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India-Africa Partnership in Agriculture and Farm Mechanisation

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INDIA-AFRICA PARTNERSHIP IN AGRICULTURE AND FARM MECHANISATION

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EXECUTIVE SUMMARY

The United Nations, amongst other Sustainable Development Goals (SDGs) is committed to end all forms of hunger and malnutrition by 2030, making sure that all people, especially children, have access to sufficient and nutritious food all year round. Approximately 795 million in the world are undernourished. The global population in the last 50 years have more than doubled from 3 billion in 1960 to 6.9 billion in 2010. It may be noted that globally, the population has grown by 1.23 times since the turn of this century, that is, from 2000 to 2017.

Introduction

India, which is the 7th largest country in terms of area and the 2nd largest country in terms of population has primarily been an agrarian state. However, India's initial tryst with modern agricultural production came in the early 1960s when India launched, what is popularly known as the country's First Green Revolution. This, in 1983, resulted in a four times increase in the production of wheat when compared to 1966. As of 2017, the production of the wheat is more than 9 times vis-à-vis 1966 level. The per capita production of wheat has also increased from 20.5 kg per year in 1966 to the level of 73.6 kg in 2017, this in spite of the rapid increase in population.

As in 2017-18, India had a positive trade balance in agricultural trade. However, even with trade surplus, India is dependent on imports of a lot of agricultural products. High imports are observed in vegetable oils and pulses where India imported US$ 11.6 billion and US$ 3 billion in 2017-18, respectively. Interestingly, India is the largest producer (25% of global production), consumer (27% of world consumption), and importer (14%) of pulses in the world.

In the case of Africa, it is expected that out of the estimated 9 billion world population by 2050, a quarter is to be in Africa. In such a scenario, it will be important for the African nations to take relevant steps in order to not just feed its population but also, use agriculture as a means to achieving economic growth in the region. While it is a fact that agricultural potential remains largely untapped in the African continent, some countries have been able to make efforts in silos to tap this potential. For instance, Ethiopia which registered an average GDP growth of only 4% during 1994 to 2003, exhibited a growth of 10.6%, during 2004 to 2017. A great deal of this consistency in growth has been due to the average agriculture value added to GDP during 2004 to 2017, which has been more than 40%.

Further, productivity is another challenge that Africa faces. A McKinsey analysis shows that Africa could produce two to three times more cereals and grains, which would add 20% more cereals and grains to the current worldwide 2.6 billion tons of output.

India-Africa Trade

While India is one of the fastest growing economies in the world (GDP growth projection of 7.4% for 2019 by IMF's Economic Outlook), Africa is also home to some of the fastest growing

economies today. Countries such as Libya (10.8%); Ethiopia (8.5%); Rwanda (7.8%); Ghana (7.6%); Côte d'Ivoire (7%); Tanzania (6.6%); Kenya (6.1%); Uganda (6.1%) are expected to be the flag bearer of Africa's growth in the years to come.

Additionally, due to the mutual economic interests, India-Africa relations are enjoying an unprecedented renaissance. In the last 15 years, the India-African trade has increased from US$ 6.9 billion in 2003 to US$ 60.2 billion in 2017, an increase of almost 9 times. The trade registered an average annual growth rate of 20.2%, during 2003 to 2017. Additionally, with respect to the products traded between the two nations, India's exports to Africa have been quite diversified with the top five products exported at 2 digit level contributing to 52.6% of India's exports to Africa in 2017. On the other hand, the top five imported products from Africa contributed to 88.2% of India's imports from Africa, during the same year.

It may be noted that only 8.2% of India's total exports to the world, went to Africa in 2017. Within this pie of exports to Africa, Indian exports are quite diversified. Some major exporting destinations for Indian exports in Africa in 2017 were South Africa (16.7%); Egypt (9.6%); Nigeria (8.5%); Kenya (7.5%); and Tanzania (6.4%). Approximately, 8.1% of India's imports from the world were sourced from Africa in 2017. The largest import sources from Africa were Nigeria (23.3%); South Africa (19.2%); Angola (11.5%); Ghana (7.7%); and Botswana (4.9%), in 2017. Approximately, 98% of India's imports from Nigeria were of mineral fuels and oils in 2017.

Agriculture Scenario: India and Africa

Agriculture in India

Agriculture sector, one of the most important sectors for India, is the backbone of the Indian Economy. The agriculture; forestry; and fishing sector together contributed 17.2% to the gross value added in 2017-18, according to the latest estimates. The total food grains production in India was registered at 284.8 million tonnes (MT) in 2017-18, which was an all-time high for the Indian agriculture. During 2013-14 to 2017-18, the AAGR registered for India's total food grains production was at 2%.

According to FAO, major agricultural products produced in India include sugarcane, rice, wheat, potatoes, amongst others. Sugarcane alone contributed to more than 30% of the Indian agricultural produce in 2017. Further, after the beginning of WTO and globalization of markets, the Indian agricultural products specially fruits, vegetables, spices and cash crops like cotton, jute, tea, coffee and rubber have exceeded the expectations and proved to be a great economic support for the country. Lately, India has also become an important market for organic products.

According to FAO, India had 156.4 million hectare of arable land available in 2016, the highest in the world. However, India's biggest challenge is its growing population. As per the World Bank, the per capita arable land in India was approximately, 0.118 hectares, which is not even in the top 100 countries in the world.

Wheat and rice contribute to most of the food grain production in India. It is observed, in the case of wheat, countries such as France (6757 kg/hectare) produce just over 1/3rd of India's production

of wheat while France has a yield, more than double of India (3219 kg/hectare). In the case of rice, while India produces more than 1/5th of the world's rice, India's yield (3848 kg/hectare) is way below the world average yield (4602 kg/hectare). A stark difference is also seen in the case of pulses where India is the largest producer (24.2% of global production) in the world while its output at 664 kg/hectare is lower than the world average. As a result, India which is a huge consumer of pulses, has to import significant volume of pulses.

Agriculture in Africa

The agricultural sector is a key source of livelihood across the African continent. While nearly two-third of Africa's population makes a living through agriculture, it contributes less than one-third to the continent's GDP. African soil remains greatly underutilized, with the region having more than half of the world's fertile unused land. Despite this, the continent still imports a substantial deal of its food requirements, essentially because food production, and its supply is not in consonance with the consumption pattern locally.

Some of the African countries that have a high percentage of agricultural land (as a percentage of the total land area) at their disposal include South Africa, Burundi, Nigeria, Lesotho and Eretria with 79.8%, 79.2%, 77.7%, 77.6%, and 75.2% share, respectively. Agricultural land essentially refers to the share of land area that is arable, under permanent crops, and under permanent pastures.

While Africa has the highest area of arable uncultivated land (202 million hectares) in the world, most farms occupy less than 2 hectares. The sector is characterized by a high percentage of smallholder farmers (80%) cultivating low-yield staple food crops on small plots with a minimal use of inputs. The level of value addition and crop processing of agricultural commodities is low, and post-harvest losses in sub-Saharan Africa average 30% of total production, meaning that the region loses over US$ 4 billion of agriculture produce each year.

A host of agricultural products are produced in Africa such as cassava, sugarcane, maize, yams, amongst others. Some of them even contribute in double digits to the global production. These are namely cassava (60.9%); yams (97.2%); sweet potatoes (24.6%); sorghum (47.3%); and plantains (60.1%).

India-Africa Trade in Agriculture

The India-African agricultural trade was registered at US$ 5.3 billion in 2017, just marginally up from the level of US$ 5.2 billion in 2013. Interestingly, while India continues to maintain a surplus in the trade of agriculture with Africa, the value has fallen consistently in the last 5 years from US$ 2.5 billion in 2013 to touch US$ 1 billion in 2017. The imports by India from Africa in agriculture sector, increased from US$ 1.4 billion in 2013 to US$ 2.1 billion, recording an AAGR of over 12%, during this period.

The top five products that saw entry into Indian market in 2017 from Africa, contributes to almost 98% of the agricultural imports from Africa by India. The main products were 'Edible fruit and nuts; peel of citrus fruit or melons' (share of 68.5% in Indian imports of agriculture from Africa); 'Edible vegetables and certain roots and tubers' (12%); 'Coffee, tea, maté and spices' (8.3%); 'Oil

seeds and oleaginous fruits; miscellaneous grains, seeds and fruit' (6.8%); and 'Cocoa and cocoa preparations' (2.1%). In fact, with in the category of 'Edible fruit and nuts; peel of citrus fruit or melons', most of the imports were of 'Fresh or dried cashew nuts, in shell'.

Agriculture contributes to more than 11% of Africa's total exports in 2017. The African exports of agricultural products to the world were recorded at US$ 47.6 billion in 2017, up from US$ 42.2 billion in 2013. On the other hand, Africa's imports of agricultural products stood at US$ 67 billion in 2017, almost the same as the 2013 when it touched US$ 67.3 billion. Agriculture imports contributed to 5.8% of Africa's total imports in 2017.

In order to understand the potential that Africa has in agriculture, it is vital to understand the dynamics at the sub-regional and individual level, as per some of the key parameters. An important benchmark here can be to assess the Agriculture Orientation Index (AOI) for Government Expenditures. Agriculture Orientation Index (AOI) for Government Expenditures, compares the central government contribution to agriculture with the sector's contribution to GDP. It may be observed that globally AOI has declined from 0.42 in 2001 to 0.26 to 2017. As on 2017, while the North Africa and West Africa regions exhibited an AOI of 0.12 each, Middle Africa had an AOI of 0.24, East Africa, 0.15, and Southern Africa, 0.74. This calls for more Government intervention in a region like Africa, where not much private players are willing to put money.

The Study also undertakes a cross-functional analysis of the various key parameters which would be the major determining factor to assess the position of agriculture in over 50 African economies. These include production (in million tonnes in 2017), yield (which would ascertain per hectare production of a crop in 2017), land area equipped for irrigation as a % of arable land, and fertilizers use per area of cropland in 2017.

India-Africa Trade in Farm Mechanisation

Mechanisation is an essential input not only for crop production, but it also has a crucial role to play along the entire value chain. Mechanisation is needed at different stages of production; harvesting post-harvest/storage; processing; and marketing. Automation in farm not just reduces labour time and post-harvest loss but also helps to cut down production cost over the long term.

In the case of India, the agricultural sector has experienced substantial mechanisation witnessing a considerable decline in the use of animal and human power in agriculture related activities. The trend has paved a way for a range of agricultural tools. A large number of these are driven by tractors, diesel engines, amongst others. This has resulted in a shift from the traditional agriculture process to a more mechanised process.

The use and power of tractors in Africa has barely increased over the past 40 years and remains negligible compared to other regions in the world. In 1980, there were just two tractors per 1,000 hectares; by 2003 this had fallen to 1.3. When this is compared to Asia and the Pacific region there were 7.8 tractors per 1,000 hectares in 1980, which increased to 14.9 by 2003. In 1960, Kenya, Uganda, and Tanzania each had more tractors in use than India. Interestingly, by 2005, India had 100 times more tractors in use than all three countries combined.

The Study takes into account different dimensions of agricultural machinery and short lists 53 products at HS-6 digit level (collectively, here after called as agro-machinery). India's trade with the world in agro-machinery was recorded at US$ 1772.9 million in 2017, up from US$ 1753.1 million in 2013. India has maintained a decent surplus in the trade of agro-machinery in the last 5 years, with the surplus increasing from US$ 743.1 million in 2013 to US$ 829.4 million in 2017.

Further, the top 10 products exported by India in the agro-machinery space at HS 6 digit level, contributed close to 83% of the total agro-machinery exports by India in 2017. Major export destinations for India agro-machinery exports include: the USA (18.4%); Bangladesh (10.6%); Nepal (9.7%); Turkey (4.7%); and Sri Lanka (4.4%). Two African countries, namely Kenya (2.8%, 7th rank); and South Africa (2.1%, 9th rank) also appeared in the list of markets where top 10 agro-machinery products were exported by India in 2017.

Whilst India has a deficit in overall trade with Africa, in terms of agro-machinery, India has a huge surplus. India has barely been importing any agro-machinery from Africa. However, India's exports to Africa in the last decade, that is, during 2008 to 2017, have nearly doubled, from US$ 134.1 million to US$ 259.7 million, registering an AAGR of 12.6%.

Additionally, India's exports of these machineries to Africa, contributed almost 20% of India's global exports of these machineries. It may be noted that out of the top 10 exported items to the world, 8 of these items appear in the top 10 exported items to Africa as well.

The Study uses the Export Specialization Index (ESI) which provides product information on revealed specialization in the export sector of a country and is calculated as the ratio of the share of a product in a country's total exports to the share of this product in imports in the specific markets or partners. An analysis of 53 HS-6 digit products under the agro-machinery category shows that India has an export specialization only in 6 of the 53 products with respect to African market. Interestingly, these 6 products contributed 69.3% of the total agro-machinery exports to the world by India in 2017. Additionally, these 6 products contribute to 50% of Africa's total imports of agro-machinery in 2017. This signifies the potential of a symbiotic Indo-Africa trade in agro-machinery, especially in the products, where India possesses an export specialization.

As far as Africa is concerned, the total trade for agro-machinery by Africa was recorded at US$ 5301.4 million in 2017, a level down from what was recorded in 2013 at US$ 6876.6 million. However, trade in agro-machinery showed signs of recovery in 2017, when it grew at 9.2% vis-à-vis 2016. Most of this trade is due to high imports, rather than exports. 90% share is through imports of the agro-machinery. Africa imported close to 5% of the total agro-machinery imported in the world by value in 2017. South Africa (16.5%); Egypt (13.2%); Algeria (9.1%); Morocco (8.9%); and Nigeria (5.7%) are some of the major importers of agro-machinery in Africa.

India-Africa Partnership in Farming and Farm Mechanisation

Farming: Cooperation between India and Africa

Since India is still largely an agrarian country and feeds a population of 1.2 billion people and one that has traditionally had close relationship with Africa, India is well poised to share its vast experience across the agro value chain, in enabling Africa to become a net exporter of agriculture produce.

Green Revolution

India and Africa can collaborate in the space of Green Revolution. Things changed phenomenally in the 1960s for India, and since then India has gradually improved to become a net exporter of agricultural items. This is largely attributed to its success in the Green Revolution. The Green Revolution, spreading over the period from 1967-68 to 1977-78, changed India's status from a food-deficient country to one of the world's leading agricultural nations.

Available land in Africa, though enough, has not been able to generate the desired productivity in the continent. With the population rising exponentially, there is a need for a Green Revolution in the region, which would involve infusion of high variety seeds, irrigation facilities, multiple cropping, farm machinery, etc.

Contract Farming

Africa could increasingly look at the contract farming model, whilst concentrating on its supply chain, in order to cut down its import bill. Africa today imports crops such as wheat and rice in huge volume. The experience of contract farming in the Indian context shows that there is considerable saving in consumption of inputs due to the introduction of improved technology and better extension services, and better gains in terms of revenue and productivity.

Seeds Development

Quality seeds are the basic and most critical input for sustainable agriculture. India actually first realised the benefits of good quality seeds during the Green Revolution in the 1960s – since then the Indian seed industry has evolved into a multi-faceted industry with a large involvement of private firms and increased emphasis on research and development. After the New Seed Development Policy (1988 – 1989), Indian Corporate and MNCs entered the Indian seed sector with strong R&D base for product development with more emphasis on high value hybrids of cereals and vegetables and hi-tech products such as Bt. Cotton.

In Africa's case, access to high quality, locally adapted, better pest resistant, and high yielding seeds at affordable prices are having significant relevance. Seed systems in most Sub-Saharan African countries are still relatively underdeveloped with farmer-saved seed accounting for approximately 80% of planted seeds, compared to a worldwide average of 35%. Opportunity exists with the African Governments to join hands with India in this space, in order to develop its seed program.

Drip Irrigation

In Africa, 86% of water withdrawals are directed towards agriculture, and this percentage is even higher in the arid and semi-arid parts of continent. Also, only a few countries in Africa can afford the financial investment in efficient irrigation systems, and water losses through leaking pipes. It is important for Africa hence to focus on low cost drip irrigation system, especially in a scenario, where there are large number of marginal landholders. India has had some successful examples in this area. Africa can partner with Indian companies like Jain Irrigation, Finolex Plasson, Kisan Irrigation, Premier Irrigation Adritech, Netafim, amongst others and Indian institutions like Central Institute for Cotton Research in India (CICRI) which have successfully developed low cost irrigation systems, in order to address the challenge of capital.

Agricultural Markets

Among the challenges that various developing nations face in the agriculture sector is that the farmers do not get the fair price of their product. This challenge is faced by the African region too and is dependent on various factors. In India's case, Indian Government had launched the National Agriculture Market (e-NAM) in 2016, with the objective of integrating agri-markets across the country through an e-platform and creating a unified national market for agricultural commodities. Further, the Indian e-mandis (e-markets) integrate various vegetable markets across the country, bringing them all to one platform and registered farmers are able to sell their produce online in any of the markets where they can get the best price. India's experience in establishing this e-market platform would be of great relevance to Africa.

Precision Farming

In India (and also 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 maximize productivity, quality and profitability. Indian Farmers Fertiliser Cooperative (IFFCO), a well-known farmer cooperative organisation, created the 'IFFCO Kisan' app which helps Indian farmers to make informed decisions by accessing customised agricultural information on market prices, weather forecast, latest agricultural advisories, farming best practices, animal husbandry/ horticulture expert advice and all agriculture-related news and recent government schemes. Given both the Indian and the African precision farming markets are expected to grow in double digits in the coming years, it is mutually beneficial for both the regions to collaborate in this area.

Marketing Support

While Africa is making an effort to increase the production and yield across the crops, it is also important to reduce the gap between the buyers and sellers. Going forward, Indian marketing agencies like Agricultural and Processed Food Products Export Development Authority (APEDA), National Agricultural Cooperative Marketing Federation of India (NAFED), Tribal Cooperative Marketing Development Federation of India (TRIFED), fair trade regulator like Competition Commission of India (CCI), state level agricultural produce market committees (APMC), and National Agriculture Market (NAM), a pan-India electronic trading portal can all share their experiences in various countries in Africa.

Institutional Support

Africa is at the forefront on the global food security efforts. This is due to the various challenges that the continent faces such as low productivity, infrastructural challenges etc. Other than the various mechanisms that can be applied to address these challenges, the institutional support from various nations becomes a part of the bigger solution. Countries such as India which have faced similar experiences in the field can be a great facilitator in Africa's story of agricultural growth. There are also some significant Africa-India initiatives undertaken at multilateral level, particularly in the domain of South-South cooperation.

Robotics

Africa has the possibility of experiencing a leap-frog approach in modern agriculture. Robotics in agriculture is one such technology. The advantage of using agricultural robots is that they are capable of collecting crop and soil samples because they are small in size, which allows them to be able to accumulate data close to the crops with the equipped cameras and sensors. The benefits of automation and mechanisation can be seen spreading to crops like tomatoes, peppers, strawberries, etc., thus making them more affordable; significantly reducing the loss of soil to erosion; reduction of agriculture's contribution to CO_2 production and reversal of the loss of soil carbon. Africa and India can thus, collaborate in this space.

Capital Formation

The African agriculture sector has been facing multiple challenges which has been hampering the investment in the region. According to FAO, within Africa, the agriculture share of central Government expenditures, in terms of regions, has not been very significant except for the region of Eastern Africa. Further, according to fDi markets, in the last decade, that is, during 2009 to 2018, a total of 129 foreign capital projects to the tune of US$ 10.1 billion were envisaged in the agricultural sector in Africa. India has been the highest contributor to this at US$ 2.1 billion

Additionally, the Government of India has been encouraging outward FDI in agriculture which would not only help Indian companies to purchase land abroad for cultivation but will also help to serve the local communities by creating employment opportunities, enhancing productivity, thereby resulting in increased income generation for the local population. These efforts would help Africa in serving its objective of becoming a self-sufficient region in food production. At the same time, there has been a growing demand of certain crops in India which it is unable to fulfil. In the current context, if there is an option available for India to outsource the production of these commodities to countries in Africa, it may well be a win–win situation for both.

Farm Mechanisation: Cooperation between India and Africa

Mechanisation is one of the various possible solutions that is yet to be exploited to a large extent, in the African region. Farm mechanisation was neglected to quite an extent in Africa, but of late the need for mechanising the farming is being realised.

Diversifying in Trade of Farm Equipment: Role of India

The technology by the western regions, especially Europe and the USA, has become increasingly sophisticated. However, a technology can be best utilized only in a condition which it is suited for. Given the size of farm holdings in Africa, which is marginal, Indian agriculture machinery are best suited, especially given that the African continent is also facing skill challenges to operate complex machines marketed by the developed countries. India has increasingly stepped in to provide tractors and farm machinery, which are present in local markets. This machinery is perceived to be more suitable for African conditions and at the same time, is considerably cheaper than machinery manufactured in Western Europe or North America.

Need for Newer Business Models

The global community has to reach a place where African countries have to be seen in isolation, since agricultural dynamics might differ across countries. Although, Sub-Saharan African regions may seem underdeveloped in terms of economic activities, there is excellent potential for the development and adoption of new ideas for business models adapted to the prevailing conditions. There should also be a greater focus to promote the public-private partnership (PPP) in this space. For example, the Potato Initiative Africa (PIA) – operating in Nigeria and Kenya – is implemented within the German Food Partnership (GFP) and involves private sector agricultural machinery suppliers. Newer models such as hiring the farm machinery can also be explored. For instance, India's largest producer of tractors, Mahindra and Mahindra Ltd, in 2016 launched Trringo to rent farm equipment to farmers across India.

Creating an Enabling Environment for the Private Sector

Government's focus should go hand in hand with the private sector's intentions. It is important for the Government to provide relevant public goods to the private sector if it wants to implement these strategies on the ground. Government of India, has in place, a scheme called, 'Sub-Mission on Agricultural Mechanisation (SMAM)', amongst others, in order to create an enabling environment for both the farmers as well as the investors. Both Africa and India can set up a cooperation mechanism in this space, in order to create such an environment that the farmers and the farm equipment manufacturers are able to complement each other.

R&D Support by the Government

According to the International Food Policy Research Institute (IFPRI)-led Agricultural Science and Technology Indicators (ASTI), as per the latest data available, in 2014, the average of R&D spending as a percentage of agriculture GDP, by 37 sub-Saharan Africa countries was just 0.88%. It is vital for the countries in Africa to increase the usage of farm machinery equipment, given its needs to increase the productivity across various crops. However, the long term aim for the continent should be to manufacture their own farm machinery equipment backed by customization, attuned to their own economies.

Exim Bank Financing for Agriculture Development in Africa

According to AfDB estimates, the total cost for agricultural transformation for the priority commodities and agro-ecological zones is between US$ 315 bn and US$ 400 bn over 10 years, equivalent to US$ 32 bn – US$ 40 bn per year. The financing needs in agriculture are not confined only to the pre-production or post-production stages, but are required throughout the value chain from procuring the seeds, to tilling the land with machinery and equipment, to maintaining and insuring the land from uncertainties, to harvesting mechanically, storing it in warehouses, processing it, if required, and selling it to the market while adhering to the quality and labelling standards.

Exim Bank's Lines of Credit

Exim Bank of India (Exim Bank) has been partnering Africa in its development by financing activities in the continent across a wide range of sectors, with agriculture being one of the important ones. A key financial instrument of the Bank is the Lines of Credit (LOCs) extended to overseas financial institutions, regional development banks, and foreign governments and their agencies in Africa.

As on March 31, 2019, Africa's share in the total value of Exim Bank's GOI-LOC program stood at US$ 9.65 billion, which constituted 39.7% of the total GOI-LOC portfolio valued at US$ 24.28 bn. Overall, 7.84% of the contracts with value aggregating US$ 737 million covered under GOI-LOCs extended to as many as 27 African countries pertain to agriculture and irrigation sector.

These contracts include acquisition of tractors, harvesters, agricultural processing equipment; farm mechanisation; setting up plantation projects and processing plants; development of sugar industry; procurement of design, supply, installation and commissioning of fuel storage facilities, establishment of irrigation network, commissioning of sugar processing facility; rice self-sufficiency programme; including setting up of the agri related institutions like the Mahatma Gandhi Institute of Technology and Biotechnology Park in Cote d'Ivoire.

Setting up a dedicated India-Africa Agricultural Fund

Government may consider setting up of an independent fund to finance the overseas expeditions of Indian companies in the agriculture sector. Besides allocating finance for establishment of this fund, the Government also needs to establish an appropriate institutional mechanism for the management of this fund. It is here that the role of India's one of the vital financial institution, viz. Exim Bank could gain significance since it has been actively promoting overseas direct investment over the last three decades, supporting several such projects.

Chapter

1 INTRODUCTION

As economies graduate from tilling of land to running machines to rendering services through an application on a mobile, the very basic need remains intact, and that is having access to a sustainable diet. The United Nations, as per the Goal Number 2 of the Sustainable Development Goals (SDGs) is committed to end all forms of hunger and malnutrition by 2030, making sure that all people, especially children, have access to sufficient and nutritious food all year round. Approximately 795 million in the world are undernourished.

This also involves promoting sustainable agricultural practices, which amongst others includes supporting small scale farmers and allowing equal access to land, technology and markets. The UN SDGs call for international cooperation to ensure investment in infrastructure and technology to improve agricultural productivity. It may be noted that agriculture is the largest employing sector across the world accounting for at 40% of total employment.

The global population in the last 50 years have more than doubled from 3 billion in 1960 to 6.9 billion in 2010. It may be noted that globally, the population has grown by 1.23 times since the turn of this century, that is, from 2000 to 2017.

The number of mouths to feed has witnessed an increase from 1.3 times in India and 1.6 times in Africa since the turn of this century. India has a population of 1.3 billion, which is over 250 million more than entire Africa's.

Food Security in India

India, which is the 7th largest country in terms of area and the 2nd largest country in terms of population has primarily been an agrarian state. Whilst agriculture's contribution to the country's gross product has waned in the recent years at the cost of services largely, majority of Indian population is still reliant on it.

