FICCI

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India-Africa partnership in agriculture
Current and future prospects



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Message from the Ministry of Agriculture

राधा मोहन सिंह
RADHA MOHAN SINGH

D.O. No. 235 /AM

सत्यमेव जयते

कृषि मंत्री
भारत सरकार
MINISTER OF AGRICULTURE
GOVERNMENT OF INDIA

04 FEB 2016

MESSAGE

Agriculture globally is under tremendous pressure owing to the multi-faceted challenges it faces in today's world: be it productivity pressures to feed a rapidly growing population with limited resources, or adoption of sustainable production methods to mitigate impending climate change risks. And ultimately, it also has the responsibility to contribute to overall socio-economic development, as is the case in many agriculture-dependent developing countries. The United Nations Food and Agricultural Organization (FAO) estimates that a 70 percent increase in overall food production from 2005/07 levels is required to feed a world population of 9.1 billion people in 2050. Pressure on developing economies like India and Africa is greater, owing to their large agricultural production base, rapidly growing population, evolving market dynamics and increasing production pressures. Production in the developing countries would need to almost double, especially for key commodities like cereals and oilseeds.

Agricultural development is critical to ensure food security, eradicate poverty and improve livelihoods, and therefore, both India & Africa have agreed to strengthen cooperation in this sector to ensure food security for the regions as well as to increase their exports to world markets. Emphasis is on ensuring sustainable development of agricultural and animal resources through effective support for raising agricultural productivity, modernizing agriculture, developing agro-allied industries and investing in value-added processing for agricultural commodities by sustainable methods & systems aided through scientific research and industry engagement.

I am happy to note that to further highlight the importance of this regional collaboration, this knowledge paper is being released. This paper is an attempt to identify key collaboration opportunities that exist in the agriculture sector which will benefit both geographies in achieving their sectoral potential. It also showcases case studies that highlight key learnings and successful intervention models from the Indian experience that can be replicated in Africa.

I am hopeful that this paper will contribute to achieving sectoral priorities and objectives in both regions.

Radha Mohan Singh
(RADHA MOHAN SINGH)

Message from the Ministry of Commerce and Industry

सूचना का अधिकार

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सत्यमेव जयते

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Government of India
Ministry of Commerce & Industry
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MESSAGE

Trade between India and Africa has a long and distinguished history. Trade between the two regions has grown from almost negligible to USD 70 billion in 2014-15. At present, India has provided USD 7.4 billion worth of concessional credit for 17 projects across 41 African countries. These projects cover diverse areas, including agriculture, water, infrastructure and energy.

Important items of trade include rice, cotton yarn fabrics, pharmaceuticals, nuts, gold, machinery and instruments etc. Rising economies in India and the African continent has brought both the countries on the global map poised for tremendous growth in the coming years. Increasing trade relations across various industries, including agriculture, will also help in aligning with the continent's development goals, human resource development and capacity building. Knowledge and technology transfer would benefit in addressing issues such as food security and small-farm mechanization. Indian investment in agriculture also has the potential to directly boost production and also emerge as a source of Foreign Direct Investment in Africa.

I am glad to learn that the knowledge paper "India–Africa Partnership in Agriculture: Current and Future Prospects" brought out by FICCI and their knowledge partner, PricewaterhouseCoopers (PwC), is being released.

I hope that this paper will be useful to all stakeholders to identify potential sub-sectors, highlight trade and investment avenues, and identify partnership opportunities between Africa and India for enhancing growth in agri-business in the two regions.

(MANOJ DWIVEDI)

New Delhi
Dated: 09th February, 2016.

Message from the Federation of Indian Chambers of Commerce and Industry (FICCI)



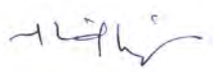
The agricultural sectors in India and Africa share common characteristics—from diversity of climatic regions to similarities in farming systems. Given these similar sectoral characteristics and complementary developmental priorities, there exist numerous opportunities for collaboration between India and Africa.

Africa has 25% of the world's arable land and it generates only 10% of global agricultural output. Therefore, it is yet to realise its full potential. According to industry reports, Africa's farm sector is expected to grow to 1 trillion USD by 2030, largely driven by science and technology. Hence, there is significant scope for the agricultural sector in Africa to benefit from the Indian experience. On the other hand, India's agriculture and food sector is poised for a transformation in terms of trade and markets. India needs to look for consumers with similar consumption patterns as ours. Africa offers one of the most attractive and large untapped markets.

Trade and investment have always been a critical dimension of the India-Africa relationship. India is Africa's third largest trading partner, with over 70 billion USD in trade and over 50 billion USD in investment.[1] Also, with the changing global landscape for agriculture and food, India and Africa have emerged as key partners in contributing to global food security.

This paper aims to identify key collaboration opportunities across the agri-value chain that can benefit both Indian and African economies. The paper highlights partnership opportunities between the two regions in areas such as agricultural science, technology and innovation, agricultural infrastructure and markets, and food security, to foster sectoral and economic development.

I am confident that this joint paper by FICCI and PwC will be instrumental in pointing out key collaboration opportunities in the agri and food space that are mutually beneficial for both India and Africa.



Dr A. Didar Singh
Secretary General, FICCI

1 Ghakar, S. et al. (2015, October 23). India-Africa partnership: Future directions. Brookings India





Foreword

> ***'Agriculture is the foundation of civilisation and any stable economy.'***
>
> *— Allan Savory, renowned ecologist and environmentalist, the Savory Institute, Zimbabwe*



Africa and India together constitute about one-third of the world's population and are seen as investment hotspots of the global economy. India is one of the fastest growing economies in the world at present, and Africa is also experiencing rapid growth.

It is predicted that Africa's gross domestic product (GDP) has the potential to reach up to 2.6 trillion USD by 2020. Moreover, 11 of the world's fastest growing economies are in Africa. At present, India and Africa together have manpower of almost 2.2 billion and a combined GDP estimate of more than 3 trillion USD.[2] The agricultural sector in Africa has great potential to contribute to this growth, with the continent having almost 60% of uncultivated land in the world and currently producing only 10% of the global output.[3]

Africa is aspiring to raise its agricultural output from 280 billion USD in 2010 to 880 billion USD in 2030. This increase will be enabled by bringing potentially cultivable land into cultivation, increasing yields and shifting to cultivation of high-value and high-yielding crops. Greater availability of agro-allied services such as increased usage of fertilisers, pesticides and farm equipment will further aid this growth. It is reported that 30-50% of sub-Saharan African yields are not realised due to biotic and abiotic stresses; usage of modern farm equipment and agrochemicals can help minimise these losses. India is committed to helping Africa implement its development agenda not only by providing credit facilities, but also through investments and partnerships in varied sectors, with agriculture as a frontrunner.[4]

India and Africa both have comparable agro-climatic and socio-economic conditions, which create the potential for enhanced cooperation in this sector. Some of the key challenges faced by these economies are related to food security, nutrition, increasing productivity and reducing losses, and raising economic returns for farmers.

India's commitment to engage with Africa is a re-enforcement of the political and economic cooperation. Both the economies are determined to work together and achieve the common goals of food security, improved health and nutritional conditions, capacity building and skill development, technology transfer, and other parameters that have an impact on the economic condition of people. The similar consumer markets in India and Africa provide great opportunities to work together and meet various global challenges.

Echoing this sentiment, this knowledge paper 'India-Africa partnership in agriculture: Current and future prospects' aims to gauge the options for partnerships and collaboration across various agriculture sub-sectors, such as land, farm mechanisation, food processing, agri-marketing and innovations in the agricultural space. All of these initiatives will ultimately contribute towards achieving the twin goals of economic growth and food security.



Ajay Kakra

Leader, Agriculture and Natural resources, PwC India

2 India in Business, Ministry of External Affairs, Government of India (GoI)

3 Ministry of External Affairs, GoI. (2015). Retrieved from www.mea.gov.in

4 India-Africa project partnership. (2014). Retrieved from http://www.indiaafricaconnect.in/index.php?param=category/india-africa-project-partnership/152

Executive summary

Given their abundant natural resources and immense production potential, both India and African economies share a central role in ensuring global food security in the near future. Considering the complementary sectoral priorities and similar role in evolving global food markets, numerous opportunities exist for collaboration between India and Africa in the agricultural sector. Although both countries share similar sectoral characteristics, they are at different maturity and transformation levels. Moreover, these economies have long realised the benefits of partnerships. With impending global production and food security pressures, there exists an urgent need to adequately channelise these investments towards 'high-impact priority areas' in order to achieve immediate and sustainable returns.

Against this background, this paper attempts to identify partnership opportunities across the agri-value chain—starting from production level aspects to developing output markets. The analysis is done in light of existing investment trends and agricultural trade relations between the two economies. The study was carefully designed to cover both sub-sector specific partnership avenues and collaboration prospects for overall sector development. The main findings of the report are as follows:

- Key 'high-impact' partnership opportunity areas include agri input and farm machinery, milk and meat products, technology transfer and capacity building, food processing, and developing institutional innovations for improving farmers' access to output markets. Opportunities exist for Indian investments in these sectors and for Africa to learn from the Indian experience.

  Based on the Indian experience, some successful intervention models are also presented, supported by case studies. Further, the paper has tried to suggest suitable intervention approaches and models to replicate India's success stories in these key partnership areas.
- It is also evident that at the production level, timely access to right quality inputs, information and technology restricts agricultural productivity, which is a major impediment restricting Africa from realising its true potential in the sector.
- Capacity building and sensitisation of farmers are critical in ensuring adoption of new technologies.
- Policy-level changes are also required to attract and sustain investments in the African agricultural sector.

In summary, the paper assesses the sub-sectors in-depth to present the partnership opportunities which can help both India and Africa meet their sectoral priorities and, subsequently, develop capabilities to adequately contribute to global food security goals.

India-Africa agricultural trade and investments

Africa has potential not only to achieve food security for the continent but also to become a major player in the global food market. This potential lies in its abundant natural resources and huge population base, which offer opportunities in terms of a large labour market and an enormous food market. Africa's middle class is estimated at 350–500 million, which is larger than India's, and has a rising per capita income and greater propensity to trade and invest. The continent is today the third fastest growing economic region in the world and its rate of urbanisation is higher than that of India.

Agriculture forms a significant portion of the economies of all African countries and therefore can contribute towards major continental priorities, such as eradicating poverty and hunger, boosting intra-Africa trade and investments, rapid industrialisation and economic diversification, and sustainable resource and environmental management. Agriculture is Africa's largest economic sector, representing more than 15% of the continent's total gross domestic product (GDP) (more than 100 billion USD annually), and employs more than 70% of its workforce on approximately 783 million hectares of its arable land (27% of the world's total). However, agricultural GDP in Africa is highly concentrated, with Egypt and Nigeria alone accounting for one-third of the total agricultural output.[5]

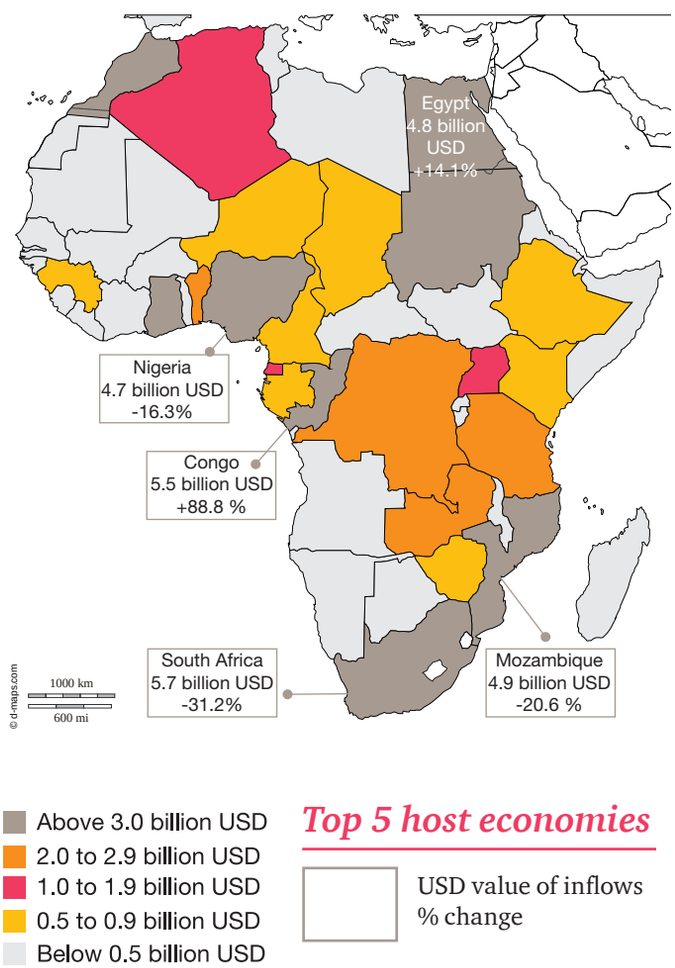
Africa's agro-ecological potential is massively larger than its current output, and so are its food requirements. While more than one-quarter of the world's arable land lies on this continent, it generates only 10% of the global agricultural output.[7] So, there is huge potential for growth in this sector, which is currently expanding at a rate of 2–5% a year.[6] Underinvestment is one of the major challenges inhibiting the faster growth of agricultural output in Africa. Experts estimate that sub-Saharan Africa alone requires additional annual investments of as much as 50 billion USD[7] to make the agricultural system work better.

Over the last decade, countries that have increased investments in agriculture as per Comprehensive Africa Agriculture Development Programme (CAADP)[8] targets (or have exceeded) have seen reductions in hunger and poverty, and increases in productivity. Ghana, Togo, Zambia, Burundi, Burkina Faso, Mali, Niger, Congo, Senegal, Ethiopia and Malawi are some examples.[9] However, as is evident from the agricultural performance numbers, Africa still needs substantial efforts to boost investments and productivity, stir intra-African trade and establish market-oriented agri-food value chains. African agriculture therefore needs business models that can significantly increase the level of investment from the private and public sectors, as well as donors.

Current investments

In 2014, Africa attracted foreign direct investment (FDI) inflows of 54 billion USD, which represented a 4.4% share of the total global FDI inflows in that year. South Africa, Congo, Mozambique, Egypt and Nigeria were the top investment hotspots in Africa.

Figure 1: FDI inflows in Africa, top five host economies in 2014



Source: United Nations Conference on Trade and Development (UNCTAD), 2014, and PwC analysis

5 *AGRA. (2015). Africa Agriculture Status Report . Retrieved from www.agra.org/download/560b8d8d1aa45/and McKinsey & Company. (2015). McKinsey Quarterly. Retrieved from www.mckinsey.com/insights*

6 *McKinsey & Company. (2015). McKinsey quarterly. Retrieved from www.mckinsey.com/insights*

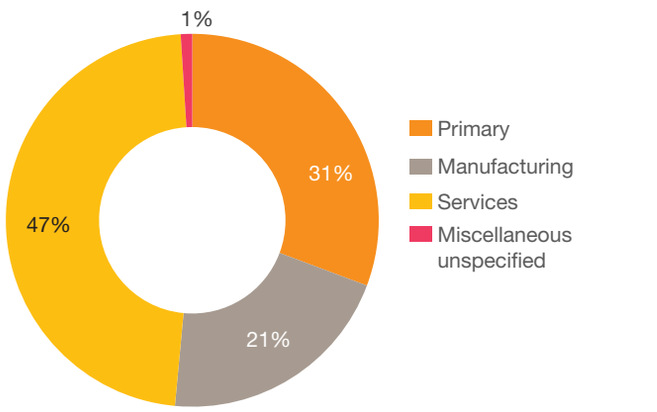
7 *ibid.*

8 *CAADP is Africa's policy framework for agricultural transformation, wealth creation, food security and nutrition, economic growth and prosperity for all.*

9 *New Partnership for Africa's Development (NEPAD). (2013). African agriculture, transformation and outlook. Retrieved from http://www.un.org/en/africa/osaa/pdf/pubs/2013africanagricultures.pdf*

In terms of inward foreign direct investment (FDI) stocks by sector, 47% of the total FDI stocks are invested in the services sector, followed by 31% in the primary sector and 21% in the manufacturing sector. The remaining goes into miscellaneous unspecified sectors.

Figure 2: Sector-wise percentage distribution of total inward FDI stocks in Africa

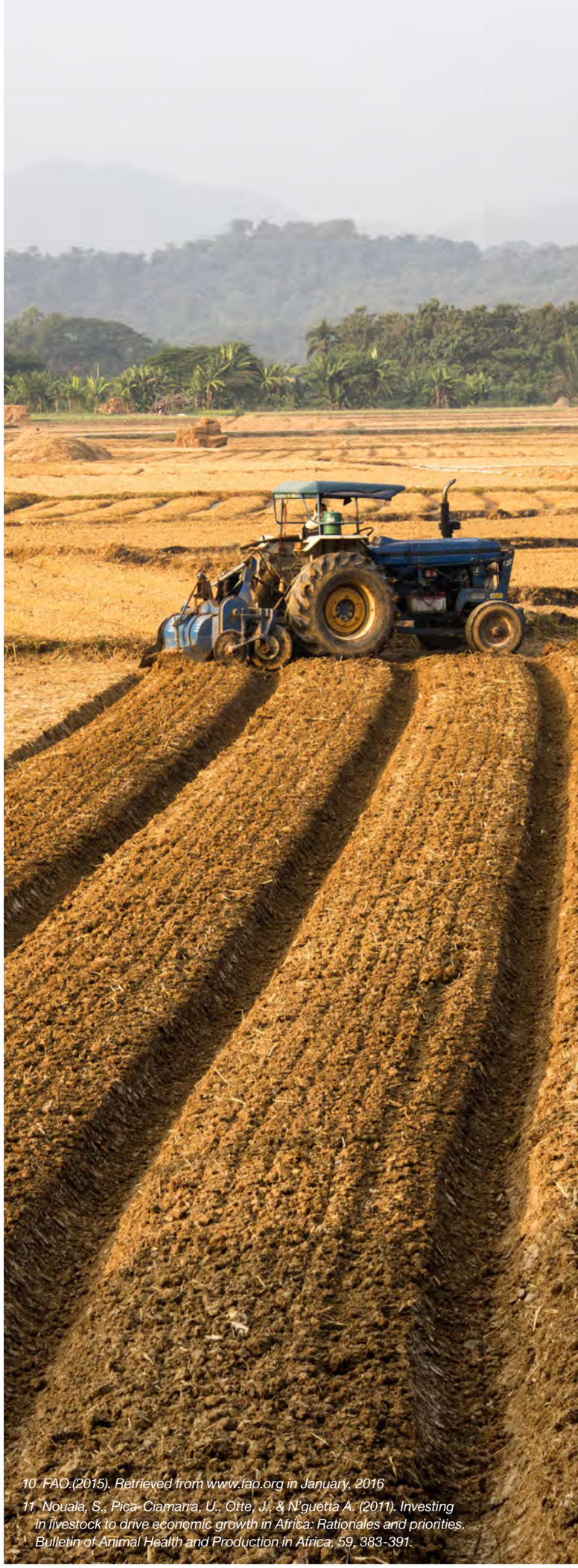


Source: UNCTAD (2014) and PwC analysis

Sector-level data are fragmented for African countries and even more so for the agribusiness sector, which is spread across primary, secondary (manufacturing) and tertiary services (marketing and distribution). Despite the paucity of data, it is observed that though domestic private sector participation and foreign investment in the agribusiness sector in Africa are very limited, they have witnessed an increasing trend over the recent years.[10] The total value of agriculture and agribusiness industries in sub-Saharan Africa is projected to reach 1 trillion USD by 2030 from 313 billion USD in 2010.[11] A snapshot of major investment destinations, with key investment areas within the agricultural space, is provided in the table below:

Major investment destinations in agricultural space	Strategic advantages from investment focus
Côte d'Ivoire	Strong production belt for cocoa, coffee, palm oil and cashew nuts
Ethiopia	Strong production belt for coffee, oilseeds, grains and spices
Tanzania	• Large commercial farming space • Strong production of coffee, tea and oilseeds • Processing and packaging opportunities
Malawi	• Strategic location with access to multiple markets, including Mozambique and Zambia • Strong production results—agricultural sector is expected to grow by 6% in 2015 and 2016
Cameroon	• Agriculture accounts for more than half of the country's non-oil export revenues and is expected to grow by 4% in 2015 and 2016. • Strategically situated among countries that could use its exports, viz., Chad, the Central African Republic, Gabon, and Nigeria

Source: Davis (2015), Ventures Africa and PwC analysis



10. FAO.(2015). Retrieved from www.fao.org in January, 2016

11. Nouala, S., Pica-Ciamarra, U., Otte, J. & N'guetta A. (2011). Investing in livestock to drive economic growth in Africa: Rationales and priorities. Bulletin of Animal Health and Production in Africa, 59, 383-391.

Agricultural trade

Africa has changed from a net exporter to a net importer of agricultural products. Up to the early 1990s, sub-Saharan Africa as a whole was a significant net exporter of agricultural products. With the resumption of growth and the mineral commodity boom in the 2000s, imports have risen sharply to exceed exports by over 30%.[12] Wide differences exist among countries: Côte d'Ivoire, Ghana and Kenya are some of the best performing economies over the years, with a positive balance of agri trade, whereas a number of economies, mainly mineral-dependent economies, are large net importers.

In terms of commodity categories, cereals (including rice, maize and wheat) and livestock products (dairy and meat) represent more than 50% of Africa's total food imports.[13] 'Nontraditional' export products (flowers, semi-processed fruits and vegetables, and textile products), traditional products (coffee, cocoa, tea and spices) and tobacco constitute a major share of Africa's agricultural exports.

Africa's exports to India

Major agricultural commodities exported by Africa include cocoa and cocoa preparations, fresh fruits, vegetables and nuts, and fish/marine products. In value terms, on an average,[14] exports to India represented a meagre share of 4.8% for these major agri commodities exported from Africa, whereas 11% of India's agricultural imports were from Africa.[15] The year-wise trend for FY10 to FY14 shows that India's bilateral trade with Africa was limited to five major product categories in these years: fresh fruits, nuts and melons; fresh vegetables; coffee, tea and spices; cotton; and fertilisers. Further, trends across these five product categories have fluctuated over the years.

