually, solar-powered cold storage, accurate weather forecasts, monitoring of soil conditions and access to market information can all have an important role, as could greater efficiencies to reduce food waste. However, this will require current practices to change.

Without food security, developing countries cannot escape from hunger, poverty and the variances of nature. Without food security, meaningful advancement is difficult, if not impossible, to sustain. It is increasingly evident that the effects of climate change are likely to hold significant negative consequences for agriculture in much of Africa.

Because of how colonialism shaped and then locked Africa's agricultural sector into the global economy and subsequent insufficient, poorly designed and inefficient government support for agriculture, Africa's economy has not been able to benefit from this crucial sector. Yet the continent has huge potential, and it is agriculture upon which the most significant portion of Africans depend for survival. Subsistence and smallholder agriculture, which primarily cater for household consumption, need targeted and coordinated support from governments. This is quite different from the private-sector growth model of medium- and large-scale commercial farming, although that too has its place. Clumsy interventions by African governments to set minimum prices for commodities such as cocoa, coffee and cashew nuts, without considering the broader impact, often have unintended consequences. For example, it could encourage an increase in production by many more poor farmers, causing the commodity's price to fall. The result is that more poor people will be trapped in subsistence farming, unable to escape. Low- and lower middle-income African countries should emphasise food self-sufficiency first and only then focus on the massive export potential of agricultural products.

Despite some progress, Robert McNamara’s prognosis in 1973 that a long-term solution to the food problem will not be possible without rapid progress in smallholder agriculture [64] remains valid today in much of Africa.

For a successful agricultural transition, it is imperative to focus both on growing indigenous crops, such as cassava, cowpea, soybeans and yam, and on using indigenous practices. [65] Once that is achieved, steady progress up the agriprocessing value chain will unlock improvements rather than efforts to enter the global food export market without sufficient domestic reform.

Across Africa, governments and the private sector are modestly investing in the critical enablers of agricultural growth. But much more is required, particularly in incorporating resilience and adaptation to climate change into forecasts.

Prosperity requires that a country move up the agricultural value chain and avoid being suckered by corporate social responsibility programmes that promise to tinker with the worst effects of colonial-style production but do not structurally intervene to promote food self-sufficiency and shift value addition to Africa. The storyline often sold to Africans is to leverage products such as cocoa and coffee to improve their share of value-add in these massive markets. But in the absence of effective agricultural management and producer associations with the muscle to manage the sector, it is
probably more important to diversify the agricultural products in countries such as Ghana and Côte d’Ivoire than to develop a cocoa cartel.

There is also the challenge that for much of Africa’s youth, the idea of turning to agriculture as a source of livelihood is associated with poverty, suffering and deprivation. Changing that mindset will be difficult, as the sector suffers from poor infrastructure, insecure property rights, lack of access to credit, no or limited provision of electricity, and lack of access to modern technologies. All these hurdles can be overcome by changing current practices of tenure insecurity, unlocking access to credit, using high-yielding seed varieties and modern inputs such as fertilisers, pesticides, and eventually, mechanisation to emulate some of the positive aspects of the agricultural revolutions in South Asia and South America in the 1950s and 1960s. Above all, harvesting prosperity from agriculture requires determined and decisive political leadership.
Endnotes


5. T Lewis, *Transatlantic slave trade*, 2018


14. World Bank, *Aggregated LPI*

15. World Bank, *Aggregated LPI*

16. Embassy of the DR Congo, *Invest in DRC, Agriculture*


19. In 2003, the New Partnership for Africa’s Development (now called the African Union Development Agency) published its Comprehensive Africa Agriculture Development Programme, with ambitious goals, namely to: allocate at least 10% of national budgets to agriculture; reach rural growth rates of 6% annually by 2015; integrate and invigorate regional and national agricultural markets; significantly increase agricultural exports; transform Africa into a ‘strategic player’ in global agricultural science and technology; practise sound environmental and land management techniques; and reduce rural poverty (see: M Fleshman, *Boosting African farm yields*, 2014).

20. The commitment to devote at least 10% of national budgets to agriculture and rural development was also included in the 2003 Maputo Declaration by African heads of state and reiterated in the 2014 Malabo Declaration on Accelerated Agricultural Growth and Transformation in Africa.