India's first tryst with modern agricultural production came in the early 1960s when India launched, what is popularly known as the country's First Green Revolution. It was the period when Indian agriculture saw the infusion of technology for the first time, adapting modern methods and technology such as the use of high yielding variety (HYV) seeds, tractors, irrigation facilities, pesticides, and fertilizers. This was part of the larger Green Revolution endeavour initiated by Norman Borlaug, which leveraged agricultural research and technology to increase agricultural productivity in the developing world[1]. As a result of the Green Revolution and the introduction

[1]Hardin, Lowell S. "Meetings That Changed the World: Bellagio 1969: The Green Revolution." Nature 25 Sep 2008: 470-471. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1027&context=envstudtheses

of chemical fertilizers, synthetic herbicides and pesticides, high-yield crops, and the method of multiple cropping, the agricultural industry was able to produce much larger quantities of food.

The production of wheat in 1983 was more than four times than the production in 1966, around the time when the Green Revolution just started. As of 2017, the production of the same is more than 9 times vis-à-vis 1966 level. The per capita production of wheat has also increased from 20.5 kg per year in 1966 to the level of 73.6 kg in 2017, this in spite of the rapid increase in population.

From a country that had to depend on imports of poor quality food grains from the West, to one which has agricultural surplus to boast about, India in the last fifty years, since the Green Revolution has achieved a lot. In fact, as in 2017-18, the country has a positive trade balance of US$ 1.2 billion in agricultural[2] trade.

While the successful narrative for India remains true, there is no denying the fact that there is also a challenge to meet the needs of certain segments of food production for which India has to intermittently rely on imports.

However, even with trade surplus, India is dependent on imports of a lot of agricultural products. High imports are observed in vegetable oils and pulses where India imported US$ 11.6 billion and US$ 3 billion in 2017-18, respectively. Interestingly, India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world.

At the same time, it may be noted that, though India has reduced the number of undernourished in the recent years, according to FAO, India still accounts for 23.8% of the global burden of malnourishment, and has the second-highest estimated number of undernourished people in the world, after China. Further, Asia alone has 2/3rd of the hungriest people in the world. According to India's National Family Health Survey, 38.4% of children in India are stunted and 21% wasted.[3]

India also faces a lot of challenges when it comes to sustaining the agriculture for its population. For instance, according to the Global Food Security Index 2018, "areas that are using water faster than it can be recharged are depleting their groundwater reserves and are being forced to prioritise between industrial, residential and agricultural users, with the largest volume of groundwater depletion happening in India, Iran, Pakistan and China". India has been grappling with the problem of malnutrition for decades and a reduction will contribute significantly to poverty alleviation and economic growth.

Drought and flooding often work in tandem to damage food systems, as prolonged drought is often followed by heavy rainfall, causing serious erosion and damage. India ranked 76th in the list of 113 countries for Global Food Security with a score of 50.1, out of 100. Countries such as Argentina (37th rank); Brazil (39th rank); Malaysia (40th rank); South Africa (45th rank); Turkey (48th rank); Colombia (49th rank); Indonesia (65th rank) performed better than India in this index.

[2]HS Code 6 to 23, as per DGCIS, Ministry of Commerce and Industry, accessed on 03 April 2019

[3]According to WHO, wasting in children is a symptom of acute undernutrition, usually as a consequence of insufficient food intake or a high incidence of infectious diseases, especially diarrhoea. Wasting in turn impairs the functioning of the immune system and can lead to increased severity and duration of and susceptibility to infectious diseases and an increased risk for death.

Africa's food situation

It is expected that by 2050, the global population will cross the 9 billion mark. Almost, a quarter of them are expected to be the people in Africa. In such a scenario, it will be important for the African nations to take relevant steps in order to not just feed its population but also, use agriculture as a means to achieving economic growth in the region. This essentially means utilising the land available to meet its burgeoning population and to employ science and technology to improve the efficiency and productivity of farming enterprises, including introducing quality inputs, such as seeds, fertilisers and pesticides and farm mechanisation.

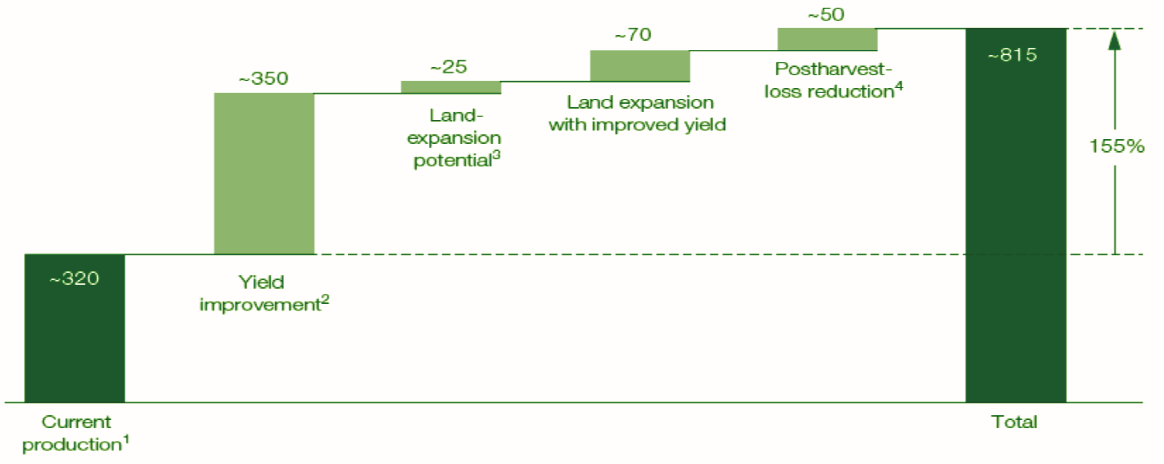
While India continues to have a trade surplus of US$ 1.2 bn in agriculture despite importing a select few items from time to time, Africa suffers a trade deficit in agriculture of close to US$ 20 billion[4]. This is despite the fact that Africa has substantial amount of arable land available for cultivation, which remains unploughed and unutilised.

While it is a fact that agricultural potential remains largely untapped in the African continent, some countries have been able to make efforts in silos to tap this potential. For instance, Ethiopia which registered an average GDP growth of only 4% during 1994 to 2003, exhibited a growth of 10.6%, during 2004 to 2017. A great deal of this consistency in growth has been due to the average agriculture value added to GDP during 2004 to 2017, which has been more than 40%[5]. Ethiopia has prioritized the agriculture as a key contributor to development and also focused on fast-paced adoption of new technologies to boost the sector. The land area equipped for irrigation in Ethiopia has grown more than twice during 2003 to 2016, from 367 (000 hectares) in 2003 to 800 (000 hectares) in 2016[6]. All this was achieved by investing in the sector, and by harnessing technology to expand irrigation to farmers who traditionally relied on rainfall to water their crops. This in lieu boosted productivity and income for farmers by helping them extend the growing season and become more consistent in their production. In addition, Ethiopia established specialized institutions with clear commitments to maximize the benefits of water control and irrigation systems. In addition, the government has invested in the sector and has plans to continue doing so. It aims to allocate US$ 15 billion to irrigation development by 2020[7].

Productivity is another challenge that Africa faces. A primary research done by McKinsey[8] shows that Africa's full agricultural potential remains untapped. The analysis determined that Africa could produce two to three times more cereals and grains, which would add 20% more cereals and grains to the current worldwide 2.6 billion tons of output.

[4]As in 2017, accessed on 03 April 2019, from ITC Trade Map
[5]World Bank
[6]FAO
[7]Investment in irrigation is paying off for Ethiopia's fast-growing economy (https://qz.com/africa/1529668/ethiopias-irrigation-investment-has-boosted-economy/) (Ejeta, 2019)
[8]Report titled 'Winning in Africa's agricultural market' by McKinsey (2019)

Exhibit 1: Cereal and coarse-grain production potential in Africa (millions of tons)

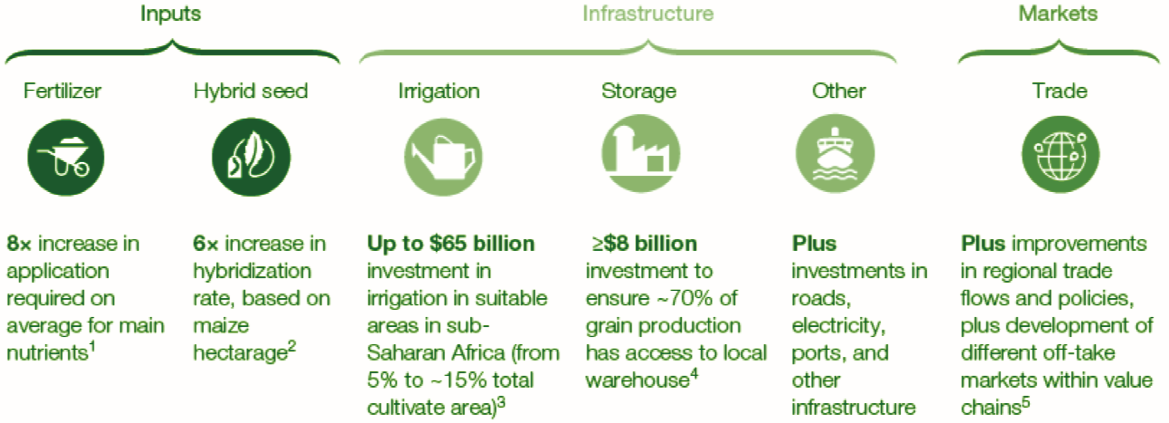


[1] Cereal and coarse-grain production in 2014, from FAOSTAT (latest year available).
[2] Economic-yield improvements without irrigation for main cereal crops for sub-Saharan Africa only, excluding South Africa; some discounts made for less "commercializable" crops, such as sorghum and millet; based on Global Yield Gap Atlas.
[3] Assumes 20-million-hectare land-expansion growth, based on McKinsey analysis.
[4] Based on sub-Saharan Africa moving from 14% agricultural and postharvest loss to 10% (Latin America benchmark).

Source: FAO; Global Yield Gap Atlas; McKinsey Analysis

There is no denying the fact that Africa needs massive amount of investments across dimensions, in order to overturn the things. The McKinsey report also estimates that Sub-Saharan Africa (excluding South Africa) will need eight times more fertilizer, six times more improved seed, at least US$ 8 billion of investment in basic storage (not including cold-chain investments for horticulture or animal products), and as much as US$ 65 billion in irrigation to tap its agricultural potential. Much investment will also be needed in basic infrastructure, such as roads, ports, and electricity, plus improvements in policies and regional trade flows.

Exhibit 2: Agricultural Investment Requirements in Africa



[1] Based on current application rates in sub-Saharan Africa and projected required application rate (based on removal rate of macronutrients) to achieve potential yield. [2] Based on estimated current maize-hybridization rates and gap needed to get to 80% hybridization rate. [3] Liangzhi You et al., *What is the irrigation potential of Africa?*, International Food Policy Research Institute, June 2010, ifpri.org. [4] Based on analysis done in select countries (Ethiopia, Ghana, Mali, and Tanzania) on grain-storage costs, extrapolated to major grain-growing areas. [5] Such as development of animal-feed market to off-take portion of grains currently almost completely grown for human consumption.

Source: McKinsey Analysis

It is vital to note that only one country, that is, South Africa is a part of top 50 countries in the Global Food Security Index (GFSI), whilst most of the low ranking countries are from rest of Africa. Out of total countries defined as low income and food deficient in the world, almost half of them are in Africa. This naturally brings along with it, a host of problems associated with the underdeveloped countries such as poverty, hunger, undernourishment etc. The situation is worse in the Sub Saharan African Region where all these problems are chronic in nature.

This Study

Challenges are being increasingly faced and remain to be faced by both India and Africa, which eventually calls for collaboration by the two regions in the agricultural field. India and Africa have almost same size of economy and even the African population is not far behind the Indian population in terms of numbers. Given this, there is a huge scope in making India achieve its goal of sustainable agriculture and building on its already self-sufficient agricultural output.

India by sharing its experiences, success stories and technologies can facilitate the poverty eradication efforts of Africa as well as reducing the hunger and undernourishment in the region. Building on this, Africa can also, in the future, be a net exporter of the agricultural products, including to India.

With the population in the world growing not only in these two largely populated regions of India and Africa, the food security thereon assumes paramount importance. While it is a foregone conclusion that there is a natural tendency in emerging and middle income economies to move away from agrarian businesses to a relatively secured means of livelihood, this has various ramifications, including migration, amongst others. However, the moot issue remains of addressing food sustainability.

India has been able to introduce a host of mechanisms in agriculture since independence such as green revolution, contract farming, drip irrigation etc. and with these efforts, it has not only become largely a self-sufficient State in terms of agriculture but also a net exporter of the agriculture products. At the same time, Africa also, in the recent years, with efforts from the various Governments has been able to lift enormous number of people from poverty.

It is empirically established that agriculture-led growth has greater impact on poverty reduction than non-agriculture-led growth. Higher returns to agriculture would transform both India's and Africa's poverty profile, improve food security and nutrition, create jobs, and contribute to inclusive economic growth across the region.

India, which has a population roughly equal to Africa, can partner with the continent in working towards making the continent not only a self-sufficient agricultural producer but also a net exporter. Over the years, India has taken significant strides towards production and provision of

food, satisfactorily to its own population. India has also been supplying agricultural equipment to various parts of the world, including Africa, and successes and milestones gained in this arena place India strategically to collaborate in African agriculture.

This Study briefly analyses the agricultural sector both in India and Africa, outlining the key challenges. It also delineates select strategies to increase agricultural efficiency and reduce drudgery by helping countries in Africa to develop strategies for sustainable farm mechanisation.

Chapter

2 SNAPSHOT OF INDIA-AFRICA TRADE

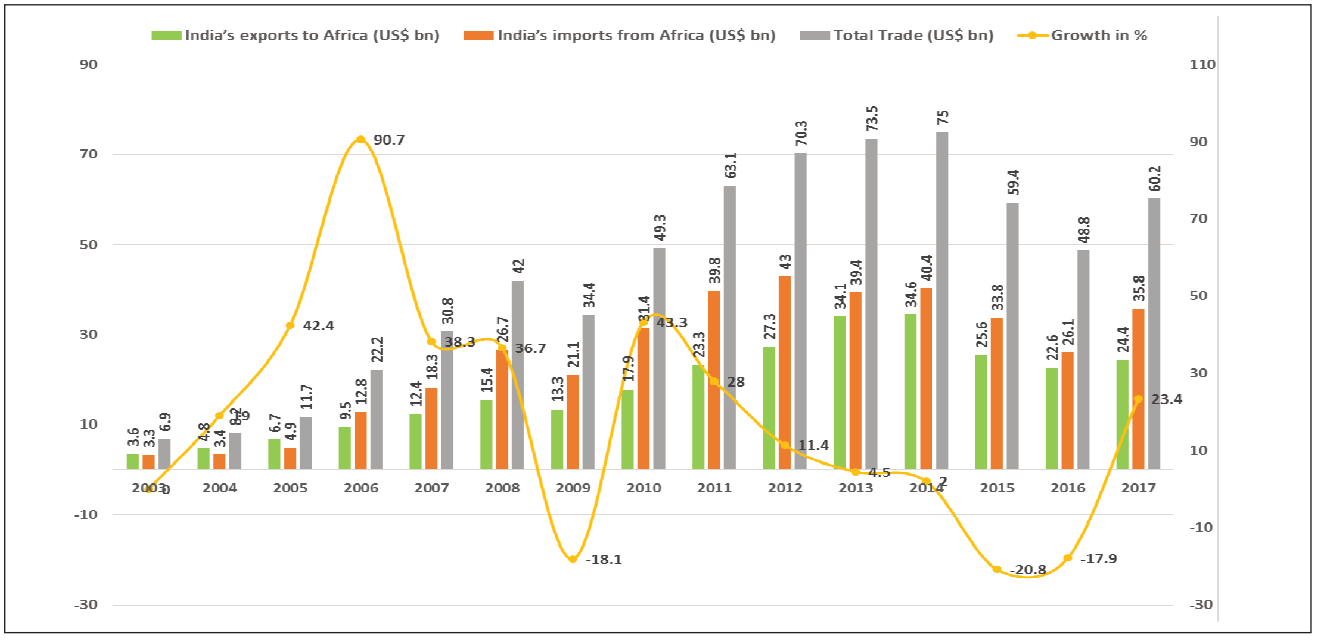
India-Africa Trade

The India-African relations date back to centuries. Whilst the interactions were mostly as a result of cultural exchanges and trade linkages in the past, in the latter half of 20th century, debates around the Non-Alignment Movement further strengthened it.

More importantly, in the last decade or so, there has been a new found approach that has found resonance. It is more symbiotic and seeks to work around each other's strengths so as to witness growth and development in unison. On the one side, while India is one of the fastest growing economies in the world (GDP growth projection of 7.4% for 2019 by IMF's Economic Outlook), Africa is also home to some of the fastest growing economies today. Countries such as Libya (10.8%); Ethiopia (8.5%); Rwanda (7.8%); Ghana (7.6%); Côte d'Ivoire (7%); Tanzania (6.6%); Kenya (6.1%); Uganda (6.1%) are expected to be the flag bearer of Africa's growth in the years to come.

Further, due to the mutual economic interests, India-Africa relations are enjoying an unprecedented renaissance. In the last 15 years, the India-African trade has increased from US$ 6.9 billion in 2003 to US$ 60.2 billion in 2017, an increase of almost 9 times. The trade registered an average annual growth rate of 20.2%, during 2003 to 2017.

Figure 1: India-Africa Trade (2003 to 2017) in US$ Billion

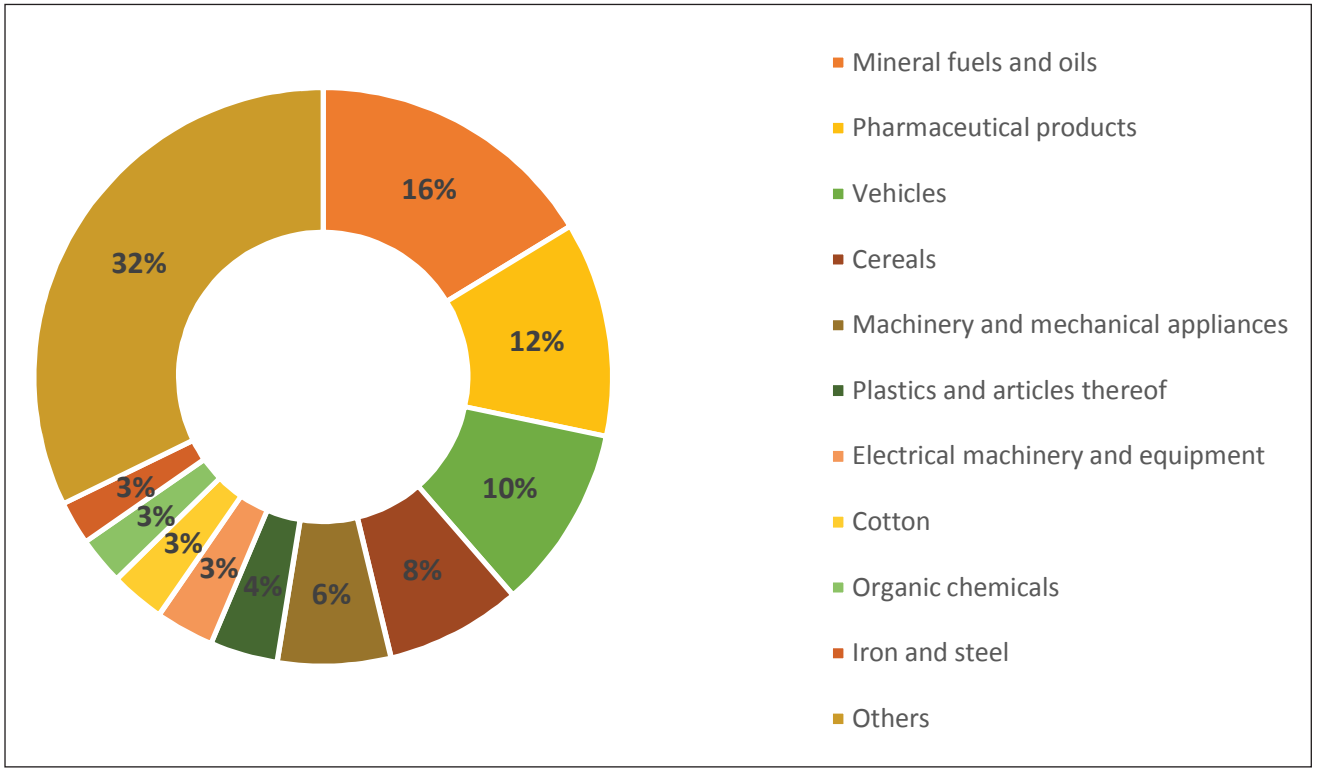


Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Additionally, with respect to the products traded between the two nations, India's exports to Africa have been quite diversified with the top five products exported at 2 digit level contributing to 52.6% of India's exports to Africa in 2017. On the other hand, the top five imported products from Africa contributed to 88.2% of India's imports from Africa, during the same year.

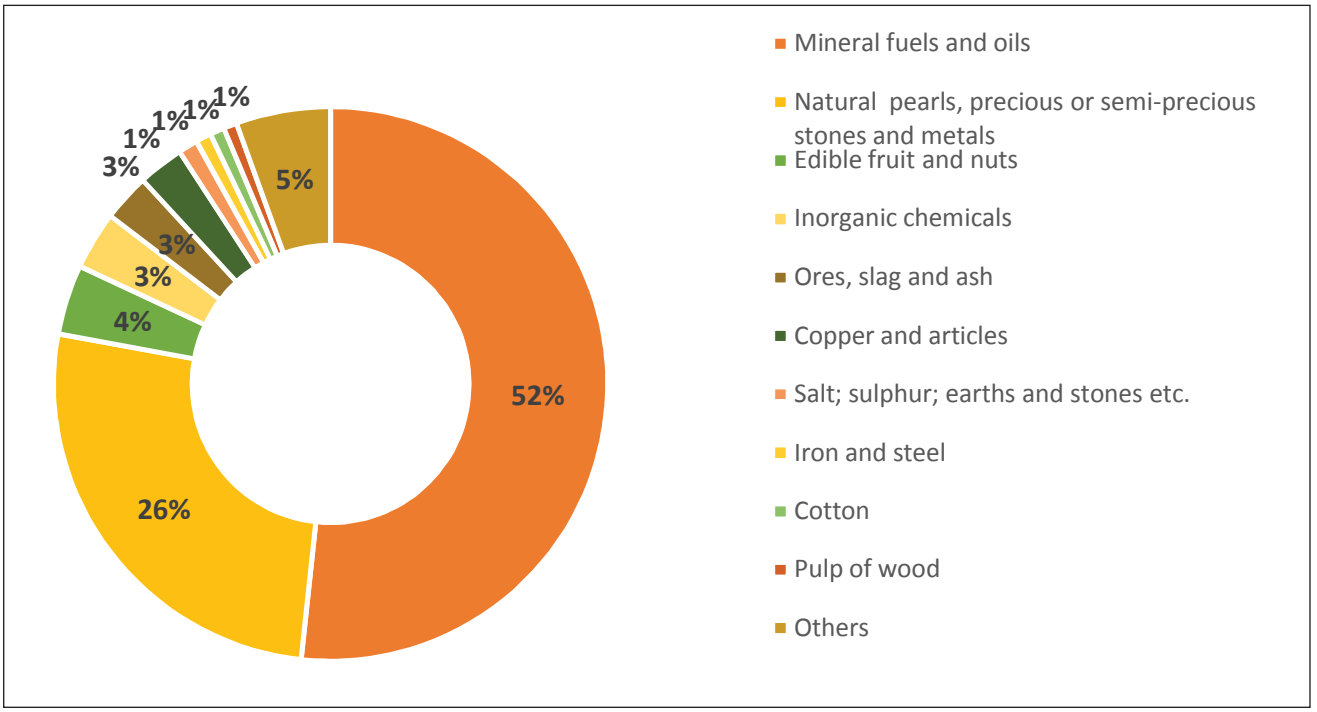
'Mineral fuels and oils' (HS code-27), at 2-digit level, comes out to be the highest exported and imported commodity by India in the India-Africa trade. Whilst, India exports mostly 'Petroleum oils and oils obtained from bituminous minerals (excluding crude)' as a part of 'minerals fuels and oils', Africa, on the other hand, exports only crude oil as a part of this product (HS-27). So, essentially, there is import of crude oil by India from Africa, which is further processed in its refineries to be exported again.