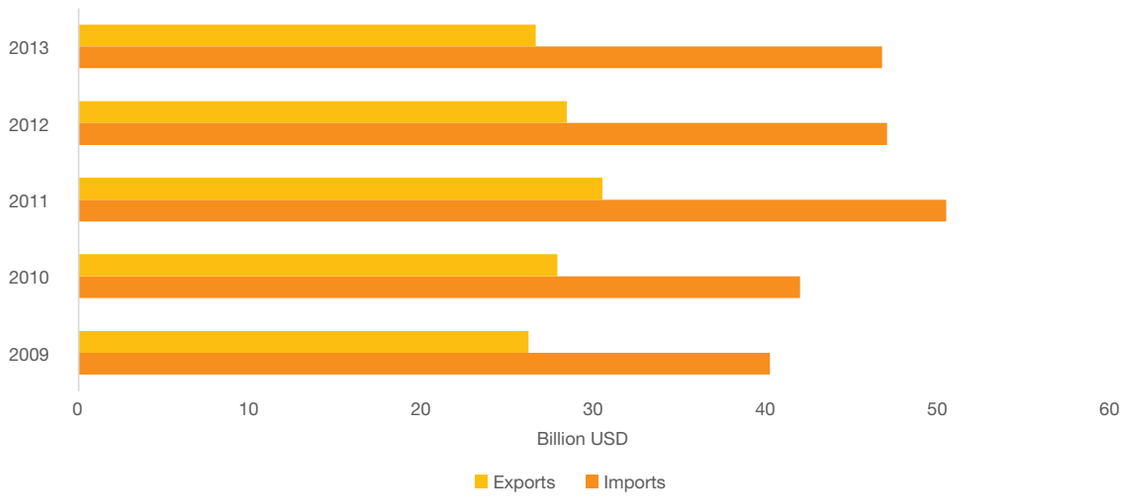
12 World Bank. (2013). Growing Africa: Unlocking the potential of agribusiness. Washington D.C. Retrieved from http://siteresources.worldbank.org/

13 FAO. (2011). Why has Africa become a net food importer? Rome.

14 Average of FY10 to FY14 export values

15 International Trade Centre (ITC): Trade Map. (2016). Retrieved from http://www.trademap.org/ and PwC analysis

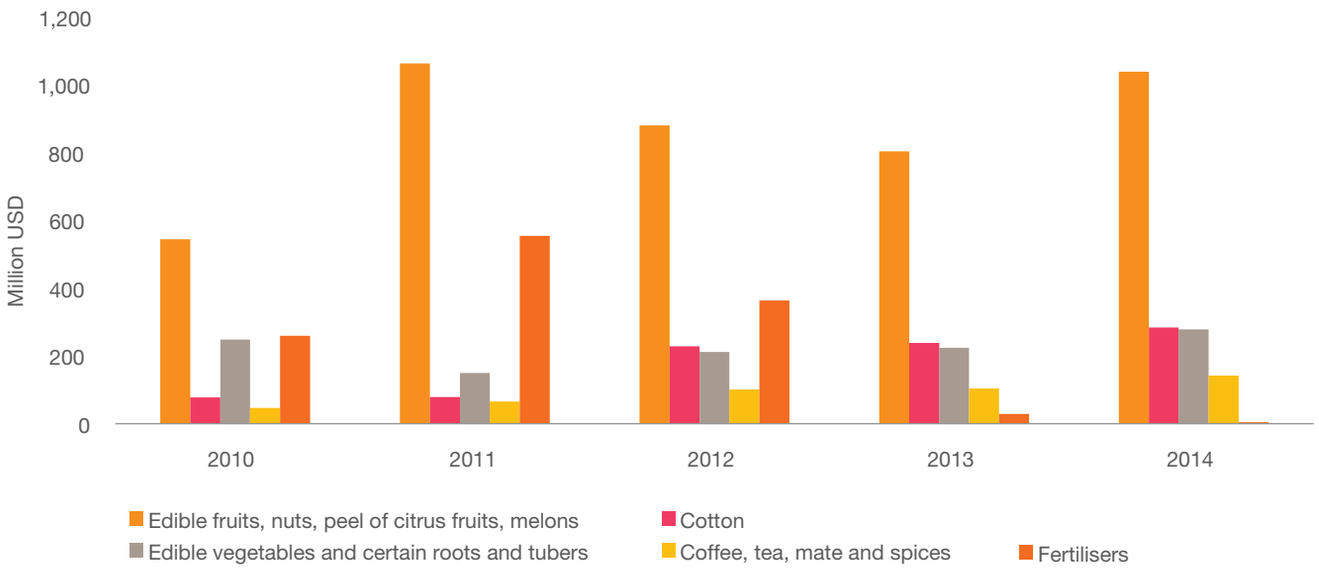
Figure 3: Comparative analysis of value of agri imports and exports of Africa



Source: FAO (2015) and PwC analysis



Figure 4: Year-wise trend for Africa's exports to India: Top exported agriproducts/commodities



Source: FAO (2015) and PwC analysis

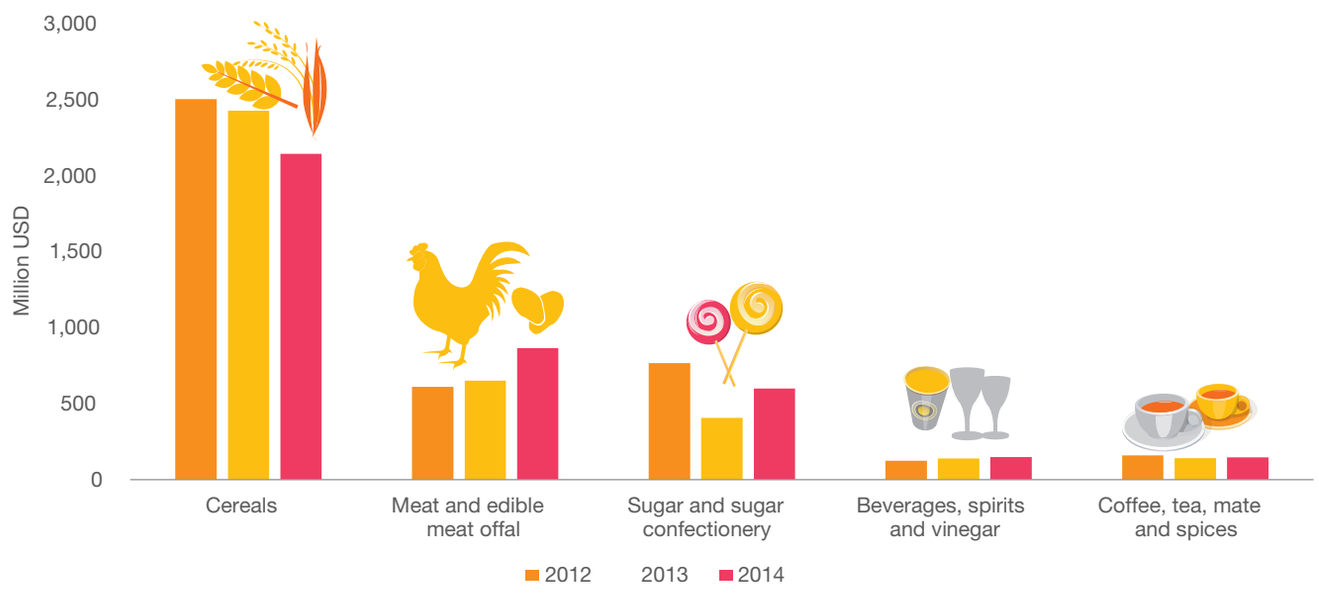
Africa's imports from India

Major agricultural commodities imported by Africa include cereals; animal fats and oils; dairy products, eggs and edible animal products; sugar and sugar confectionery; and edible meat. In terms of value, Africa imported agricultural products worth 4,205 million USD in FY13, wherein exports from India represented a meagre share of 5.1%.[16]

The year-wise trend for FY10 to FY13 shows that India's bilateral trade with Africa was limited to five major product categories in these years: cereals, edible meat, sugar and sugar confectionery, beverages/spirits/vinegar, and coffee and spices, with cereals, followed by meat and sugar and sugar confectionery, being the prominent product categories imported from India.

16 ITC: Trade Map. (2016). Retrieved from http://www.trademap.org/ and PwC analysis

Figure 5: Year-wise trend for Africa's imports from India: Top imported agriproducts/commodities



Source: FAO (2015) and PwC analysis

Based on the trade trends, it can be concluded that despite abundant natural resources and immense production potential, Africa is largely dependent on imports for agricultural and food products, even for staples like cereals (maize) and meat.

Partnering for growth in key agribusiness sub-sectors

Land and crops

Land as a factor of production is of immense importance and is a critical resource for agriculture. Economic prosperity and the quality of agricultural wealth that a nation possesses are directly linked, which in turn is dependent on the nature of soil, climate, rainfall, etc. The foundation of trade and industry lies in the agricultural products that a country produces. Industry also depends upon the availability of fuels, water, resources, etc., all of which are derived from land in some form or the other. Thus, all aspects of economic life—that is, agriculture, trade and industry—are directly or indirectly influenced by the availability and type of land.

Different areas have different land characteristics; however, the three main factors that affect the productivity of land are as follows:

- **Natural factors:** Soil, climate, rainfall and topography, which in turn influence agricultural productivity
- **Human factors:** Interventions used by man in the form of fertilisers, manure or mechanisation, etc., that help increase productivity.
- **Location factors:** Proximity to markets and trade hubs that help increase value—land areas that are nearest to trade hubs tend to be utilised more than a distant hinterland.[17]

Why Africa has become a net food importer

Agricultural land in Africa is approximately 40.52% of the total area. The African economy has been growing at an average rate of 7% from 2011–2013,[18] and the agriculture sector contributes 32% to the GDP.[19] On the other hand, approximately 60.48% of India's total land area is agricultural area[20] and contributes 18% to the GDP of the country.[21]

India has the maximum percentage (nearly 88%) of its agricultural area as arable land. Whereas Africa has only 19% of its agricultural area as arable land; its maximum agricultural land (nearly 80%) is under permanent meadows and pastures. A comparison of the various elements of land under agricultural area for India, Africa and the world has been depicted in the graph below.

17 Factors of production–Land.(2015). My Agriculture Information Bank, retrieved from http://www.agriinfo.in/?page=topic&superid=10&topicid=194

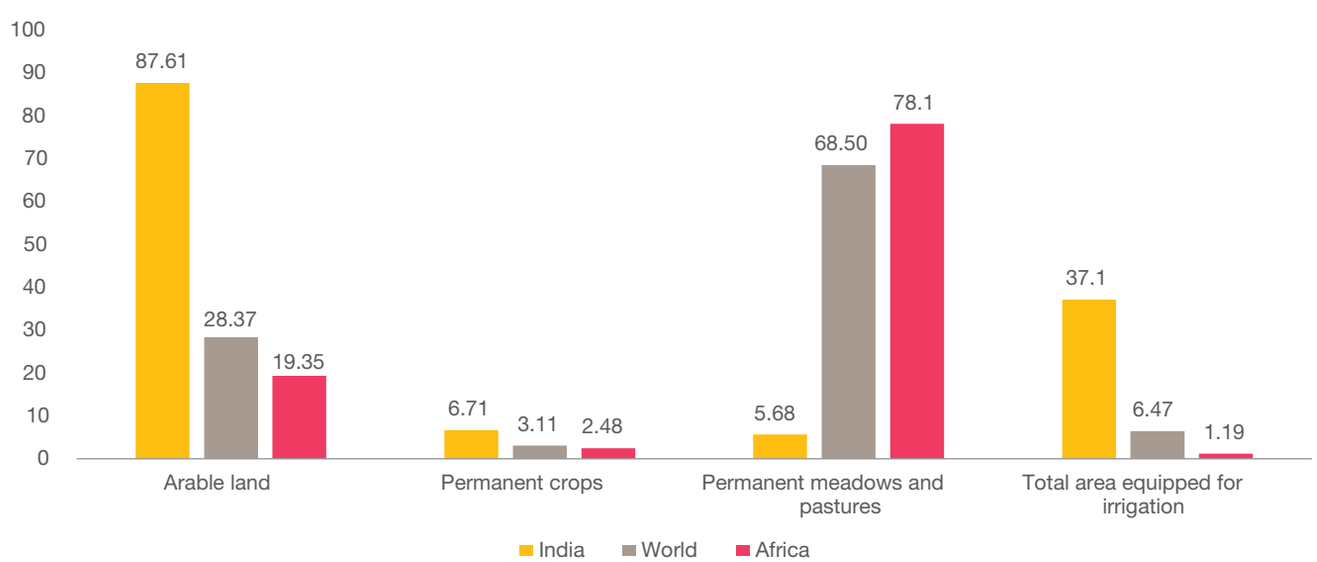
18 FAO, 2013

19 World Bank. (2013). Fact sheet: The World Bank and agriculture in Africa. Retrieved from http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/0,,contentMDK:21935583~pagePK:146736~piPK:146830~theSitePK:258644,00.html

20 FAO Statistics Division. Retrieved from http://faostat3.fao.org/download/M/MK/E

21 Planning Commission, GoI. (2015). Sector-wise contribution of GDP in India. Retrieved from http://planningcommission.nic.in/

Figure 6: Elements of land as percentage of agricultural area for India, the world and Africa (based on the average from 2009—2011)



Source: FAO (2013) and PwC analysis

On the available arable land, the major cereal crops that are grown in Africa are corn, wheat and rice, while bananas, pineapples and oranges are the major fruits. The major plantation crops include cocoa and coffee, which are among the key agricultural commodities exported from Africa.

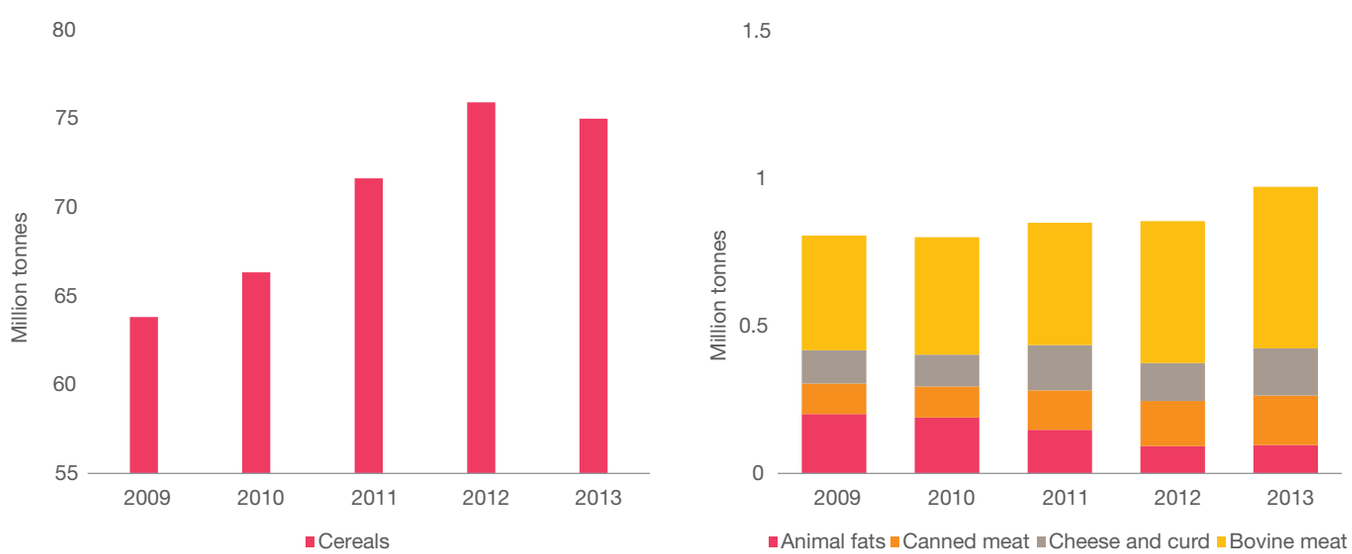
The following table lists the countries and the crops whose average production was reported to be more than 10 million tonnes from 2012–2014.

Sr. no.	Major crops grown	Country
1	Wheat, rice, maize, sorghum, potatoes, cassava, sugarcane, beans, nuts, oilseeds, cotton, tomatoes, onion, banana, pineapple, cocoa beans, fibre crops (jute, bast fibres, etc.), tobacco	Angola
2	Rice, maize, sorghum, potato and other tuber crops, sugarcane, cashew nuts, kola nuts, oilseeds, cotton, okra, maize, cocoa beans, coffee, tobacco	Côte d'Ivoire
3	Rice, maize, millet, potatoes, cassava, yams, sugarcane, beans, oilseeds, cabbage and other brassicas, onions, okra, banana, citrus crops, cocoa beans, rubber	Congo
4	Wheat, rice, barley, maize, rye, sorghum, potatoes, sugarcane, beans, peas, lentils, oilseeds, cotton, cabbage and other brassicas, tomato, onion, garlic, eggplant, citrus fruits, grapes, melons, mango, fibre crops (jute, flax, etc.), pulses	Egypt
5	Rice, maize, millets, sorghum, potato, cassava, sugarcane, beans, pulses, nuts, oilseeds, cotton, tomatoes, chillies, onion, citrus fruits, mango, pineapples, cocoa beans	Ghana
6	Wheat, rice, maize, sorghum, potato, cassava, sugarcane, beans, cowpeas, nuts, oilseeds, tomatoes, onion, beans, mango	Niger
7	Wheat, rice, maize, sorghum, potatoes, cassava, yam, sugarcane, cowpeas, nuts, oilseeds, tomato, onion, carrots, okra, pineapple, papaya, cotton	Nigeria
8	Wheat, rice, barley, maize, sorghum, potatoes, sugarcane, tobacco, nuts, oilseeds, cotton, tomato, pineapple, mango, rubber	South Africa

Source: PwC analysis

Despite the diversity in agricultural production and economic importance of the agricultural sector, agricultural imports have been constantly rising for basic commodities, such as cereals, animal fats and dairy products.

Figure 7: Import of cereals and other staple consumables in Africa



Source: FAO (2013) and PwC analysis

Land development issues and other causes of rising food imports

Arable land and agricultural land availability

Most African regions hold sizeable amounts of land, nearly 20–40% of land area is fit for agricultural production and has little or no climate, soil or terrain specific constraints to respond to rain-fed crop production. Despite such potential, most suitable land remains idle or badly maintained. Data shows that the utilised agricultural land per capita in Africa has declined.

Population increase also stresses arable land availability in Africa. For example, in 2005, sub-Saharan Africa had the highest proportion of agricultural land (relative to total land area) at about 40%, but available arable land per person shrank from 0.5 ha in 1960 to 0.2 ha in 2005 owing to increase in population. This also indirectly indicates that investment and land management policies aimed at expanding arable land have not been adequately implemented.[22]

Land development issues

Land development for agriculture in Africa is plagued by various issues—ranging from natural to political to economic to unequal distribution of land.[23] This has resulted in degradation of land and declining yields. The major land development issues affecting land use and availability in Africa are described below.

Population growth, migration and urbanisation

With increasing population, migration and urbanisation, the per capita availability of land, especially agricultural land, tend to follow a decreasing trend. For instance, in many countries in West Africa, as much as 50-75% of the population lives on 25% of the land along the coastal zones. Given the rising population, it is very likely that the pressure on urban and peri-urban infrastructure services will increase, thereby decreasing the per capita availability of agricultural land.

Global climate change

Though the magnitude of the effects of climate change is still unfolding, their impacts, such as reduced availability of water, saline intrusion, increase in temperatures, biodiversity loss and desertification are becoming prevalent, thereby reducing land productivity. In coastal countries, the effects are more severe owing to the rising sea level and inundation of the land, which have necessitated population relocation and further decreased the availability of agricultural land.

The scramble for Africa's land resources: The land grab

The accelerated exploitation of resources, coupled with the establishment of industries and infrastructure, has led directly to a 'new scramble' for Africa's land resources. Investors have already claimed millions of hectares (at least 1 million ha each in Ethiopia, Liberia, Mozambique, and Sudan between 2004 and 2009).[24] While this new scramble for Africa is generally seen in the context of valuable mineral endowments, the concept has become more widespread, in relation to demand for land for investments in timber, tourism, commercial development and, lately, food production for consumption abroad. Such investments in land are not governed by proper policies and regulations, thus leading to land exploitation and degradation.

Low yields and productivity

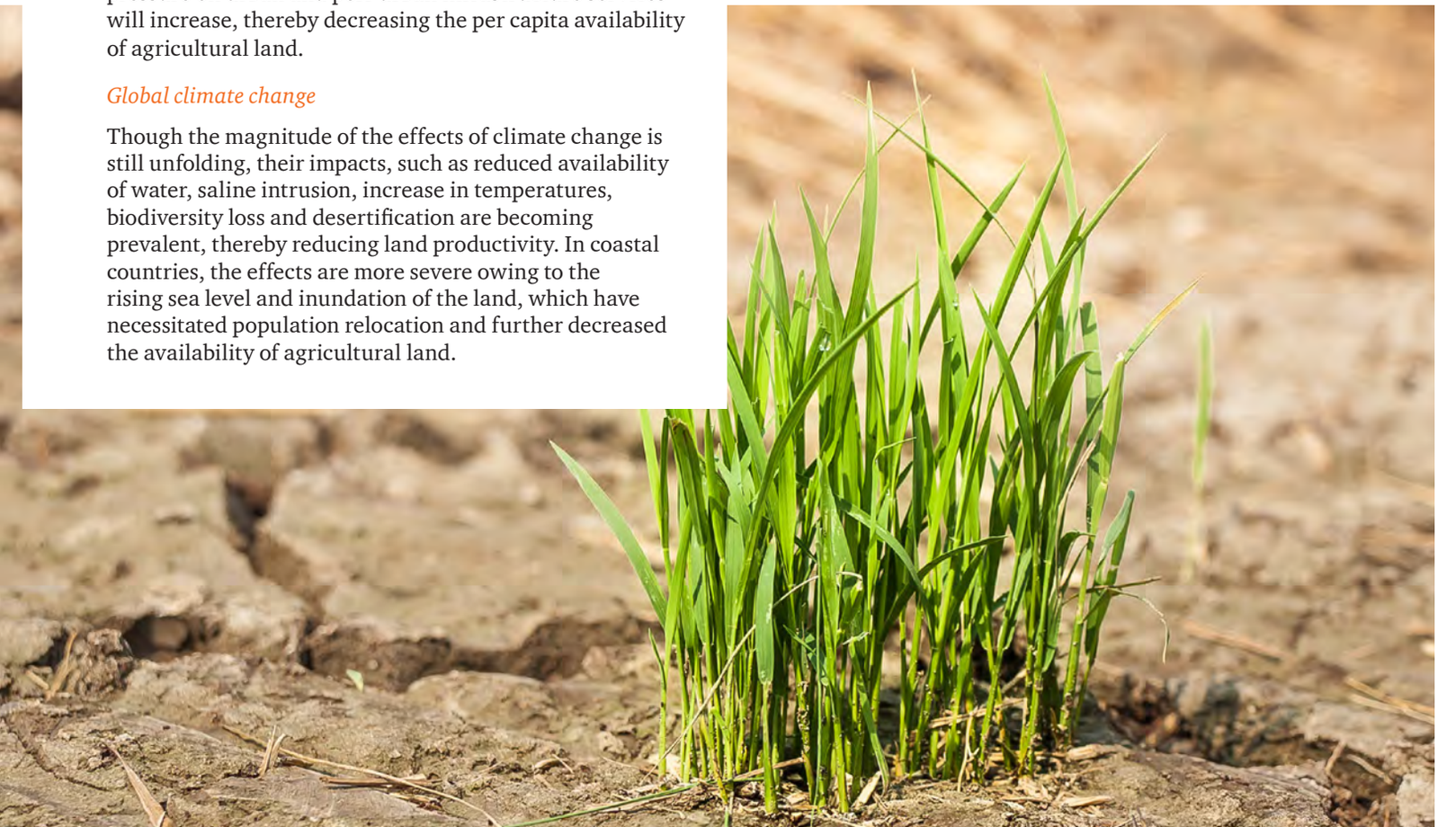
Low crop yields are also another major factor affecting food imports in Africa. The average grain yields remained at around one-third to one-half of the world's average (1.1–1.5 t/ha versus 3.2 t/ha) between 2000 and 2010. Zambia and Malawi had the highest average yields—about 2 t/ha during 2008–2010.[25] The average yields for fruits, vegetables, pulses and cereals in the world increased from 10.25–10.51 t/ha (growth rate of nearly 3%) from 2009 to 2013; however, for Africa, it increased from 8.5–8.6 t/ha (growth rate of only 1%).