21. On aggregate, Africa spends only 5–7% of national budgets on agriculture, although a 2018 study found that 11 African countries did manage to allocate 10% or more of their budgets to agriculture in some years since 2005, with Ethiopia, Kenya, Mozambique and Sierra Leone achieving 6% agricultural...

22. AllAfrica, *Communique: Africa food security leadership dialogue*, August 5, 2019

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24. The world cocoa industry is worth more than US$100 billion annually; also see: Y Adegoke, *Why Europe dominates the global chocolate market while Africa produces all the cocoa*, 2018; D Philling, The African farmers taking on big chocolate, *Financial Mail*, 16 December 2019; H Fofack, *Overcoming the colonial development model of resource extraction for sustainable development in Africa*, 2019


31. World Bank, *Agriculture in Africa: Telling facts from myths*


33. World Bank, *Agriculture in Africa: Telling facts from myths*

34. In contrast to the tripling in growth cited earlier, this was an improvement across the entire country, so the growth is understandably much smaller; see: JY Lin, *The Household Responsibility System in China’s Agricultural Reform: A Theoretical and Empirical Study*, *Economic Development and Cultural Change*, 36:S3, 1988, S199–S224

35. China-Africa Project, Chinese and African agriculture have a lot more in common that most people think: *Interview with Xinqing Lu, Associate Programme Officer for Alliance for a Green Revolution in Africa*, 3 December 2019

36. OEC, Brazil


38. L Abboud, *The robot revolution down on the farm*, 2018


40. R Kimani and P Bosire, *FarmDrive*, 2019

41. In most of rural Africa, precise location of a farm is objectively unknown so the location is determined via a series of SMS questions (e.g. time to walk to different primary schools). The more schools a farmer is familiar with in their area, the easier it is to hone in on their specific location.

42. J Bird, *‘Smart’ insurance helps poor farmers to cut risk*, *Financial Times*, 5 December 2018; also see, for example, [https://agrocenta.com/](https://agrocenta.com/) and [https://www.zenvus.com/](https://www.zenvus.com/).

44. S Gebre, AGRA plans to invest $500 million in African seed companies, Bloomberg, 7 September 2016

45. The Alliance for Food Sovereignty in Africa and its allied organisations argue that ‘AGRA has unequivocally failed in its mission to increase productivity and incomes and reduce food insecurity, and has in fact harmed broader efforts to support African farmers.’ See: Various co-signatories, Open letter: The Green Revolution in Africa has unequivocally failed, 15 September 2021


47. Ammonia manufacturing contributes 1% of worldwide carbon dioxide emissions. See LK Boerner, Industrial ammonia production emits more CO2 than any other chemical-making reaction. Chemists want to change that, Chemical & Engineering News, 15 June 2019


49. Indorama Petrochemicals, About IEPL, Port Harcourt


54. Food and Agriculture Organization, Food wastage: Key facts and figures

55. InspiraFarms, Our team

56. The improvements in yields are similar in magnitude to the improvements seen in South Asia between 1980 and 2020, and in a similar timeframe. Indeed, South America achieved a much more rapid increase between 2000 and 2010, moving from roughly 7.8 tons per hectare to about 11.8 tons.

57. Chart 14 presents the reduction in extreme poverty in African countries across the low- and middle-income categories. The reduction in extreme poverty in Seychelles, Africa's only high-income country, is negligible.

58. The contribution of agriculture as a proportion of the Seychelles’ economy, the continent's only high-income island state, was about 4% in 2019.

59. Some of these constraints can be overcome through technology, such as the use of precision irrigation and application of precise amounts of fertiliser exactly where they are required. Then there is also the potential of vertical farming, which could produce 180 m tons of food globally, according to some analysts.


61. Food and Agriculture Organization, Government expenditure on agriculture, 2019


63. Intergovernmental Panel on Climate Change, Working Group II: Impacts, adaptation and vulnerability, 2018


65. The International Institute of Tropical Agriculture does particularly impressive work in this regard. See: https://www.iita.org/
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About the authors

Jakkie Cilliers is the founder and former executive director of the Institute for Security Studies (ISS). He currently serves as chair of the ISS Board of Trustees and head of the African Futures and Innovation (AFI) programme at the Pretoria office of the ISS. His 2017 best-seller Fate of the Nation addresses South Africa’s futures from political, economic and social perspectives. His two most recent books, Africa First! Igniting a Growth Revolution (March 2020) and The Future of Africa: Challenges and Opportunities (April 2021), take a rigorous look at the continent as a whole.

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