Figure 2: Major products (HS 2-digit) exported by India to Africa: 2017



Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Figure 3: Major products (HS 2-digit) imported by India from Africa: 2017

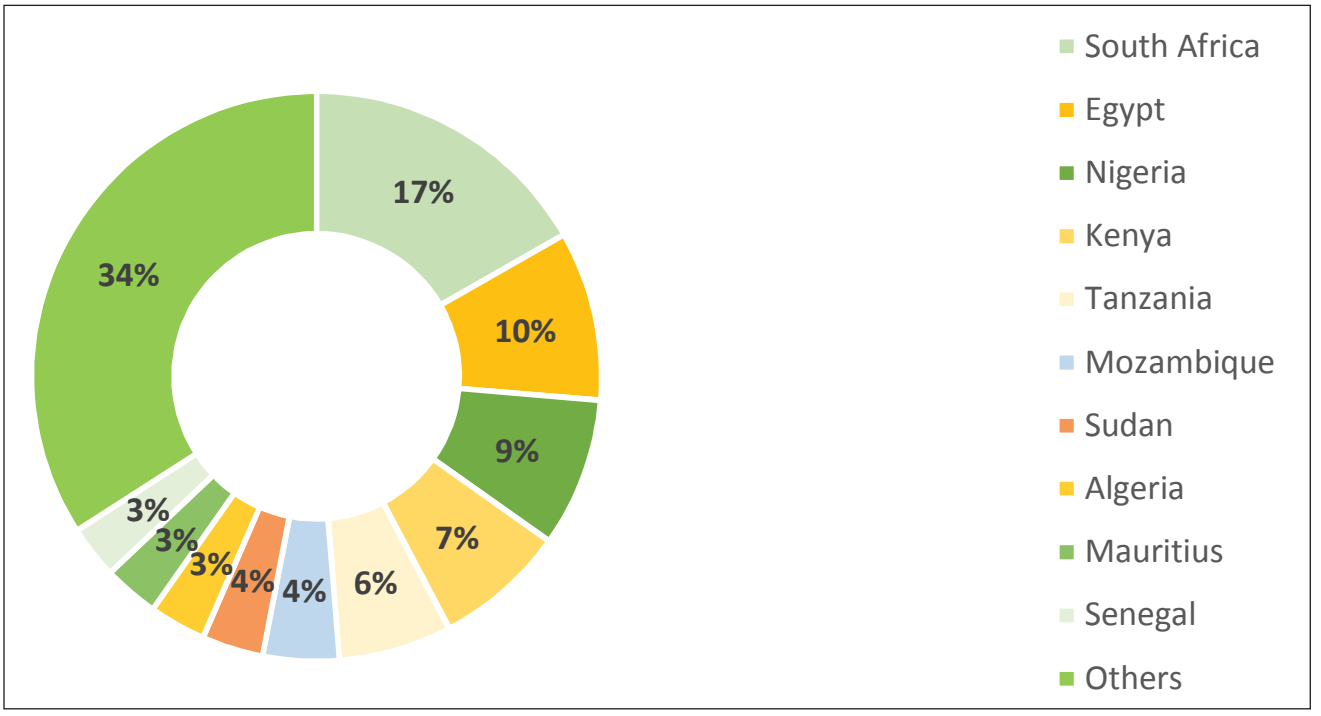


Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

It may be noted that only 8.2% of India's total exports to the world, went to Africa in 2017. Within this pie of exports to Africa, Indian exports are quite diversified. Some major exporting destinations for Indian exports in Africa in 2017 were South Africa (16.7%); Egypt (9.6%); Nigeria (8.5%); Kenya (7.5%); and Tanzania (6.4%).

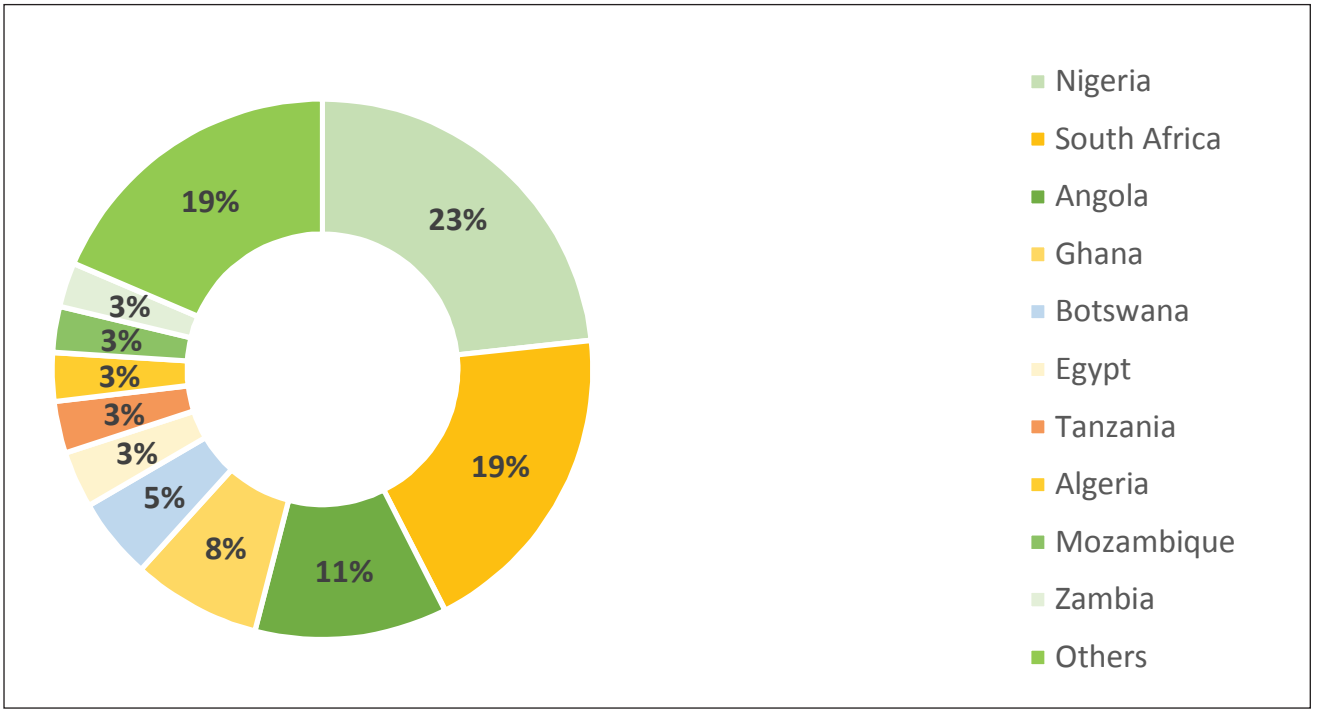
Interestingly, in terms of imports, India has almost the same percentage of imports from Africa as that of exports. Approximately, 8.1% of India's imports from the world were sourced from Africa in 2017. Contrary to the exports, Indian imports from Africa are quite concentrated with top five sources alone contributing to more than 2/3rd of the total imports from Africa. The largest import sources from Africa were Nigeria (23.3%); South Africa (19.2%); Angola (11.5%); Ghana (7.7%); and Botswana (4.9%), in 2017. Approximately, 98% of India's imports from Nigeria were of mineral fuels and oils in 2017.

Figure 4: Major export destinations in Africa for Indian exports: 2017



Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Figure 5: Major import sources in Africa for Indian imports: 2017



Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Chapter

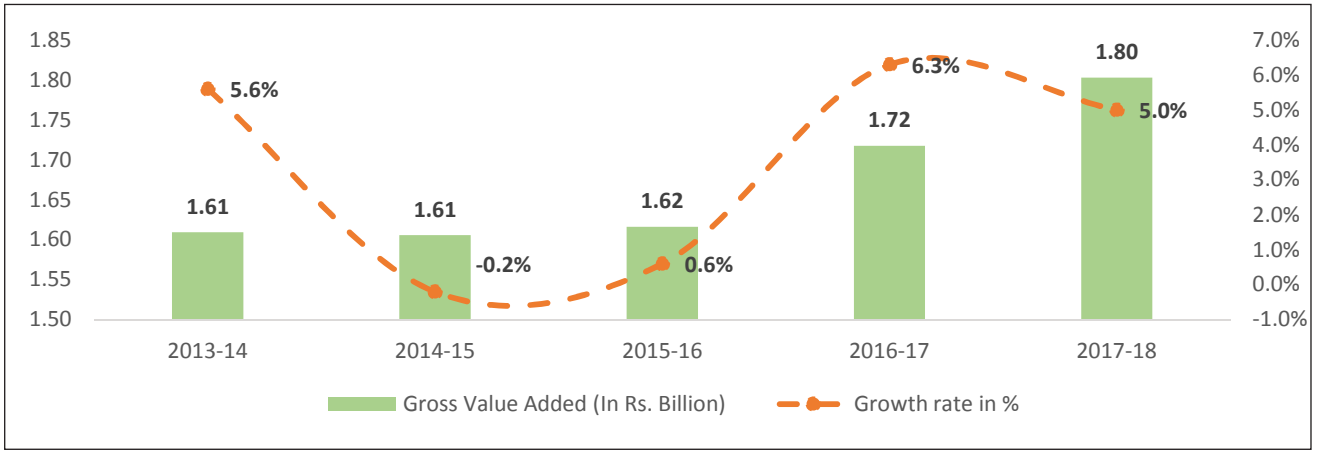
3 AGRICULTURE SCENARIO: INDIA AND AFRICA

Agriculture in India

Agriculture sector, one of the most important sectors for India, is the backbone of the Indian Economy. The agriculture; forestry; and fishing sector together contributed 17.2% to the gross value added in 2017-18, according to the latest estimates. The crops and the livestock contributed 10% and 4.9% respectively, while the rest was contributed by 'Forestry and logging' (1.2%) and 'Fishing and aquaculture' (1.1%). While the crops segment registered a growth of 3.8% in the gross value added, the livestock segment registered a 7% growth.

In isolation, the contribution of the agricultural sector might appear to be small, however, it is important to understand that this sector employs over 50% of the Indian population, and catering to the needs of more than a billion people.

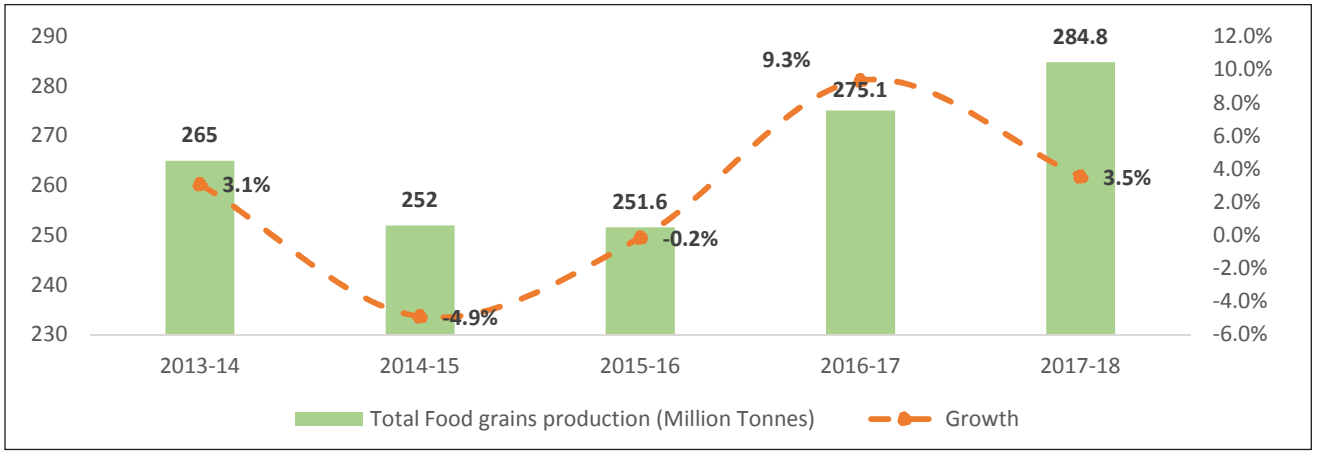
Figure 6: Gross Value Added by Agriculture and Allied sector at constant 2011-12 prices in India



Source: MOSPI; EXIM Bank Research

The total food grains production in India was registered at 284.8 million tonnes (MT) in 2017-18, which was an all-time high for the Indian agriculture. The production was recorded at 265 MT in 2013-14, which fell to 251.6 MT in 2015-16. During 2013-14 to 2017-18, the AAGR registered for India's total food grains production was at 2%.

Figure 7: India's food grain production (Million Tonnes)



Source: Department of Agriculture, Cooperation & Farmers Welfare; EXIM Bank Research

According to FAO, major agricultural products produced in India include sugarcane, rice, wheat, potatoes, amongst others. Sugarcane alone contributed to more than 30% of the Indian agricultural produce in 2017.

Table 1: Production of Major Agricultural Products in India (MT)

Crop	2013	2014	2015	2016	2017	Share in total agricultural produce	AAGR in % (2013-17)
Sugar cane	341.2	352.1	362.3	348.4	306.1	30.9%	-2.5
Rice, paddy	159.2	157.2	156.5	163.7	168.5	17.0%	1.5
Wheat	93.5	95.9	86.5	92.3	98.5	9.9%	1.5
Potatoes	45.3	46.4	48.0	43.4	48.6	4.9%	2.0
Vegetables, fresh	33.2	36.8	34.1	33.1	33.3	3.4%	0.3
Bananas	27.6	29.7	29.2	29.1	30.5	3.1%	2.6
Maize	24.3	24.2	22.6	25.9	28.7	2.9%	4.7
Onions, dry	19.3	19.4	18.9	20.9	22.4	2.3%	4.0
Tomatoes	18.2	18.7	16.4	18.7	20.7	2.1%	3.8
Mangoes, mangosteens, guavas	18.0	18.4	18.5	18.6	19.5	2.0%	2.0
Total agricultural produce	1005.5	1009.1	987.9	996.5	990.9	100.0%	-0.4

Source: FAO; EXIM Bank Research

India aimed to achieve self-sufficiency in agriculture post the independence. In the post-independence era, India was majorly dependent on the US program Public Law 480. However, beginning in the 60s, India initiated work toward becoming self-sufficient in agriculture. The Green Revolution under which High Yielding Varieties Programme (HYVP) was implemented came to

lay the future of Indian agriculture. The HYVP introduced package of practises including varieties, mechanisation, irrigation, fertilizers and plant protection.

Within some years of Green Revolution, India became largely self-sufficient. India, today, is one of the largest producers of wheat and rice in the world.

Further, export of agricultural products took a great leap after 1990-91, when Government of India introduced economic reforms in all sectors. After the beginning of WTO and globalization of markets, the Indian agricultural products specially fruits, vegetables, spices and cash crops like cotton, jute, tea, coffee and rubber have exceeded the expectations and proved to be a great economic support for the country. Lately, India has also become an important market for organic products.

India has one of the largest agricultural arable land in the world. According to FAO, India had 156.4 million hectare of arable land available in 2016, the highest in the world. However, India's biggest challenge is its growing population. As per the World Bank, the per capita arable land in India was approximately, 0.118 hectares, which is not even in the top 100 countries in the world. This essentially calls for the need to improve productivity. India's yield in the agricultural products is still below many countries' yields with lesser land. There are many reasons for low yield such as insufficient irrigation coverage, marginal land holdings, lack of finance etc.

Table 3 lists down select crops which India produces in large quantities such as wheat; rice; maize; pulses; sugarcane; fruits; and vegetables. As stated previously, wheat and rice contribute to most of the food grain production in India. It is observed, in the case of wheat, countries such as France (6757 kg/hectare) produce just over 1/3rd of India's production of wheat while France has a yield, more than double of India (3219 kg/hectare). In the case of rice, while India produces more than 1/5th of the world's rice, India's yield (3848 kg/hectare) is way below the world average yield (4602 kg/hectare). This means, a large part of India's arable land is being put to rice cultivation; however, the output is still below the desired level.

A stark difference is also seen in the case of pulses where India is the largest producer (24.2% of global production) in the world while its output at 664 kg/hectare is lower than the world average. As a result, India which is a huge consumer of pulses, has to import significant volume of pulses.

India boasts itself in the production of fruits and vegetables too, and similar to the yield in the other crops, its yield in the case of horticulture also, is below the world average.

Table 2: Cross Country Comparison of Production (000 tonnes); Area (000 hectares); and Yield (kg/hectare) for Select Crops (2017)

Wheat				
	Production	**Area**	**Yield**	**% production**
World	**771719**	**218543**	**3531**	**100%**
China	134341	24510	5481	17.4%
India	98510	30600	3219	12.8%
Russia	85863	27517	3120	11.1%
USA	47371	15211	3114	6.1%
France	36925	5465	6757	4.8%
Rice				
	Production	**Area**	**Yield**	**% production**
World	**769658**	**167249**	**4602**	**100%**
China	214430	31035	6909	27.9%
India	168500	43789	3848	21.9%
Indonesia	81382	15788	5155	10.6%
Bangladesh	48980	11272	4345	6.4%
Viet Nam	42764	7709	5548	5.6%
Maize				
	Production	**Area**	**Yield**	**% production**
World	**1134747**	**197186**	**5755**	**100%**
USA	370960	33469	11084	32.7%
China	259234	42429	6110	22.8%
Brazil	97722	17394	5618	8.6%
Argentina	49476	6531	7576	4.4%
India	28720	9219	3115	2.5%
Sugarcane				
	Production	**Area**	**Yield**	**% production**
World	**1841528**	**25977**	**70891**	**100%**
Brazil	758548	10184	74482	41.2%
India	306069	4389	69736	16.6%
China	104793	1377	76097	5.7%
Thailand	102946	1368	75238	5.6%
Pakistan	73401	1217	60319	4.0%

Pulses				
	Production	**Area**	**Yield**	**% production**
World	**95979**	**95167**	**1009**	**100%**
India	23241	34991	664	24.2%
Canada	8715	4438	1964	9.1%
Myanmar	7053	4419	1596	7.3%
China	5017	2914	1721	5.2%
Russia	4265	2124	2008	4.4%
Primary Fruits				
	Production	**Area**	**Yield**	**% production**
World	**865590**	**65220**	**13272**	**100%**
China	264737	16130	16413	30.6%
India	92303	7108	12986	10.7%
Brazil	39882	2182	18280	4.6%
USA	26506	1162	22803	3.1%
Turkey	23154	1384	16727	2.7%
Primary Vegetables				
	Production	**Area**	**Yield**	**% production**
World	**1094344**	**58172**	**18812**	**100%**
China	556679	23951	23243	50.9%
India	127144	8591	14800	11.6%
USA	32623	956	34133	3.0%
Turkey	24933	814	30617	2.3%
Russia	16406	651	25206	1.5%

Source: FAO

Agriculture in Africa

The agricultural sector is a key source of livelihood across the African continent. While nearly two-third of Africa's population makes a living through agriculture, it contributes less than one-third to the continent's GDP. Although, its significance in the economy varies widely across African countries, agriculture remains a vital sector for most countries. Furthermore, an estimated 38% of Africa's working youth is presently employed in agriculture[9]. African soil remains greatly underutilized, with the region having more than half of the world's fertile unused land. Despite this, the continent still imports a substantial deal of its food requirements, essentially because food production, and its supply is not in consonance with the consumption pattern locally.

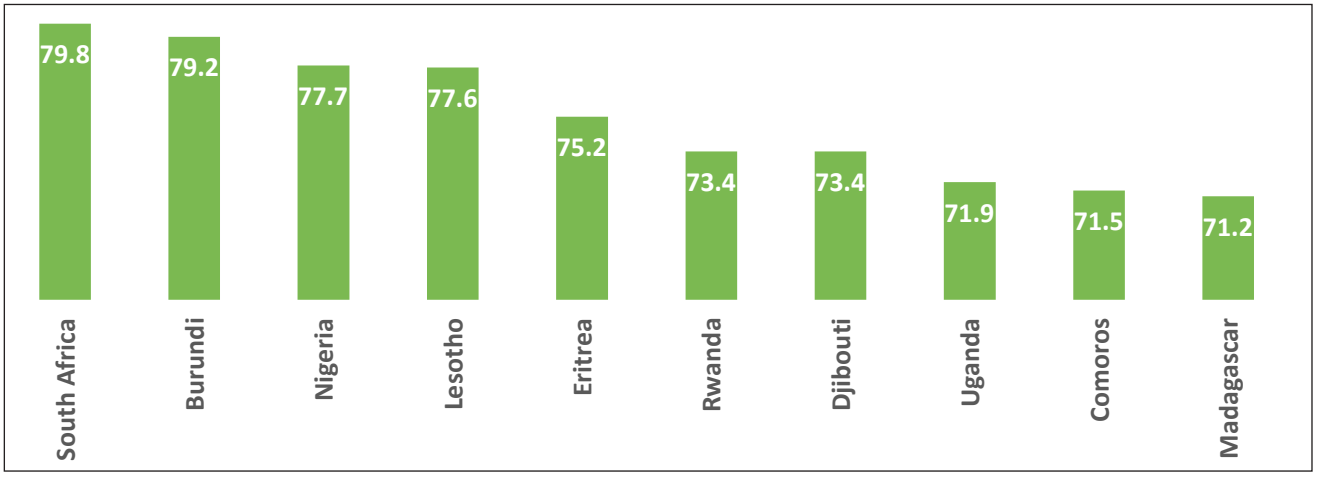
[9]World Bank

As in the case of India, the issue of yield exists for Africa as well. A detailed country wise analysis for yield in cereals, pulses and primary vegetables is shown in Table 8. In case of cereals, highest yield is observed in the case of Egypt (7310.8 kg/hectare); South Africa (5648.2 kg/hectare); and Mauritius (5234.8 kg/hectare). Egypt at 2892.4 kg/hectare is the leader in yield for pulses too. It is followed by Ethiopia (1809.6 kg/hectare) and Libya (1671.8 kg/hectare). For vegetables, Malawi, Morocco and Tunisia have the highest yields at 34307.8 kg/hectare; 28078.7 kg/hectare; and 24752.7 kg/hectare, respectively.

The share of agriculture and agro-processing[10] imports in total imports of Africa was nearly 6% during 2017[11] and was valued at US$ 67 billion. This is 1.4 times of its exports in 2017. It is coupled with the fact that Africa has the highest incidence of undernourishment (estimated at almost one in four persons) worldwide[12].

Given Africa's situation, agriculture, especially value added agriculture, is an immediate need. A large part of African population is engaged in subsistence farming and could be brought into the mainstream production through structured interventions like land reforms, mechanisation, etc. This would help in ameliorating poverty levels faster, given that the agricultural sector consists mostly of smallholder farmers, the majority of which are women. With higher agricultural productivity; gender-equal access to land, seed, and fertilizer; and overall better performance in rural economies, the benefits of agriculture growth will reach the most disadvantaged.

Figure 8: Top Countries with Agricultural Land (as a percent of total land area) in Africa: 2017



Source: World Bank; EXIM Bank Research

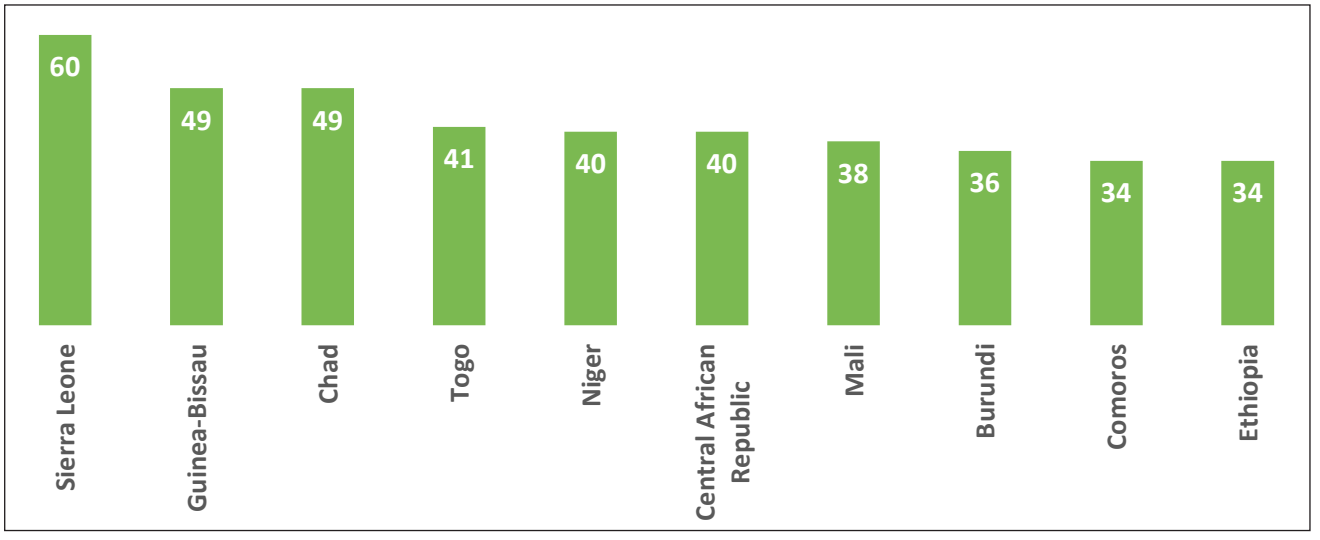
Some of the African countries that have a high percentage of agricultural land (as a percentage of the total land area) at their disposal include South Africa, Burundi, Nigeria, Lesotho and Eretria with 79.8%, 79.2%, 77.7%, 77.6%, and 75.2% share, respectively. Agricultural land essentially refers to the share of land area that is arable, under permanent crops, and under permanent pastures.

[10]HS Code 06-23
[11]Source: UN COMTRADE, accessed on 03 April 2019
[12]The State of Food Security and Nutrition in the World, 2018 (FAO)

Given the lack of mechanisation of African agriculture, the productivity and value addition have been far below the desired levels. The slow productivity growth in agriculture is also constraining Africa's structural transformation process and economic diversification. Value addition to agricultural products is the process of increasing the economic value and consumer appeal of an agricultural commodity.

While Africa has the highest area of arable uncultivated land (202 million hectares) in the world, most farms occupy less than 2 hectares[13]. The sector is characterized by a high percentage of smallholder farmers (80%) cultivating low-yield staple food crops on small plots with a minimal use of inputs. These farms depend on rainwater, thus subjecting production to the vagaries of weather. Mechanisation of agriculture in Africa hence, is the way forward.

Figure 9: Top Countries with Agricultural Value Added (% of GDP) in 2017 in Africa



Source: World Bank; EXIM Bank Research

Amongst the countries which figure at the top in the World Bank Development Indicators, Ethiopia, Rwanda, and Tanzania offer good scope for investments given their current growth and improving economic conditions.

The level of value addition and crop processing of agricultural commodities is low, and post-harvest losses in sub-Saharan Africa average 30% of total production, meaning that the region loses over US$ 4 billion of agriculture produce each year.

A host of agricultural products are produced in Africa such as cassava, sugarcane, maize, yams, amongst others. Some of them even contribute in double digits to the global production. These are namely cassava (60.9%); yams (97.2%); sweet potatoes (24.6%); sorghum (47.3%); and plantains (60.1%). Focusing on augmenting production of these products for local consumption and for exports offers good prospects for the continent.