22 *Rakotoarisoa, M., Iafrate, M., Paschali, M. (2011). Why has Africa become a net food importer? Trade and Markets Division, FAO. Retrieved from www.fao.org/docrep/015/i2497e/i2497e00.pdf*

23 *Economic Commission for Africa. (2010, March). Frameworks and guidelines on land policy in Africa. Retrieved from http://www.uneca.org/sites/default/files/PublicationFiles/fg_on_land_policy_eng.pdf*

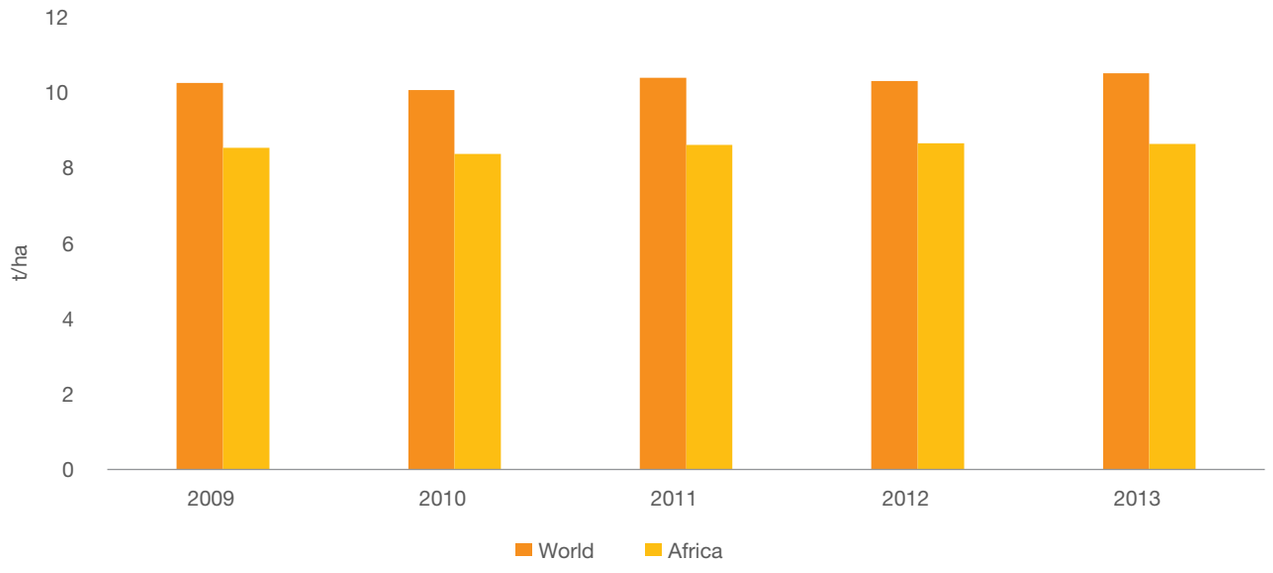
24 *Byamugisha, F. F. K. (2013). Securing Africa's land for shared Prosperity: A program to scale up reforms and investments. Africa Development Forum series. Washington, DC: World Bank. doi: 10.1596/978-0-8213-9810-4*

25 *AGRA.(2013). Africa agriculture status report: Focus on staple crops. Nairobi, Kenya. Retrieved from www.agra.org/download/533977a50dbc7/*



Apart from land degradation issues, other major reasons limiting the yield potential in Africa include ***limited access to essential inputs such as fertilisers, pesticides and farm mechanisation, and limited options for technology transfer due to high costs involved and lack of trained personnel.*** Another reason for the low yield is the ***severe water constraints*** that the continent faces. Water for food production is threatened by other uses of water for industries and urban centres.

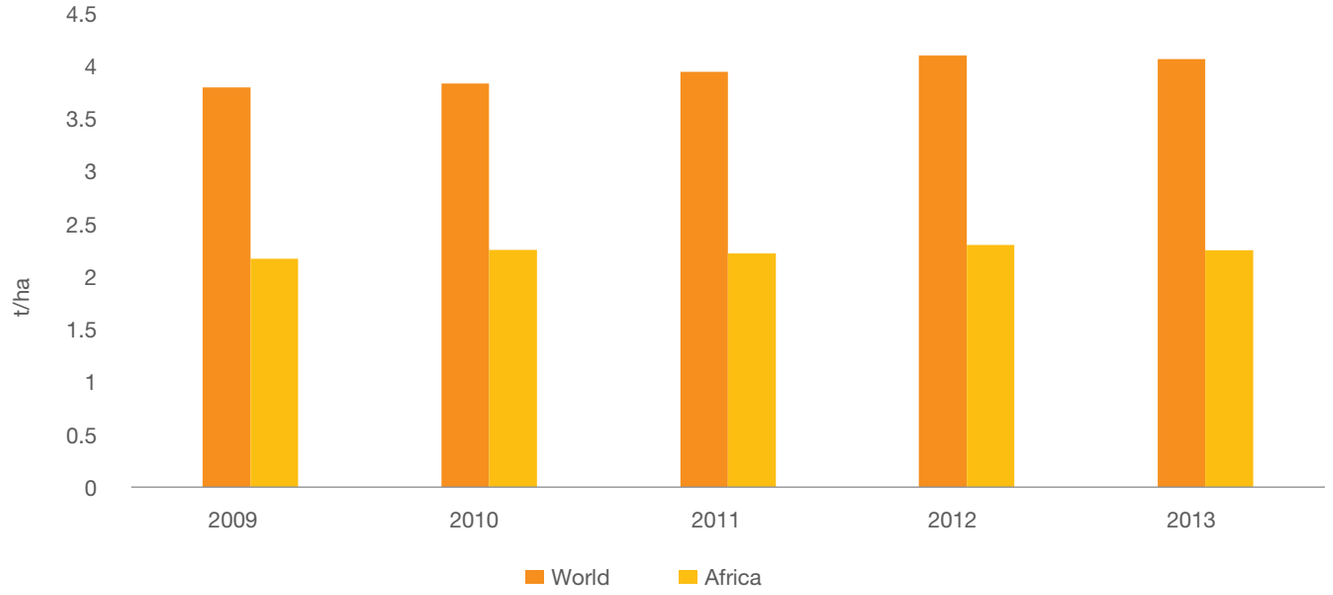
Figure 8: Comparison of average yield for vegetables, fruits, cereals and pulses between the world and Africa



Source: FAOSTAT and PwC analysis

Maize is a major staple food crop of Africa. The average yield for maize increased from 2.16–2.24 t/ha (growth rate of 3.5%) from 2009 to 2013, while the global average yield for maize rose from 3.80 t/ha in 2009 to 4 t/ha in 2013 (growth rate of approximately 7%).

Figure 9: Comparison of average yield for maize between the world and Africa in t/ha



Source: FAOSTAT and PwC analysis

The low productivity levels have resulted in a decreasing trend for per capita food production in Africa for the last 40 years, although there has been positive sector growth in past five to six years. This in turn has led to severe food and nutritional insecurity, reduced on-farm incomes[26] and contributed to farmers expanding production to less suitable lands, thus further extending the frontiers of degradation.[27]

Low investment in infrastructure and services

The main cause of Africa's inability to increase its exports is primarily the low yields. However, even in the case of countries such as **Côte d'Ivoire, which produces coffee, palm oil and cashew nuts, and Ethiopia, which is a top coffee exporter, issues such as lack of proper infrastructure (such as roads, ill-equipped harbours and ports) render the produce uncompetitive both in the domestic and export market.**

Possible areas of collaboration

A one-size-fits-all approach to African agricultural development will not lead to growth, because of the different nature of the economies and political and natural conditions. However, the common refrain is that Africa requires new and modern investments, be it in infrastructure, irrigation methods or other farming practices to be able to utilise its agricultural production and trade potential to the fullest.

Land records management

Introduction of digitisation of land records and GIS-based land survey systems, such as the National Land Records Modernisation Programme (NLRM) of India

Farm equipment

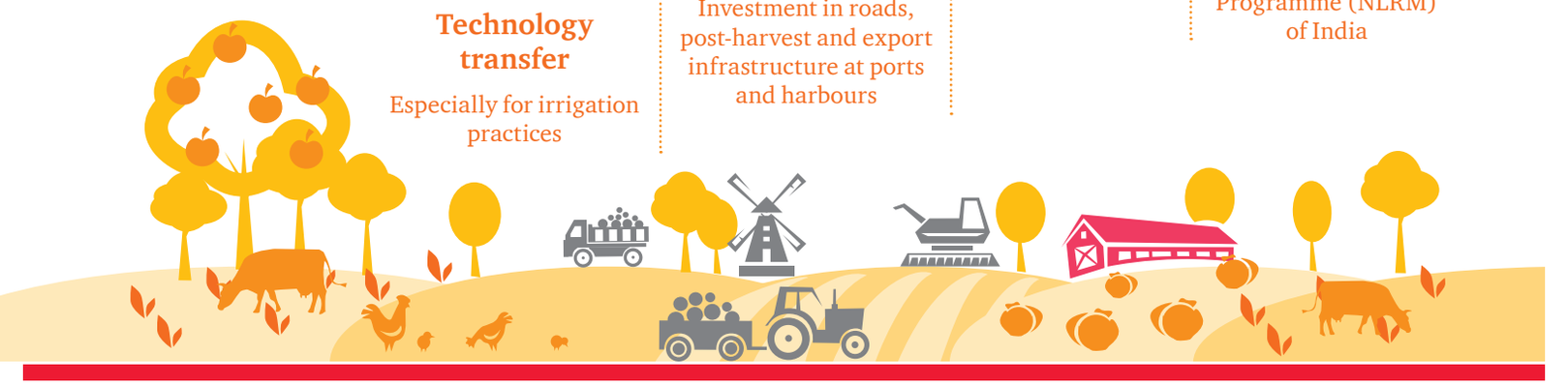
Introduction to mechanised farm machinery for soil health and water management

Provision of better infrastructure

Investment in roads, post-harvest and export infrastructure at ports and harbours

Technology transfer

Especially for irrigation practices



India as a crucial player: India holds 4.5 million ha of African land under foreign land acquisition deals and is perceived to be a significant player in farmland acquisitions.[28] About 70 Indian companies are already in the process of making an entry into the agriculture sector in Africa. The countries which offer big opportunities include Ethiopia, Malawi, Kenya, Uganda, Liberia, Ghana, Congo and Rwanda.[29]

Animal protein segment

The animal protein segment in Africa includes both livestock (milk, meat and poultry products) and aquaculture/fisheries products. Both these subsegments are critical to rural incomes, nutrition and food security, and resilience in smallholder integrated farming systems in most of Africa.[30]

Livestock sector in Africa

With about 300 million heads of cattle, more than 630 million sheep and goats, 140 million camels and more than 1.8 billion chicken and birds, the livestock sub-sector plays an important role in the life of rural communities in Africa.[31] A sustained increase in healthy livestock production can work as an essential tool for poverty alleviation and enhancement of food security in Africa. In most African countries, 60–80% of rural households keep livestock as mobile and liquid assets, income generators, and for household food security and nutrition.[32] The livestock sector accounts for almost one-third of the value added to African agriculture and is anticipated to become one of the main contributors to the sector in the coming decades. By way of comparison, in industrialised countries, livestock accounts for only 50–60% of the agricultural value added.[33]

Supply and demand of meat and milk products in Africa

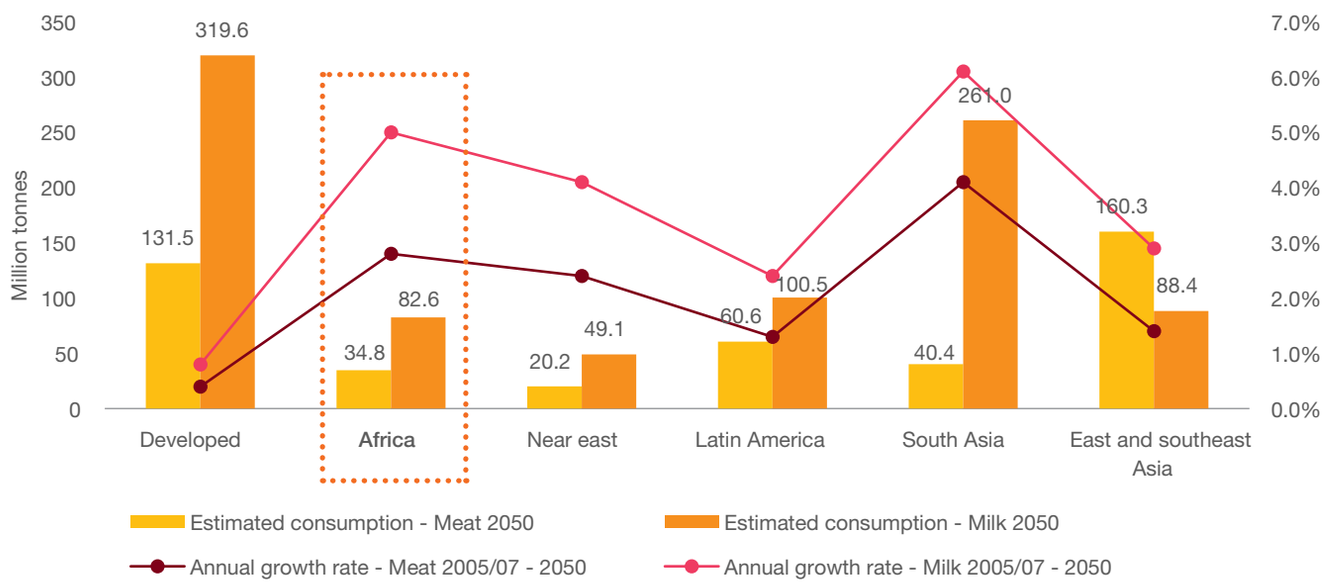
Cattle, chicken, goat, sheep and pig meat are commonly consumed in Africa. South Africa, Egypt, Nigeria and Morocco are the major meat-producing countries in Africa. These countries together produce more than 44% of the total African

26 *FAO. (2009). The least developed countries report 2009: The state and development governance. Geneva, retrieved from http://unctad.org/*
27 *Nkonya, E., Gerber, N., Baumgartner, P., von Braun, J., de Pinto, A., Graw, V., Kato, E., Kloos, J., & Walter, T. (2011). The economics of land degradation: Towards an integrated global. Berlin, retrieved from http://www.zef.de/index.php?id=2321&project=7&contact=1255&cHash=4d4caa72dab5d772bf02768f4042bc61*
28 *Oxfam India. (2014, April). Indian private agro-investments in Zambia: A case study.*
29 *Duttagupta, I., & Ghosal, S. (2010, 13 June). Indian companies get into commercial farming in Africa. The Economic Times. Retrieved from http://articles.economictimes.indiatimes.com/2010-06-13/news/27629818_1_land-lease-commercial-farming-agriculture*
30 *Smith, J. (2015). African livestock transformation: Background paper. Dahar, Senegal: United Nations Economic Commission for Africa.*
31 *FAO, 2013*
32 *Ibid.*
33 *Nouala S., Pica-Ciamarra, U., Otte, J., & N'guetta, A. (2011). Investing in livestock to drive economic growth in Africa: Rationales and priorities. Bulletin of Animal Health and Production in Africa, 59, 383–391.*

meat production. South Africa is the major producer of beef, chicken and pig meat. Egypt is known for the production of chicken and buffalo meat. Also, Nigeria is a major producer of goat meat and beef. On the other hand, Egypt, Ethiopia and Kenya are major milk-producing countries in Africa. According to the Food and Agriculture Organisation (FAO) projections, African meat and milk markets are projected to reach 34.8 and 82.6 million tonnes respectively by 2050—an increase of 145 and 155% respectively over 2005/07 levels.

This growth in demand for animal protein can provide major business opportunities for livestock producers, with implications for poverty reduction.

Figure 10: Projected growth of meat and milk markets in world's regions, 2005/07, 2030 and 2050

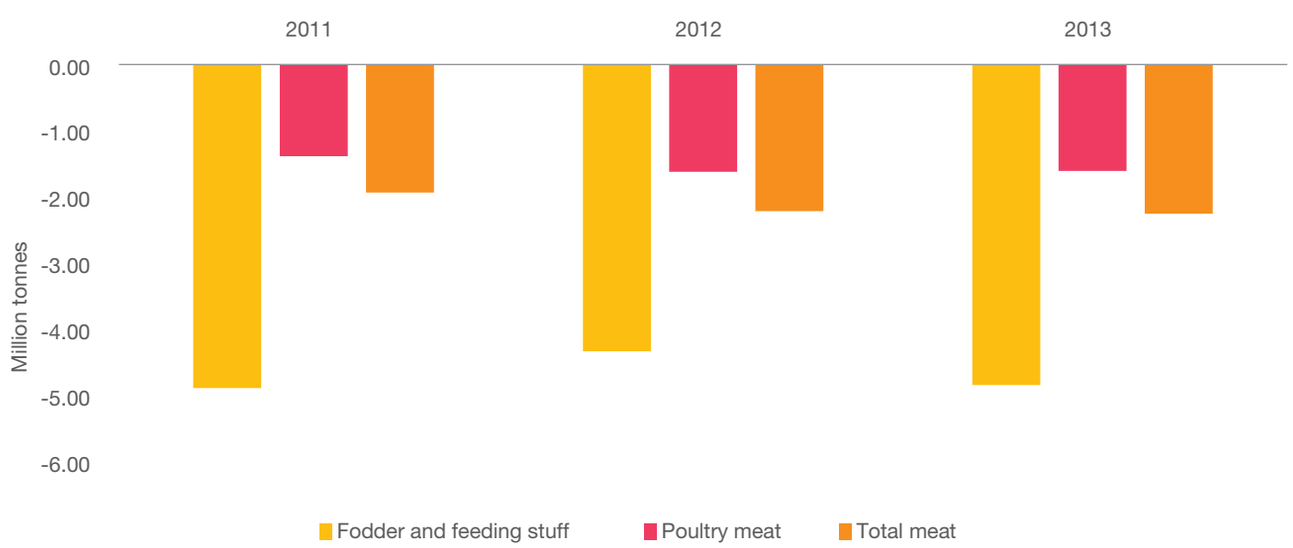


Source: PwC analysis elaborated from data of the FAO Global Perspective Studies Unit[34]

34 *Nouala, S., Pica-Ciamarra, U., Otte, J. & N'guetta, A. (2011). Investing in livestock to drive economic growth in africa: Rationales and priorities. Bulletin of Animal Health and Production in Africa, 59: 383–391.*

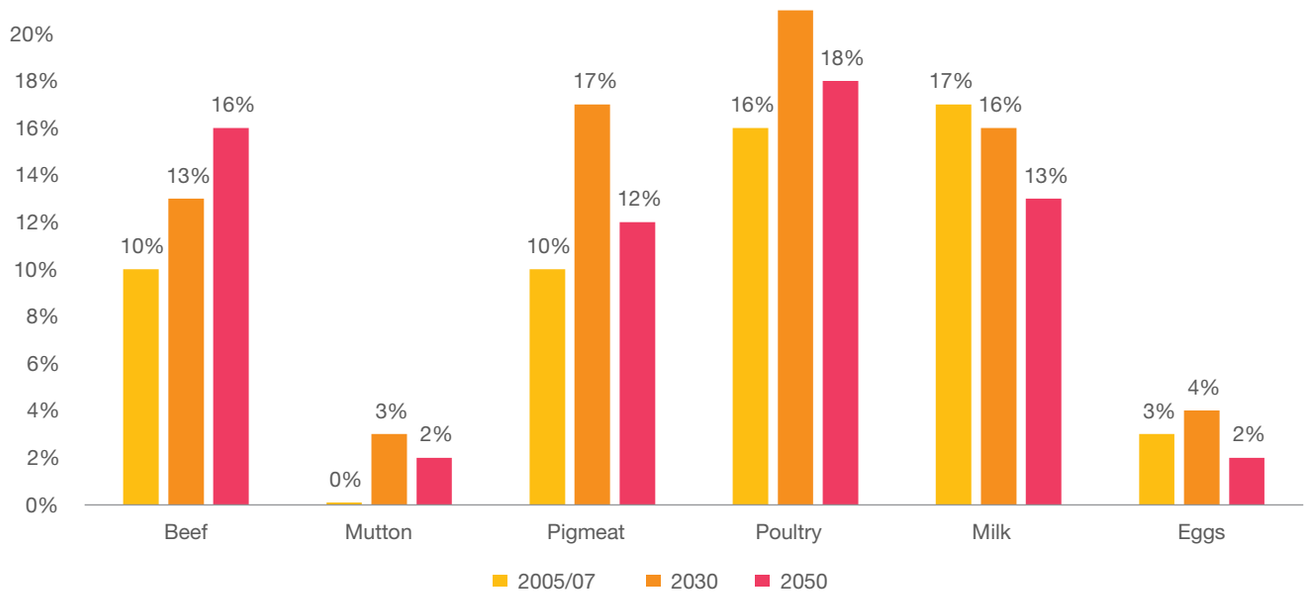
In spite of positive market opportunities, Africa's domestic livestock sector is unable to meet current demands. According recent FAO data, Africa currently has a negative balance of trade for almost all animal protein products. Feed and fodder requirements are also satisfied majorly through imports.

Figure 11: Africa's net trade position for major animal protein inputs and products



Source: FAOSTAT (2015) and PwC analysis

Figure 12: Africa's trade position (percent consumption from imports) for animal proteins from imports: 2005/07, 2030 and 2050



Source: PwC analysis elaborated from data of the FAO Global Perspective Studies Unit[35]

For the reference period from 2005/07 to 2030 and 2050, FAO estimates that Africa will become a net importer of livestock products. In 2030 and 2050, it is estimated that between 12 and 15% of African consumption will be supplied by foreign producers. Considering the supply scenario, Africa will find it increasingly challenging in coming years to fulfil this expected growth in demand for livestock products.

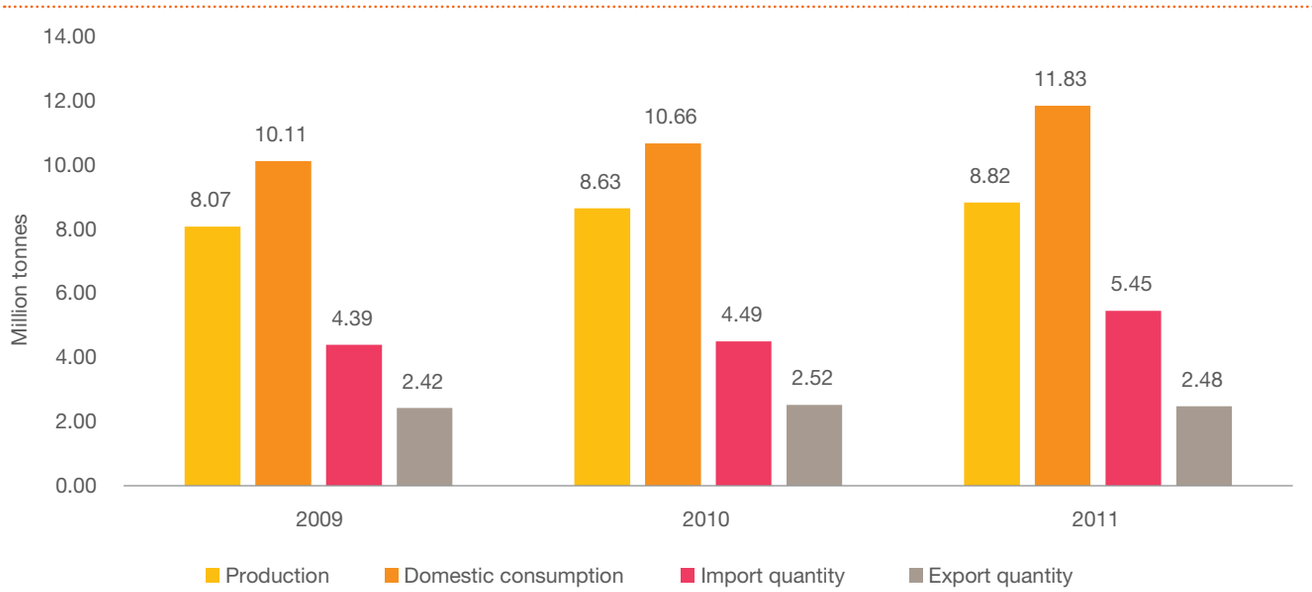
Fisheries sector in Africa

Africa is a continent that is endowed with an enormous coastline and plentiful fish resources in oceans, rivers, lakes and floodplains. While fishing in most of rural Africa tends to be overshadowed by agriculture and livestock raising, it is not a marginal sector. The fisheries and aquaculture sector contribute significantly to Africa's overall economy. Fishing provides direct incomes to more than 10 million people—half of whom are women—and contributes to the food supply of 200 million more. In FY11, the value added by the fisheries sector as a whole—which includes inland and marine capture fisheries, post-harvest, licensing of local fleets and aquaculture, was estimated to be more than 24 billion USD, representing 1.26% of the GDP of all African countries.[36]

Supply and demand of fish and marine products in Africa

In spite of its economic importance, the fisheries and marine segment in Africa is yet to realise its true potential. Africa's participation in the global fish trade remains insignificant. In FY14, despite a progressive trend for global fish trade, Africa accounted for merely 3.6% of the total global trade in fish. On an average, only 30% of the production is exported every year.[37]

Figure 13: Africa's production, supply and trade of fish, seafood and aquatic products



Source: FAOSTAT (2015) and PwC analysis

35 *Nouala, S., Pica-Ciamarra, U., Otte, J. & N'guetta, A. (2011). Investing in livestock to drive economic growth in Africa: Rationales and priorities. Bulletin of Animal Health and Production in Africa, 59: 383-391.*

36 *FAO, 2014*

37 *FAOSTAT (2016) and PwC analysis, last five-year average (calculated based on data availability)*

Further, production falls short of meeting the domestic demand, more than one-fourth of which is satisfied through imports, leading to a negligible surplus for exports.

Investment opportunities in Africa's animal protein segment

Although various African countries have some of the largest herds of livestock in the world, and the African population, in general, depends greatly on livestock for their livelihoods, the potential of the sector has not been fully exploited to significantly improve economic and social well-being, reduce poverty, create wealth, strengthen food security and health, and accelerate economic growth.

Challenges in the livestock segment: Lack of quality feed and fodder, animal health issues, improper sanitary measures, inadequate produce quality and insufficient remuneration limits the African livestock segment to realise its full potential.

Challenges in fisheries and marine segment: Other than deficient policy and institutional frameworks, tariff and other barriers, the segment suffers from a lack of proper infrastructure for capturing, storage, packaging and distribution of fish and marine captures, both at field (onshore/farm), processing sites and markets, inadequate hard and soft market and trade infrastructure, lack of capital, and technology and information-linked bottlenecks.

The animal protein segment in Africa has both livelihood-oriented keepers and business-oriented keepers. However, similar to the Indian industry, small livelihood-oriented keepers dominate the production end of the animal protein segment. Therefore, for the sector to realise its full potential, it is necessary to help these smallholders graduate their livestock/fisheries farming to sustainable income generating enterprises, to gain capability and competencies to cater to increasing supply requirements, both in domestic and international markets.

The solution: Considering these challenges faced by African smallholders and increasing demand from both domestic and foreign markets, there is a need to create structured marketing linkages by integrating smallholders with potential markets. Support and interventions from foreign players, who understand the market dynamics and can appreciate the consumer diversity, can help the African animal protein segment to emerge from these limitations and realise its full potential. India, which has similar experience in the meat and milk products segments, can share the learnings accumulated over the years.

The AMUL success story (Gujarat, India)

Anand Milk Union Limited (AMUL) is a classic case study to illustrate the importance of structured marketing linkages in achieving sustainable economic returns from a rural/smallholder enterprise. It has pioneered the cooperative model in the Indian dairy segment. It is the biggest dairy cooperative in India, established in the pre-Independence period in 1946, when the dairy sector in India was dominated by unorganised small players, with few private companies.

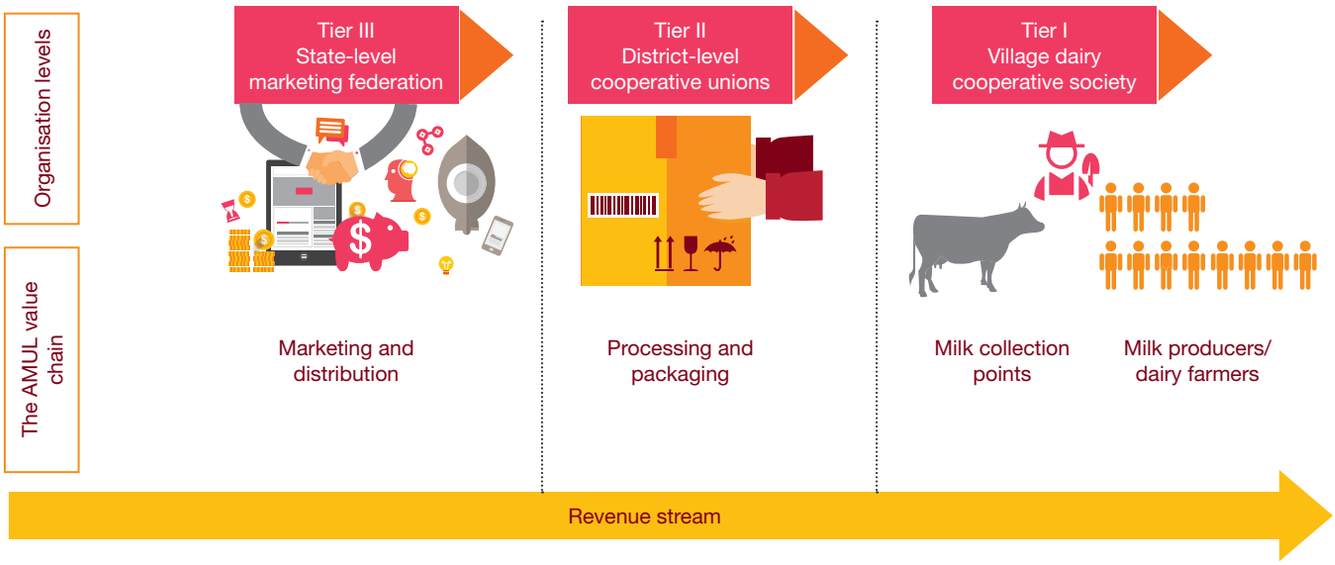
Amul started with two village societies and 247 litres of milk collected per day. Currently, in the state of Gujarat, Amul produces 10.16 million litres of milk daily, which is collected from 2.7 million farmers, processed through 30 dairy plants, and distributed through 500,000 retail outlets. The group turnover is estimated at 19,100 crore INR or 3.2 billion USD in 2013. At present, Amul's cooperative dairy model has been replicated across several Indian states, and is helping increase the incomes of 80-100 million farmer families across the country.

Source: National Dairy Development Board (NDDB), 2015



The intervention model: Under the model, the entire value chain—from procurement, to processing and marketing—is controlled by the farmer's cooperative, which is directly linked to the final customer. There are no middlemen; the cooperative collects the milk directly at the producers' doorsteps.

Figure 14: The cooperative intervention model of AMUL



Source: PwC analysis

Livestock owners are organised in small producer groups at the village level to form producer groups and cooperative societies. These producer groups are organised and managed by district-level cooperative unions, which are then managed and controlled by the state-level marketing federation, which directly supplies milk and milk products to the end consumers, after necessary processing and value addition. Disease management guidance and veterinary services, feed and fodder, and necessary training to livestock owners is provided by the state-level marketing federation through the district and the village-level cooperative societies. Producers are paid upfront based on quality of the produce. This ensures centralised quality management. Produce collected from the member farmers is dispatched to the district-level processing and packaging units. This ensures timely dispatch and appropriate value addition of the produce. This three-tiered centralised model helps in effective management and ensures coordinated delivery of services and products. To ensure farmers get fair share of returns, farmers are given positions at different levels of decision-making throughout the network. This structure also benefits producers through increased access to technology, training and veterinary services, and access to assured market and better remuneration, thereby contributing to their economic and social betterment.

The complex task of procurement is broken into various village-level small cooperatives and societies, while processing and distribution are centralised, making the supply chain agile and the entire operation lean, ensuring quality of produce and proper remuneration to producers. Overall, this system renders cost benefit to every member across the entire supply chain.

Expected impact and benefits: The model is applicable to both small and large milk producers and is well applicable to other livestock produce, like meat and fish products, with minor changes in the value addition process levels and levels of horizontal integration.

The African animal protein industry can benefit through this cooperative model by increased livestock and fisheries production through the following:

- Effective governance with centralised management, including livestock/fisheries keepers as decision-makers
- Coordinated delivery of services
- Horizontal and vertical integration of animal produce keepers
- Agile and lean value chain offers cost benefits and results in increased remuneration

Involvement of foreign players, with experience in similar markets, can provide added benefits like the following:

- Professional training and capacity building of animal keepers for enhanced production and productivity and improved quality management to meet international requirements
- Shared investment in infrastructure, along with opportunities for public-private partnership (PPP) for infrastructure development
- Enhanced opportunities for technology transfer
- Access to newer markets

India's role in growth of Africa's animal protein segment: Similar industry and market characteristics offer multiple collaboration opportunities between India and Africa. India's animal protein segment is also dominated by smallholder producers/keepers. It has also pioneered the cooperative model in its dairy segment and presents numerous learnings for the African animal protein segment.

African players can partner with Indian/foreign players, who can provide access to relatively more matured markets and also, can help Africa's animal protein industry to utilise the experience and expertise of these players to their benefit.

Agri inputs and farm machinery

The region's agriculture involves diverse crops and livestock but productivity is particularly important for cereals and starchy roots, which provide two-thirds of the total energy intake for the population (three-quarters for the poor).[38] Though there are increasing cereal yield trends in most sub-Saharan Africa countries, these yield levels remain low compared to other regions of the world.[39] As evident from the yield numbers presented above, despite of diversified agro-climatic advantages, agriculture productivity in Africa for almost all major food product categories lags considerably behind that of other continents, including staples such as maize and important African export commodities such as cocoa. In addition, prices of these commodities fall between import and export parity prices, limiting their international trading prospects.[40]

38 Diao, X., Thurlow, J., Benin, S., & Fan, S. (Eds.). (2012). Strategies and priorities for African agriculture: Economy-wide perspectives from country studies. Washington, DC: International Food Policy Research Institute.

39 Chauvin, N. D., Mulangu, F., & Porto, G. (2012). Food production and consumption trends in sub-Saharan Africa: Prospects for the transformation of the agriculture sector. New York, NY: United Nations Development Programme.

40 Africa Agriculture Status Report: Focus on staple crops. Nairobi, Kenya: AGRA, 2013

Other than land and soil degradation and structural and policy-level limitations, plausible explanations for low yields include **lack of timely access to quality inputs, such as seeds, fertilisers and pesticides and relatively low levels of farm mechanisation**.



Seed sector in Africa

Access to high quality, locally adapted, better resistant and high yielding seeds at affordable prices has long been recognised as an essential ingredient to increase crop productivity. It holds even greater relevance for Africa, where a variety of formal and informal seed systems exist. Diversity in structure of formal and informal systems also varies—depending on the type of targeted farmers (smallholders vs commercial), type of crop reproduction cycles and cropping systems (self-pollinating vs vegetatively reproducing crops), and geographic location. The seed systems in Africa also vary in terms of maturity–ranging from nascent to growing/mature seed systems.

Table 1: Stages of seed sector development in sub-Saharan Africa

Stage of growth	Stage 1 Nascent	Stage 2 Emerging	Stage 3 Early growth	Stage 4 Late growth	Stage 5 Mature
Improved seed adoption	Aid/relief programmes, Few commercial farmers	<2.5% Innovators	2.5-16% Early adopters	16-84% Early to late majority	>84% All but laggards
Breeding and variety release	No original breeding No formal variety release process	Some original breeding Variety release formalised	Strong breeding systems Significant policy issues preventing further growth	Robust breeding pipeline Favourable seed policies	Mostly private sector driven
Policy and regulation	Non-existent in most cases	Basic and incomplete	Evolving seed policy and regulations	Established and enforced	Industry-driven and self-regulating
Private sector participation	No private seed companies	Few small seed companies	Many small/medium seed companies	Many stable seed companies	Mostly large seed companies
Distribution system	Imported seed only	Limited agro-dealer network	Growing agro-dealer network	Strong agro-dealer network plus specialised outlets	Vertical integration
Country examples	South Sudan, Liberia, Sierra Leone, Angola, DR Congo	Niger, Mozambique, Rwanda, Mali, Senegal, Botswana, Madagascar, Ivory Coast	Burkina Faso, Ghana, Ethiopia, Tanzania, Nigeria	Uganda, Zambia Kenya, Malawi, Zimbabwe	South Africa

Source: This table is adapted from Africa Agriculture Status Report: Focus on staple crops, AGRA, 2013[41]

Africa's seed market is estimated at 1.5 billion USD—about 3% of the world total— and is expected to double to 3 billion USD within the next 10 years.[42] Currently, Africa is a minor player in the global seed trade, accounting for less than 2%. Approximately 80% of the seeds are distributed through informal seed systems, wherein the farmer saves and replants the seeds every year. Constraints holding back investment, progress and trade in this crucial sector include a highly fragmented seed system, inconsistent policies, standards, regulations and procedures, high costs for registering new varieties, and an inadequate infrastructure to support the development of the seed industry.[43]

The seed industry in Africa suffers from five major levels of bottlenecks:

- **Research and development (R&D)**: Lack of interest, capacity and investment of the public sector research system to develop new genotypes suitable for African agro-climatic requirements. Also, there is minimal or no interaction/technology transfer and knowledge sharing between public and private sector on developing new varieties.
- **Inefficient seed marketing channels** that limit the access of seeds to farmers in remote areas

41 Africa Agriculture Status Report: Focus on staple crops. (2013). Nairobi, Kenya: AGRA.
42 Bloomberg. (2012). Retrieved from www.bloomberg.in
43 Technical Centre for Agricultural and Rural Cooperation (CTA). (2014). Seed systems, science and policy in East and Central Africa.

- **Limited effectiveness of the formal system** in providing timely and adequate access to quality seeds of improved varieties
- **Limited access to markets** restricts the farmer's ability to spend on quality seeds/inputs
- **Limited access to financial support or credit lines** to buy quality seed or engage in seed production

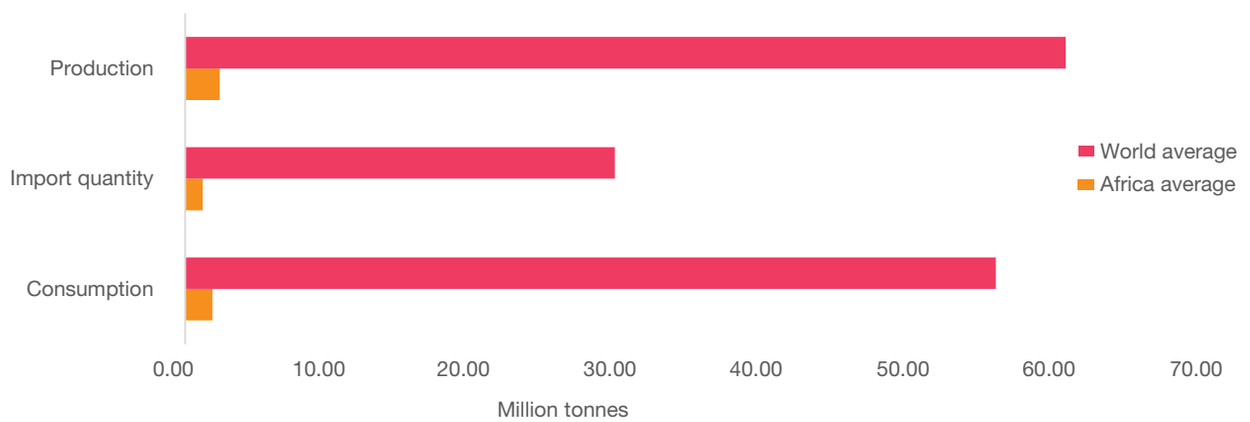
Also, most of the seed system development efforts are targeted only for maize, while other root and tuber crops (cassava, sweet potato, yams and potato), food legumes and small grains are left 'orphan' despite their significant contribution to the daily diet of an average African.

Agro-chemicals sector in Africa

Soil health and nutrition is critical to sustainable agriculture productivity and positive environmental balance. There is consensus among the R&D community that increasing fertiliser use by smallholder farmers is essential to reverse the declining trend of food production in Africa.[44] The use of fertilisers in Africa can be regarded as the lowest in the world, averaging only 8 kg per hectare with a range of less than 1 kg/ha in Uganda and Democratic Republic of Congo (DRC) to about 48 kg/ha in Zimbabwe.[45] The reason for the low fertiliser usage is the high cost of fertilisers, leading to an increase in the cost of cultivation for the farmers. Higher costs of other agricultural inputs due to poorly developed input market and costly transportation due to lack of infrastructure, further increase the overall cost of cultivation for farmers in Africa.

In general, the high fertiliser prices are a result of weak marketing linkages and underdeveloped fertiliser markets, which lead to high transaction costs. Consequently, fertiliser use by smallholder and subsistence farmers is limited, thereby affecting crop nutrition and productivity. These demand-side constraints, coupled with supply-side constraints in terms of raw material availability and high operational costs, exacerbate the transaction costs for the fertiliser industry. As a result, efficient and effective private sector-led development of fertiliser markets in Africa is hindered. Domestic production, consumption and imports for fertilisers in Africa is far below the respective global averages.

Figure 15: Fertiliser production, imports and consumption: Africa vs world



Source: FAOSTAT (2015) and PwC analysis

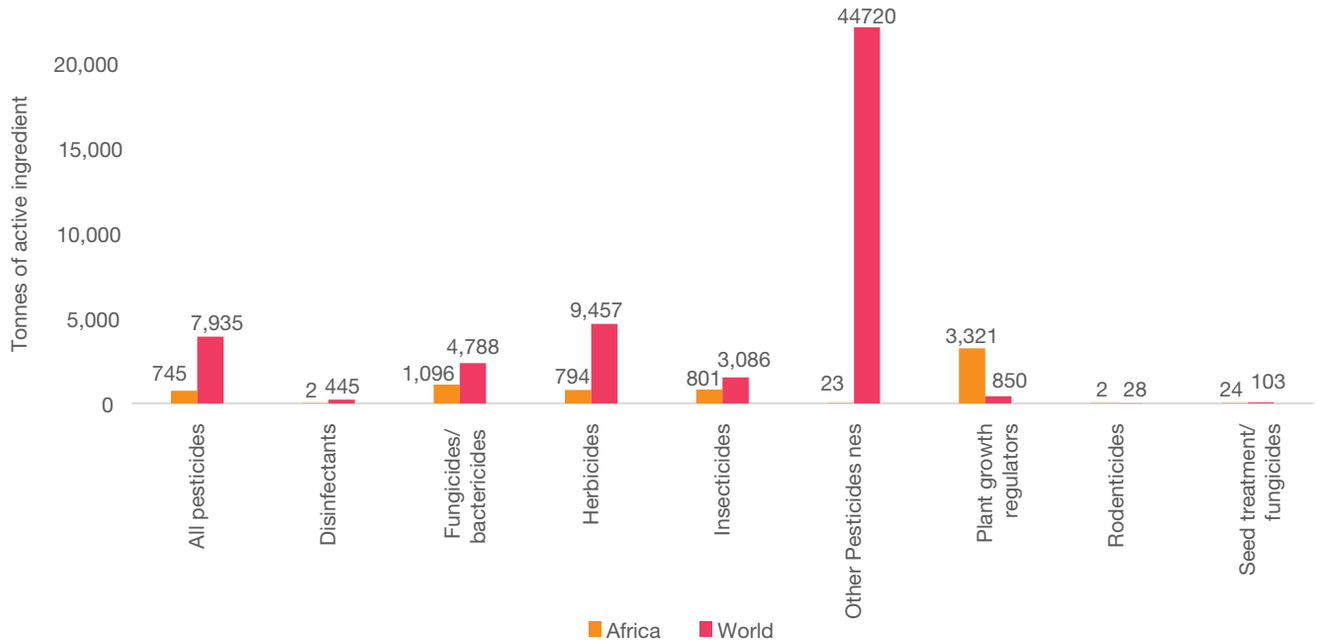
Lack of access to finance for various fertiliser value chain stakeholders is one of the key constraints for both supply and demand side of fertiliser market in Africa. Owing to the risky nature of fertiliser business, banks charge high interest rates and impose strict collateral requirements on potential borrowers (farmers, importers and agro-dealers).