[13]World Bank Development Indicators

Table 3: Production of Major Agricultural Products in Africa (Million Tonnes)

Crop	2013	2014	2015	2016	2017	Share in world (2017)	AAGR in % (2013-17)	Major African Producers in 2017 (share in %)
Cassava	159.8	169.6	173.4	177.7	177.9	60.9%	2.7	Nigeria (33.4), Democratic Republic of the Congo (17.8), Ghana (10.4), Angola (6.6), Mozambique (4.9)
Sugarcane	97.4	94.3	91.8	91.4	92.1	5.0%	-1.4	South Africa (18.9), Egypt (16.6), Sudan (6.3), Eswatini (6.2), Kenya (5.2)
Maize	71.1	79.1	73.6	73.5	84.2	7.4%	4.7	South Africa (20), Nigeria (12.4), Ethiopia (9.6), Egypt (8.4), Tanzania (7.1)
Yams	55.7	66.3	67.1	71.6	71.0	97.2%	6.5	Nigeria (67.5), Ghana (11.2), Cote d'Ivoire (10.1), Benin (4.4), Ethiopia (2)
Rice, paddy	28.8	30.8	30.8	38.0	36.6	4.8%	6.7	Nigeria (27), Egypt (17.5), Madagascar (8.5), Tanzania (7.9), Mali (7.6)
Sweet potatoes	24.8	25.0	24.5	25.9	27.7	24.6%	2.9	Malawi (19.7), Tanzania (15.3), Nigeria (14.5), Ethiopia (7.2), Angola (6.7)
Sorghum	25.3	29.3	26.1	30.5	27.2	47.3%	2.8	Nigeria (25.5), Ethiopia (17.7), Sudan (13.8), Niger (7.1), Mali (5.1)
Wheat	28.1	25.4	29.1	23.3	27.2	3.5%	0.4	Egypt (32.4), Morocco (26.1), Ethiopia (17.8), Algeria (9), South Africa (5.7)
Potatoes	28.3	24.2	25.2	23.5	25.0	6.4%	-2.7	Algeria (18.4), Egypt (17.3), South Africa (9.8), Morocco (7.7), Tanzania (7)
Plantains and others	22.2	23.9	24.2	23.2	23.6	60.1%	1.6	Democratic Republic of the Congo (20.4), Cameroon (19.2), Ghana (17.2), Uganda (13.9), Nigeria (13.4)

Source: FAO; EXIM Bank Research

India-Africa Trade in Agriculture

The India-African agricultural trade[14] was registered at US$ 5.3 billion in 2017, just marginally up from the level of US$ 5.2 billion in 2013.

Interestingly, while India continues to maintain a surplus in the trade of agriculture with Africa, the value has fallen consistently in the last 5 years from US$ 2.5 billion in 2013 to US$ 1 billion in 2017. The imports by India from Africa in agriculture sector, increased from US$ 1.4 billion in 2013 to US$ 2.1 billion, recording a decent AAGR of over 12%, during this period.

The top five products that saw entry into Indian market in 2017 from Africa contribute to almost 98% of the agricultural imports from Africa by India. The main products were 'Edible fruit and nuts; peel of citrus fruit or melons' (share of 68.5% in Indian imports of agriculture from Africa); 'Edible vegetables and certain roots and tubers' (12%); 'Coffee, tea, maté and spices' (8.3%); 'Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit' (6.8%); and 'Cocoa and cocoa preparations' (2.1%). In fact, with in the category of 'Edible fruit and nuts; peel of citrus fruit or melons', most of the imports were of 'Fresh or dried cashew nuts, in shell'.

[14]HS Code 06 to 23

Table 4: Major Agricultural Products Exported from Africa and Major Export Destinations

Product	Exports in 2013 (US$ Billion)	Exports in 2017 (US$ Billion)	Share in Africa's agricultural exports (2017)	AAGR in % (2013-17)	Major exporters (% of African export)	Major exporting destinations
Edible fruit and nuts; peel of citrus fruit or melons	6.6	9.5	20.0%	9.8	South Africa (35.5), Côte d'Ivoire (14.7), Egypt (13.3), Morocco (9.6), Tanzania (5.8)	Viet Nam (15.9), Netherlands (11.1), India (10.1), UK (7.6), France (5)
Cocoa and cocoa preparations	7.5	9.1	19.1%	5.5	Côte d'Ivoire (54.3), Ghana (26.8), Cameroon (11.8), Nigeria (2.6), Egypt (1.1)	Netherlands (26), USA (12.7), Belgium (7.9), Germany (7.6), Malaysia (7.3)
Coffee, tea, maté and spices	3.9	5.3	11.2%	8.3	Kenya (31.4), Ethiopia (18.1), Madagascar (17.9), Uganda (12.3), Tanzania (3.8)	Pakistan (12.6), USA (12.3), Germany (8), France (5.6), UK (4.7)
Edible vegetables and certain roots and tubers	3.3	3.8	8.0%	3.7	Morocco (29.4), Egypt (27.9), Ethiopia (14.1), South Africa (5.6), Kenya (5.5)	France (17.3), Spain (7.2), UK (6.3), Russia (6), Somalia (5.8)
Animal or vegetable fats and oils and their cleavage products; prepared edible fats;	2.3	2.7	5.8%	7.8	Niger (24), Tunisia (19.2), South Africa (9.8), Morocco (7.9), Côte d'Ivoire (7.2)	Nigeria (14.5), Benin (11.4), Italy (5.8), Spain (4.4), Libya (4.3)
Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit	2.8	2.6	5.4%	0.5	Sudan (23.7), Ethiopia (17.4), Egypt (11.7), South Africa (7.8), Nigeria (7.1)	China (23.9),UAE (6.6),Turkey (5.1),Japan (4.6),Saudi Arabia (3.5)
Sugars and sugar confectionery	3.0	2.6	5.4%	-3.0	South Africa (15.3), Eswatini (13.9), Egypt (13.6), Mauritius (9.9), Morocco (9.9)	South Africa (10.7), Kenya (8), Italy (6.5), Democratic Republic of the Congo (3.8), Turkey (3.6)
Beverages, spirits and vinegar	2.5	1.9	4.1%	-6.1	South Africa (68.4), Namibia (4), Kenya (2.7), Togo (2.7), Zambia (2.6)	UK (6.6), Namibia (6.5), Germany (5), South Africa (4.6), Netherlands (4.1)
Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates	1.8	1.7	3.5%	-1.6	Morocco (41.8), Mauritius (17.7), Seychelles (15.3), Ghana (8.4), South Africa (8.1)	France (15.7), UK (15), Italy (11.2), Spain (11.1), Netherlands (5.1)
Preparations of vegetables, fruit, nuts or other parts of plants	1.6	1.5	3.2%	-0.5	South Africa (38.4), Egypt (26), Morocco (13.3), Kenya (7.2), Sudan (2.7)	France (10), Netherlands (5.7), USA (5.5), Germany (4.5), UK (4.4)

Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

In products of some areas such as cereals; sugars and sugar confectionery; prepared animal fodder; coffee, tea, maté and spices; and oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, where India has registered a decent share in the global export market and is also ranked well, Africa can strengthen its trade with India, in order to further deepen its relationship.

Agriculture contributes to more than 11% of Africa's total exports in 2017. The African exports of agricultural products were recorded at US$ 47.6 billion in 2017, up from US$ 42.2 billion in 2013. On the other hand, Africa's imports of agricultural products stood at US$ 67 billion in 2017, almost the same as the 2013 when it touched US$ 67.3 billion. Agriculture imports contributed to 5.8% of Africa's total imports in 2017.

Table 5: Major Importers and Source Countries for Imports in Agricultural Products for Africa (US$ Billion)

Product	2013	2014	2015	2016	2017	Share	AAGR in % (2013 - 17)	Major importers (% of African import)	Major import sources	India's share in global exports in% (Rank in world)
Cereals	22.6	23.7	20.6	20.0	23.2	34.6%	1.2	Egypt (19), Algeria (11.9), Nigeria (6.2), Morocco (6), Kenya (4.8)	Russia (14.4), Thailand (10.8), Argentina (10.2), India (9.2), Ukraine (9.2)	7.1% (Rank: 3)
Animal or vegetable fats and oils and their cleavage products; prepared edible fats	8.8	8.0	6.8	7.3	9.6	14.3%	3.6	Egypt (14), Algeria (9.4), South Africa (8), Kenya (6.9), Morocco (6.6)	Indonesia (23.7), Malaysia (20.3), Argentina (3.6), Russia (4.8), Spain (3.6)	1.2% (Rank: 16)
Sugars and sugar confectionery	6.5	5.5	5.5	6.2	7.8	11.6%	5.8	Algeria (13.3), Egypt (10.5), South Africa (8), Nigeria (7.9), Kenya (7.6)	Brazil (52.9), India (5.9), UAE (4.4), Eswatini (3.7), France (2.7)	2.4% (Rank: 10)
Residues and waste from the food industries; prepared animal fodder	3.9	4.0	3.6	3.4	3.2	4.8%	-4.1	Egypt (26.6), Morocco (15.6), Algeria (14.9), South Africa (12.7), Kenya (3.7)	Argentina (41.9), USA (9.6), South Africa (5.1), France (5.1), Netherlands (4.1)	2.1% (Rank: 13)
Preparations of cereals, flour, starch or milk; pastrycooks' products	3.1	3.3	2.8	2.6	3.2	4.7%	1.5	Nigeria (14.6), Algeria (6), Libya (5.8), Angola (5.8), Senegal (5)	France (16.9), Turkey (10.5), South Africa (7.4), Netherlands (5.8), Italy (5.4)	0.7% (Rank: 31)
Miscellaneous edible preparations	3.2	2.8	2.9	2.7	3.0	4.5%	-1.0	Algeria (11.8), South Africa (10.3), Nigeria (7.7), Egypt (7.2), Sudan (3.9)	France (11), South Africa (9.7), China (7.6), Spain (5.4), Egypt (5.2)	1% (Rank: 28)

Product	2013	2014	2015	2016	2017	Share	AAGR in % (2013 - 17)	Major importers (% of African import)	Major import sources	India's share in global exports in% (Rank in world)
Beverages, spirits and vinegar	3.6	3.6	2.8	2.4	2.8	4.1%	-5.7	South Africa (18.4), Nigeria (6.7), Namibia (5.7), Angola (5), Cameroon (4.3)	South Africa (19.3), UK (12.5), France (10.5), Spain (5.5), USA (4.8)	0.3% (Rank: 41)
Edible vegetables and certain roots and tubers	2.4	2.3	2.4	2.4	2.6	3.9%	2.8	Egypt (17.3), Algeria (17.1), Somalia (9), Morocco (6), Sudan (4.7)	Netherlands (12.3), Ethiopia (11.6), Canada (10.5), South Africa (6.3), Australia (5.4)	1.6% (Rank: 13)
Coffee, tea, maté and spices	1.9	1.9	2.0	1.9	2.3	3.4%	5.7	Egypt (21.6), Algeria (18.4), Morocco (16.2), South Africa (9.7), Sudan (6.2)	China (17.5), Kenya (13.9), Viet Nam (13.6), India (7.5), Indonesia (6.9)	6.5% (Rank: 4)
Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit;	2.5	2.5	2.2	1.9	2.2	3.3%	-2.0	Egypt (52.4), Tunisia (11.3), Algeria (7.8), Morocco (7.3), South Africa (6.2)	USA (25.2), Ukraine (10), Argentina (9.7), China (7.8), Paraguay (4.2)	1.8% (Rank: 11)

Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

As has been discussed before, the challenge before Africa is huge, as the region's two-thirds people are employed in the agriculture sector. However, it has to import substantially to feed its more than a billion population, largely because of un-utilisation of the arable land and limited mechanisation of the existing farming systems. To add to this, the Sub-Saharan African region is facing a challenge of high population growth and high urbanization.

In such a scenario where productivity is less despite arable land, it will be important for the African authorities to take relevant steps in order to not just feed its population, but also, use agriculture as means to achieving economic growth in the region. This amplifies the need for Africa to take a big leap forward to satiate its growing demand.

A big factor that goes into Africa's favour is that the land available for food production is large, and therefore one of the possible solutions is to increase production on land that is currently underused or not used at all, and to employ science and technology to improve the efficiency and productivity of farming enterprises. Another factor that is a challenge for Africa is the productivity in agriculture. 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[15].

[15]India-Africa partnership in agriculture: Current and future prospects, PWC (2016)

In order to understand the potential that Africa has in agriculture, it is vital to understand the dynamics at the sub-regional and individual level, as per some of the key parameters. An important benchmark here can be to assess the Agriculture Orientation Index (AOI) for Government Expenditures. Agriculture Orientation Index (AOI) for Government Expenditures, compares the central government contribution to agriculture with the sector's contribution to GDP. An AOI of less than 1 indicates a lower orientation of the central government towards the agricultural sector relative to the sector's contribution to the economy, while an AOI of greater than 1 indicates a higher orientation of the central government towards the agricultural sector relative to the sector's contribution to the economy (FAO). Mathematically,

AOI= (Agriculture Expenditure/Total Outlays) / (Agriculture Value Added/GDP)

It may be observed that globally AOI has declined from 0.42 in 2001 to 0.26 to 2017. As on 2017, while the North Africa and West Africa regions exhibited an AOI of 0.12 each, Middle Africa had an AOI of 0.24, East Africa, 0.15, and South of Africa, 0.74.

The North African region registered an AOI of more than 1 in 2001 and 2002 (indicating a higher orientation of the central government towards the agriculture sector relative to the sector's contribution to the economy), experienced a drastic fall to 0.12 by 2017. This is due to faster decline in agricultural share in total Central Government Expenditures in this region (from 9.87 in 2001 to 1.38 in 2017) than the increase in agriculture value added share of GDP (9.42 in 2001 to 11.49 in 2017). The sub-Saharan Africa which is one of the important regions for Africa observed almost a stable AOI over the course of last 17 years (2001 to 2017). The AOI for Southern Africa has experienced a marginal increase during this period from 0.59 to 0.74.

Table 6: Region wise Agriculture Orientation Index for Government Expenditure in Africa

Year	World	Northern Africa	Sub-Saharan Africa	Western Africa	Middle Africa	Eastern Africa	Southern Africa
2001	0.42	1.05	0.23	0.17	0.15	0.16	0.59
2002	0.4	1.14	0.23	0.22	0.09	0.19	0.5
2003	0.36	0.95	0.15	0.07	0.1	0.18	0.69
2004	0.37	0.37	0.19	0.14	0.2	0.18	0.62
2005	0.39	0.26	0.25	0.18	0.33	0.25	0.89
2006	0.42	0.26	0.24	0.24	0.31	0.24	0.83
2007	0.35	0.21	0.26	0.22	0.56	0.25	0.91
2008	0.35	0.31	0.23	0.23	0.42	0.23	0.78
2009	0.3	0.22	0.18	0.16	0.15	0.23	0.7
2010	0.28	0.14	0.17	0.11	0.14	0.21	0.8
2011	0.28	0.13	0.19	0.13	0.19	0.24	0.77
2012	0.28	0.17	0.17	0.12	0.22	0.16	0.8
2013	0.26	0.17	0.16	0.1	0.18	0.15	0.81
2014	0.27	0.14	0.21	0.24	0.16	0.15	0.79
2015	0.28	0.13	0.19	0.22	0.12	0.14	0.76
2016	0.28	0.11	0.21	0.22	0.13	0.16	0.77
2017	0.26	0.12	0.2	0.12	0.24	0.15	0.74

Source: FAO

Further, the Study undertakes a cross-functional analysis of the various key parameters which would be the major determining factor to assess the position of agriculture in over 50 African economies. These include production (in million tonnes in 2017), yield (which would ascertain per hectare production of a crop in 2017), land area equipped for irrigation as a % of arable land, and fertilizers use per area of cropland in 2017.

Table 8 depicts critical parameters to benchmark and compare the position of agriculture in African countries. Colour coding is used to differentiate the performance of countries; the green shaded area indicates that the countries have performed better than the African average, with respect to the identified parameters. From such analysis, inferences could be derived through mapping of investment potential in various African countries.

Table 7: Country wise Scenario in Africa on the Basis of Various Parameters

	Production (MT) in 2017			Yield (kg/ha) in 2017			Irrigation (2016)	Fertilizers Use per area of cropland (2016)		
	Cereals	Pulses	Primary Vegetables	Cereals	Pulses	Primary Vegetables	Land area equipped for irrigation as a % of arable land	Nitrogen	Phosphorous	Potassium
Africa total	**201.41**	**19.72**	**79.91**	**1643.3**	**784.4**	**8474.7**	**6.7%**	**14.11**	**5.48**	**2.45**
Algeria	3.48	0.11	6.39	990.7	1067	22178.7	18.4%	11.5	5.3	2.8
Angola	2.89	0.38	0.76	904.5	487.7	3719.3	1.8%	4.9	1.1	1.6
Benin	1.89	0.15	0.73	1489.9	952.9	7152.6	0.9%	5.7	3.4	3.4
Botswana	0.04	0.01	0.06	400.9	359.7	15110.3	1.0%	80.9	4.3	3.7
Burkina Faso	4.06	0.68	0.29	1009	511.4	9614.5	0.9%	11.1	5.0	5.4
Burundi	0.38	0.39	0.55	1413.5	1503.8	9057	1.9%	2.9	0.8	0.5
Cabo Verde	0.01	0.01	0.03	167.6	265.2	12213.3	7.3%	#N/A	#N/A	#N/A
Cameroon	4.06	0.66	3.11	1664.9	1114.5	4088.6	0.5%	4.3	1.0	2.5
Central African Republic	0.14	0.04	0.09	937.4	1014.2	7606.9	0.1%	#N/A	#N/A	#N/A
Chad	2.72	0.18	0.11	825.2	734.6	10835.7	0.6%	#N/A	#N/A	#N/A
Comoros	0.04	0.02	0.01	1357.1	866.1	6297.2	0.2%	#N/A	#N/A	#N/A
Congo	0.03	0.01	0.13	828.9	770.6	8459.5	0.4%	0.5	0.1	1.0
Cote d'Ivoire	3.29	0.06	0.73	2148.4	821.2	3818.2	2.5%	7.7	5.9	6.7
Democratic Republic of the Congo	2.99	0.36	0.60	770.4	470.4	6564.4	0.2%	1.4	0.2	0.6
Djibouti	0.00	0.00	0.04	1935	316.3	7348.6	50.0%	#N/A	#N/A	#N/A
Egypt	23.22	0.23	15.25	7310.8	2892.4	23915.8	133.3%	366.9	99.3	18.4
Eritrea	0.30	0.03	0.04	642.8	665.8	3239.1	3.0%	2.8	0.0	0.0
Eswatini	0.09	0.00	0.01	1136.9	577	8234.7	28.6%	#N/A	#N/A	#N/A
Ethiopia	26.28	2.92	1.63	2538.2	1809.6	5294.9	5.3%	9.5	3.9	0.0
Gabon	0.05	0.00	0.05	1601.1	1552.2	5759.2	1.2%	6.9	4.7	6.0
Gambia	0.22	0.00	0.01	847.9	206.2	6466.1	1.1%	0.7	0.3	0.2
Ghana	3.08	0.19	0.79	1872.9	481.4	9526.2	0.8%	8.5	2.1	2.7

	Production (MT) in 2017			Yield (kg/ha) in 2017			Irrigation (2016)	Fertilizers Use per area of cropland (2016)		
	Cereals	Pulses	Primary Vegetables	Cereals	Pulses	Primary Vegetables	Land area equipped for irrigation as a % of arable land	Nitrogen	Phosphorous	Potassium
Guinea	3.76	0.06	0.56	1167.1	923.3	2879.4	3.1%	0.8	0.2	0.3
Guinea-Bissau	0.23	0.00	0.04	1563.8	379.6	5541.8	8.3%	#N/A	#N/A	#N/A
Kenya	3.71	1.25	2.04	1473.8	699.7	13298.6	2.6%	24.0	9.8	1.3
Lesotho	0.22	0.01	0.03	986.8	330.6	9039.6	0.9%	#N/A	#N/A	#N/A
Liberia	0.30	0.00	0.11	1283.6	706.5	4922.9	0.6%	#N/A	#N/A	#N/A
Libya	0.18	0.01	0.67	766.7	1671.8	15593	23.3%	5.9	3.6	0.3
Madagascar	3.39	0.13	0.45	3778.7	1112.3	9458.7	31.0%	2.3	1.1	1.1
Malawi	3.71	0.75	1.68	1903.1	1008.6	34307.8	1.9%	18.1	1.3	1.4
Mali	8.87	0.34	1.45	1526.4	1059.5	10946.9	5.9%	25.5	11.6	6.1
Mauritania	0.36	0.05	0.00	1371.2	519.2	5786.2	10.0%	#N/A	#N/A	#N/A
Mauritius	0.00	#N/A	0.07	5234.8	#N/A	12740.3	22.7%	102.6	42.5	78.3
Morocco	9.79	0.25	3.93	1757.7	705.7	28078.7	18.8%	25.4	23.4	11.6
Mozambique	1.95	0.36	0.80	871.5	465.7	10481.7	2.1%	2.3	1.1	0.2
Namibia	0.13	0.02	0.07	435.9	1118.2	10658.9	1.0%	24.3	1.1	0.4
Niger	5.90	2.02	3.28	541.9	380.2	10275.2	0.6%	0.4	0.0	0.0
Nigeria	28.87	3.48	16.38	1462.1	885.6	4388.6	0.9%	2.1	1.5	0.9
Rwanda	0.63	0.47	0.62	1282.3	822.6	5416.5	0.8%	3.1	4.9	0.9
Sao Tome and Principe	0.00	#N/A	0.00	2083.9	#N/A	7426.8	114.9%	#N/A	#N/A	#N/A
Senegal	1.69	0.06	0.72	1275.1	371.8	19573.1	3.8%	8.7	4.8	2.6
Sierra Leone	1.50	0.08	0.36	1956.1	629.8	6931.8	1.9%	#N/A	#N/A	#N/A
Somalia	0.19	0.03	0.11	547	304.8	3589.1	18.2%	#N/A	#N/A	#N/A
South Africa	18.91	0.09	2.79	5648.2	1249.2	17613.5	13.4%	31.2	16.1	9.3
South Sudan	0.76	0.03	0.65	1414.5	903.9	9363.2	#N/A	#N/A	#N/A	#N/A
Sudan	5.24	0.36	3.63	674.2	741.1	11990.3	9.4%	6.5	0.5	0.1
Togo	1.30	0.22	0.14	1139.3	555.3	5059.7	0.3%	4.4	3.7	2.3
Tunisia	1.64	0.10	3.02	1532.9	1026.7	24752.7	16.4%	18.1	13.3	1.5
Uganda	3.83	1.07	1.33	2050.4	1460.3	5331.5	0.2%	0.9	0.3	0.3
Tanzania	10.09	2.00	2.81	1543.8	938.4	6936.8	2.7%	6.9	3.5	0.5
Zambia	3.90	0.03	0.46	2477.6	490.3	8064.9	4.1%	72.9	8.1	7.7
Zimbabwe	1.10	0.02	0.24	616	497.2	7322.7	4.4%	10.4	7.2	4.7

Source: FAO; EXIM Bank Research

More than the average of the continent

Chapter

4 INDIA-AFRICA TRADE IN FARM MECHANISATION

Sustainable Agricultural Mechanisation

Mechanisation is a decisive contribution towards agricultural production. Unfortunately, due to various reasons it remains neglected especially in the context of developing and less developed countries, more so because of the information asymmetry and lack of finance.

Mechanisation is an essential input not only for crop production, but also has a crucial role to play along the entire value chain. For example, mechanisation is needed at different stages - production: for land preparation, crop establishment, weeding, fertilisation, irrigation, crop protection; harvesting post-harvest/storage: for drying, grading, winnowing, cleaning, storage; processing: for chopping, milling, grinding, pressing; and marketing: for packaging, transport[16]. Automation in farm not just reduces labour time and post-harvest loss but also helps to cut down production cost over the long term.

Agricultural mechanisation systematises farm related practices using machinery to enhance productivity and profitability of farm workers. This mechanised farming empowers farmers to make sure the accuracy of farm operations, reduce possible input losses, augment the effectiveness of use of expensive inputs such as seeds, chemical fertilisers, irrigation and water, and eventually lowers the unit price of total production.

Sustainable agricultural mechanisation can contribute significantly to the development of value chains and food systems as it has the potential to render post-harvest, processing and marketing activities and functions more efficiently and effectively. In fact, applying new technologies that are environmentally friendly enables farmers to produce crops more resourcefully by using less power.