At present, the African fertiliser industry is dominated by foreign players as these players are trying to tap this highly under developed market. Major companies include Belaruskali, Agrium, CF Industries Holdings, Yara International, Bunge (BG), Potash Corporation of Saskatchewan, E.I. du Pont de Nemours & Co. (DuPont), etc. Other famous companies operating in the region are One Acre Fund and Sasol, etc.

Pesticides industry in Africa also faces similar constraints—in terms of fragmented market structure, underdeveloped distribution linkages and access limitations. Average pesticide usage by African countries is much lower than the global average, except for plant growth regulators.

44 Sanchez, P. A., Denning, G. C., & Nzighubea, G. (2009). The Africa Green Revolution moves forward. Food Security, 1(1), 37–44. doi: 10.1007/s1571-009-0011-5.
45 African Agriculture and Productivity Report, AGRA: 2011

Figure 16: Average pesticide usage (by type): Africa vs world



Source: FAOSTAT, 2015, and PwC analysis

Pesticide use in Africa is concentrated on high-value cash crops intended for export. The leading pesticide users in sub-Saharan Africa are, therefore, nations with a well-developed cash-crop sector such as Cameroon, Côte d'Ivoire, Kenya, Sudan, Tanzania, and Zimbabwe.[46] However, with rising environmental concerns and rapid land degradation, the advocacy for alternate disease management measures; such as use of bio pesticides and disease resistant varieties, is gaining voice.

Farm machinery sector in Africa

Hand-tool technology and manually powered machines are the most commonly used farm machinery used by smallholders in Africa, particularly in sub-Saharan Africa. Availability and use of farm power is a major limiting factor affecting intensification of agriculture in sub-Saharan Africa.

According to FAO (2014), the main reasons why Africa should replace the power source for crop production from muscles (both human and animal) to tractors or other mechanised farm power sources are given below:

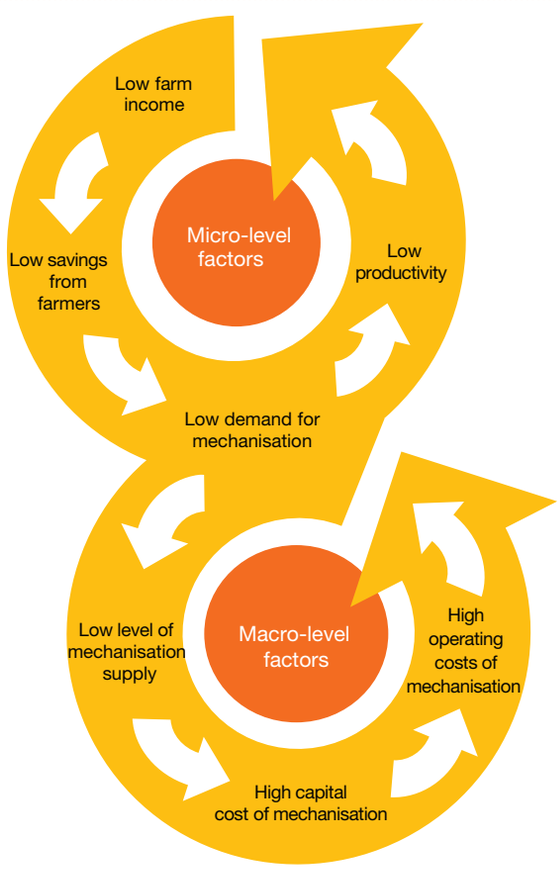
- Mechanisation provides the ability to perform right operations at the right time to achieve the production potential by raising productivity levels.
- Mechanisation reduces human drudgery and can compensate for seasonal labour shortages. In fact, mechanisation allows humans to be freed for more productive work.
- Mechanised farm power is multifunctional by characteristic and can also be deployed for transport and stationary power applications as well as in infrastructure improvement (drainage, road works, etc.).

46 Pesticides and the Agrichemical Industry in sub-Saharan Africa, U.S. Agency for International Development

47 Fuglie, K. O. & N. E. Rada. (2013). Resources, Policies, and Agricultural Productivity in Sub-Saharan Africa. ERR-145. Washington, DC: US Department of Agriculture, Economic Research Service.

Use of irrigation machinery is also expected to increase in the near future with change in environmental and precipitation patterns. In such a scenario, reliance on rain fed agriculture would not work. Estimates for Africa predict that average yields in irrigated farms are 90% higher than the yields of nearby rain-fed farms.[47]

Figure 17: Factors weakening the demand and supply of agricultural mechanisation in Africa



Source: PwC analysis (adapted from FAO report, 2013)

Despite of these perceived benefits, farm mechanisation in Africa is extremely low. In contrast to other countries that experienced the Green Revolution (e.g. India), the farm power available per area of agricultural land has declined or at best stagnated in many sub-Saharan Africa countries over the past decades, resulting in sub-Saharan Africa agriculture increasingly relying on human muscle power.[48] Only 5% of arable land in Africa (excluding Egypt and Mauritius) is under irrigation as compared to an average of 38% of arable land under irrigation in Bangladesh, Brazil, China, India, Pakistan, Philippines, Republic of Korea, Thailand and Vietnam taken together. Similarly, there are only 28 tractors per 1,000 hectares of land as compared to an average of 241 in these select countries.[49]

Major challenges faced by the African farm machinery sector are listed below:

1. Low farmer income results in low demand of agricultural inputs, including quality seeds, fertilisers and farm machinery. This results in low level of agricultural productivity, leading to a continuum of low farmer incomes.
2. The low demand of farm machinery leads to supply-side challenges limiting the mechanisation supply. Such supply-side challenges include high capital and operating costs of farm mechanisation at the macro level. This in turn leads to low demand for farm machinery.

These challenges are exacerbated by the lack of agri-finance mechanisms for both farmers and machinery suppliers.

Investment opportunities in Africa's agri-input segment

Opportunities in seed sector

Access to quality seeds, including high-yielding and hybrid seeds, is a must for African seed systems to achieve increased crop productivity and improve farm incomes, and to consequently ensure better nutritional food security for the region. Literature review suggests that concrete opportunities exist for greater integration of the formal and informal seed systems, revolving around fostering R&D in the sector to develop improved varieties, structuring marketing channels to include smallholders and marginal farmers in remote rural areas, and strengthening linkages to local and regional markets to enhance income improvement opportunities for farmers.

Considering the anticipated growth and the current structure and stage of seed sector development in Africa, the sector is attracting investments from domestic, regional and multinational seed companies. The sector is currently dominated by local start-ups; however, investments from regional and multinational players are on an increasing trend. Investment opportunities exist across the seed value chain, starting from seed production and processing to seed marketing and distribution. While a better seed production and processing system will provide access to the right quality seeds suitable for the local climatic and ecological requirements, improved seed marketing and distribution systems will ensure timely access by farmers at affordable costs.



Over the last few decades, the Indian seed sector has undergone a revolutionary transformation owing to joint efforts from the public as well as private sectors and has emerged as one of the largest agricultural seed markets globally. The sector has focussed on developing efficient seed systems with greater involvement of the public sector in research and varietal development, and the private sector sharing the responsibility of marketing, distribution and dissemination of improved varieties.

Public research agencies adopted a targeted research plan and provided access to genetic material and scientific expertise to both local and multinational private players to facilitate the improvement of better crop varieties that are more suited for the Indian climate. Private companies are responsible for the final development of improved seed varieties and seed distribution. This ensured timely and affordable access to a majority of farmers.

On the same lines, investment in Africa's seed sector needs to be targeted to specific crops that are identified based on the regional potential. The investments should be channelised as per pre-defined public and private sector roles. This change, coupled with targeted investments in public plant breeding and PPPs, can result in vibrant and sustainable seed supply systems in Africa.

48 *Baudron et al. (2013). Appropriate and equitable mechanization in Africa through conservation agriculture, use of two-wheel tractors, and involvement of the private sector. CIMMYT-Ethiopia*

49 *World Bank Indicators, World Bank, 2013*

The African seed sector can also look towards developing partnership opportunities at three levels: government to government, government to private sector/PPP and private to private partnership in agriculture. This will help the sector to adopt the learnings from the Indian experience to its benefit and will also, offer marketing opportunities for the Indian players.

Opportunities in the agro-chemicals sector

Considering the challenges faced by the agro-chemicals sector in Africa, it is imperative to increase fertiliser use from the current 8 kg to 50 kg nutrients per ha by improving fertiliser availability at prices affordable to smallholder farmers, through interventions at marketing, policy and socio-economic environment levels. Similar to seed sector, opportunities exist across the fertiliser supply chain, starting from production to marketing and distribution. Investments from foreign players with experience and expertise of operating in similar markets, could come handy. Africa's fertiliser sector should prioritise both domestic and foreign investments in following activity areas:

- Development of domestic fertiliser manufacturing capacity
- Development of financing mechanisms to support fertiliser production, distribution and access to farmers, with credit guarantees provided to fertiliser importers and distributors to ensure adequate fertiliser availability to meet increased demand
- Support for the establishment of regional fertiliser procurement and distribution facilities to improve farmer access

New Partnership for Africa's Development (NEPAD) has worked closely with the African Union Commission (AUC) and the African Development Bank (AfDB) to establish the Africa Fertiliser Financing Mechanism. Over 35 million USD has been mobilised and will be directed to countries through country roundtable processes.[50]

Government interventions are also needed to ensure availability of the right type of fertilisers, at the right price, and at the right times. Subsidies can be helpful,[51] but strong governance and farmer education are both essential for success.[52]

Opportunities in farm mechanisation sector

Considering the prevailing scenario and the perceived benefits of agricultural mechanisation for intensification of African agriculture, efforts are required both at policy and industry level. Policies should provide for creating conducive financing mechanisms and tools for both buyers and suppliers to overcome the challenges faced by the sector.

To increase the availability of mechanisation, investment from foreign players can also be encouraged, especially players with similar land holding patterns and consumption requirements, such as India. Consumption requirements in more developed countries are very different from those of India and Africa, owing to the difference in farm holding patterns and availability of farmer assets. Agricultural equipment from India can be adopted in Africa, with minimum customisation, as both regions have smaller landholdings and farmers have limited disposable incomes for utilising (purchasing/custom hiring) such assets. This would enable the businesses to save on customisation and high inventory costs due to demand gluts in Africa. Similar opportunities also exist in the irrigation sector, where the internal rates of return on irrigation projects are estimated to reach as high as 28%, depending on the type of irrigation and other conditions.[53]

50 UNDP African Facility for Inclusive Markets, 2013
51 Africa Progress Panel, 2010
52 Fuglie, K. O. and N. E. Rada. 2013. Resources, Policies, and Agricultural Productivity in sub-Saharan Africa. ERR-145. Washington, DC: US Department of Agriculture, Economic Research Service.
53 You, L., Ringler, C., Wood-Sichra, U., Robertson, R., Wood, S., Zhu, T., Nelson, G., Guo, Z., & Sun, Y. (2011). What is the irrigation potential for Africa? A combined biophysical and socioeconomic approach. Food Policy 36: 770–82



Food processing and value addition

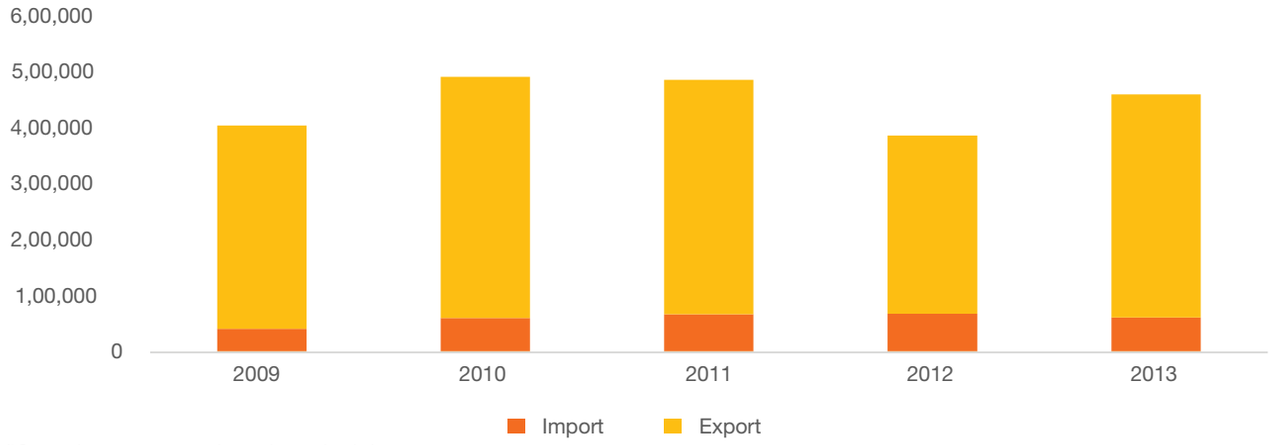
Africa's urban population is expected to increase from 414 million to over 1.2 billion by 2050.[54] This increase in urban populace generates demand for products that are fast and easy to use, and to produce such products at least one processing stage is required between the field and the shopping basket.

The exports in Africa from mid-1990s started to fall. Cocoa alone accounted for 70% of the continent's agricultural exports; other products such as coffee, tea, cotton, sugar, shellfish and fruits such as pineapple and banana constituted the rest of the export basket. Due to lack of diversification both within agricultural products and other industrial products, the export base has declined.

Currently exports are largely based on unprocessed products (less than 6% of African cotton is processed, and only 25% of cocoa is processed as most of the processing is done in importing nations).[55]

20% of the GDP is contributed by agribusiness input supply, processing, marketing and retailing. The urban food markets are set to increase to 400 billion USD by 2030 and will require investments in processing, logistics, market infrastructure and retail networks. The rising middle class is also seeking greater diversity on its food plate. The sectors likely to be in limelight are rice, feed grains, poultry, dairy, vegetable oils, horticulture and processed foods for import substitution, along with the traditional tropical exports and their derived products (especially cocoa, rubber, cashews and palm oil), together with some higher-value horticultural crops, fish and biofuels for exports.[56]

Figure 18: Import vs export of cocoa* in Africa (based on an average from 2009–2013)



*(*Cocoa butter, paste and powder and cake)*

Source: FAO (2013) and PwC analysis

54 Africa and Asia to lead urban population growth in next 40 years, UN News Centre, 2012
55 Agriculture in Africa: Transformation and outlook; NEPAD–Transforming Africa, November 2013
56 Growing Africa: Unlocking the potential of agribusiness, The World Bank, January 2013



Some of the major food processing industries that are already in operation and the source from where they source their raw material is provided in the table below:[57]

Table 2: Major food processing industries in Africa and their raw material source

Food processing industry	Regions (raw material source)
Milling and baking; confectionery (snacks and treats), beverages, value added meat products, fruit and vegetables	South Africa, Cameroon, Kenya and Zimbabwe
Groceries (tea, coffee, biscuits and snacks) Frozen (fish farming, fish and seafood products) Fresh to market (fresh and canned vegetables, especially mushrooms) and juices	South Africa
Bread, flour and maize meal	South Africa
Baking aids or cake mixes; tea/coffee, breakfast cereals, biscuits, condiments, juices, dried fruits and animal feeds	South Africa
Milling, baking, processed fish, beverages, with high-end specialty of ready-to-eat meals	South Africa
Cream, milk, flavoured milk, condensed milk, yoghurt, cheese, health teas, butter, spreads, desserts and beverages like fruit juices, nectars and flavoured iced teas	South Africa with subsidiaries in Botswana, Namibia, Swaziland and West Africa
Fast moving consumer goods (FMCGs) in foods, home and personal care products Product line includes spices, sauces, dressings, margarine, teas, syrups and food solutions	South Africa
Breweries	South Africa and Namibia
Wines, spirits and flavoured alcoholic beverages, including Amarula cream liqueur (the world's most consumed exotic liqueur brand)	South Africa
Sugar	South Africa, Malawi, Mozambique, Swaziland, Tanzania and Zambia

Source: PwC analysis (adapted from Food Processing Ingredients Market Report, USDA Foreign Agriculture Service, 2013)

South Africa: The current hotspot in food processing in Africa

Though Africa as a continent is net importer of staple agriculture goods, the South African region holds the promise to develop into a food-processing hub as it is still one of the net exporting region of Africa. The export group comprises of raw sugar, fresh grapes, citrus, nectarines, wine and deciduous fruits.[58] South Africa also is home to the world's third largest brewery—SABMiller.

The population of the region is expected to increase by 20% of the existing level, to about 60 million by 2050. Therefore, the country will have to provide for an additional 20% of volume of food requirements. With a projected increase in per capita income from 3,710 USD in 2010 to 9,308 USD in 2050, the population is expected to undergo a drastic shift in dietary patterns and choices. It is predicted that the shift will be more towards protein-based foods and higher oil and fat content compared to grain and cereals based foods.[59]

The food processing industry (inputs, primary production and processing) contributes approximately 14% of the GDP of South Africa and employs 10% of the population in the formal sector.[57]

South Africa has five prominent food-processing value chains: meat, poultry and seafood; fruit and vegetables; confectionery; milk and dairy products; and grains and related products. However, these value chains are facing strategic issues, which have been detailed out in the following diagram:

Meat, poultry and seafood

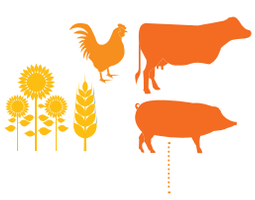
- Domestic poultry and pork industries are under pressure from low-cost imports.
- Lack of certifications, regulations have limited international trade opportunites.
- Import of processed products have resulted in low investments in local industries.

Fruit and vegetables

- High cost of packaging is a major disadvantage.
- There is low investment in the fruit and vegetable processing industry.
- There is an increase in the export demand for fresh produce.

Confectionery

- Import of processing inputs has lead to the local industry losing its market share.
- Small producers struggle to find access to larger retail chains.

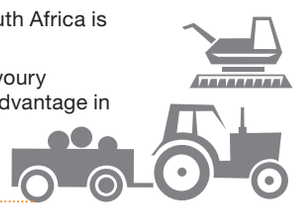


Milk and dairy products

- Raw material availability is a major constraint.
- Import of ultra high temperature (UHT)/ sterilised products has increased pressure on the domestic market to sustain.

Grains and related products

- The maize value chain in South Africa is strong.
- Innovation in the form of 'savoury additions' will be a definite advantage in the local market.



57 Food Processing Ingredients Market Report, USDA Foreign Agriculture Service, 2013
58 South Africa: Food & Beverage Industry Food Processing, Swiss Business Hub South Africa, December 2011
59 Barnes, J. South-African and global food processing trends: Development implications, benchmarking and manufacturing analysts

Key challenges for the development of food processing sector in Africa

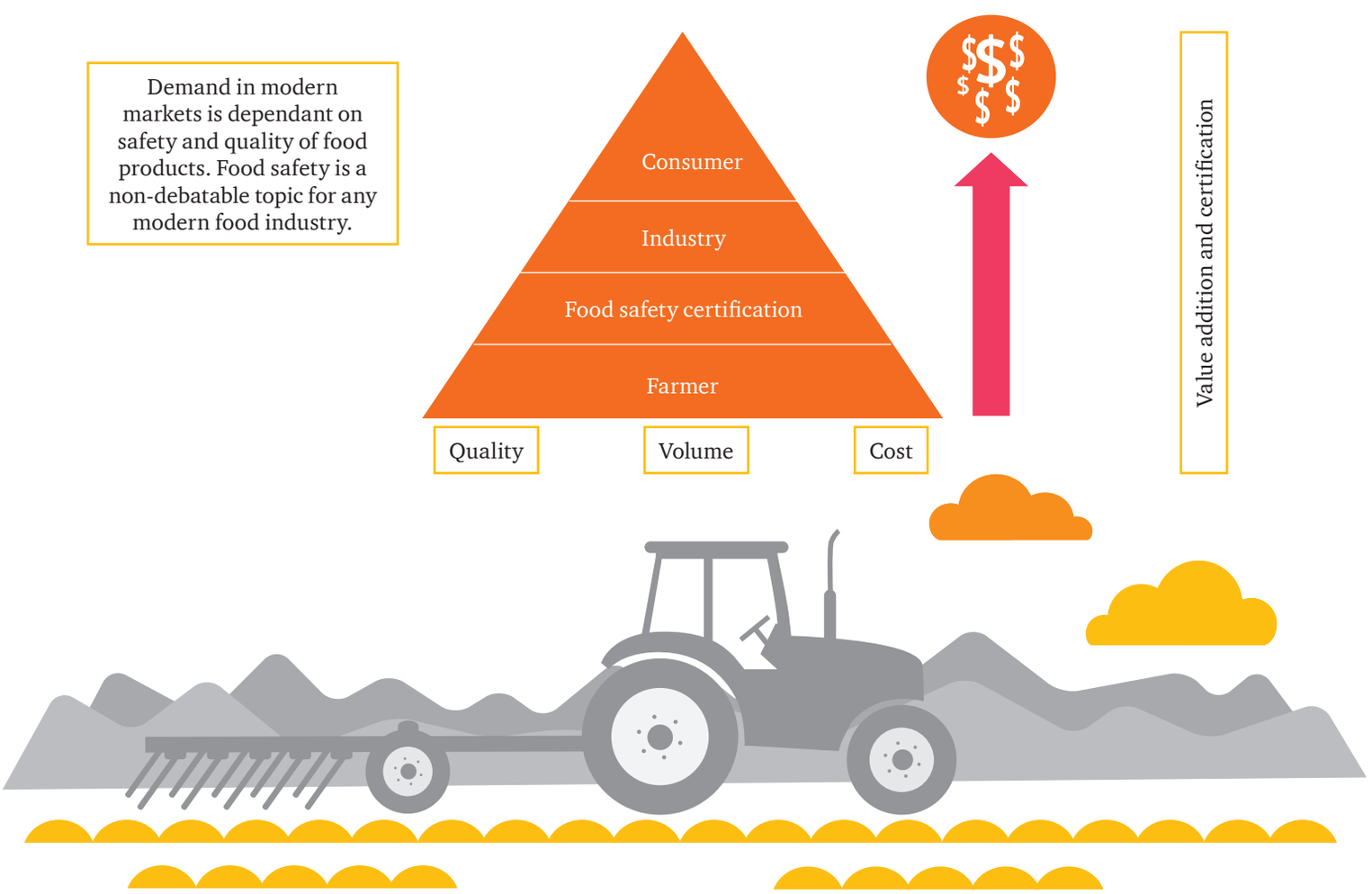
Most of the food processing industries mainly source the raw material from Africa; however, for Africa to become self-sufficient in food processing, there are certain key constraints that need to be overcome:[60]

1. **Low agricultural productivity and post-harvest losses:** The growth and competitiveness of any sector is directly linked to its raw material supplies. Along with increase in production, managing post-harvest losses through proper disease and pest management and safe storage practices are equally important. For instance, in sub-Saharan Africa, average post-harvest losses are reported to be over 40% (up to 30% in cereals and 70% in some fruits and vegetables).
2. **Lack of capacity building in agro-industry and market linkages:** With all the focus on increasing production, capacity building for post-harvest handling, storage and processing for crops is low in the continent, which contributes to the increase in post-harvest losses. There is a need to develop market linkages, as the value chains are driven by markets and finally by consumers. For instance, oranges and tomatoes in Uganda are being cultivated in some districts as raw produce without the knowledge of threshold and potential processing needs of the market, leading to over production and losses.
3. **Lack of supporting infrastructure:** There is lack of proper infrastructure especially in rural areas from where the raw produce is sourced. Lack of storage capacity in combination with poor rural electrification and water access, insufficient road network, and difficult access to basic communication tools hinders the development of the agro-industry.
4. **Low access to technology:** Limited access to agro-processing technologies also leads to negligible to low value addition of agricultural produce in Africa. High cost of water, electricity and fuels, such as diesel and petrol, and high taxation norms on import of agro and food processing equipment also exacerbates the issue.
5. **Lack of certification schemes and certified products:** There is lack of quality certification systems both at the industry and farm level, mainly due to lack of knowledge and high costs associated with obtaining certifications. Availability of local certification bodies also acts as a deterrent.