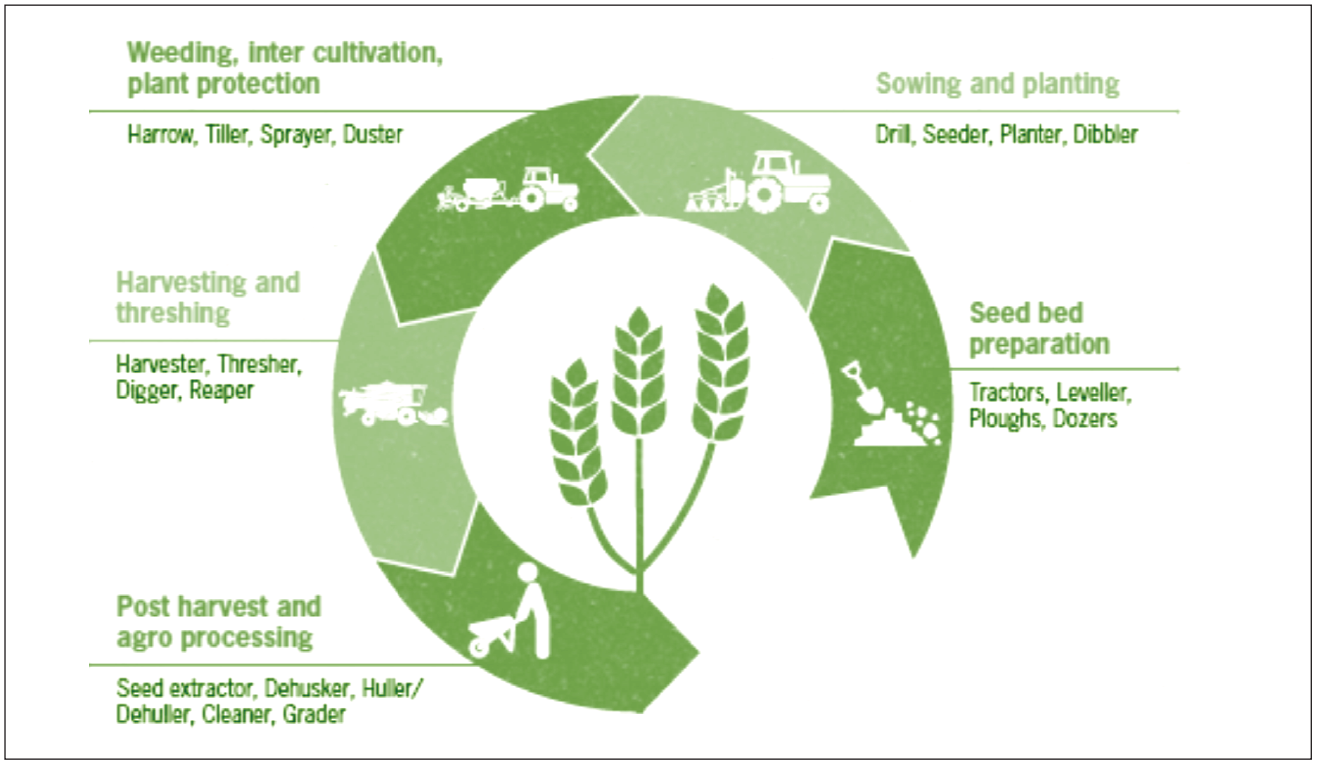
Sustainable agricultural mechanisation covers all levels of farming and processing technologies, from simple and basic hand tools to more sophisticated and motorized equipment. It eases and reduces hard labour, relieves labour shortages, improves productivity and timeliness of agricultural operations, improves the efficient use of resources, and even enhances market access. A more formal sustainable mechanisation broadly considers technological, economic, social, environmental and cultural aspects when contributing to the sustainable development of the food and agricultural sector.

[16]https://www.zef.de/uploads/tx_zefportal/Publications/ZEF_WP_169_web.pdf (Kirui et al., 2018)

Exhibit 3: Sustainable Agricultural Mechanisation

Source: EXIM Bank Research

Exhibit 4: Instruments at various stages of Agricultural Production



Source: Grant Thornton

Farm Mechanisation: India and Africa

India's share in the world's geographical area stands at 2.4%, and has 4% of the water resources; however, it has to cater to 17% of the world's population. This ever growing demand for food is putting stress on agricultural productivity in the country. This in lieu is putting increasing pressure asking for more efficient and effective means of agricultural productivity.

On the contrary, a big factor that goes into Africa's favour is that arable land in Africa is very much available for food production. However, the production in Africa continues to be low. Further, almost a quarter of world population by 2050 is expected to be in Africa. Therefore, in Africa, one of the possible solutions to cater to this population will be to increase production on land that is currently underused, and to employ science and technology to improve the efficiency and productivity of farming enterprises.

Mechanisation remains the key tool to increase the production globally.

According to a report titled, 'Mechanised: Transforming Africa's Agriculture Value Chains', the use and power of tractors in Africa has barely increased over the past 40 years and remains negligible compared to other regions in the world. In 1980, there were just two tractors per 1,000 hectares; by 2003 this had fallen to 1.3. When this is compared to Asia and the Pacific region there were 7.8 tractors per 1,000 hectares in 1980, which increased to 14.9 by 2003. In 1960, Kenya, Uganda, and Tanzania each had more tractors in use than India. Interestingly, by 2005, India had 100 times more tractors in use than all three countries combined.

In the case of India, the agricultural sector has experienced substantial mechanisation witnessing a considerable decline in the use of animal and human power in agriculture related activities. The trend has paved a way for a range of agricultural tools. A large number of these are driven by tractors, diesel engines, amongst others. This has resulted in a shift from the traditional agriculture process to a more mechanised process.

According to India's Economic Survey 2017-18, Indian Farmers are adapting to farm mechanisation at a faster rate in comparison to recent past, if the sale of tractors is taken as a possible barometer.

The role of tractors in the Indian agriculture sector reflects the growing trend of farm mechanisation in the country. Custom hiring of farm equipment is a prevalent practice in India, especially among small land owners who find ownership of large farm machines expensive and uneconomical.

Limited farm labour, easy credit availability and fund access, moderate penetration and shortening replacement cycle have been some factors encouraging the demand for tractors and farm equipment in the country. Today a number of loan schemes, low interest rate plans and easy instalment breakdowns linked with the crop cycle have been made available to facilitate the generation of funds for farmers. As a result of this incentivisation, a large section of the farming

community is now willing to embrace mechanisation rather than scouting for cheap farm labour. On the pricing front, the minimum support price (MSP) rates decided by the Government of India indirectly influences the usage of farm equipment and tractors. Lower MSPs leave farmers with little or no money to spend on mechanisation.

While farm mechanisation in India has made strong strides and Africa has a long way to catch up, there is much scope for improvement in India too. Most of the developed countries are completely mechanised. Some of the Asian giants have also seen higher dispersion of farm machineries.

India's Trade in Agro-Machinery

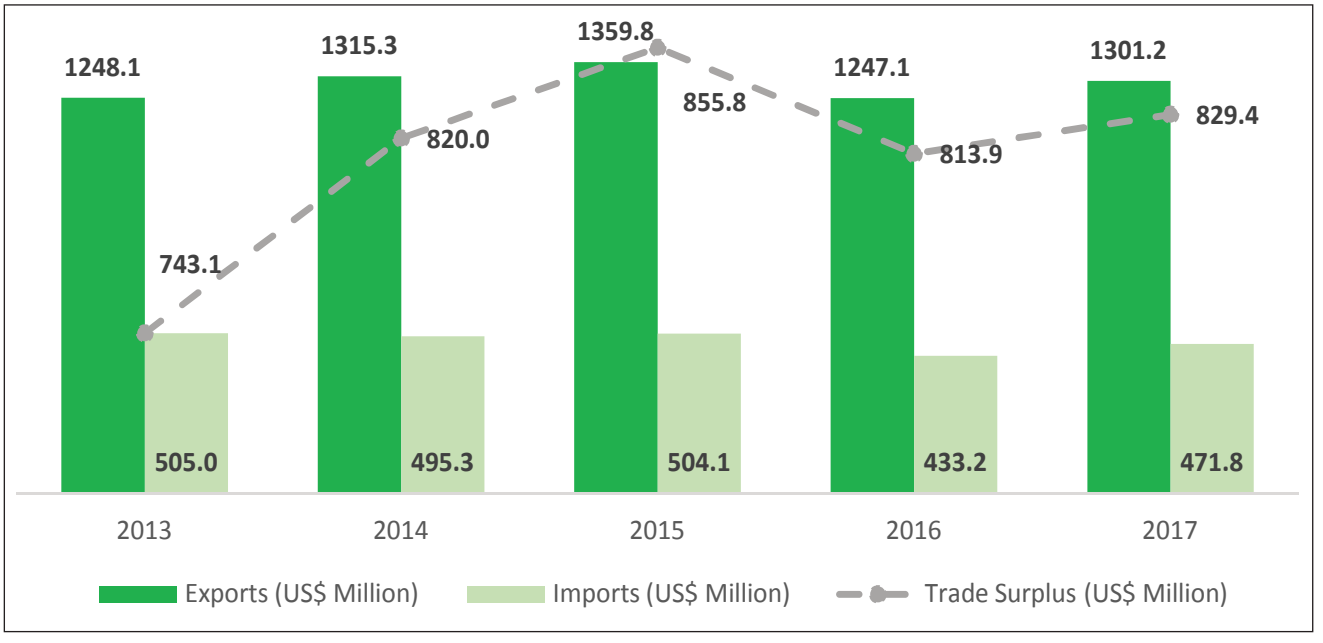
According to FAO, "Mechanisation is not the same as tractorisation. Mechanisation covers all levels of farming and processing technologies, from simple and basic hand tools to more sophisticated and motorised equipment."

Taking a clue from the above, the Study herein takes into account different dimensions of agricultural machinery and short lists 53 products at HS-6 digit level (collectively, here after called as agro-machinery), in order to understand the dynamics of trade in this field (list of 53 products is in the Annexure) .

India's trade in agro-machinery was recorded at US$ 1772.9 million in 2017, up from US$ 1753.1 million in 2013.

India has maintained a decent surplus in the trade of agro-machinery in the last 5 years, with the surplus increasing US$ 743.1 million in 2013 to US$ 829.4 million in 2017. Whilst the imports fell at an average of (-) 1.3%, during this period, the exports recorded an AAGR of 1.2%.

Figure 10: India's Trade Surplus in the Agro-Machinery



Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Further, the top 10 products exported by India in the agro-machinery space at HS 6 digit level, contributed close to 83% of the total agro-machinery exports by India in 2017. Major export destinations for India agro-machinery exports include: the USA (18.4%); Bangladesh (10.6%); Nepal (9.7%); Turkey (4.7%); and Sri Lanka (4.4%). Two African countries, namely Kenya (2.8%, 7th rank); and South Africa (2.1%, 9th rank) also appear in the list of markets where top 10 agro-machinery products were exported by India in 2017.

Table 8: Major Agro-Machinery Items Exported by India (US$ Million)

HS Code	Description	2013	2014	2015	2016	2017	AAGR (%) for India's exports to world (2013-17)	Share in India's exports to world (2017)
870193	Tractors, of an engine power > 37 kW but <= 75 kW	0.0	0.0	0.0	0.0	360.1	-	27.7%
870192	Tractors, of an engine power > 18 kW but <= 37 kW	0.0	0.0	0.0	0.0	199.6	-	15.3%
870190	Tractors (excluding those of heading 8709, pedestrian-controlled tractors)	852.5	903.5	958.4	862.3	184.2	-19.2	14.2%
870130	Track-laying tractors (excluding pedestrian-controlled)	2.4	4.5	2.1	5.5	89.4	434.6	6.9%
843890	Parts of machinery for the industrial preparation or manufacture of food or drink, n.e.s.	64.2	59.6	73.0	45.6	57.0	-	4.4%
870120	Road tractors for semi-trailers	19.3	28.5	40.7	52.3	52.2	29.7	4.0%
843290	Parts of agricultural, horticultural or forestry machinery for soil preparation or cultivation	60.4	47.8	48.5	38.2	45.3	-	3.5%
843880	Machinery for the industrial preparation or manufacture of food or drink, n.e.s.	28.4	23.9	23.9	30.2	36.1	7.5	2.8%
843780	Machinery used in the milling industry or for the working of cereals or dried leguminous vegetables	30.6	25.7	30.2	30.7	32.9	2.6	2.5%
843830	Machinery for sugar manufacture (excluding centrifuges and filtering, heating or refrigerating)	46.9	51.4	25.5	12.8	27.3	5.6	2.1%
Top 10		**1104.7**	**1145.0**	**1202.2**	**1077.6**	**1084.2**	**-0.3**	**83.3%**
Total Indian agro-machinery exports		**1248.1**	**1315.3**	**1359.8**	**1247.1**	**1301.2**	**1.2**	**100.0%**

Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

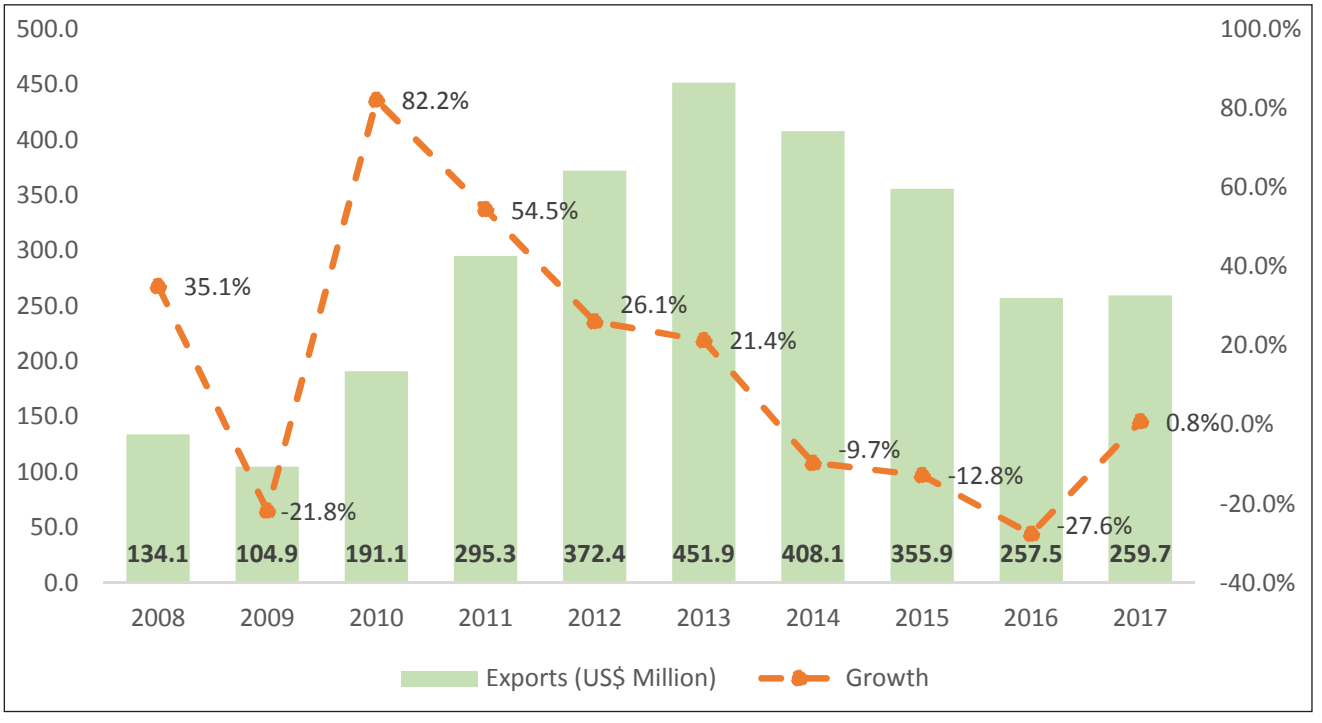
India-Africa Trade in Agro-Machinery

Whilst India has a deficit in overall trade with Africa, in terms of machinery relating to agriculture and agro-processing, India has a huge surplus. With the growing demand for food and agro-processing machinery globally, India's exports in this space have also started growing. India's exports of agro-machinery has more than doubled in the last 10 years from US$ 611.4 million in 2008 to US$ 1301 million in 2017.

With respect to the trade in this space with Africa, India has barely been importing any agro-machinery from Africa. However, India's exports to Africa in the last decade, that is, during 2008 to 2017, have nearly doubled, from US$ 134.1 million to US$ 259.7 million, registering an AAGR of 12.6%. However, in the last 5 years, after achieving a high of US$ 451.9 million in 2013, the agro-machinery's exports to Africa started falling till 2016, before recovering in 2017. The AAGR registered in the exports of these machineries from India to Africa, during 2013 to 2017, was (-) 12.3%. Nevertheless, exports in 2018, have crossed the US$ 320 million mark.

Additionally, India's exports of these machineries to Africa, contributed almost 20% of India's global exports of these machineries. It may be noted that out of the top 10 exported items to the world, 8 of these items appear in the top 10 exported items to Africa as well.

Figure 11: India's Exports to Africa of Machinery Relating to Agriculture and Agro-processing



Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Table 9: Top 10 Agro-Machinery Items Exported by India to Africa vis-à-vis their Exports to World

HS Code	Description	India's exports to the world (US$ Million)	India's exports to Africa (US$ Million)	Rank in India's exports of top 10 agro-machinery items to Africa	Africa's share in India's exports to world
870193	Tractors, of an engine power > 37 kW but <= 75 kW	360.1	82.6	1	22.9%
870192	Tractors, of an engine power > 18 kW but <= 37 kW	199.6	9.3	7	4.7%
870190	Tractors (excluding those of heading 8709, pedestrian-controlled tractors)	184.2	27.5	2	14.9%
870130	Track-laying tractors (excluding pedestrian-controlled)	89.4	11.8	5	13.2%
843890	Parts of machinery for the industrial preparation or manufacture of food or drink, n.e.s.	57.0	24.4	3	42.7%
870120	Road tractors for semi-trailers	52.2	-	-	-
843290	Parts of agricultural, horticultural or forestry machinery for soil preparation or cultivation ...	45.3	-	-	-
843880	Machinery for the industrial preparation or manufacture of food or drink, n.e.s.	36.1	17.4	4	48.4%
843780	Machinery used in the milling industry or for the working of cereals or dried leguminous vegetables ...	32.9	11.0	6	33.3%
843830	Machinery for sugar manufacture (excluding centrifuges and filtering, heating or refrigerating)	27.3	7.0	10	25.7%

Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research
Note: '-'indicates that although the item appeared in the top 10 exports to the world, it didn't feature in the top 10 exports to Africa

It may be further noted that out of the 53 products at HS-6 digit level for agro-machinery exports, the top 10 exported to Africa contributed to almost 80% of the total agro-machinery exports to Africa. In fact, the same 10 products account for similar share with respect to India's exports of agro-machinery items to the world.

Table 10: India's Exports of Major Agro-Machinery Items to Africa (US$ Million)

HS Code	Description	2013	2014	2015	2016	2017	AAGR (%) for India's agro-machinery exports to Africa (2013-17)	Share in India's agro-machinery exports to Africa (2017)	AAGR (%) for India's total agro-machinery exports to world (2013-17)	Share in India's total agro-machinery exports to world (2017)
870193	Tractors, of an engine power > 37 kW but <= 75 kW	0.0	0.0	0.0	0.0	82.6	-	31.8%	-	27.7%
870190	Tractors (excluding those of heading 8709)	280.5	251.9	205.0	145.3	27.5	-34.7	10.6%	-19.2	14.2%
843890	Parts of machinery for the industrial preparation or manufacture of food or drink	38.3	32.9	39.8	20.4	24.4	-5.6	9.4%	0.7	4.4%
843880	Machinery for the industrial preparation or manufacture of food or drink	15.1	9.1	8.2	15.1	17.4	12.5	6.7%	7.5	2.8%
870130	Track-laying tractors (excluding pedestrian-controlled)	0.1	2.2	0.1	0.0	11.8	-	4.6%	434.6	6.9%
843780	Machinery used in the milling industry or for the working of cereals or dried leguminous vegetables	8.9	7.7	11.4	13.8	11.0	8.9	4.2%	2.6	2.5%
870192	Tractors, of an engine power > 18 kW but <= 37 kW	0.0	0.0	0.0	0.0	9.3	-	3.6%	-	15.3%
843790	Parts of machinery used in the milling industry or for the working of cereals or dried leguminous vegetable	7.0	9.6	7.9	5.5	8.8	12.3	3.4%	4.2	1.4%
843710	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables	9.7	8.8	3.9	4.3	8.0	8.0	3.1%	9.0	1.7%
843830	Machinery for sugar manufacture	33.5	29.3	16.9	4.1	7.0	-14.5	2.7%	5.6	2.1%
Top 10		**393.1**	**351.4**	**293.2**	**208.7**	**207.9**	**-14.1**	**80.1%**	**-0.6**	**78.9%**
India's exports of all agro-machinery to Africa		**451.9**	**408.1**	**355.9**	**257.5**	**259.7**	**-12.3**	**100.0%**	**1.2**	**100.0%**

Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Export Specialization Index

The Export Specialization Index (ESI) is a slightly modified version of Revealed Comparative Advantage (RCA) index, in which the denominator is usually measured by specific markets or partners. It provides product information on revealed specialization in the export sector of a country and is calculated as the ratio of the share of a product in a country's total exports to the share of this product in imports in the specific markets or partners (rather than benchmarking its share in world exports):

$$ESI = (x_{ij}/X_{it}) / (m_{kj}/M_{kt})$$

Where 'x_{ij}' and 'X_{it}' are export values of country 'i' in product 'j', respectively, and where mkj and Mkt are the import values of product 'j' in market 'k' and total imports in market 'k'. The ESI is similar to the RCA in that the value of the index less than unity indicates a comparative disadvantage and a value above unity represents specialization in this market.

An analysis of 53 HS-6 digit products under the agro-machinery category shows that India has an export specialization only in 6 of the 53 products with respect to African market.

The total export value of these identified 6 products from India to world stands at around US$ 902 million. Interestingly, these 6 products contributed 69.3% of the total agro-machinery exports to the world by India in 2017. Additionally, these 6 products contribute to 50% of Africa's total imports of agro-machinery in 2017. This signifies the potential of a symbiotic Indo-Africa trade in agro-machinery, especially in the products, where India possesses an export specialization.

All these variants of tractors as identified in the ESI, are being produced in India by John Deere, Preet Tractors, Escorts, and Mahindra and Mahindra, amongst others, signifiy opportunity for India to explore the African market

Table 11: Export Specialization Products in Agro-Machinery for India with respect to African Imports

HS code	Description	India's exports in 2017 (to the world) (US$ Million)	India's exports in 2017 (to Africa) (US$ Million)	Export Specialization index
870193	Tractors, of an engine power > 37 kW but <= 75 kW	360.1	82.6	3.93
870192	Tractors, of an engine power > 18 kW but <= 37 kW	199.6	9.3	12.52
870190	Tractors (excluding those of heading 8709, pedestrian-controlled tractors)	184.2	27.5	1.53
870130	Track-laying tractors (excluding pedestrian-controlled)	89.4	11.8	2.52

HS code	Description	India's exports in 2017 (to the world) (US$ Million)	India's exports in 2017 (to Africa) (US$ Million)	Export Specialization index
843290	Parts of agricultural, horticultural or forestry machinery for soil preparation or cultivation	45.3	6.3	1.28
843280	Agricultural, horticultural or forestry machinery for soil preparation or cultivation	23.6	1.5	1.16

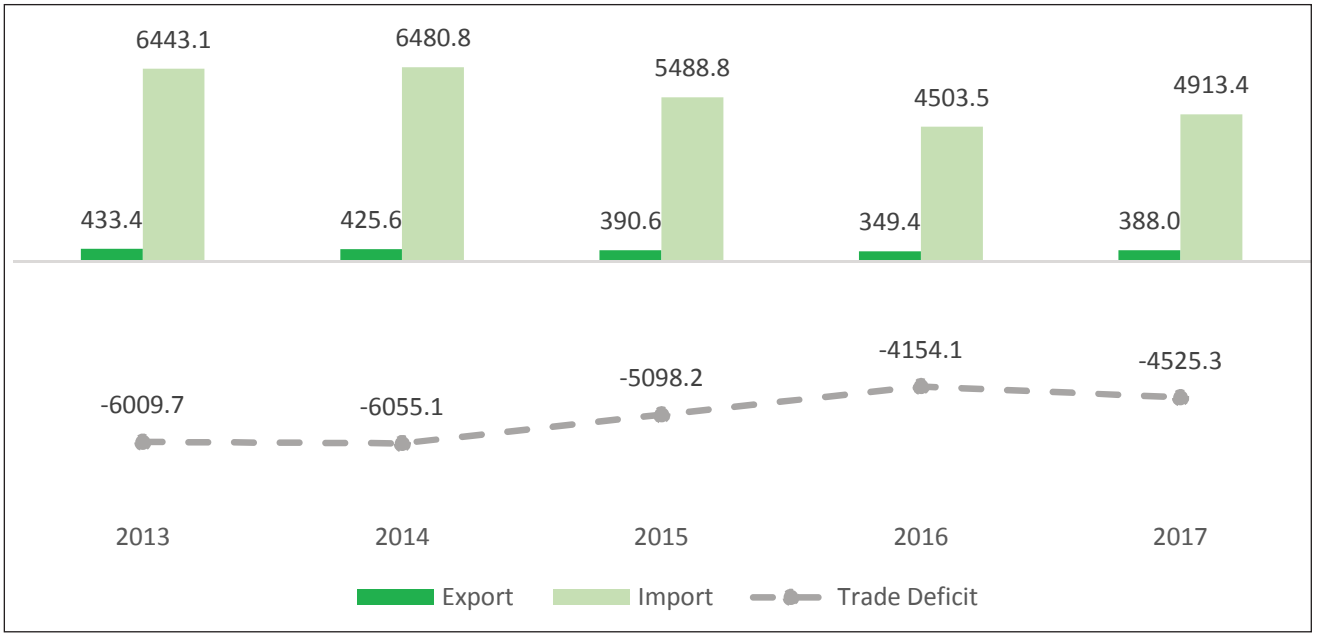
Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Africa's Trade in Agro-machinery

The total trade for agro-machinery by Africa was recorded at US$ 5301.4 million in 2017, a level down from what was recorded in 2013 at US$ 6876.6 million. However, trade in agro-machinery showed signs of recovery in 2017, when it grew at 9.2% vis-à-vis 2016.

Most of this trade is due to high imports, rather than exports. 90% share is through imports of the agro-machinery. For instance, in 2017, while the imports of agro-machinery by Africa were recorded at US$ 4913.4 million, exports were just US$ 388 million. As a result, Africa has a huge deficit in the trade of agro-machinery. This also signifies a huge existing market for agro-machinery in Africa, and where India can play an increasing role to work collaboratively and match their needs.

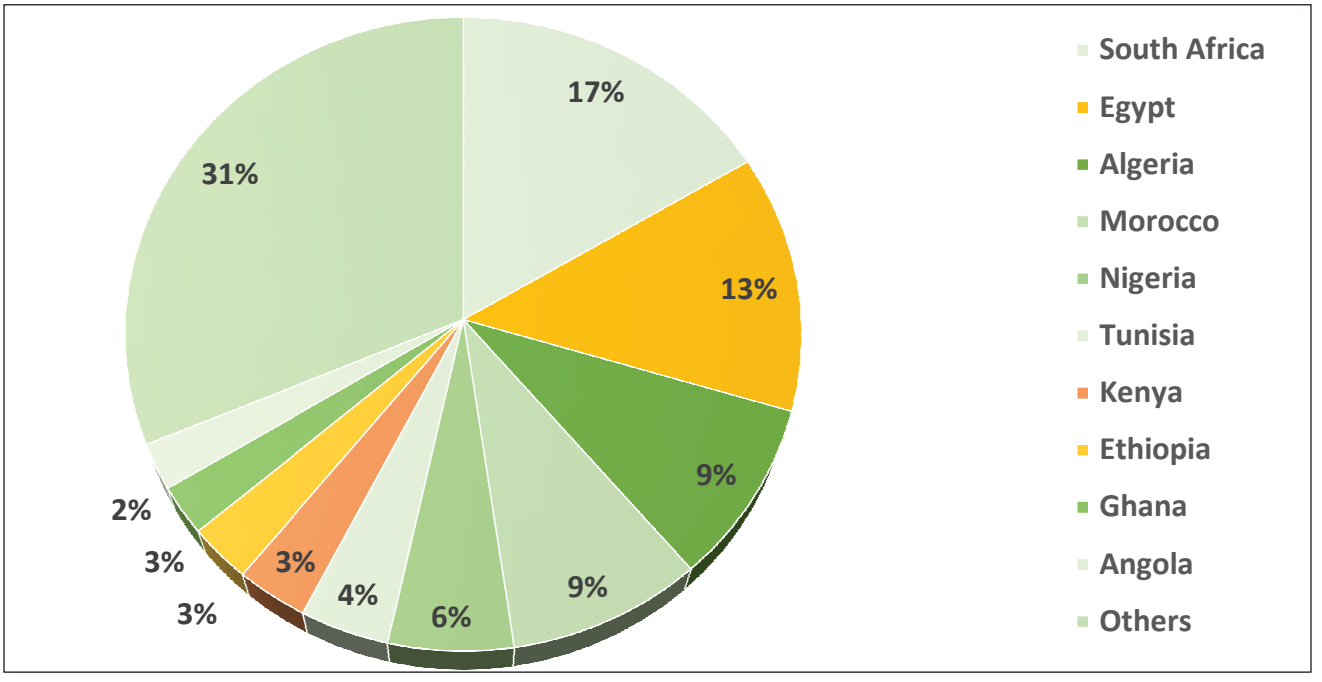
Figure 12: Africa's trade deficit in Agro-Machinery (US$ Million)



Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Africa imported close to 5% of the total agro-machinery imported in the world by value in 2017, whereas the share 10 years ago (in 2008) was 4.6% – this shows a significant appetite. The top 10 African importers contributed close to 69% of Africa's total agro-machinery imports in 2017, with top 5 contributing to more than half of total imports. South Africa (16.5%); Egypt (13.2%); Algeria (9.1%); Morocco (8.9%); and Nigeria (5.7%) are some of the major importers of agro-machinery in Africa.

Figure 13: Top Importers of Agro-Machinery in Africa: 2017



Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Further, in order for India to be an important partner in the development of agriculture in Africa, especially when it comes to usage of agro-machinery, it is vital to map the demand for such machinery in Africa, major importing countries in Africa, major source countries (competitors for India in those countries) as also India's current position (ranking) as a source country in these markets.

Table 12: Major Agro-Machinery Items Imported by Africa, Including Demand-Supply Dynamics: 2017

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
870120	Road tractors for semi-trailers	27.8	5.1%	Algeria	18.3%	Germany (56.8), France (29.2), China (3.9), Sweden (3.5), South Korea (3.1)	0	24
				Morocco	12.1%	Netherlands (26.8), Germany (22), France (16.3), Sweden (15.7), Italy (7.7)	-	-
				Egypt	5.8%	Germany (83.7), China (4.8), Italy (2.8), Sweden (2.3), USA (1.4)	-	-
				Kenya	5.2%	Germany (32.1), UK (24.1), China (21.5), Brazil (9.4), South Korea (4.6)	1	8
				Tanzania	4.4%	China (39.1), UK (27.8), Kenya (12.9), Germany (4.6), Sweden (4.3)	0.8	11
843810	Bakery machinery and machinery for the industrial preparation	2.4	9.8%	Algeria	15.2%	Italy (31.3), China (27.4), Turkey (18.5), France (13.1), Austria (4.3)	0	15
				South Africa	10.1%	China (23), Italy (22.4), Netherlands (20.8), UK (10.9), Chinese Taipei (9.6)	-	-
				Egypt	10.0%	Italy (36.6), USA (11.4), Germany (10), Austria (9.9), China (9.7)	0.1	17
				Nigeria	9.8%	China (32.4), Italy (19), Switzerland (13.1), Germany (10.9), Japan (10.1)	2.9	8
				Morocco	7.8%	Italy(35.5), France (28.9), Austria (17.9), China (3.2), Germany (3)	-	-

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
843780	Machinery used in the milling industry or for the working of cereals or dried leguminous vegetables	0.9	25.4%	Algeria	25.5%	Turkey (63.1), China (12.2), Italy (10.3), Netherlands (4.5), Switzerland (4.4)	0	22
				Kenya	13.7%	China (49.7), Switzerland (19.5), Turkey (12.3), South Africa (3.5), Eswatini (2.9)	2.6	7
				Nigeria	10.1%	Switzerland (47), China (41.2), India (6.6), Brazil (2.6), Germany (1.5)	6.6	3
				Uganda	8.8%	China (47), South Africa (19.3), Italy (13.9), Belgium (10), Turkey (4.2)	1.1	7
				Zambia	5.2%	South Africa (33.2), China (27.1), USA (14.6), India (10.7), Turkey (10.7)	10.7	4
870195	Tractors, of an engine power > 130 kW	5.1	4.2%	South Africa	53.4%	Italy (32.5), USA (23.6), Germany (13.3), India (8), France (7.4)	8	4
				Sudan	29.6%	Japan (52.8), Netherlands (15.8), Germany (7.8), South Korea (7.1), Italy (3.8)	0.1	12
				Algeria	8.8%	Germany (93.7), China (2.7), France (2.3), Italy (1.3)	-	-
				Zimbabwe	2.3%	NA	NA	NA
				Angola	1.7%	NA	NA	NA

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
870190	Tractors (excluding those of heading 8709, pedestrian-controlled tractors)	1.4	14.7%	Kenya	18.3%	India (38.3), China (16.3), Italy (7), UK (6.5), USA (6.1)	38.3	1
				Nigeria	16.1%	India (27), UAE (22.8), China (17.5), Pakistan (9.2), USA (9.1)	27	1
				Egypt	13.4%	Romania (14.9), Italy (12.1), China (11.2), Belarus (8.8), France (8.3)	3.4	11
				Tunisia	8.2%	Italy (36.6), India (24.5), Mexico (7.3), Pakistan (7.7), Turkey (6.5)	24.5	2
				Senegal	7.8%	USA (64.1), Brazil (13.1), Belgium (6.4), France (5.8), India (1.6)	1.6	5
843890	Parts of machinery for the industrial preparation or manufacture of food or drink, n.e.s.	3.2	5.5%	South Africa	15.7%	USA (19.8), Netherlands (17.5), Germany (14.2), Italy (10.4), UK (7.4)	0.8	16
				Ethiopia	10.5%	China (55.7), France (23.2), Netherlands (6.8), Italy (5.3), Germany (2.4)	1.8	7
				Algeria	7.8%	Italy (33.3), Turkey (15.4), France (15.3), China (12.2), Germany (6.6)	3.2	7
				Sudan	7.7%	India (15.9), UAE (15.5), Germany (15.3), UK (11), Austria (9.2)	15.9	1
				Cameroon	5.9%	Italy (53.2), France (20.1), Germany (6.2), Switzerland (5.9), Belgium (4.6)	0.3	16

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
870191	Tractors, of an engine power <= 18 kW	1.4	11.6%	Sudan	88.1%	Netherlands (21.1), China (15.8), Italy (13.1), India (13), France (7.9)	13	4
				Zambia	5.2%	South Africa (23.1), Singapore (22.4), India (16.6), China (8.4), Mauritius (6.1)	16.6	3
				Algeria	2.6%	Brazil (32.7), Netherlands (24.3), India (19.6), Italy (14.2), Germany (6.2)	19.6	3
				Zimbabwe	1.3%	NA	NA	NA
				South Africa	0.9%	Japan (26.5), Montenegro (20.4) USA (19.2), UAE (15.8), Netherlands (4.7)	2.1	9
843880	Machinery for the industrial preparation or manufacture of food or drink, n.e.s.	2.4	6.9%	Algeria	16.1%	Italy (34.6), Germany (20.9), China (18.1), Turkey (11.8), Netherlands (5.3)	0.1	14
				South Africa	12.4%	Germany (18.7), China (18), Denmark (13.4), USA (11.7), Italy (5.5)	0.4	12
				Kenya	9.6%	India (51.8), China (28.9), Germany (5), UK (3.9), Netherlands (3.4)	51.8	1
				Nigeria	9.0%	China (45.9), Italy (10.6), India (8.9), Germany (6.9), France (6.1)	8.9	3
				Zambia	5.6%	China (35.9), UAE (28), Hong Kong (11.6), South Africa (10.2), India (4.3)	4.3	5

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
870193	Tractors, of an engine power > 37 kW but <= 75 kW	4.0	3.9%	South Africa	41.4%	India (36.9), Mexico (21.7), Turkey (11.4), China (9.7), Italy (8)	36.9	1
				Morocco	24.0%	Italy (49.5), Turkey (22.8), India (17.6), China (4.2), Spain (3.1)	17.6	3
				Algeria	22.2%	India (69.4), Italy (17.8), China (10.2), South Korea (1.5), Turkey (1.1)	69.4	1
				Tanzania	4.1%	Poland (68), India (16.4), Pakistan (8.4), UK (2.1), Mexico (0.9)	16.4	2
				Zimbabwe	2.4%	NA	NA	NA
843840	Brewery machinery (excluding centrifuges and filtering, heating or refrigerating equipment)	0.7	19.7%	Nigeria	35.7%	Germany (35.9), Belgium (32.2), China (17.6), South Africa (10.7), Netherlands (1.5)	0.5	7
				South Africa	18.6%	Germany (59.3), China (23.2), Belgium (12.4), Italy (1.6), Argentina (1.4)	-	-
				Ghana	7.9%	Germany (80), Belgium (17.1), South Africa (2.5), Mauritius (0.4), China (0)	0	6
				Zambia	7.1%	Mauritius (96.4), Germany (2.2), South Africa (0.6), Belgium (0.6), China (0.1)	0.1	6
				Ethiopia	7.0%	Germany (94.8), Egypt (2.8), Belgium (1.7), China (0.8)	0	14

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
843351	Combine harvester-threshers	3.9	3.5%	South Africa	34.1%	USA (73), Germany (13.5), Belgium (7.4), Italy (1.8), Brazil (1.5)	0	19
				Sudan	23.1%	China (60.9), USA (13.8), Italy (6.2), Poland (4.6), Turkey (4.5)	1.2	7
				Ethiopia	9.9%	Poland (46.7), Germany (42.6), Italy (6.9), Croatia (1.4), France (1.3)	0.4	7
				Nigeria	8.0%	South Korea (49.7), China (41.1), USA (5.2), India (3.2), Netherlands (1.6)	3.2	4
				Tunisia	2.9%	Germany (47.7), China (15.5), France (14.9), Poland (12.4), Hungary (5.8)	1.9	6
843710	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables	0.7	18.6%	Nigeria	36.1%	China (52.4), India (26.8), UK (4.3), USA (4), Switzerland (1.7)	26.8	2
				Egypt	13.9%	Turkey (36.7), China (24.1), Italy (10.4), Germany (6.9), South Korea (2.7)	0.6	11
				Algeria	5.2%	Turkey (53.2), Italy (19.6), China (13.4), Spain (9), France (3.3)	0	18
				Ethiopia	5.1%	China (33), Colombia (16), Germany (13.9), India (9.2), Spain (8)	9.2	4
				Sudan	5.1%	Turkey (68.9), China (22.2), India (6.7), Egypt (1.1), UAE (0.6)	6.7	3

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
870194	Tractors, of an engine power > 75 kW but <= 130 kW	4.9	2.3%	South Africa	69.4%	Germany (39.1), UK (20.5), China (11), Italy (9), France (7.7)	3.9	7
				Morocco	9.3%	Mexico (61.2), Germany (13.4), UK (9.2), Italy (8.2), France (2.6)	2.5	6
				Algeria	4.0%	Italy (46), Turkey (25.4), India (22), France (4.5), UK (2)	22	3
				Djibouti	3.6%	NA	NA	NA
				Tanzania	3.4%	India (66.2), Brazil (8), China (6.6), South Africa (6.1), Italy (5.3)	66.2	1
843830	Machinery for sugar manufacture (excluding centrifuges and filtering, heating or refrigerating)	0.3	32.5%	Ethiopia	51.6%	China (98.7), India (1.3)	1.3	2
				Kenya	19.7%	India (90.2), Italy (5.1), Germany (4.4), Brazil (0.4)	90.2	1
				Algeria	7.0%	Belgium (55.5), Spain (18.5), Turkey (11.3), Italy (6.6), China (4.9)	0	13
				Egypt	4.1%	Germany (37.4), China (25.6), Italy (20.7), Romania (16.1), France (0.1)	-	-
				Nigeria	3.0%	China (48.9), Spain (25.6), India (11.1), UK (4.9), Lebanon (4.7)	11.1	3

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
843610	Machinery for preparing animal feeding stuffs in agricultural holdings and similar undertakings	0.9	10.5%	Nigeria	34.0%	China (64.5), Netherlands (11), Brazil (5.1), Spain (4.6), France (4)	3.2	6
				Algeria	17.5%	China (23.1), Spain (19.7), Turkey (19.6), Tunisia (13.8), France (10.4)	-	-
				Egypt	9.6%	China (38.2), Turkey (22.4), Germany (12.5), Italy (10.8), USA (4.1)	0.1	18
				South Africa	7.5%	China (29.6), Italy (19.2), Netherlands (14), Ireland (8.7), Brazil (4.8)	0	18
				Kenya	6.3%	France (47.6), India (25.4), China (18.4), Brazil (2.8), Netherlands (1.7)	25.4	2
843629	Poultry-keeping machinery (excluding machines for sorting or grading eggs, poultry pickers)	1.2	7.6%	Algeria	23.6%	Italy (35.3), Spain (19.9), Germany (19.3), China (8.4), Netherlands (4.7)	0.1	13
				Nigeria	13.9%	Germany (32), China (29.7), India (25.7), Netherlands (4.4), Malaysia (1.6)	25.7	3
				Morocco	13.2%	Italy (52.4), Germany (28), Spain (7.7), USA (3.4), Turkey (3.1)	-	-
				Egypt	7.7%	Italy (56.4), Germany (10.7), Turkey (9.4), Belgium (7.4), USA (6.9)	-	-
				Sudan	7.2%	Germany (41.5), Italy (24.7), Turkey (17.9), Egypt (5.5), Netherlands (4.4)	-	-

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
843790	Parts of machinery used in the milling industry or for the working of cereals or dried leguminous vegetables	0.6	15.5%	Nigeria	33.5%	India (33.8), China (30.5), Switzerland (19.9), Turkey (3.6), Belgium (3.4)	33.8	1
				Algeria	11.1%	Turkey (41.1), Italy (24.2), Spain (12.7), France (7.6), China (7.2)	0.8	8
				South Africa	10.7%	USA (27.4), Switzerland (22.4), China (16.6), Germany (9.3), Turkey (4.7)	2	12
				Mali	5.9%	China (44.9), France (41.9), Italy (5.7), Turkey (2.6), Ghana (2.1)	0.3	8
				Ethiopia	4.6%	China (69.6), India (19.4), Germany (2.8), Belgium (1.8), USA (1.2)	19.4	2
843390	Parts of harvesting machinery, threshing machinery, mowers and machines for cleaning, sorting	5.4	1.4%	South Africa	54.1%	USA (34.6), Germany (16.3), Netherlands (7.6), China (5.9), France (5.6)	0.4	25
				Sudan	8.9%	France (33.5), China (30.4), Spain (13.1), Turkey (9.4), Germany (4.4)	0	26
				Nigeria	4.7%	USA (75.9), China (9.6), India (3.9), Portugal (3.7), Italy (2.2)	3.9	3
				Morocco	4.7%	Spain (43), Italy (13.7), Turkey (10.1), France (8.4), China (6.2)	5.8	6
				Algeria	4.3%	Finland (44.2), India (20.3), France (13.1), Italy (6.2), Spain (5.5)	20.3	2

HS code	Description	World Imports (US$ Billion)	Africa's share in world import	Major importers in Africa	Share of the major importers in Africa	Key exporters to the major importers in Africa (share in %)	India's share in the key importing countries in Africa (%)	India's rank in the key importing countries in Africa
843860	Machinery for the industrial preparation of fruits, nuts or vegetables	0.6	10.8%	Algeria	39.2%	Italy (50.7), France (20.9), Spain (10), China (9.9), Turkey (2.9)	-	-
				South Africa	21.4%	China (39.6), France (29.2), USA (14.1), Spain (8.3), Netherlands (2.3)	0	16
				Kenya	7.9%	Italy (42.3), China (35.5), South Africa (13.2), Germany (5.3), USA (1.8)	0.5	6
				Egypt	4.9%	Italy (32.5), Spain (27.2), Denmark (14.7), China (7.8), Turkey (3.8)	-	-
				Ethiopia	4.7%	China (50.2), Netherlands (42.1), Italy (6.6), Turkey (0.8), Hong Kong (0.1)	0.1	6
843850	Machinery for the industrial preparation of meat or poultry	2.0	3.0%	South Africa	35.6%	Germany (35), Netherlands (19.1), China (7.9), Denmark (5.5), USA (5.4)	-	-
				Algeria	16.7%	Italy (43), France (29.6), China (11.7), Turkey (8.4), India (3.5)	3.5	5
				Morocco	12.4%	France (47.1), Germany (26.2), Austria (9.2), China (6.2), Italy (5.7)	-	-
				Sudan	4.4%	Turkey (80.5), China (15.2), Australia (2), Egypt (0.7), France (0.6)	-	-
				Egypt	4.2%	Italy (30.6), Netherlands (14.2), Germany (11.6), UK (9.8), China (9.8)	-	-

Source: Data accessed from ITC Trade Map as on April 3, 2019; EXIM Bank Research

Indicates the products in which India has export specialization with respect to African imports

*NA indicates that the import data by those countries has not been furnished

Chapter

5 India-Africa Partnership in Farming and Farm Mechanisation

In the previous chapters, the Study has brought out that Africa faces competitively more challenges in the agricultural space when compared to India, given that Africa's population is huge and growing at almost 2.5% per annum while utilization of agriculture to feed the people has not been up to the mark.

Out of the total countries defined as low income and food deficient in the world, almost half of them are in Africa. However, Africa is also a major producer in the global market for some of the crops such as cassava (60.9%); yams (97.2%); sweet potatoes (24.6%); sorghum (47.3%); and plantains (60.1%). While Africa does show good signs in production of some agricultural products, it exhibits a trade deficit of close to US$ 19 billion with the world in agriculture.

India has a trade surplus of US$ 1 billion with Africa, in agricultural products, with almost 60% of the exports to Africa from India, being in the cereals category.

It has also been highlighted that Africa, though, is a huge producer of agro commodities, much of its land remains underutilized due to low application of farm machinery equipment. It was observed that in the trade of farm machinery equipment, India's exports of farm mechanisation equipment has more than doubled in the last 10 years from US$ 611.4 million in 2008 to US$ 1301 million in 2017 and holds a trade surplus of almost US$ 830 million.

A major challenge is also observed in the Agriculture Orientation Index (AOI) for government expenditures in agriculture in Africa. As discussed earlier, a region wise analysis of Africa reveals that Southern Africa had the highest AOI at 0.74 in 2017, while the lowest was registered by Northern and Western Africa at 0.12. The Sub-Saharan region recorded the same at just 0.2. A comparison of the same index with Southern Asia reveals that the AOI of Southern Asia increased from 0.20 in 2001 to 0.56 in 2017.

While Africa always had the potential to play a key role in global growth and development, the realisation today is truer than ever before. A major part of this is also expected to be played by the agriculture in Africa since it engages the maximum number of people in this profession, in the entire continent. The region has a tremendous potential of not only becoming self-sufficient in agriculture but also to cater to the increasing food demand both in the developing and developed world. Africa, in fact, can collectively be a leader in fulfilling this demand.

Given the fact that Africa and India face a lot of similar challenges, there is a huge space to fill in terms of cooperation between these two regions, especially in the context of agriculture. This can involve trade in crops, farm machinery equipment, amongst others.

FARMING: COOPERATION BETWEEN INDIA AND AFRICA

Since India is still largely an agrarian country and feeds a population of 1.2 billion people and one that has traditionally had close relationship with Africa, India can share its vast experience across the agro value chain in enabling Africa to become a net exporter of agriculture products. The importance of agriculture sector in India can be gauged from the fact that it provides livelihood for more than 70% of Indians who live in the rural areas, and contributes around 15% to the total GDP of India whilst being the largest employer, providing employment to close to half of the total workforce in India.

Whilst Africa aims to feed its increasing population, it would be important for some of the economies in Africa to take a cue from a country such as India which has a population almost close to that of the continent, and have successfully been able to be largely self-sufficient in food through various forms of inputs, mechanisation, etc.

Exhibit 5: Learnings from India: Scope for cooperation

Source: EXIM Bank Research

Green Revolution

Available land in Africa, though enough, has not been able to generate the desired productivity in the continent. With the population rising exponentially, there is a need for a Green revolution in the region, which would involve infusion of high variety seeds, irrigation facilities, multiple cropping, farm machinery, etc. In fact, in 2006, two of the world's largest foundations, the Bill and Melinda Gates Foundation and the Rockefeller Foundation, joined forces to launch the Alliance for a Green Revolution (AGRA) in Africa. Till date, AGRA has supported more than 400 projects, including efforts to develop and deliver better seeds, increase farm yields, improve soil fertility, upgrade storage facilities, improve market information systems, strengthen farmers' associations, expand access to credit for farmers and small suppliers, and advocate for national policies that benefit smallholder farmers.

However, it is also required for the Governments in Africa to increasingly get involved in such initiatives. Africa can also take a cue from the success that India tasted in implementing the Green Revolution back in the 1960s.

Positive effects of green revolution shows that India is amongst the leading producers of agriculture products globally. It may be noted that India today is the 2nd largest producer of wheat and rice, largest producer of millet and 5th largest producer of maize, sorghum and soybean, globally.

India was a food importing country and depended on food imports from North America under the PL-480 scheme. In 1965, India had imported 10 million tonnes of wheat under PL-480, and the following year India again imported 11 million tonnes.

However, things changed phenomenally in the 1960s, and since then India has gradually improved to become a net exporter of agricultural items. This is largely attributed to its success in the Green Revolution. The Green Revolution, spreading over the period from 1967-68 to 1977-78, changed India's status from a food-deficient country to one of the world's leading agricultural nations.

There were various elements to green revolution. First was the area under cultivation. The area under wheat and rice cultivation which was 47.8 million hectares in 1966, shot up to over 60 million hectares by 1977[17]. Second, High Yielding Variety Programme (HYVP) was launched in 1966 especially on five crops viz. wheat, rice, pearl millet, maize and sorghum. The impact on the production of wheat and rice was such that the production of rice which was 45.7 million tonnes in 1966 increased by almost two times by 1977, while the same for wheat (10.4 million tonnes in 1966), almost tripled during the same time period, as per FAO. The use of chemical fertilizers and increased irrigation improved the productivity and production of Indian agricultural products even further.

[17]FAO

Contract Farming

Contract farming refers to an agreement between farmers and marketing firms for the production and supply of agricultural products under forward agreements, mostly at predetermined prices. The contract between farmers and buyers insulates farmers from price risk, helps them develop new skills, and opens new markets.

Africa could increasingly look at this contract farming model, whilst concentrating on its supply chain, in order to cut down its import bill. Africa today imports crops such as wheat and rice in huge volume. For example, wheat flour is used by bakeries and food processors across the continent to make bread, noodles, biscuits and several other pastries. Despite the demand, over 80% of wheat in Africa is imported. A suitable contract farming set up in some of the African countries can result in the mutual benefit of both the farmers and the processors. It may be noted that there has already been some successes in this field in Uganda, where SABMiller had set up a contract farming arrangement of sorghum for brewing purposes in 2008. Sorghum-based beer now accounts for half of SABMiller's share of the Ugandan beer market.

In the Indian context, contract farming has proved to be very useful. Today, it is being practiced across India and has established itself as a win-win partnership for both the farmers and the private sector firms. Major Indian and global multinationals, such as Hindustan Lever Ltd (HLL), Rallis India, ITC, Reliance and PepsiCo India among others are associated with contract farming in the country.

The experience of contract farming in the Indian context shows that there is considerable saving in consumption of inputs due to the introduction of improved technology and better extension services. Recently, the Government of India has also released a draft Model Contract Farming Act, 2018. The draft Model Act seeks to create a regulatory and policy framework for contract farming. Based on this draft, legislatures of states can enact a law on contract farming.