It is also necessary to take one step backwards up to farm level (first step of the supply chain) to secure full traceability and implementation of good management systems (e.g. Good Agricultural Practices (GAP) certification). Quality-certified goods fetch higher prices both in domestic and international markets.

60 *Key challenges in agro-industrial development in Africa, African Development Bank, GAIF, 2008*

Figure 19: Effect of value addition and certification on quality and cost of processed food products



Lessons from the Indian experience and the way forward

The Indian food processing industry is one of the fastest growing industries in the country. The sector contributes as much as 9% and 11% of GDP in the manufacturing and agriculture sectors respectively. At an average annual growth rate (AAGR) of around 8.4%, though in its nascent stage, the industry is poised for tremendous growth owing to the changing demographics of consumers.[61]

The McCain case study

McCain is the largest producer of French fries and potato specialities based in Canada. It supplies to leading fast food chains, such as Pizza Hut, McDonald's and KFC. When McDonald's first tried to establish itself in India in 1996, it realised that the potatoes grown in India were unsuitable for the production of standard French fries. Importing the fries was not a viable option as such a product did not appear on India's schedule of tariffs. Growing the potatoes was the only option and it took approximately six years and a 100 billion USD investment for McDonald's to put together a reliable supply chain, with McCain facilitating the process.[62]

Figure 20: The McCain model in India for procurement and food processing

McCain model for procuring best quality potatoes for potato specialities (French fries)

Strategic initiatives taken by McCain:

- Seed supply; quality control; storage; processing
- Training of farmers
- Introduction of better irrigation systems such as drip irrigation
- Undertaking fertiliser application programmes
- Seed treatments
- Provision of better storage facilities

Indian scenario

The country is one of the largest producers of potato; however, there is a lack of high-quality seed potatoes and the produce is not suitable for standard French fries.

Drawbacks:

- Farmers should have access to institutional credit or have their own source of finance to buy seed potato against advance payment of 50% of the seed cost.
- A fixed amount of produce is to be sold to the company at a pre-set price which inhibits them to take advantage of increase in spot prices in the market.

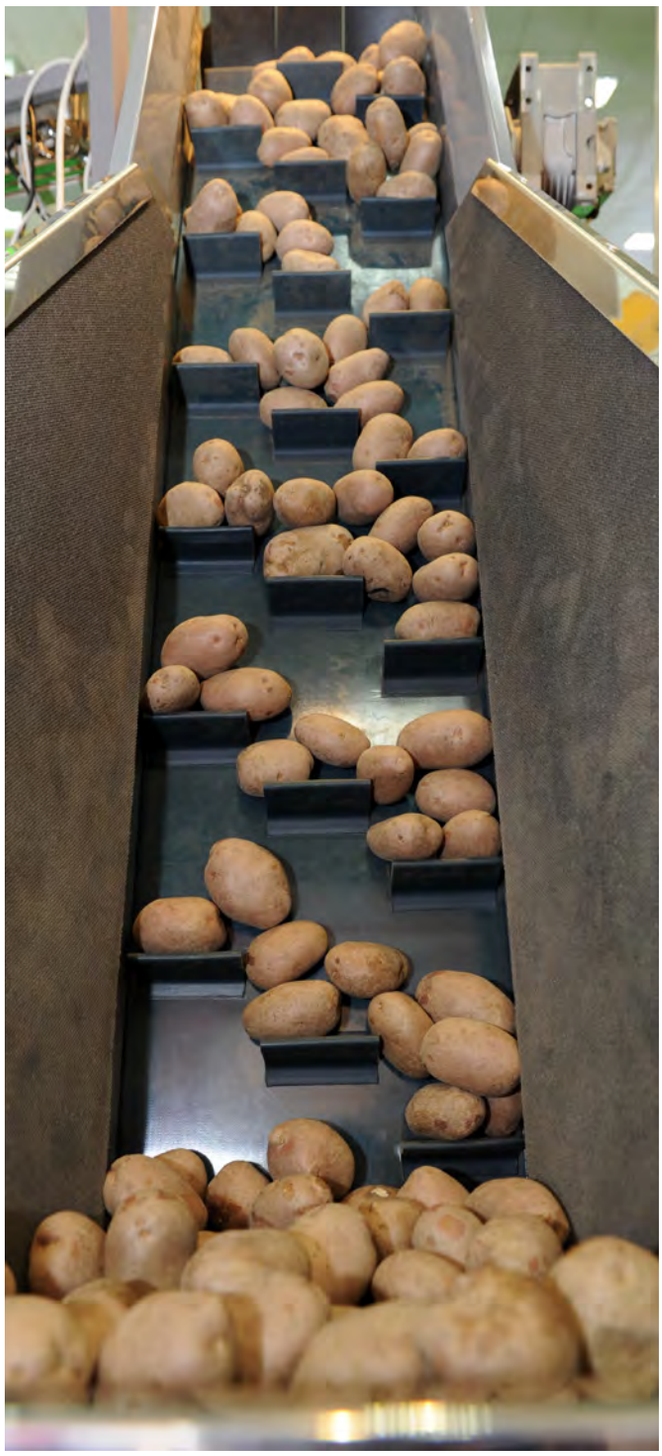
Positive effects of the initiatives:

- 30% reduction in water use
- Government subsidy to farmers to install drip irrigation systems/micro-irrigation methods.
- Increased crop productivity from ~ 18 t/ha to over 40 t/ha
- Higher profits to farmers
- Company follows a buy-back policy; in case the market prices fall below the minimum price set by McCain, it buys the produce at the minimum price set by itself.
- In case the market prices are higher than the maximum price set by McCain, the farmer is free to sell the extra produce in the market.

Source: PwC analysis

61 PwC, FICCI. (2015, December). Winning consumer trust. Retrieved from https://www.pwc.in/assets/pdfs/publications/2015/winning-consumer-trust.pdf

62 Sharma, V. et al. (2012, June). Managing agricultural commercialisation for inclusive growth in South Asia, Global Development Network, Global Development Network.



The McCain model provides useful lessons for the African food processing industry to overcome its challenges. This contract farming model not only provides technical support and advisory to farmers, but also facilitates timely access to inputs, fertilisers and technology. Credit linkages are also provided on a case to case basis. Storage infrastructure also ensures the quality of the produce, thereby reducing post-harvest losses. Continuous handholding by the firm ensures consistent quality of the produce. All these factors, coupled with an assured market, enables farmers to earn better returns on the produce. McCain, in turn, benefits from assured supply of consistent quality raw material at pre-agreed prices.

Since India and Africa as agrarian economies have many things in common—such as availability of arable land, low cost labour force and favourable agro-climatic regions—the continent can take cues on increasing its productivity and minimising post-harvest losses from India. Key takeaways from the Indian food processing industry are listed below:

- Liberalised policy regime, with several government initiatives, such as the following:
  - Tax holiday for five years
  - Government grants for setting up food parks, marine parks and cold chain infrastructure
- The Indian food industry has significant support from the R&D capabilities of Indian firms and research institutions, such as the Central Food Technological Research Institute (CFTRI) and National Dairy Research Institute (NDRI).

Alongside, there is a need for Africa to invest in technical capacity development in production, processing and equipment maintenance for its food processing industry to flourish. It should also focus on building networking platforms at regional, national and international levels to help aid technology transfer and benefit from available credit facilities. There is also a need for stricter packaging norms and stringent food safety standards.

African economies that have the potential to emerge as future raw material bases and processing hubs include Ghana and Senegal for rice-based products; Zambia and Ghana for maize-based products, and Kenya for dairy products.

Partnership opportunities for overall sector development

Agricultural science, technology and innovation

The India-Africa partnership for overall growth of the agriculture sector is moving towards one common goal–food security, and both economies have been flexible in their approach towards achieving the same. Therefore, there exists significant potential for both India and Africa to explore and leverage from various agricultural technologies that have been successful in increasing the productivity of small-scale farming. With Africa's economic growth gaining momentum, now is the time to evolve and collaborate for the agriculture sector to develop as a whole.

More than one-fourth of the world's fertile land is in Africa. However, it has the most undeveloped and unutilised arable land. ***With the removal of barriers in agricultural development, the agricultural output has the potential to boom into an 880 billion USD industry by 2030.***[63]

Today, agriculture has become time-critical and an information-intense operation. To achieve higher productivity, information-based decision-making is crucial. Farmers should get information as and when the need arises. Lack of information and access to correct information often increases the transaction time and also increases production costs. Information is required at every stage of farming—right from selecting the right crop to be grown in a particular set of agro-climatic conditions to harvesting and transporting it to the market. Information on critical factors such as temperature and precipitation is an important factor in affecting the crop yield. Information and communication technology (ICT), especially mobile technology, is now increasingly seen as a game changer for smallholder agriculture.

63 *UN Economic Commission for Africa. (2015, October). Feeding Africa: An action plan for African agriculture transformation.*

Figure 21: Need of information at various stages of farming

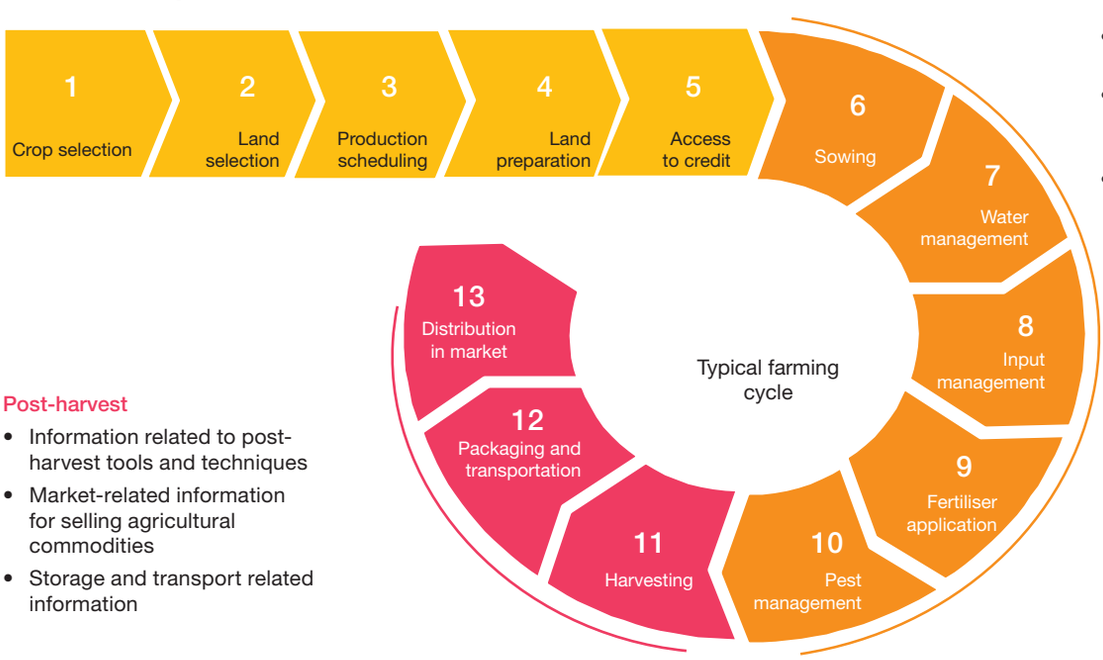
Pre-cultivation

- Information for the selection of the best crop according to land, future market demand, cost-benefit, etc.
- Advisory services and access to input and credit
- Production scheduling calendar for cropping and/or livestock management

Cultivation and harvesting

Information on management of complete management activities such as the following:

- Amount of fertilisers, pesticides to be applied
- Advice/solutions on pest and water management
- Time of harvest based on weather conditions, market prices, etc.
- Early warnings on expected calamities, such as floods, diseases, and pest attack



Post-harvest

- Information related to post-harvest tools and techniques
- Market-related information for selling agricultural commodities
- Storage and transport related information

Source: E-transform Africa, 2012, and PwC analysis

To help increase crop yields and achieve the larger goal of food security, interventions from all value chain stakeholders are required. For instance, farm input manufacturers need to develop appropriate tools and technologies to better respond to diverse soil and changing climate types, whereas investments in processing infrastructure are required to reduce post-harvest losses. Future demand projections must also be taken into account owing to rapidly changing consumption patterns.

In this complex scenario, technological changes will define the future of agriculture. Research and innovation, and usage of technological inputs will also play a critical role in traversing the African agricultural sector to reach the 880 billion USD mark by 2030.[64] The major innovations that can help increase productivity include **mechanical innovations** such as drones, sensors, GIS-imaging and other farm equipment; **biotechnology innovations** such as the development of new seed varieties; **chemical innovations** like development of nano-fertilisers, semio-chemicals, environment-friendly and more potent fertilisers/pesticides; **agronomic innovations,** for example, novel agricultural management practices, such as no-till/zero-till agriculture and inter-cropping, and **technological innovations** such as such as deployment of ICT in agriculture.[65] This section aims to analyse various technological innovations in the agricultural space and their relevance in fostering agricultural growth.

64 *Vallabh, G. (2011, November 30). Revamp agriculture sector. The Indian Express. Retrieved from http://www.newindianexpress.com/columns/article250735.ece*

65 *Sunding, D. & Zilberman, D. (2000). The agricultural innovation process: Research and technology adoption in a changing agricultural sector. University of California.*



Technology intervention 1: Seed technology

Seed is the backbone of agriculture; however, many times, traditional varieties are low-yielding, high water consuming and susceptible to pests and diseases. With biotechnological innovations, selection of high-yielding varieties suitable for the given climatic conditions ensures the availability of the right quality of seeds for a given geographic area. For instance, traditional varieties give a mean average yield of 5,000 kg/ha (in Andhra Pradesh) compared with the Indian maize variety JC-1441 (developed by Punjab Agricultural University (PAU), Ludhiana), which gives a mean average yield of 5,846 kg/ha in regions of Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra.

Similarly, Africa requires a reliable supply of high-quality seeds suitable to its agro-climatic conditions to ensure productivity growth. However, differing standards, regulations and procedures; low investment in science; and poor infrastructure act as barriers to enhancing quality seed production.[66]

India has the potential to offer useful technology to African farmers in the form of hybrids (e.g. maize and cotton) and transgenic technologies (especially Bt cotton), with the potential for further expansion in the future. Other channels through India can help develop the African seed sector includes skill development and capacity building in this sector and R&D through knowledge transfer and exchange of technical expertise.

Technology intervention 2: Zero-till agriculture

Zero-till agriculture is one of the innovations in conservation agriculture which is based on three principles: 1) minimum soil disturbance, i.e. 0 to 20-25% tillage, so that minimum amount of soil is disturbed; 2) retention of crop residues on soil surface, and 3) use of crop rotations or intercropping where land availability is an issue.[67] It has special relevance to Africa where land degradation is a major issue.

The concept of zero-till is being used from 1999 on about 45 million ha worldwide, which grew to 72 million ha in 2003 and further to 111 million ha in 2009. Fastest adoption rates were experienced in South America where about 70% of the total cultivated area used this technique. The no-till technique is now being practiced by farmers in Finland in the Arctic region, in Kenya and Uganda in the tropics, and Western Australia and Northern China.

One of the examples where the use of zero-till agriculture has led to increase in yields is the rice/wheat fields in the Indo-Gangetic plains of India. Wheat planting is done with a tractor-drawn zero-till seed drill that plants seeds directly into unploughed fields; sometimes fertiliser is also applied at the same time, which eliminates the need for multiple tractor passes. Zero-till thus reduces the turnaround time between rice and wheat crops and allows timely planting of rice. On-farm trials have shown yield gains between 1% and 15% (0.05 and 0.63 t/ha), due to timely planting and decreased emergence of an herbicide-resistant weed, which is a particular problem in the area, even though other weeds were more abundant.[68]

Technology intervention 3: Precision farming

Traditional agriculture techniques follow tasks such as planting, irrigating or harvesting against a predetermined schedule. By collecting real-time data on the weather, soil, crop maturity, and equipment, farmers can make better-informed decisions. This is called as precision agriculture– using exactly the right amount of inputs at the right time and through the right means.[69]

Techniques such as global positioning systems (GPS) help in providing geographic coordinates of the fields and locating and navigating agricultural vehicles in theses areas. Automated steering systems navigate the path for the farmers, thus avoiding the edges and rows in the field. Technologies such as sensors and remote sensing techniques help in collecting data from a distance, evaluating soil and crop health, and capturing data on moisture, nutrients, soil compaction and crop diseases.[70]

Precision farming is different from traditional agriculture with respect to its level of management, where, instead of managing the whole field as a single unit, management is customised for small areas within the field. However, such form of agriculture is useful for large fields where there are significant variations in the field area. In India and Africa, where most of the farm holdings are small, precision agriculture mainly provides precise application of agricultural inputs based on soil, weather and crop requirements to maximise productivity, quality and profitability.[71]



66 *ASARECA, CTA. (2014). Seed systems, science and policy in East and Central Africa (policy brief)*

67 *Food and Agriculture Organisation of the United Nations. (2014, September). Climate-smart agriculture: Overview of conservation agriculture, Practice Brief*

68 *Ibid*

69 *IBM Research. Precision agriculture. Retrieved from http://www.research.ibm.com/articles/precision_agriculture.shtml in January 2016*

70 *CEMA. Precision farming: Key technologies and concepts. Retrieved from http://cema-agri.org/page/precision-farming-key-technologies-concepts in January 2016*

71 *Singh, A. K. Precision farming, IARI (lecture series), Delhi. Retrieved from http://www.iasri.res.in/design/ebook/EBADAT/6-Other%20Useful%20Techniques/14-Precision%20Farming%20Lecture.pdf in January 2016*

Figure 22: Diagrammatic representation of the benefits and impacts of using precision agriculture

Increasing crop yields

90%

of all crop losses are due to weather.

Weather-related crop damage can be reduced by 25% using **predictive weather modelling and precision agriculture techniques.**

Precision agriculture

Using data to help farmers become more efficient in their operations, by making precise decisions on planting, growing, harvesting and transporting crops, can lead to better price realisation and a stable supply chain.

Transportation

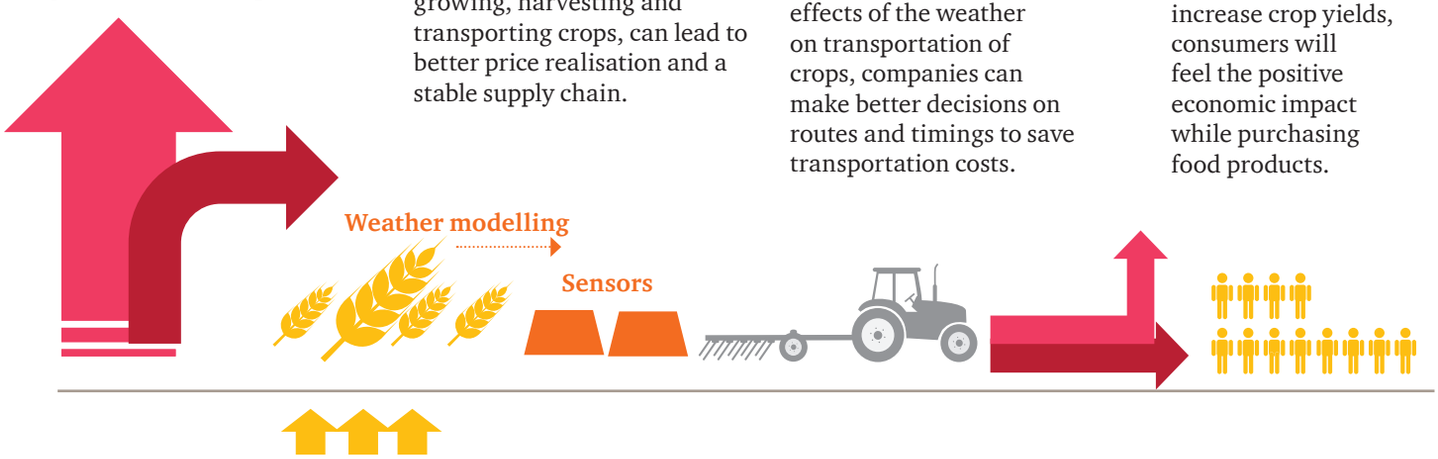
50%

of food ready for harvest never reaches consumers due to high transit losses.

By understanding the effects of the weather on transportation of crops, companies can make better decisions on routes and timings to save transportation costs.

Impact

As farmers reduce wastage and increase crop yields, consumers will feel the positive economic impact while purchasing food products.



Water

Growing

70%

of freshwater worldwide is used for agricultural purposes.
If a farmer knows when and where it's going to rain, they can better schedule the irrigation and know when they should put down the fertiliser to avoid run-offs.

There are various types of ICT tools that can be used to provide information to end users, such as web-based information systems, SMS-based services, mobile apps, and even directly through telephones. The diagram alongside illustrates the various types of ICT tools currently being used in India to provide information to farmers.

Figure 23: Types of ICT tools

Web-based information systems

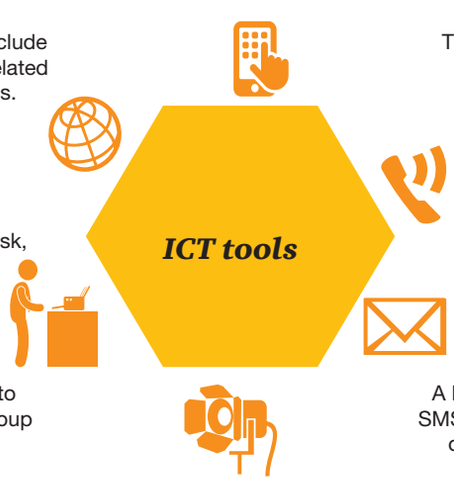
Web-based information systems for agriculture include websites providing technical, finance and trade-related information to farmers and online trading platforms.