There are various instances where companies have indulged in this sort of farming and resulted in savings for both the communities- farmers and processors. For instance, launching its agro-business in India with special focus on exports of value-added processed foods, PepsiCo entered India in 1989 by installing a state of-the-art tomato processing plant at Zahura in Hoshiarpur district, Punjab. The total Punjab tomato crop was 28000 tons, available over a 25-28 day period, while PepsiCo required at least 40000 tons of tomato to operate its factory, which had a gigantic processing capacity of 39 tons fresh fruit per hour. This resulted in PepsiCo's backward linkage with farmers of Punjab. The company focused on developing the region and desired produce-specific research, and extensive extension services. It was thus successful in bringing about a drastic change in the Punjab farmers' production system towards its objective of ensuring supply of right produce at the right time in required quantities to its processing plant[18].

[18]National Institute of Agricultural Extension Management, 2003

Another example is of Hindustan Unilever Ltd (HUL), which formed partnerships in 2012, with 3,500 farmers in Karnataka and Punjab to grow tomatoes for the company's Kissan ketchup in a bid to sharpen focus on its foods business and promote sustainable agriculture in the country. Post this, HUL also partnered with the Government of Maharashtra to source tomatoes. The company, in the recent times has moved from virtually 100% imported tomato paste to a lot less.

Seeds Development

Quality seeds are the basic and most critical input for sustainable agriculture. The output of all other inputs depends largely on the quality of the seeds, to a large extent. It is estimated that the direct contribution of seed alone to the total production is about 15 – 20% depending upon the crop, and it can further be raised up to 45% with efficient management of other inputs.

India actually first realised the benefits of good quality seeds during the Green Revolution in the 1960s – since then the Indian seed industry has evolved into a multi-faceted industry with a large involvement of private firms and increased emphasis on research and development. A major re-structuring of the seed industry by Government of India happened over three phases of the National Seed Project (NSP) - Phase-I (1977-78), Phase-II (1978-79) and Phase-III (1990-1991). This project strengthened the seed infrastructure in the country to a great extent.

Amidst the NSP, the New Seed Development Policy (1988 – 1989) was also introduced which was yet another significant milestone for the Indian seed industry. The policy gave Indian farmers, the access to some of the best seeds and planting materials available in the world. Indian Corporate and MNCs entered the Indian seed sector with strong R&D base for product development with more emphasis on high value hybrids of cereals and vegetables and hi-tech products such as Bt. Cotton.

In Africa's case, access to high quality, locally adapted, better pest resistant, and high yielding seeds at affordable prices are having significant relevance. Seed systems in most Sub-Saharan African countries are still relatively underdeveloped with farmer-saved seed accounting for approximately 80% of planted seeds, compared to a worldwide average of 35%. Most farmers have not been able to take advantage of new crop varieties developed by the National Agricultural Research Systems (NARS) and the International Agricultural Research Centres (IARCs), mainly due to weak seed production and distribution linkages. Formal seed sector in Sub-Saharan Africa can be classified into five stages of development, namely, nascent; emerging; early growth; growth; and mature[19].

[19]Africa Agriculture Status Report, 2013

Table 13: Various Stages of Seed 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
Country Examples	South Sudan, Liberia, Sierra Leone, Angola, Democratic Republic of the Congo	Niger, Mozambique, Rwanda, Mali, Senegal, Botswana, Madagascar, Ivory Coast	Burkina Faso, Ghana, Ethiopia, Tanzania, Nigeria	Uganda, Zambia, Kenya, Malawi, Zimbabwe	South Africa
Improved seed adoption	Aid/relief programs, 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 formalized	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 & self -regulating
Private sector participation	No private seed companies	Few small seed companies	Many small/ med 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 specialized outlets	Vertical integration

Source: Table adapted from Africa Agriculture Status Report, 2013

However, some African nations such as Ethiopia have shown a significant progress in this sector. Over the period 2004-05 to 2013-14, the number of improved seed varieties released to farmers has increased rapidly, mostly with local capabilities of research and seed multiplication structures. An estimated 54 of the 87 improved wheat varieties available in Ethiopia were developed and released during the period 2001–2011. While adoption rates of improved seed varieties by farmers are low overall, the proportion of farmers using improved seeds, however, has seen significant improvements, more than doubling over the last decade, from 10% of cereal producers using improved seeds in 2004-2005 to 21% in 2013-2014. Further, 12% of the contribution in the crop output growth in Ethiopia during 2004-05 to 2013-14 was due to the improved seeds[20].

The Indian Seed Improvement Programme is backed up by a strong crop improvement programme in both the public and private sectors. At the moment, the industry is highly vibrant and energetic and is well recognized in the international seed arena. Several developing and neighbouring countries have benefited from quality seed imports from India. India's Seed Programme has a strong seed production base in terms of diverse and ideal agro-climates spread throughout the country for producing high quality seeds of several tropical, temperate and sub-tropical plant varieties in enough quantities at competitive prices. The African Governments can also join hands with India in this space, in order to develop its seed program.

Drip Irrigation

In drip irrigation, the water pumped out from a well is first sent through sand separators and media/screen filters to remove silt and impurities such as algae or dead plant matter. This filtered water is then applied to the crop via a network of mainline and sub-mainline pipes, valves (that turn on or off the water flow) and smaller diameter polytubes or 'laterals', which have pre-installed emitters at spaces corresponding with the placement of each plant. These ensure delivery of water directly to each plant's root zone (where it is really required) and at discharge rates as low as one litre per hour. Drip irrigation systems also have provision for 'fertigation' — application of fertiliser, in liquefied form from a separate tank, along with the water.

It becomes important for Africa to use water-efficient technologies such as drip irrigation, so as to address the challenge of food security. While the efficiency of overhead irrigation, such as rotors, and pop-up spray heads is typically 50% and rarely exceeds 70%, the efficiency of a well-designed drip irrigation system can reach nearly 100%[21].

In the African continent as a whole, 86% of water withdrawals are directed towards agriculture, and this percentage is even higher in the arid and semi-arid parts of Africa. In those areas, the water withdrawn for agriculture from the hydrologic system may represent a significant part of the water resources. 60% of food production is from non-irrigated agriculture in Africa and a large part of irrigation potential remains unused in sub-Saharan Africa. Also, only a few countries in Africa can afford the financial investment in efficient irrigation systems, and water losses through leaking pipes. Besides, evaporation rates are as high as 50% in South Africa alone[22].

[20]Africa, Agriculture Status Report, 2018
[21]FAO 2008
[22]Alliance for Water Efficiency

It may be observed that while drip irrigation is an efficient method, it involves high capital investment. For instance, in India, indicative cost of drip irrigation for closed spaced crops with 1.5m X 1.5m spacing of laterals, varies from US$ 316 per ha, to US$ 6927 per ha for a lateral spacing of 1.2m X 0.6m. Therefore, to offset the financial constraints of the farmer, the State Governments in India have focused largely on financial assistance in the form of subsidies to the extent of 40-90% of the cost of micro-irrigation[23].

It is important for Africa to focus on low cost drip irrigation system, especially in a scenario, where there are large number of marginal landholders. Low-cost drip irrigation is an irrigation method that is suited for small fields and maintains the water-saving advantages, hence gaining the advantage of being a water-smart technology through its affordability, simplicity, easy maintenance and operation, and big water saving[24].

Africa can partner with Indian companies like Jain Irrigation, Finolex Plasson, Kisan Irrigation, Premier Irrigation Adritech, Netafim, amongst others and Indian institutions like Central Institute for Cotton Research in India (CICRI) which have successfully developed these sort of low cost irrigation systems, in order to address the challenge of capital.

For instance, CICRI developed two low cost drip systems of micro-tube drip and poly-tube based drip through rigorous testing procedures for optimum efficiency. The testing of it revealed that drip fertigation had increased the number of bolls and seed cotton yield when compared to farmers' practice of surface irrigation and soil application of fertilizer. Low cost micro-tube and poly-tube drip systems, respectively, produced yields equivalent to 93.4% and 96.7% of existing drip system (CICR, 2011)[25].

However, Africa, also needs to create awareness about this system of irrigation to address the other challenges. For instance, various NGOs started to promote drip irrigation kits in Sub-Saharan Africa in recent times. However, farmers rarely, if ever, seek drip irrigation kits and show little interest in using them, especially in sub-Saharan Africa. Even if they do, it is often because the kits are seen, or act, as a gateway to receiving other development benefits such as seeds, fertilizers, pesticides, pumps and loans. It is important for the African Governments and NGOs to provide attention to whether and how such kits are used by farmers[26].

Drip irrigation can be a transformational technology strategy for smallholder producers in Africa. The commercial potential for the private sector to expand this technology to smallholder farmers is enormous, given the sheer volume of potential customers at the smallholder level, and the area of arable land yet to be irrigated. Such measures could be more popularly implemented in African farms to improve efficiency and productivity, considerably.

[23]Global Water Forum, 2017 (Harsha, Micro-irrigation in India: An assessment of bottlenecks and realities, 2017)
[24]Low-cost Drip Irrigation Systems for Smallholder Farmers in Tanzania [CGIAR, Low-cost Drip Irrigation Systems for Smallholder Farmers in Tanzania)] (https://wle.cgiar.org/sites/default/files/documents/31_WaSA_Ch3.9.pdf)
[25]Low Cost Drip – Cost Effective and Precision Irrigation Tool in Bt Cotton, 2011
[26]A wakeup call from the drip dream, IHE Delft Institute for Water Education (Zwarteveen et al., 2014))

Agricultural Markets

A good agricultural harvest is of little use if the produce does not fetch enough returns to warrant a sustainable agricultural venture. Thus, marketing agriculture-produce efficiently becomes important not only for expansion of the size of the market but also for transfer of appropriate price signals. An agricultural market backed by strong and adequate infrastructure goes a long way in efficiently selling agricultural produce without the interference of middlemen.

Among the challenges that various developing nations face in the agriculture sector is that the farmers do not get the fair price of their product. This challenge is faced by the African region too and is dependent on various factors. This can be due to a limited set of buyers and at times, merely due to the information asymmetry. In order to address this, it becomes important to have a common agricultural market, so that ultimately, the farmer gets the fair price and is able to have a sustainable income. Amidst these challenges, there are some private players which have started coming up with models lately. For instance, a firm with the name 'FarmGate' was launched recently in Nigeria by the FarmCrowdy Group. It focuses on providing big buyers and processors direct access to farmers while eliminating the roles of the many intermediaries in the demand and supply value chain. The company's model works on two approaches. The first approach is for the commodity trader. Here, the sponsor selects from an available range of agro products to trade, specifies how much they want to trade in, and is assigned an accounts manager to close the deal, and finally gets back their capital plus yield to end the investment period. The second approach is for the commodity purchaser. Here, the buyer selects from an available range of products, selects volume and an assigned accounts manager contacts user/farmer, and finally order is processed and shipped to buyer's delivery address. Similarly, Twiga Foods, which was founded in 2014, links smallholder farmers in rural Kenya to informal retail vendors in cities. With Twiga's mobile platform, vendors can order fresh produce from farmers across Kenya at the most competitive prices.

Taking cognizance of such similar set of challenges, the Indian Government had launched the National Agriculture Market (e-NAM) in 2016, with the objective of integrating agri-markets across the country through an e-platform and creating a unified national market for agricultural commodities.

In India's case, a successful example is of Rythu Bazar which was established in the year 1999 by the Government of Andhra Pradesh. The concept of Rythu Bazar was developed to facilitate direct marketing between consumers and farmers.

Further, the Indian e-mandis (e-markets) integrate various vegetable markets across the country, bringing them all to one platform and registered farmers are able to sell their produce online in any of the markets where they can get the best price. Involvement of private sector ensures investment and entrepreneurial skills required for creation and management of modern markets. Thus, the e-marketing platform promotes free flow of agricultural commodities across the country and have gradually been providing better prospects for marketing of agriculture produce. Improved access to market related information and better price discovery, through a more efficient, transparent and competitive marketing platform, have provided agriculture producers access to a greater

number of buyers within the State and from outside, through transparent auction processes. It has also increased access to markets through warehouse based sales and thus, obviated the need for transporting agri products to the nearby markets.

In fact, almost 585 mandis (markets) in 16 States and 2 Union Territories have already been linked with e-NAM and another 415 markets are expected to be on the platform by March 2020. Further, the Government of India is planning to link 22,000 mandis across the country with the e-NAM by 2021-22. India's experience in establishing this e-market platform would be of great relevance to Africa.

Precision Farming

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

In India (and also 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 maximize productivity, quality and profitability. 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.

Indian Farmers Fertiliser Cooperative (IFFCO) a well-known farmer cooperative organisation, created the 'IFFCO Kisan' app which helps Indian farmers to make informed decisions by accessing customised agricultural 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.

According to a study by Mordor Intelligence, the Asia-Pacific region has recorded a remarkable growth in the precision farming segment, in the recent years. Large countries, like China and India, have witnessed great growth rates in the past and are likely to remain the largest markets in the region. The Study reveals that the precision farming market in India is expected to increase from US$ 56.3 million in 2017 to US$ 248.5 million in 2023, registering a significant AAGR of over 28%, during this period. On the other hand, precision farming market in Middle East and Africa together accounts for US$ 124.6 million in 2017 and is forecasted to reach US$ 287.8 million in 2023, recording an AAGR of over 15%.

Given both the Indian and the African precision farming markets are expected to grow in double digits in the coming years, it is mutually beneficial for both the regions to collaborate in this space.

Box 1: Precision Farming in Africa: Start-Up boom

In Africa, various start-ups are coming into the mainstream, using technology, and entering the space of precision farming. The innovative practices being used by them can help in raising the yield of the crops in the African land and as a result, the overall production.

For instance, Zenvus, a Nigerian precision farming start-up, uses analytics to measure and analyze soil data like temperature, nutrients, and vegetative health to help farmers apply the right fertilizer and optimally irrigate their farms.

Agrocenta, another Ghanaian start-up, has two platforms AgroTrade and AgroPay in place to solve the problems of access to market and access to finance. Its platform AgroTrade is a comprehensive supply chain platform that has smallholder farmers on the one end and large off-takers on the other end, so that they can trade directly. AgroPay, on the other hand, is a financial inclusion platform which provides any smallholder farmer who has traded on AgroTrade with a financial statement, to get access to finance.

Precision Agriculture for Development (PAD), an NGO, piloted an SMS-based advisory service among 1,900 smallholder maize farmers that provided input recommendations conditional on local soil tests, in 2016. In early 2017, it rolled out a more intensive system that offered information not only via SMS but also through phone calls and an e-extension system among 5,900 farmers.

There are various other start-ups such as UjuziKilimo; SunCulture; FarmDrive; AgroSpaces; M-farm etc. which are working in this space to make agriculture not just more precise and certain but also an attractive field.

Marketing Support

While Africa is making an effort to increase the production and yield across the crops, it is also important to reduce the gap between the buyers and sellers. There may be various methods to do so, but a vital part is also played by the marketing of those crops. Marketing comes at the last stage of the value chain and can be an important factor in contributing to the farmers' growth and at the same time, has the potential to reduce the post-harvest losses.

Going forward, Indian marketing agencies like Agricultural and Processed Food Products Export Development Authority (APEDA), National Agricultural Cooperative Marketing Federation of India (NAFED), Tribal Cooperative Marketing Development Federation of India (TRIFED), fair trade regulator like Competition Commission of India (CCI), state level agricultural produce market committees (APMC), and National Agriculture Market (NAM), a pan-India electronic trading portal can all share their experiences in various countries in Africa.

Various Indian agricultural marketing agencies in conjunction with the Government of India and national agencies in Africa can undertake pilot projects exploring the feasibility of having similar operations in Africa. Such projects will also throw open a lot of experiences, which could then be improved in their next level of engagements.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), a CGIAR (Consultative Group on International Agricultural Research) Centre, conducts agricultural research for development in Asia and Sub-Saharan Africa with a wide array of partners throughout the world. The recent initiatives taken by ICRISAT include enhancing public-private partnership (PPP) and developing entrepreneurship. Through its Agri-Business and Innovation Platform, ICRISAT envisions enhancing prosperity of farmers by promoting market-oriented innovative product development, such as exploring new business opportunities for soybean and millets. ICRISAT has established Agri-Business Incubators and Value-Chain Incubators in six African countries by partnering with local bodies.

Institutional Support

Africa is at the forefront on the global food security efforts. This is due to the various challenges that the continent faces such as low productivity, infrastructural challenges etc. Other than the various mechanisms that can be applied to address these challenges, the institutional support from various nations becomes a part of the bigger solution. Countries such as India which have faced similar experiences in the field can be a great facilitator in Africa's story of agricultural growth.

One of the main features of India-Africa cooperation in agriculture is India having actively pursued capacity building and sharing its experiences to help develop the African agriculture sector.

Particular attention has been given to research and knowledge sharing methods on various agricultural practices. India has sent teams of farm experts from the Indian Council of Agricultural Research (ICAR) to Zambia, Ethiopia and South Africa and also to several African countries to get first-hand knowledge of how African countries could learn from Indian experiences and explore ways of improving their agricultural practices.

Moreover, Platform for India-Africa Partnership in Agriculture (PIAPA) has been set up by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Agriculture Consulting Group (IACG), New Delhi, and Indian Council of Agricultural Research (ICAR), New Delhi to bring various stakeholders on board as consortium partners to create better policies, more effective institutions, improved infrastructure and better access to markets and higher quality inputs, particularly for dry land farmers in India and Africa.

There are also some significant Africa-India initiatives undertaken at multilateral level, particularly in the domain of South-South cooperation. ICRISAT has also set up ICRISAT South-South Initiative (IS-SI) to provide a systematic and effective cooperation between India and Africa in the agriculture sector. It has already established strong and successful India-Africa partnerships to scale up its role as a driver of prosperity and economic opportunities in the dry-land tropics. ICRISAT has intervened towards sorghum yields in Eastern and Southern Africa which are affected by both biotic and abiotic constraints. Improved crop management and new varieties with increased resistance to pests and diseases can significantly increase crop yields. ICRISAT, in this case, has made available high-yielding sorghum cultivars (OPVs and hybrids) with resistance to the main biotic and abiotic stresses and with farmer-preferred/market traits. It has also trained farmers, extension staff, agro dealers, and seed companies in Good Agricultural Practices in this region.

Besides, a MoU for cooperation in the field of agricultural research and education was also signed in 2011 between the Department of Agricultural and Research (DAER) and ICAR and the Director General of Ethiopian Institute of Agricultural Research (EIAR), Ethiopia. The priority areas of cooperation include agricultural research in horticulture, crop science, fisheries, animal science, agricultural engineering and natural resource management, agricultural extension and agricultural education. Both countries agreed to extend cooperation through exchange of scientists, scholars, technologies, literature, information and germplasm, as well as pursue collaborative research projects.

India has extended support for the development of cotton sector in the Cotton Four (C-4) countries (i.e. Benin, Burkina Faso, Chad and Mali) and also in Nigeria, Uganda and Malawi where India is providing cotton technical assistance, support and cooperation. India's assistance includes, assessing the requirements of partner countries in the areas of capacity building, technology transfer, and R&D in the cotton sector; sharing the expertise developed in Indian R&D; and formulating an effective cooperation programme and exploring business and investment opportunities in these countries.

International Livestock Research Institute (ILRI), has also been working to improve food security and reduce poverty in developing countries through research for better and more sustainable use of livestock. Some of the ILRI's ongoing India-Africa programmes are: IM Goats (India-Mozambique), Milk IT (India-Tanzania), Value-Chain Development (India-Tanzania, Ethiopia, Mali) and South-South Dairy Development (India-Kenya).

Under the India-Africa Forum Summit – I (IAFS-I), the Department of Agricultural Research & Education (DARE) under the Ministry of Agriculture & Farmers Welfare, Government of India has been entrusted with the capacity building of African countries through agricultural education of African students in different Agricultural Universities/ Deemed Universities of Indian Council of Agricultural Research. In accordance, the students from Africa are being admitted in Indian Agricultural Universities. Further, various training programmes were also organised in India under IAFS-I for capacity building of African scientists.

Further to implementation of IAFS-I, the Ministry of External Affairs launched IAFS-II (Indo-Africa Forum Summit-II) towards further strengthening of capacity building through agricultural education. DARE has been entrusted to establish some centres in Africa such as (a) Soil, Water and Tissue Testing Laboratories; (b) Farm Science Centres; and (c) Agricultural Seed Production-cum-Demonstration Centres. The work relating to establishment of these centres has been taken up with the Ministry of External Affairs. Many countries in Africa have identified locations, building, etc. for the projects and some countries have already been visited by experts from India to study the existing infrastructure.

Various institutes such as Central Food and Technology Research Institute (CFTRI), National Dairy Research Institute (NDRI), Central Institute for Cotton Research (CICR), Indian Institute of Horticultural Research, Indian Institute of Vegetable Research, etc. can be vital in Africa's agriculture space. Additionally, Table 15 lists down some of the crops where select agricultural institutions in India can be a partner in Africa's agriculture growth.

India also has a host of many other research institutes in the field of agriculture which can work with the African institutes and the sovereign governments in the continent, sharing their experiences and introducing successful practices, tried and tested in India, but which are in sync with the African economies.

Table 14: Scope for Institutional Cooperation between India and Africa

Institute in India	Select Crop	Top producers
Indian Institute of Sugarcane Research	Sugarcane	Egypt, South Africa, Kenya, Eswatini, Sudan
Indian Institute of Wheat and Barley Research	Wheat	Egypt, Ethiopia, Morocco, Algeria, South Africa
National Rice Research Institute	Rice	Nigeria, Egypt, Madagascar, Tanzania, Mali
Central Potato Research Institute	Potato	Algeria, Egypt, South Africa, Morocco, Tanzania
Indian Institute of Soybean Research	Soybean	South Africa, Nigeria, Zambia, Benin, Malawi

Source: FAO; EXIM Bank Research

Tested and quality seeds

In recent years, several Indian seed companies are making inroads into overseas markets such as Africa and South-East Asia. While it is a fact that the Indian seed companies looking for expanding their business into international markets is a push factor, the demand for better quality-standard-compliant seeds to increase their productivity and income by African farmers is a pull factor for the Indian seed companies. This is coupled with the favourable agro-climatic conditions prevailing in Africa which is similar to that of India. All these factors create a huge scope for enhanced cooperation in the seed sector between India and Africa.

Some of the Indian seed companies have partnered with various African NGOs, and initiatives have also been taken for market distribution, such as IFDC, One Acre Fund, Grow Africa, AGRA, SFSA's Seeds2B, USAID Feed the Future, etc.

Advanta India Ltd. is a regional partner in Grow Africa initiative, and is working with leading developmental agencies for improving the farm productivity and income. Besides this, Safal Seeds and Biotech Ltd. exports onion seeds to their Kenyan partner, East African Seed Co. Ltd and Safari Seeds Ltd. There are also companies like East West Seeds India Ltd, Nirmal Seeds, Nuziveedu Seeds,

MAHYCO, which are active in African seed market. Indian seed companies have also been actively looking at buyout of local seed companies. For example, Mahyco (Indian seed company) acquired 60% stake in Zimbabwe-based Africa's largest listed seed company, Quton Seed company. This acquisition gave Mahyco a strong platform to deliver genetically modified crop seeds to African cotton farmers for yield and income enhancement. Few Indian seed companies have registered themselves as local company in Africa to expand and establish their business. For example, Nirmal Seeds has got itself registered as Nirmal Seeds PLC in Ethiopia for establishing strong foothold of its seed business there, and also partnered with the Ethiopian Institute for Agricultural Research for development and evaluation of crop seeds.

Robotics in Agriculture

Africa has the possibility of experiencing a leap-frog approach in modern agriculture. Robotics in agriculture is one such technology. It is a subset of the precision farming set of technologies used in every stage of crop yielding, from soil assessment to ploughing/seeding to harvesting and packaging. The stages include usage of various types of robots (including drones) to increase overall productivity. The advantage of using agricultural robots is that they are capable of collecting crop and soil samples because they are small in size, which allows them to be able to accumulate data close to the crops with the equipped cameras and sensors. They are also capable of mowing, spraying pesticides, finding diseases or parasites, and performing mechanical weeding. The benefits of automation and mechanisation can be seen spreading to crops like tomatoes, peppers, strawberries, etc., thus making them more affordable; significantly reducing the loss of soil to erosion; reduction of agriculture's contribution to CO_2 production and reversal of the loss of soil carbon.

Box 2: Case Study: Green Robot Machinery Private Limited

The Green Robot Machinery Private Limited (GRoboMac), a farm robotics company in India, was established as a result of techniques involved in cotton farming. Cotton picking requires manual labour which consumes considerable amount of time. This sector also faces issues related to child labour. However, GRoboMac, aims to address not only the peak labour challenge but has also devised the capability to fill the demand-supply gap.

The working of the robot has been designed in such a way that the computerized vision detects and locates the precise 3D coordinates of the bloomed cotton from the images of the cotton plant. A robotic arm uses these coordinates to pick the cotton and the arm, then uses a vacuum for precision picking of cotton and avoids picking any other contaminant.

Multiple of these robotic arms is mounted on a semi-autonomous vehicle that moves over rows of cotton plant to harvest the complete cotton field. This mechanism closely mimics the human method of picking, but at a much higher productivity level of manual picking.

GRoboMac is further developing smart machines for harvesting cotton and horticulture crops like eggplant, okra and capsicum. Technology such as 3D machine vision and Robotics is used to make these machines smart and automate some of the tasks done by humans. The machines can be customized to do other labour demanding tasks like weeding, pruning and spraying.

Capital Formation in Agriculture

The African agriculture sector has been facing multiple challenges which has been hampering the investment in the region. These challenges include access to finance; infrastructure; skilled labour; policy initiatives, amongst others. According to FAO, within Africa the agriculture share of central Government expenditures, in terms of regions, has not been very significant except for the region of Eastern Africa. This share of government expenditure in agriculture in Africa is lower than the regions such as South Asia which also involves various developing economies. The South Asia region has consistently maintained a share of over 5% since 2006 for agriculture, out of the total government expenditures.