Kiosk

Technical and other need-based information is collected, digitised and hosted on the Internet/kiosk, which can be accessed by farmers through the kiosks installed at the village/mandal level.

Knowledge dissemination using projectors

Projectors, preferably small-sized ones, are used to display information such as best practices to a group of farmers.



Mobile apps

These mobile applications are designed specifically for farmers. The apps may be used for seeking information on the market, weather, or advice on cultivation, pest management, etc.

Telephone

Farmers connect with experts over the telephone to solve their issues.
E.g: Kisan Call Centre

SMS-based services

A host of information can be sent to farmers through SMS, such as weather forecast, market prices, advice on crop and nutrient management, etc. It is usually specific to a commodity and geography.

Mobile communications technology is now the most common way of transmitting voice, data and services in the developing world. Given this change, mobile applications (m-apps) in general and mobile applications for agricultural and rural development (m-ARD apps) in particular hold significant potential for advancing development. They can provide the most affordable ways for millions of people to access information, markets, finance, and governance systems previously unavailable to them.

Figure 24: The various icons of the IFFCO Kisan mobile app



IFFCO Kisan mobile application

Indian Farmers Fertiliser Cooperative (IFFCO) is a well-known farmer cooperative organisation. It created the 'IFFCO Kisan' app which helps Indian farmers to make informed decisions by accessing customised agricultural information related to their needs. It also gives farmers information on market prices, weather forecast, latest agricultural advisories, farming best practices/tips, animal husbandry/horticulture expert advice and all agriculture-related news and recent government schemes. This app can provide agriculture alerts and advisories in 10 different Indian languages, and features audio clips for the convenience of farmers.[72] The important sections featured in the app are listed below:

Weather: This segment provides instant access to the weather forecast for the next five days, along with information on temperature, relative humidity, expected rainfall, expected wind speed and its direction. Farmers can add or remove locations for the weather forecast based on their preference. At a time, two districts can be selected as preferences for weather access. The data is sourced from the India Meteorological Department (IMD).

Market or *Mandi*: This feature provides instant access to market prices for agricultural produce. Farmers can also view the price trends for their produce and accordingly plan the sale of their produce. Farmers can get the last three updates on the transactions in the market on any agricultural commodity at any point of time.



Agricultural advisories: This section provides crop-specific advisory for different agro-climatic zones. The experts advise rural farmers on the necessary and corrective actions required based on the prevailing weather conditions.

With the help of the app, farmers can also talk to industry experts and get agricultural advice with the click of a button. Solutions are also provided over voice calls for those who find it difficult to send their queries in writing. Apart from their personal information, Farmers can also update their personal data like land, crop and animal details.

Model of operation: The app is voice based and in agreement with a cellular service provider. The IFFCO Kisan Sanchar Limited (IKSL) distributes SIM cards named 'Green SIM' to the farmers. All subscribes are provided five one-minute voice-based messages free of cost every day. The advisories that are given through the app are answered by experts in the field of agronomy, pathology, entomology, etc.[73]

The IFFCO Kisan app is one of the most effective technology interventions to deliver mobile-based application services to farmers. IFFCO has its presence in 98% of Indian villages and is considered as a boon for rural and smallholder farmers.[74]

Envisaged benefits: It is a one-stop platform for all agricultural information—right from inputs and crop management practices to spot prices of various agricultural commodities. It is an integrated information system for agriculture stakeholders, which minimises the duplication of data, ensures consistency, improves the integrity of the data and caters to a wide variety of information needs.

72 IFFCO Kisan mobile app. Retrieved from http://www.iksl.in/Our-Initiatives/IFFCO-Kisan-Mobile-App in January 2016
73 Kumar, P. Mapping and preliminary evaluation of ICT applications supporting agricultural development, IFC. Retrieved from http://acdivoca.org/sites/default/files/attach/legacy/site/Lookup/ACDIVOCA_MappingEvaluationofICTAppsforAg/$file/ACDIVOCA_MappingEvaluationofICTAppsforAg.pdf in January 2016
74 ICT in agriculture: Mobile devices and their impact. Retrieved fromhttp://www.ictinagriculture.org/sourcebook/module-3-mobile-devices-and-their-impact in January 2016

The way forward

Technologies and technological innovations play a crucial role in agricultural production and impact the lives of farmers. Many innovations in the various sub-sectors of agriculture, such as seeds, cropping systems, and new and innovative farm information techniques (precision agriculture, ICT) have the potential to transform business and policy in both economies. However, with the majority of farmer's still practicing agriculture on smallholder farms, it will take some time before technological solutions can be fully integrated into the farming systems of both India and Africa. Furthermore, a one-size-fits-all approach may not be useful for either of the economies.

Effective implementation of technology tools will require the following:

- Training and capacity building of farmers, especially smallholders. This will empower them to adopt and use these new technologies.
- Efficient input delivery systems in combination with technologies such as ICT. This will require integration of conventional dealers.

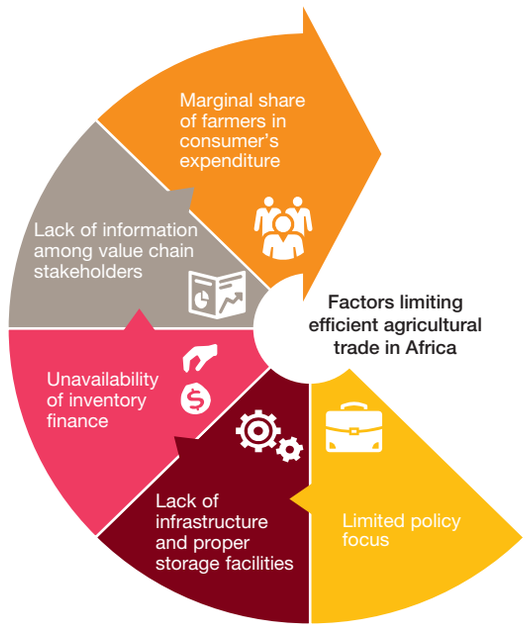
Linking farmers to markets

Structured and efficient output markets are critical for sustained agricultural growth in Africa. Discussions in preceding sections clearly illustrate the importance of agriculture and its role in achieving economic growth, poverty reduction and food security objectives for Africa. Evaluation of the challenges faced by agriculture in Africa reiterates that strengthening output markets for agricultural commodities through an integrated approach can be explored to foster inclusive development of the sector. Some of the challenges faced by agriculture in Africa includes: smallholder farming systems, conventional agricultural practices, limited access to right quality of inputs and markets, inadequate infrastructure for storage, processing and marketing and unavailability of proper financing mechanisms. Improved access to right seeds, fertilisers, crop protection products and on-farm technology–at the right time, in the right quality, in reasonable proximity to their farms and for a reasonable price, coupled with access to output markets through structured and efficient marketing linkages will benefit agricultural producers in Africa through decreased transaction costs and better remuneration. Efficient output markets are important to sustain producer incentives and, therefore, output and productivity growth, as they offer a means to absorb surpluses resulting from improved farm technology and practices.[75]

Current status of agricultural output markets in Africa

Output markets in Africa have been undergoing some major structural changes with regard to removing restrictions on the involvement of private traders, promotion of market supporting institutions (warehouse receipt systems (WRS) have been promoted as part of the solution), etc. Despite these reforms, the output markets generally remain inefficient, with squeezed producer margins. Factors limiting efficient agricultural trade in Africa include **lack of proper storage facilities**, in addition to **unavailability of inventory finance**, and restricts the capacity of rural assemblers to absorb crop surpluses. As a consequence, post-harvest losses are very high—estimated to range between 11% for rice and 19% for maize.[76]

Figure 25: Factors limiting efficient agricultural trade in Africa



Wide disparities exist between intra-region and intra-seasonal prices of agricultural commodities. Farmers have a minimal share in the consumer's expenditure, while distributors enjoy high margins. For example, marketing margins in grain markets range between 32% and 100% in Malawi and are even more in Ghana.

Also, **farmers and other value chain stakeholders tend to be poorly informed on buyers and prevailing prices** of agricultural commodities in local and regional markets. Buyers lack information on the quantity and quality of available stocks owing to lack of proper grading and measuring systems. Sampling is usually by sight and is highly subjective. This inhibits transparent price discovery and also interferes with the consistent quality of the produce.

The policy focus tends to be more on traditional export commodities, especially staple grains such as maize, which account for more than 50% of the total cropped area in Africa and are cultivated by the majority of the rural population.[77] However, the value of the domestic and regional foodgrain trade is estimated to exceed the traditional export commodities—the aggregated value of the domestic agricultural markets is estimated at more than 50 billion USD per annum compared to only 16.6 billion USD for the traditional agricultural exports.[78] A major difference between typical African marketing

75 Alliance for Green Revolution in Africa (AGRA). (2013). Africa agriculture status report: Focus on staple crops. Nairobi, Kenya.
76 World Bank. (2011). World development indicators. Washington DC.
77 Ibid.
78 Diao, X., Dorosh, P., & Rahman, S. (2003). Market opportunities for African agriculture: Examination of demand-side constraints on agricultural growth. Washington DC: International Food Policy Research Institute (IFPRI).

systems and the matured markets elsewhere is high transaction costs due to non-existence of market institutions that can reduce these costs, such as reliable market information systems (MIS), trade-friendly commodity standards, credible WRS, and viable agricultural commodity exchanges.[79]

Lessons from India: Improving farmers' access to markets through institutional innovations

Considering the prevailing challenges that limit the efficiency of Africa's agricultural output markets, various models exist for increasing the farmers' access to markets. These may vary depending on focus commodities, market types and farmer assets. Taking cues from the Indian experience, some successful models of linking farmers to markets are illustrated below:

1. **Cooperatives:** Cooperatives are very similar to a partnership firm, which is owned and run jointly by its members, who share the profits or benefits. They are also legal institutional structures in India. India's dairy cooperative model is one of the most successful models linking farmers to markets. Since AMUL, the cooperatives model is being replicated for other products, including oilseeds, fruits and vegetables. Mahagrapes in Maharashtra and Horticultural Producers' Cooperative Marketing and Processing Society (HOPCOMS) in Karnataka are the two important cooperatives in the horticulture sector. Cooperatives empower individual farmers to pool in their resources and gain collective bargaining power. Cooperatives link farmers to markets, input suppliers, new technologies and sound farm management techniques, while eliminating intermediaries in the chain, and thereby reducing transaction costs. This empowers farmers to produce output with consistent quality, which conforms to food safety and quality standards of the importing countries. Access to shared infrastructure such as refrigerated transport and cold storage facilities is provided on a pay-per-use basis by the cooperative to the member farmers. Mahagrapes exports to all major export destinations for Indian grapes, including the UK, Netherlands and the Middle East. The profits earned are passed on to the farmers. It charges a fixed amount for farmers, on per kg basis, to meet transportation, labour and other miscellaneous costs. The net revenue for farmer members was about 60% higher than those selling in the open market.[80]

2. **Grower associations:** Grower associations are informal cooperatives and are managed by the farmers themselves. One such successful example is Safal—a village level-association promoted by the Mother Dairy Fruits and Vegetables Limited (MDFVL), a prominent retail chain of fresh fruits, vegetables and dairy products. Safal was a business initiative established in 1988 to cater to the growing demand for fruits and vegetables in Delhi. MDFVL provides technical support, quality inputs (seeds, bio-pesticides and bio-fertilisers) and extension support to the member farmers. All member farmers are supposed to comply with MDFVL's quality standards for fruits and vegetables with respect to size, weight, colour and appearance. The firm also assists the farmers in preparing their production schedules in line with the market requirements to avoid post-harvest losses and get better remuneration for the quality produce. Quality standards and daily price information is displayed at all Safal collection centres, which are located in the proximity of the production areas, thereby helping farmers save on transportation costs. Farmers are paid the modal price plus a 5%-10% premium for quality. The firm does not share any production and price risk with the farmers.

   At present, there are 250 Safal associations with about 20,000 farmer-members in the country. The MDFVL markets produce in fresh, frozen and processed forms under the brand name Safal. There are 400 company-owned and franchisee-run outlets in Delhi and 35 company-owned-company-operated (COCO) outlets in Bengaluru. Major export destinations for Safal products are: Europe, the US, Australia, the Middle East, Japan, Singapore and Hong Kong. Safal is targeting a turnover of 2,000 crore INR by 2020. Safal farmers, on an average, realised 78% higher profits, 8% higher prices and incurred 92% less marketing costs over those supplying it in the open market.81 Such grower associations also exist for other commodity groups, such as self-help groups (SHGs), promoted by Appachi Cotton Company Limited in Tamil Nadu, and Agrocel Pure & Fair Cotton Growers' Associations, promoted by Agrocel Industries Limited in Gujarat.

3. **Contract farming:** This refers to interlinked contracts with specifications on quality standards, price and purchase volumes. In addition to the agreement on sales, the buyer also supplies inputs, finance and technical assistance in advance to the supplier on the promise of sales with these costs deducted from their payment.[82] Contract farming in India is in its nascent stages; however, the recent developments in policies and regulations governing the activity are expected to open up new

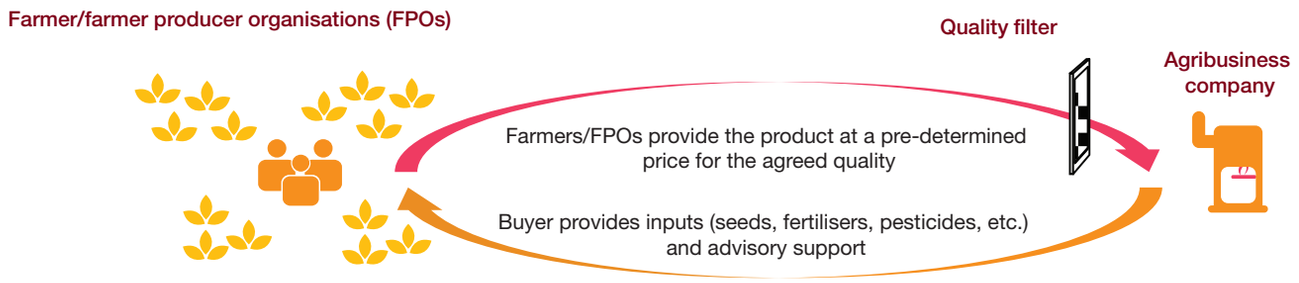
79 Onumah, G. E. (2011). Improving the efficiency of African agricultural marketing systems through promoting exchange infrastructure: potential benefits, challenges and prospects. Proceedings of an International Conference on Priority actions for development of markets for African farmers. Nairobi, Kenya: International Livestock Research Institute (ILRI).

80 Bakshi, K., D. Roy, & A. Thorat. (2006). Small they may be and Indian farmers they are but export they can—the case of Mahagrapes farmers in India. Paper presented at the workshop From plate to plough: Agricultural diversification and its implications for smallholders, organised by the International Food Policy Research Institute (IFPRI), New Delhi Office, and Institute of Economic Growth, New Delhi, India, 20-21 September.

81 Birthal, P.S., & Joshi, P., K.(2007). Institutional innovations for improving smallholder participation in high-value agriculture: A case of fruit and vegetable growers' associations. Quarterly Journal of International Agriculture, 46 (1), 49-68.

82 Wiggins, S., & Keats, S. (2013). Leaping and learning: Linking smallholders to markets in Africa. London: Agriculture for impact, Imperial College and Overseas Development Institute.

Figure 26: Contract farming model for linking farmers to markets



avenues for the Indian agricultural sector. Private sector agro-based/food companies with large raw material requirements of specific quality enter into contract farming to ensure their raw material supply. Contract farming is practiced in many agricultural commodities, including wheat, Basmati rice, fruits, vegetables, medicinal plants, and even for poultry and dairy.

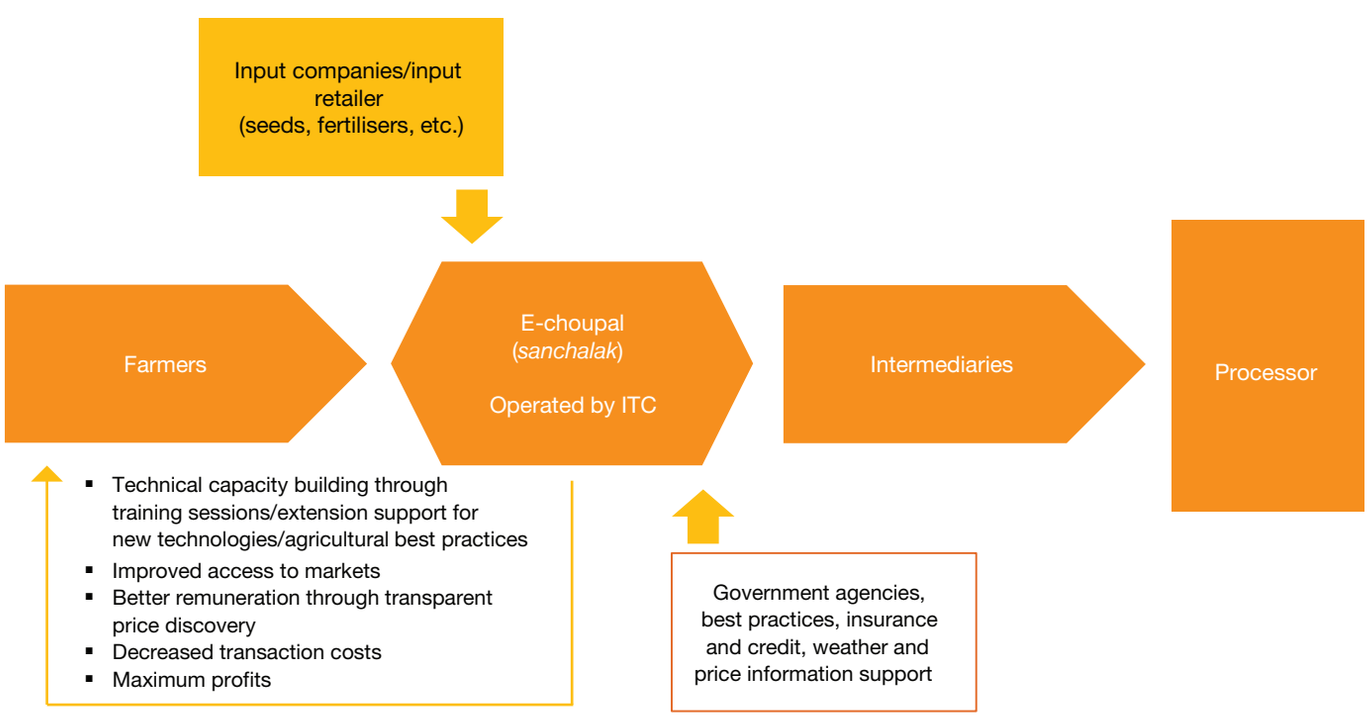
Both bipartite to multipartite agreements are followed in India. Bipartite agreements include only the farmers and the agribusiness firm as the two entities, wherein the farmers are paid by the agribusiness firm on a pre-agreed price based on the quality of the produce. Inclusion of other entities providing credit, insurance and agri inputs in the contract leads to multipartite contracts. Main benefit from contract farming is the reduction in marketing and transaction costs and with contract farming, dairy farmers can save as much as 92% of these costs.[87] This enabled them to earn almost twice the net revenue compared to independent farmers.

4. **ICT-enabled supply chains:** As evident from the preceding section, ICT is creating ripples of transformation throughout the agricultural space. ICT-enabled agri-supply chains are expected to provide an open, inclusive and participatory socio-technical architecture, ensuring enhanced access to markets with minimum transaction costs and improved remuneration to farmers.

Indian Tobacco Company (ITC), one of India's leading private agribusiness companies, pioneered one such ICT-enabled supply chain through its (meaning 'village meeting place') model. E-Choupal is a virtual market place where farmers can transact directly with a processor and can realise better prices for their produce, with minimum number of intermediaries. This model connects large/small producers and small/large buyers from various geographies, including local markets/*mandis* and ITC procurement hubs, thereby eliminating the hierarchy of aggregators saving transaction costs and inducing transparent price discovery.

Information asymmetry, which is a major disadvantage of a conventional market, is also surpassed through transparent price negotiations between the buyer and the seller. Current agriculture commodity prices at the village level are displayed on the web portal.

Figure 27: ICT-enabled ITC's e-Choupal model



The Internet is the backbone of this virtual marketplace. Every e-Choupal centre is equipped with a computer. Additionally, e-Choupal also promotes best practices in farming and dissemination of novel agricultural technologies through training sessions. It also provides information on weather conditions, and supplies quality agricultural inputs like seeds and fertilisers.

The e-Choupal model is positioned as an alternative to traditional modes of procurement where farmers travel to the government market (or *mandi*) to sell their produce. ITC provides infrastructure and connectivity at the e-Choupal centres. One e-Choupal centre services 4–5 villages. An ITC procurement hub is also set up for every 20–30 km radius, servicing about 30–40 centres. Farmers may choose to sell their produce at the e-Choupal centre, the local *mandi* or the ITC procurement hub. The portal empowers the farmer to make an 'informed decision' of where to sell their produce for maximum profit.

ITC also initiated the Choupal Pradarshan Kheth (Choupal Demonstration Field) programme to improve yields with a demonstration plot of land for every village cluster. In the process, ITC benefits from information on agricultural marketing channels and lowest fetch prices for a specific quality grade for its focus agricultural commodities. It also, as a result, connects to the rural community, which forms an important supplier base for the company, which deals in a wide range of agricultural commodities and caters to both domestic and international markets. Farmers on the other hand benefit from decreased transaction costs, technical capacity building, increased market and technology access and better price for their produce.

5. **Commercial farming:** Large-scale crop and animal production to reap maximum profits with minimum inputs. This is achieved through vertical integration. Large-scale commercial farms (LSCF) have the advantages of being technically more advanced, are able to reap economies of scale, mobilise funds and invest, and to react to evolving market demand.[83] Commercial farming is often adopted by large- and medium-scale farmers. These farms generate jobs for other farm labourers.

   Commercial farming has given rise to numerous success stories in Africa: be it the coffee farms in central Kenya, cocoa in Ghana, cotton in Francophone Africa, or maize in Zimbabwe. Commercial farming has long been the heart of agricultural land investments in Africa. Steered by the need to secure long-term food, fuel and feed supplies for investor nations, and increasing land and water resource constraints, commercial farming has become the 'sweet spot' for foreign investments in Africa. Currently, Indian firms have acquired over 600,000 ha of land in Africa for commercial farming. Most investors plan to grow edible oils and crops while a few have plans to grow cotton. Ethiopia has emerged as a favourite commercial farming investment destination for India. Numerous Indian firms have entered into long-term land deals in Ethiopia for cultivating various crops.

   The segment offers immense investment opportunities for both domestic (large plantation owners) and foreign players. However, the government needs to streamline the regulatory and policy framework around these deals and acquisitions to ensure scalability and sustainability for African agricultural growth and food security.

83 *Wiggins, S. Are large-scale commercial farms the answer to Africa's agricultural prayers? Future Agricultures. Retrieved from http://www.future-agricultures.org/ in January 2016.*

The way forward

Africa, with its inherent advantages in agricultural resources, has the potential to significantly contribute to global food value chains and gain social, monetary and economic benefits. Translating the Indian experience to the African context, the following recommendations have been prioritised:

1. Organisation of smallholders can be quite beneficial in ensuring access to quality inputs, markets and technology, and gain improved knowledge on how to access markets, information and technology. It will also facilitate competitive and transparent transactions. As illustrated, various market institutions can be adopted depending upon the type of crop, type of target markets and the available farmer assets. Players from India or with the Indian experience can be looped in to help implement such models. Also, a holistic approach should be adopted while implementing these market institutions ensuring adequate synergy between them.
2. Empowering smallholders is the key to increase efficiency of agricultural output markets in Africa. Empowerment can be though greater decision-making power (cooperative model), assured markets and increased access to technology and inputs (contract farming) or through improved access to information (ICT-enabled supply chain models). Access to credit through innovative value chain financing can also foster development.



Innovative Value Chain Microfinance Scheme, Juhudi Kilimo, Kenya

Juhudi Kilimo is a microfinance company that provides asset-based loans to smallholders in Kenya, enabling them to purchase productive agricultural assets, such as agricultural equipment or dairy cows. It also provides business, technical and finance training to its borrowers, thereby generating capabilities for loan repayment.

K-Rep Development Agency, an NGO that performs product development for the microfinance sector in Kenya, started Juhudi Kilimo in 2004 as an initiative for developing agriculture production and marketing for smallholder farmers in Kenya. In the process, K-Rep attracted other funding partners, namely Swiss Contact, KIVA Microfunds, and Grassroots Business to support the initiative.

Juhudi Kilimo gives loans to individual farmers through solidarity groups which act as credit guarantee structures. Loan amounts usually range between 40,000–300,000 KES (450–3,500 USD) at an interest rate of 18%. Repayment periods are segmented: 12 months; 18 months; and 24 months, and the financed assets are insured throughout the loan period. The financed assets act as security for the loans. Regular meetings/forums to mobilise group savings and collect loan repayments are organised in solidarity groups. These routine meetings also provide Juhudi an opportunity to conduct technical and management trainings to farmer members of the solidarity group. Juhudi supported the groups in establishing market linkages and establish relevant partnerships across the value chain to support the entrepreneurial farmer ventures. Some of the value chain and market upgrading strategies for the institution include business tie ups with milk processors and packers such as KCC, linking farmers to Heifer International for improving the quality of their herds, facilitating the provision of local veterinary services for preventive and curative animal health. As a result, credit-driven value chains developed **and helped farmers graduate to a better standard of living.**

The impact: Independent evaluations of the model suggest an increased efficiency in farm-level production, increased engagement in rural entrepreneurship through small-scale commercial enterprises and increased standard of living of the group members. In the first quarter of 2011, Juhudi Kilimo had a client base of about 10,000 who are taking agriculture from the level of subsistence to agricultural enterprises.

Creation of appropriate marketing linkages and infrastructure development for storage, value addition and marketing of agricultural commodities will pave the way for further development. Investment in physical storage infrastructure is a must.



Contributing to regional and global food security

Food security is still a major concern for Africa as over 1 billion people suffer from starvation and undernutrition in the continent. The FAO of the United Nations (UN) reveals that Africa was far too short from achieving its 2015 target for Millennium Development Goal (MDG) 1: to halve extreme poverty and hunger. Notable progress has been seen on other social development indicators, covering the remaining seven MDGs, except for those directly or indirectly relating to food security. **The AfDB clearly states that the reason behind Africa's slow performance in achieving its social indicators and MDGs was the continent's inability to resolve its food security issues.** Since the mid-1980s, the number of food emergencies in African countries tripled, and emerging challenges like climate change and underdeveloped agriculture have only made the problem worse.[84] Currently, in SSA only, the number of people suffering from hunger is estimated at 239 million, and this figure can increase in the near future.[85]

High-impact imperatives for achieving food security

Creating stable and self-sufficient grain markets

Multiple production level issues limit Africa to achieve its food security targets, including productivity issues, restrictions in technology, market and credit access and improper land reforms. These factors clearly highlight how agricultural productivity and growth can be restored in the continent, which will enable it to achieve its food security targets.

In addition to these issues, structural issues in supply of staple consumables such as foodgrains and pulses also exacerbate the issue. For instance, Maize is among the key commodities contributing to food security in West and Central Africa. In Malawi, as per 2014–15 production estimates by the Ministry of Agriculture, Irrigation and Water Development, total production of maize constituted about 92.5% of the total cereal produced in the country. Smallholders contribute to over 90% of the total maize production in Malawi.[86] Despite the economic and nutritional importance of maize for Malawi, maize markets in Malawi can be characterised as being extremely 'thin'—minor changes in production lead to large deviations in marketed supplies. This issue can be majorly attributed to large number of maize cultivators practicing subsistence agriculture, with limited or negligible marketable surplus. Extreme weather events like floods and drought also creates additional pressure on maize supplies. Few dry spells in 2014 led to a low 2015 cereal harvest, leading to a steep reduction in both national and household stocks for the 2015–16 marketing year, with Malawi importing about 90,000 tonnes of maize from Zambia to boost national supplies.[87] Fluctuating supply levels also induces price volatility. Maize markets in Malawi have been the most volatile markets in the region.[88] ***Relatively simple measures such as streamlining maize market policies for better transparency and predictability, and improving information dissemination and access for price and production data*** can reap substantial benefits for Malawi through more resilient systems and greater investment in the country. Similar issues exist in other African economies, including Burkina Faso and Nigeria. Weak and volatile staple food markets render the food supply systems adopt a 'reactive approach' to food security, with an objective of crisis management. **There is a need to transform these crisis management oriented food security systems to stable and self-sufficient systems.**

African economies can take cues from the Indian experience. The Food Corporation of India (FCI) is the nodal agency of Government of India (GoI) responsible for procurement, storage and distribution of wheat, paddy and coarse grains under price support schemes and rice under statutory levy scheme. Before the incorporation of FCI in 1964, Indian food staple markets also faced similar constraints. The country faced severe famines and food shortages. Food procurement and distribution system in India is still in its developing phase; however, there are few takeaways that the African economies can benefit from.

Procurement

The FCI procurement guidelines are specifically laid with details about the minimum support prices (MSP) and the total period of procurement. It also has various collection points across the country to ensure that the farmers are able to bring their produce and get the benefit of MSP. The declaration of MSP before the farming season acts as an incentive to the farmers to grow crops for the particular season.

African governments can follow a similar procedure of announcing the MSP right before the sowing season, thereby encouraging farmers to grow food grains. MSP ensures that in case of demand fluctuations, farmers get a good price for their crop.

Storage

FCI in India has ensured that there are enough storage facilities to stock wheat and paddy (main staple crops in India). The government uses its own storage facilities and also utilises third-party storage facilities to stock procured grains.

Some African economies such as Malawi have well established strategic grain reserves to stock grains to address the food insecurity situation. However, the countries need to increase their storage facilities to stock grains to meet the ever increasing food requirement of the country.

84 AfDB. Retrieved from http://www.afdb.org/in January 2016

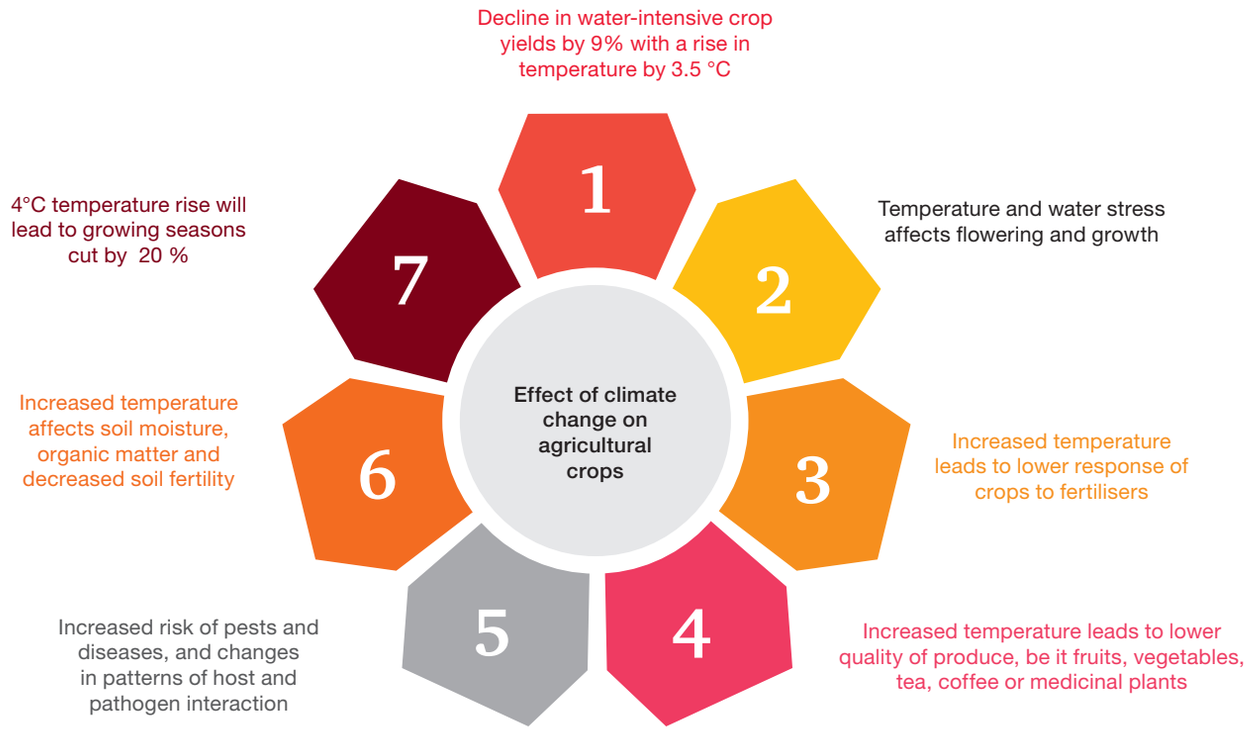
85 Sasson, A. (2012). Food security for Africa: An urgent global challenge, Agriculture & Food Security, Retrieved from http://www.agricultureandfoodsecurity.com/content/1/1/2 in January 2016

86 Jayne, S., Nicholas, S., Gilbert, J., Mangisoni, J., (2010, February), Malawi's maize marketing system report, submitted to Ministry of Agriculture and Food Security, Agricultural Input Subsidy Programme, Malawi. Retrieved from http://fsg.afre.msu.edu/malawi/Malawi_maize_markets_Report_to-DFID-SOAS.pdf in January 2016

87 GIEWS Country Briefs. (2015). Retrieved from http://www.fao.org/giews/countrybrief/country.jsp?code=MWI in January 2016.

88 USAID, IFPRI. (2015). Making maize markets work. USAID, International Food Policy Research Institute (IFPRI), Retrieved from http://massp.ifpri.info/files/2015/11/Maize-Symposium-Event-Report-25NOV2015.pdf in January 2016

Figure 28: Effect of climate change on agricultural crops



Source: Watershed Organisation Trust. (2013, December): Towards resilient agriculture in a changing climate scenario.

Mitigating climate change risks

In addition to market-related issues, there are also external impact factors, which limit Africa in attaining food security. Climate change is one of the most important factors having the potential to define India and Africa's contribution to global food security. Proactive approach to better manage and even mitigate climate change risks will delimit the production potential for India and Africa. Climate-smart agriculture (CSA) is an integrative approach to address the interlinked challenges of food security and climate change. It aims for three objectives: (1) increasing agricultural productivity in a sustainable manner to support farm incomes, food security and development; (2) building the adaptive capacity and resilience of agricultural systems to achieve food security and (3) reducing the greenhouse gas emissions from agriculture.[89]

89 *FAO. (2015). Climate-smart agriculture for development. Retrieved from http://www.fao.org/climatechange/climatesmart/en/in January 2016*



Crop diversification for livelihood security and resilience to climate variability (Maharashtra, India)

Cotton is an important cash crop of Maharashtra; however, the crop also consumes large amounts of water. For production of a kg of cotton the crop can consume up to 20,000 litres of water. The crop is sensitive to water availability particularly at the height of flowering and ball formation.

The problem: The Aurangabad region of Maharashtra whose main crop is cotton, lies in rainfall deficit region; it also faces climate vulnerability in the form of droughts, heat wave and floods.

Existing practice: Sole cropping of cotton is undertaken in this scant rainfall region.

Resilience practice/technology introduced: Intercropping of cotton with legumes reduces risk and ensures reasonable returns and is a key drought coping strategy. Growing cotton and green gram together performed better than sole crops.

Crop	Grain yield*	Cost of cultivation**	Gross income**	Net income**
Cotton	1,080	20,230	48,600	28,370
Cotton + green gram (1:1)	1,440	24,450	65,150	40,700

* Kg/ha ** INR/ha

Source: Deshmukh, D. & Lunge, H. (2014, July). Impact of global warming on rainfall, and cotton lint with vulnerability profiles of five districts in Vidharbha, India; and smart practices and technologies for climate resilient agriculture, Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad.

The two main climatic parameters that affect agriculture are temperature and precipitation. Even a minor increase in temperature of 1°C would lead to reductions of 5–10% in the yields of major cereal crops by 2020.[90] Temperature rise also leads to weather extremes such as cyclones, floods, droughts, etc., which have a direct impact on agricultural productivity.

Climate smart agriculture approaches can vary from crop to crop and from region to region based on the agro-climatic potential and agricultural vulnerability assessment profile of the region. However, in general, most of the climate smart approaches are simple to implement and are cost effective. In short term, these approaches can result in productivity gains with low chemical use, thereby, increasing the farmer's returns.

90 World Future Council. How does climate change affect agriculture? Retrieved from http://www.worldfuturecouncil.org/2324.html in October 2015



Conclusion: Potential for collaboration and the way forward

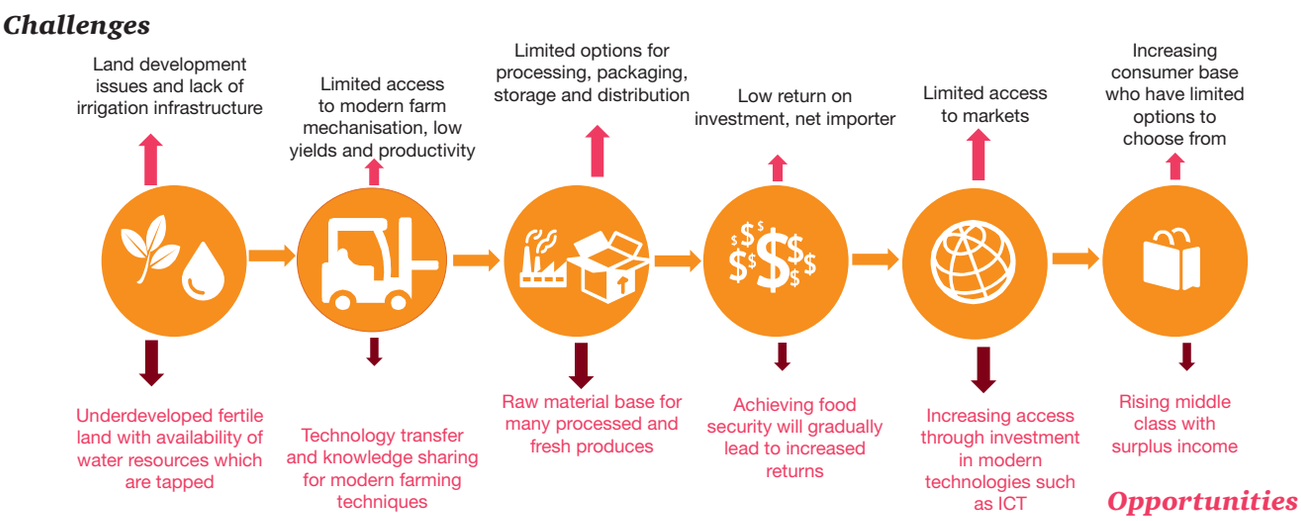
> *'The heartbeat of 1.25 billion Indians and 1.18 billion Africans are in rhythm. It is not just a meeting of India and Africa. Today, the dreams of one-third of humanity have come together under one roof.'*
>
> *— Narendra Modi, Prime Minister, India, India-Africa Forum Summit, 2015*



The partnership between India and Africa is beyond strategic concerns and economic benefits; the partnership is poised for achieving the greater goals of shared prosperity and food security for all. With predictions of Africa's GDP scaling up to 2.6 trillion USD by 2020, there are hopes of creating new collaborations and partnerships between the two economies. It is estimated that additional annual investments of as much as 50 billion USD will be required to make the agricultural systems better. However, it comes with its own set of challenges, the major one being underinvestment which has inhibited growth of the African economy.

The following figure sums up the various challenges a typical farm value chain is facing today in Africa and the associated opportunities with it. The major challenges are lack of availability of modern technologies, be it in cultivation, farm machinery, packaging, or access to markets. It is in these main areas that opportunities exist for investment. Another golden opportunity is the rising middle class with sizeable amounts of surplus income, which needs avenues to spend their money, making investment in agriculture and its allied sector as a safe bet.

Figure 29: Challenges and opportunities across a typical farm value chain



It also needs to be realised that these investments will involve the cooperation of all stakeholders, i.e., the government, people (farmers–both large and smallholders, middle-class working population, local entrepreneurs, etc.) and the private sector.

The private sector brings with it financial resources which are a critical requirement to strengthen all points of the value chain and achieve sustainable productivity. Along with it, the role of the public sector also becomes crucial as it provides the private sector an enabling environment to function, by revamping the existing policies. The PPP model allows both the sectors to align their respective agendas and share the risk of investments in a challenging economy like Africa.

Since the economy is still dependent on primary commodities and staples, which also account for majority of their imports; strengthening the links with the industry at each point of the value chain is the key to encourage a shift to also invest in producing commodities which can fetch higher values. The inclusion of new and updated technologies in farm inputs, post-harvest infrastructure and storage and distribution will all help in adding value and reduce post-harvest losses. Since more than half of the farmers are smallholder farmers in Africa, it is crucial to increase their access to various credit opportunities in the market. It improves the farmer's access to market and increase their purchasing power and give investors security of supply.

Some of the major areas of investment in terms of technology, money and soft-skills, that will help both the government and private sector strategise their plan of action include; ***infrastructure*** for rural areas especially for water and electricity. Development of roads and post-harvest storage structures is also one of the major areas where investment has been long pending. ***Fostering trade relations both intra and inter continent*** is important to balance the food trade between surplus and deficit areas. **Investment in the food processing industry** will also be a rewarding investment in the coming years, with rapidly changing consumer choices and increased preference for processed food. A competitive edge will be established for the agriculture industry once it is fully equipped with modern technology such as ***high-yielding seed varieties, efficient irrigation methods, novel nutrient management and delivery systems,*** etc. ***New-age technologies such as global positioning systems (GPS) and remote sensing*** techniques also need be introduced.

In summary, each of the stakeholders have shared and joined responsibilities with some individual responsibilities in taking the two economies ahead. The key takeaways for the stakeholders that need to be worked are overlapping. Takeaways for the government sector include the following:

- Development of an inclusive policy environment that enables knowledge exchange and technology transfer
- Fostering policies that help in developing PPPs for investment
- Engaging in increased intra and inter country dialogue to understand the various challenges that different areas face
- Provision of funds for agriculture research especially in improved inputs and farm equipment
- Easy access to technology such as mobiles and lower rentals for smallholder farmers
- Capacity building and sensitisation seminars/ knowledge camps for farmers to increase easy information dissemination and adoption of new technologies

The key takeaways for the private sector are listed below:

- Investment in the key areas identified for investment such as farm technology, irrigation facilities, food processing, etc.
- Provision of new equipment and technology on trial basis to farmers
- Introducing novel financial inclusion and credit enhancement tools for smallholder farmers in joint collaborations with the government such as agri-insurance schemes to ensure adequate capacity development of farmers so that they can better respond to government and private sector investment and initiatives.

While the majority of the responsibility lies with the government and private sector for leading the transformational growth, the farmers form a key component of this relationship. The key takeaways for farmers include the following:

- Willingness to adapt to new forms of cultivation and integrate technologies with farming
- Participation in seminars/knowledge camps held by the government
- Sharing indigenous knowledge that can help improvise the modern technologies

A vibrant agriculture sector is crucial to generating sustainable economic prosperity in both Africa and India. It is a key to achieve food security and alleviate economy. Access to finance, innovation and technology and expert knowledge will lead the way for competitive growth.

About the study

The need for this study stems from the fact that economies cannot grow and achieve their full potential without shared cooperation and knowledge transfer. India and Africa, poised as two emerging economies, need to step up their cooperation in the field of agriculture and leverage from the successful models that will ultimately lead to their shared goals of achieving food security and sustained economic growth.

The study is woven around suggesting partnership opportunities and possible areas of collaboration in various sub-sectors of agriculture between Indian and Africa. As the economies move towards a progressive economic growth with a growing middle class and increasing disposable incomes, it is important to cater to the increasing food demands and achieve food security along with investment in sectors to support and sustain the rise in economy.

The main objectives of the study are outlined below:

- Mapping the current investments from India in Africa in the agricultural sector and assessing the status of intra-regional agricultural trade
- Identifying partnerships for growth in key agribusiness sub-sectors, such as land, animal protein (dairy, livestock, etc.), agri inputs and food processing
- The study also attempts to identify collaborations between India and Africa that can lead to overall sector development by leveraging the Indian experience in agricultural science, technology, output market development, and how they can contribute to regional and global food security.

For mapping the current investments from India in Africa, the trade data was sourced through dependable secondary data sources, such as FAO Statistics and UN Comtrade. For identifying the collaborations between India and Africa, the study leverages mainly on the Indian experience and case studies that can be implemented in Africa with suitable adaptations according to the local environment.

The study points towards one common factor that agriculture is the basis of achieving balanced economic growth as well as food security, and that it can be achieved with ease by economic cooperation, technology transfer and leveraging each other's sector experience.



Notes

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Established in 1927, FICCI is one of the largest and oldest apex business organisations in India. FICCI's history is closely interwoven with India's struggle for independence, industrialisation and emergence as one of the most rapidly growing global economies. FICCI has contributed to this historical process by encouraging debate, articulating the private sector's views and influencing policy.

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To be the thought leader for industry, its voice for policy change and its guardian for effective implementation

Our mission

To carry forward our initiatives in support of rapid, inclusive and sustainable growth that encompasses health, education, livelihood, governance and skill development

To enhance the efficiency and global competitiveness of the Indian industry and to expand business opportunities both in domestic and foreign markets through a range of specialised services and global linkages.

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Data Classification: DC0

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PD 487 - February 2016 India-Africa partnership in agriculture: Current and future prospectsindd
Designed by Corporate Communications, India