Table 15: Agriculture Share of Central Government Expenditures in %

Regions	2001	2005	2009	2013	2017
North Africa	9.87	3.25	2.58	1.90	1.38
Sub-Saharan Africa	2.81	3.43	2.88	2.32	3.04
West Africa	4.78	4.73	4.60	2.10	3.42
Middle Africa	1.23	1.68	0.93	1.57	2.69
East Africa	4.42	6.24	5.50	4.11	3.35
South Africa	1.99	2.31	2.08	1.81	3.06

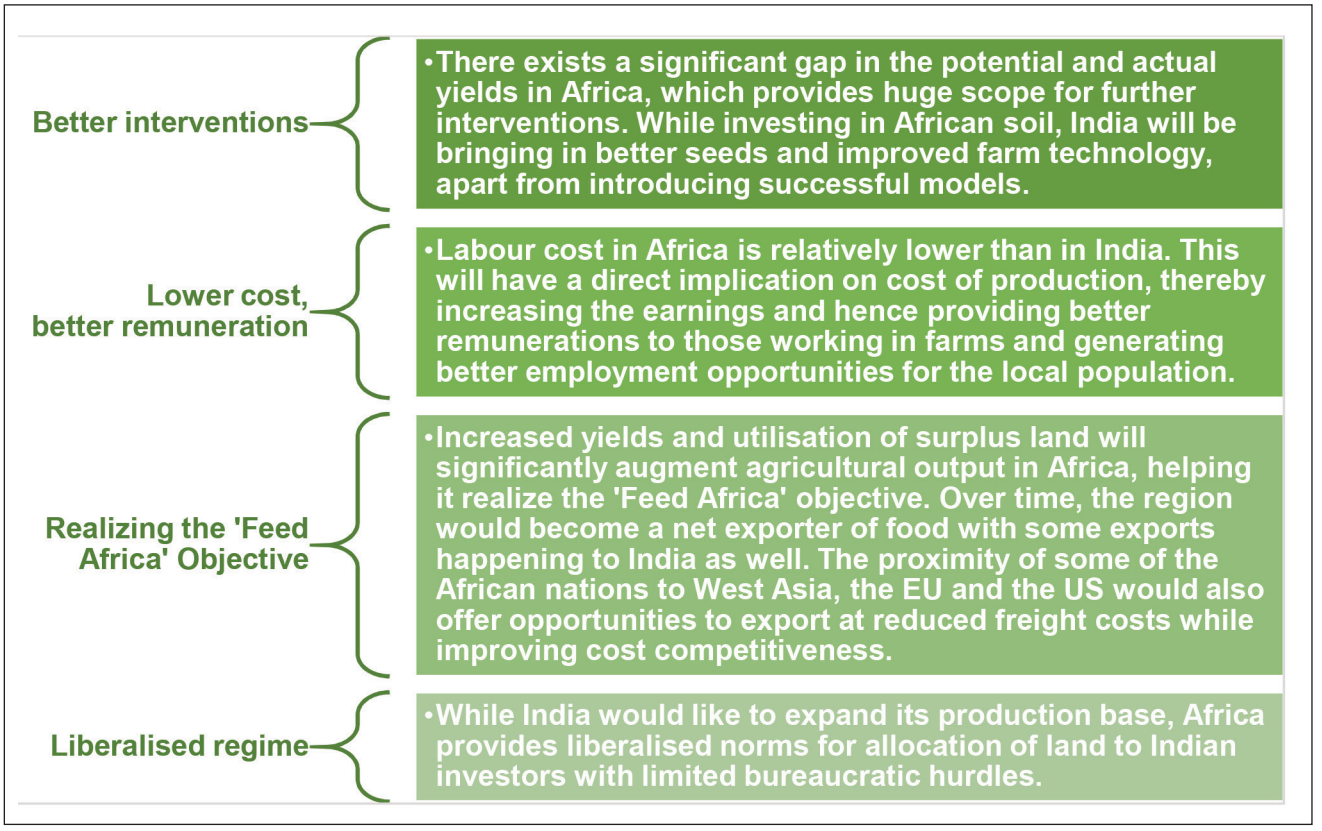
Spruce: FAO; EXIM Bank Research

Further, according to fDi markets, in the last decade, that is, during 2009 to 2018, a total of 129 foreign capital projects to the tune of US$ 10.1 billion were envisaged in the agricultural sector in Africa. India has been the highest contributor to this at US$ 2.1 billion, followed by Ukraine at US$ 2 billion, Kuwait at US$ 1.5 billion, and the US at US$ 1.1 billion. More than half of the total foreign capital envisaged has been in the sector of crop production. It is important to observe that the total capital envisaged in agriculture of US$ 10.1 billion during the period 2009-2018, is just 1.1% of the total foreign capital envisaged in Africa, during the same period.

With the challenges in place, and the low levels of both public and private investment in agriculture, AfDB's 'Feed Africa: Strategy for Agricultural Transformation in Africa 2016-2025' has identified an initial set of agricultural commodities and agro ecological zones for being the initial lead areas for investment. It further highlights the fact that transforming this initial set of commodity value chains and agro-ecological zones could open markets worth US$ 85 billion per annum by 2025 and will have a substantial impact on realizing Sustainable Development Goals on poverty reduction and ending hunger, and will require mobilizing US$ 315 billion - US$ 400 billion in investments.

Additionally, the Government of India has been encouraging outward FDI in agriculture which would not only help Indian companies to purchase land abroad for cultivation but will also help serve the local communities by creating employment opportunities, enhancing productivity, thereby resulting in increased income generation for the local population. These efforts would help Africa in serving its objective of becoming a self-sufficient region in food production. At the same time, there has been a growing demand of certain crops in India which it is unable to fulfil. In such a situation, offshore agriculture investments emerge as a necessary solution to India's

Exhibit 6: Win-Win situation for India-Africa Cooperation in Farm Investments



Source: EXIM Bank Research

policy framework for addressing food security, especially as incomes rise, population increases, and longevity grows and available land declines in the country..

In the current context, if there is an option available for India to outsource the production of these commodities to countries in Africa, it may well be a win–win situation for both.

There is ample scope for India to enter into agricultural ventures abroad, especially in Africa. Africa offers immense opportunity in terms of investment in large-scale commercial farming, mainly due to availability of huge tracts of fertile land at modest prices. It may also be noted that due to the large size of the farms in Africa, it becomes much easier to go for mechanised farming in such plots, thereby, increasing farm efficiency leading to greater output and as a corollary, higher incomes for the local population. Better interventions by India in African soil, lower cost and better remuneration of local farmers, exporting abroad, and a liberalized regime in Africa are win-win causes for both.

As with regard to small farm holdings, as and where available, India can offer solutions in terms of setting cooperatives which could facilitate warehousing facilities, supply of machineries and equipment for the communities, providing logistics to supply to the primary markets of sale, etc.

Box 3: Basic Principles for Engagement at the Local Level during Agri investments

Basic principles that should be followed in engaging communities and local level stakeholders include:

- Consulting when all options are still open;
- Ensuring information is available to the community in understandable forms, including the full prior project proposal, explanation of options, impacts and alternatives, record of any agreement and pledges from either side;
- Making sure that diverse local interests are properly represented, by going beyond local elites and by making specific efforts to include groups who may be left out, such as women, minority ethnic groups and non-resident people like transhumant pastoralists;
- Crystallising any investor-community agreement emerging from the consultation in readily monitorable and legally enforceable terms;
- Providing effective arrangements for local people to voice concerns and seek redress, particularly where access to formal courts is constrained (e.g. grievance mechanisms);
- Committing to clear plans for revisiting the dialogue and reviewing progress in consultation with community.
- Attention to increased agricultural productivity needs to be balanced with assessment of how gains are achieved (for example, through mechanised or labour-intensive production) and how benefits are shared.
- State-of-the-art assessments of the social and environmental impacts of proposed investments are needed.
- Investors need to make realistic assessments of their capacity to manage farming projects at this scale.

FARM MECHANISATION: COOPERATION BETWEEN INDIA AND AFRICA

Mechanisation is one of the various possible solutions that is yet to be exploited to a large extent, in the African region. Farm mechanisation was neglected to quite an extent by the African region, but of late the need for mechanising the farming is being realised in African nations, and the demand is growing, given its success across the world in productivity enhancement. The contribution of mechanisation is generally in all the stages of value chain from production to post-harvest to processing, and ultimately, to marketing.

Diversifying in Trade of Farm Equipment: Role of India

The technology by the western regions, especially Europe and the USA, has become increasingly sophisticated and complex. However, a technology can be best utilized only in a condition which it is suited for. Given the size of farm holdings in Africa, which is marginal, Indian agriculture machinery are best suited, especially given that the African continent is also facing skill challenges to operate complex machines marketed by the developed countries.

As discussed earlier, about 60% of the farms in Africa are smaller than one hectare. Further, 95% of farms are smaller than 5 hectares and make up the majority of farmland in Sub-Saharan Africa. Here, it is important to note that India, which is also facing similar challenges, with respect to marginal land holdings, has increased its productivity through farm mechanisation. According to 10th Agricultural Census of India, small and marginal holdings (below two hectares) constituted 86.21% of the total land holdings, an increase of 1.2 percentage points compared to the level that prevailed in 2010-11. These farmers with small and marginal holdings own just 47.3% of the crop area. In comparison, semi-medium and medium land holding farmers owning between 2-10 hectares of land account for 13.2% of all farmers, but own 43.6% of crop area. Therefore, the new emerging industrial economies such as India, which are facing almost similar challenges in terms of the size of land holdings, can be a real partner in Africa's growth in agriculture, especially through farm mechanisation.

India has increasingly stepped in to provide tractors and farm machinery, which are present in local markets. This machinery is perceived to be more suitable for African conditions and at the same time, is considerably cheaper than machinery manufactured in Western Europe or North America.

In particular, economical versions of not so sophisticated 2 and 4-wheel tractors are adequate for supplying the tractive power for smallholder farms; they may be owned directly or cooperatively, or purchased by enterprises to provide mechanisation services.

Need for Newer Business Models

As discussed earlier, there is a realisation in Africa that farm mechanisation is the need of the hour. However, due to low income of the farmers, this realisation does not translate into tractor demand. Due to a large number of small and marginal landholders, there is generally a lack of awareness about the existence of the mechanisation services. It is of vital importance to make the farmers aware and disseminate information to expand agricultural mechanisation. In addition, it is important to identify business models appropriate to local conditions in the various Sub-Saharan countries. The global community has to reach a place where African countries have to be seen in isolation, in order to promote this sort of process, since agricultural dynamics might differ across countries. Although Sub-Saharan African regions may seem underdeveloped in terms of economic activities, there is excellent potential for the development and adoption of new ideas for business models adapted to the prevailing conditions.

There should also be a greater focus to promote the public-private partnership (PPP) in this space. For example, the Potato Initiative Africa (PIA) – operating in Nigeria and Kenya – is implemented within the German Food Partnership (GFP) and involves private sector agricultural machinery suppliers. Further, in 2015, FAO and the European Agricultural Machinery Industry Association (CEMA), an international non-profit organisation, forged a new partnership that aims to promote wider use of sustainable agricultural mechanisation in developing countries. The initial focus of the FAO-CEMA partnership will be on capacity building activities in Africa, where human muscle remains the most important power source for smallholder farmers. For example, in sub-Saharan

Box 4: Growth of Indian Tractor Market

India, today, is one of the largest manufacturers of tractors in the world. The sales of tractors have increased in the past due to the increased rate of farm mechanisation. Furthermore, the low availability of manual labour has positively influenced the sales of tractors in India.

According to Tractor and Mechanisation Association of India (TMAI), the sales of tractor in India was registered at 8.9 lakh units in 2017-18. This is a jump from 5.5 lakh units in 2014-15. As a result, the average annual growth rate (AAGR) registered during this period in tractor sales was 20.1%. During the same time, the exports have increased from 75376 units in 2014-15 to 93280 units in 2017-18, recording an AAGR of 7.7%. The exports share in the total sales is well over 10% for the Indian tractor market.

Further, various companies have been showing increasing interest in the African market. Indian companies such as Escorts Ltd. (India's third-largest tractor maker), are aiming to quintuple exports over the next three years by focusing on Africa and boosting contract manufacturing production for overseas brands. Mahindra & Mahindra, largest tractor manufacturer in India has presence in almost 41 African countries.

Africa, humans provide 65% of the power required for land preparation compared to 40% in East Asia, 30% in South Asia and 25% in Latin America and the Caribbean.

Newer models such as hiring the farm machinery can also be explored. Machinery hire services can cover a wide range of operations such as crop operations (e.g. soil tillage, planting and spraying); post-harvest services (e.g. threshing, shelling and processing); transport services; and collection of bio-waste and other refuse in rural, peri-urban and urban areas.

In India's case, various start-ups have been coming up with models that are directly and positively impacting the farm mechanisation space in India.

For instance, India's largest producer of tractors, Mahindra and Mahindra Ltd, in 2016 launched Trringo to rent farm equipment to farmers across India. Triringo has set up a mobile app and a toll-free number where farmers can place their order, according to their requirement. They receive a well-maintained tractor along with a professional operator. With presence in five states—Karnataka, Maharashtra, Rajasthan, Rajasthan, and Madhya Pradesh - till date, over 1 lakh hours of farm mechanisation rental has been successfully completed.

Creating an Enabling Environment for the Private Sector

The private sector led mechanisation, though possible, can be very slow in its pace to have effects on the overall agriculture scenario. This becomes even more difficult in case of the regions which have huge amount of small and marginal land holding as the impact on the total size is going to be fragmented. This is one of the reasons that governments of the day, especially in the developing regions, take the issue of mechanisation in the farm sector as a primary work rather than associating it with indirect benefits or means to achieve an end. However, even the Government's focus should

go hand in hand with the private sector's intentions. It is important for the Government to provide relevant public goods to the private sector if it wants to implement these strategies on the ground. This can include the awareness about the benefits of mechanisation, easier process to import the machinery (if not locally manufactured), skill development, establishing institutional mechanisms, amongst others.

Government of India, has in place, a scheme called, 'Sub-Mission on Agricultural Mechanisation (SMAM)', amongst others, in order to create an enabling environment for both the farmers as well as the investors.

In India, many farm mechanisation schemes such as 'Promotion and Strengthening of Agricultural Mechanisation through Training, Testing and Demonstration' and 'Post Harvest Technology & Management' have got subsumed within the Sub-Mission on Agricultural Mechanisation (SMAM) scheme. With its various components such as assistance to farmers for farm mechanisation, the scheme has increased the demand for the mechanisation processes and ultimately, has created a room for private sector in this field. Both Africa and India can set up a cooperation mechanism in this space, in order to create such an environment that the farmers and the farm equipment manufacturers are able to complement each other.

R&D Support by the Government

According to the International Food Policy Research Institute (IFPRI)-led Agricultural Science and Technology Indicators (ASTI), as per the latest data available, in 2014, the average of R&D spending as a percentage of agriculture GDP, by 37 sub-Saharan Africa countries was just 0.88%. The top countries that have achieved greater level of R&D spending were Mauritius (5.9%); Namibia (3.1%); South Africa (2.8%); Botswana (2.8%); and Senegal (1.6%).

Two-wheel tractors are small and inexpensive, and can be coupled with energy-saving farming techniques such as conservation agriculture, while ensuring profitability for farmers, service providers, and other private-sector actors in the value chain. Moreover, two-wheel tractors can be used for multiple purposes, including transport, post-harvest operations, and water pumping, which leads to high annual rates of return on investment. The two-wheel tractor also lends itself for the hiring-service market.

It is vital for the countries in Africa to increase the usage of farm machinery equipment, given its needs to increase the productivity across various crops. However, the long term aim for the continent should be to manufacture their own farm machinery equipment backed by customization, attuned to their own economies. These machineries, in the long run, might have the ability to perfectly suit their local conditions and at the same time, address various challenges in African agriculture. Therefore, Government's support in African economies for encouraging R&D spend becomes important in this space. The support in R&D is expected to bring in the technology which will be more specific to African countries and situations than relying on imported machinery. In fact, there would be a need for a continuous upgradation of skills, given the pace of emerging technologies, globally. Farmers in Africa, in fact, assessing the benefits of mechanisation in agriculture have

started using various low cost technologies. For instance, based on the experience in Bangladesh, where the agriculture sector is also dominated by smallholder farmers and relies heavily on small machines, smallholders in several African countries have adopted two-wheel tractors for use in their farms.

In Bangladesh, although, almost all farmers have access to two-wheel tractors, however only about one-third of farmers own one. In several countries, including Kenya and Tanzania, two-wheel, toolbar-based seeders or tow-behind seeders are used to seed both larger and small grains, such as maize and cotton or wheat and rice farmed under conservation agriculture. These seeders minimize soil disturbance and maximize the fraction of crop residue retained as surface mulch. Furthermore, two-wheel tractors can also be used in transport, post-harvest operations, and water pumping, and simple equipment, including trailers, threshers, and water pumps can easily be procured or produced locally.

Agricultural Education

According to Malabo Montpellier Panel (MaMo Panel)'s new report, 'Mechanised - Transforming Africa's Agriculture Value Chains', only 2% of students in Africa are enrolled in agricultural programs at universities, compared with 26% who study humanities.

At the secondary school level, agriculture has been introduced as a compulsory or optional subject in some countries; however, in most countries agriculture and agriculture-related training does not feature in the schools' syllabus, and where it does, a strong focus is placed on agricultural production. Other important post-production aspects, such as processing, value addition, and packaging, are not included, and neither are the technical skills needed for animal breeding, machine handling and repair, and dairy technologies. This leads to a roadblock in the growth and expansion of agriculture-related industries in rural areas.

The report states that the question of skills development and upgrading cannot be solved within the traditional general education system. The large majority of current farmers are out of school, yet they need access to training to adapt and expand their skills. Moreover, skilled labour is needed in all segments of the agribusiness value chain to deal with specific tasks and handle equipment properly. Such skills can only be acquired in specialized training institutions dedicated to the agribusiness professions.

Thus, without increased attention to, and investment in strong vocational training and skill development at scale, African countries will be unable to harness the opportunities of their burgeoning youth population and those of a dynamic agriculture sector. The mainstreaming of formal vocational training is needed to turn young people and farmers in the food system into skilled entrepreneurs who can run their farms or businesses as economical, productive, sustainable enterprises (Mamo Panel, 2018)[27].

[27]https://www.mamopanel.org/media/uploads/files/MaMo2018_Mechanized_Transforming_Africas_Agriculture_Value_Chains.pdf

In India, the education has now moved to another dimension to address the challenge of sustainable food production. For instance, in 2015, the "Agri Udaan" was announced as a food and agribusiness accelerator, which would guide new start-ups, entrepreneurs, and help them to establish connect with potential investors. Agri Udaan would also help the selected start-ups with regulatory services like company registration and environmental compliances. It is expected to reach out to agri-start-ups in several cities like Chandigarh, Ahmedabad, Pune, Bangalore, Kolkata and Hyderabad. The programme would shortlist 40 start-ups in the first round who will pitch their ideas to a panel of evaluators. Out of these 40, around 8 to 12 start-ups will be selected for the final capacity building workshop. The programme is being managed by ICAR- National Academy of Agricultural Research Management Technology Business Incubator (TBI), a-IDEA[28] along with IIM Ahmedabad's Centre for Innovation. Here, a huge opportunity lies for Africa and India to come together and share their experiences and complement their learnings.

In India's case, agricultural education and extension in India have geared to harness the modern science and technology for higher productivity and production. This substantially helped to reduce the food scarcity in India.

CONCLUSION

India recognizes the fact that agriculture is an important conduit for Africa to move out of poverty. Improving Africa's agriculture and agribusiness sectors means higher incomes and more jobs. It also allows Africa to compete globally.

A common thread which binds both India and Africa is food security. Given the priorities of both the regions, it becomes quite imperative that they collaborate together, utilizing each other's strengths while creating opportunities for the masses in both the regions. This would simultaneously also encourage greater participation of Africa in the global agricultural value chain.

India has been playing a proactive role in mitigating the inherent challenges in Africa's agriculture, and it will be a win-win situation for both India and Africa to partner for enhancing their agricultural growth and development.

[28]Association for Innovation Development of Entrepreneurship in Agriculture

Chapter

6 EXIM BANK FINANCING FOR AGRICULTURE DEVELOPMENT IN AFRICA

Africa has the potential not only to feed itself but also to be a breadbasket for the world. With the right support, the continent can leverage its considerable resources – land, water, people, knowledge and potential markets – to overcome food insecurity and become a leading competitor in global food markets.

According to the World Bank, agriculture and agribusiness together could create a US$ 1 trillion market in Sub-Saharan Africa by 2030, up from US$ 313 billion in 2010. The growth generated by agriculture in Sub-Saharan Africa is estimated to be 11 times more effective in reducing poverty than GDP growth in other sectors, a vital multiplier given that 65% of the continent's labour force is engaged in agriculture alone.

While there exists huge opportunity, investment is the key to addressing the challenges facing the sector and ensuring that agriculture delivers on its potential.

For too long, the sector has been seen as the one, requiring government subsidy and donor funding. The realisation of agriculture becoming a potential driver of economic growth, rural incomes and job creation, in addition to food security has emerged only during the last few years, after which it has started getting increasing attention even from the private sector.

AGRICULTURE FINANCING IN AFRICA

According to AfDB estimates (Exhibit 7), the total cost for agricultural transformation for the priority commodities and agro-ecological zones is between US$ 315 bn and US$ 400 bn over 10 years, equivalent to US$ 32 bn – US$ 40 bn per year. Current finance for agricultural development originate primarily from three sources: funds from sovereign, non-sovereign and multilateral development banks into agriculture from multi-lateral and bilateral development partners, including the AfDB; public sector spending; and private sector investments into agriculture. Overall, these total up to US$ 9 bn per year of investments into African agriculture (AfDB's level of spend is assumed to be US$ 2.4 bn per year, rather than the current US$ 0.6 bn per year), leaving a gap of US$ 23 bn to US$ 31 bn per annum to be mobilized in order to drive the transformation of African agriculture.

Exhibit 7: African Development Bank's Estimated Investment in Agriculture

Investment required to transform Africa agriculture; USD billion, 2016-2025

Indicative Estimate

Enablers

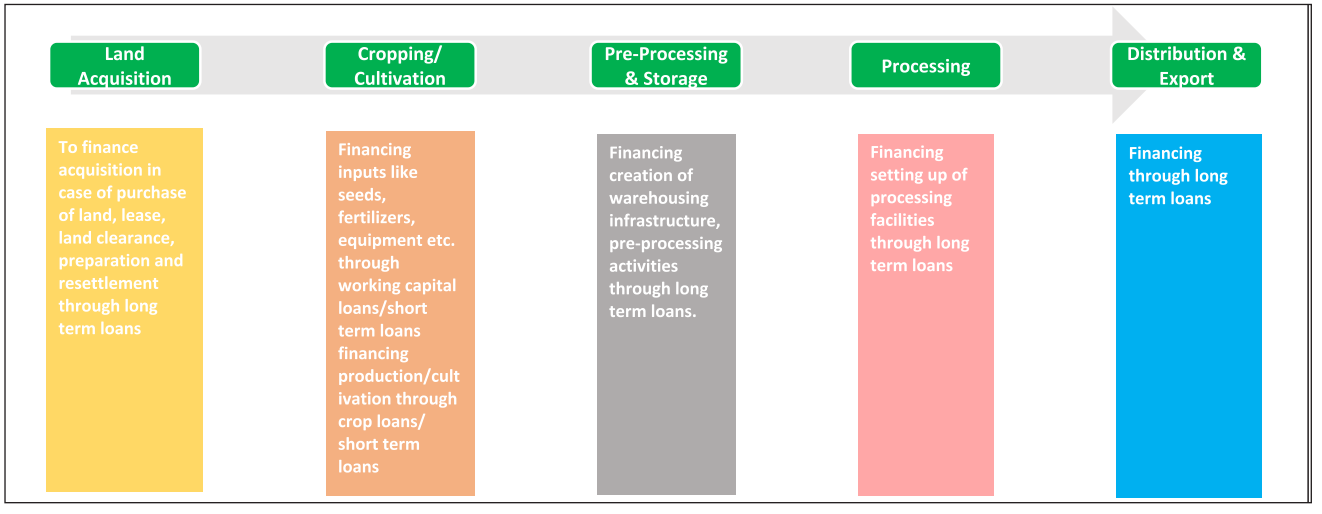
Commodities / Agro-Ecological Zones	Value Chain Development			Hard & Soft Infrastructure[6]	Ag. Finance[7]	Enabling Environment[8]	Inclusivity, Sustainability, Nutrition	ATA Partnership for Africa	Total	Annual revenue opportunity by 2025
	Production[4]	Value Addition[5]	Total							
Rice	~18-22	~3-4	~21-26							~5
Cassava	~2-2	~2-3	~4-5							~1
Wheat	~22-27	~16-20	~38-47							~13
Cotton	~0.4-0.5	~1-1.2	~1-2							~0.3
Horticulture	~5-6	~4-5	~9-11	~65-80	~265-330	~20-30	~30-40	<5	~315-400	~16
Aquaculture	~1-1	~19-23	~20-24							~8
Tree crops[1]	~14-17	~9-11	~23-28							~11
Sahel Region[2]	~6-7	~9-11	~15-18							~6
G. Savannah[3]	~42-52	~26-32	~68-84							~23
Total	**~110-135**	**~90-110**	**~200-250**	**~65-80**	**~265-330**	**~20-30**	**~30-40**	**<5**	**~315-400**	**~85**

Source: AfDB

The financing needs in agriculture are not confined only to the pre-production or post-production stages, but are required throughout the value chain from procuring the seeds, to tilling the land with machinery and equipment, to maintaining and insuring the land from uncertainties, to harvesting mechanically, storing it in warehouses, processing it, if required, and selling it to the market while adhering to the quality and labelling standards (Exhibit 2).

To meet the entire gamut of these needs, banks and financial institutions should look at long term finance for agriculture development – including technology orientation, creation of agriculture-related infrastructure, and agro-processing, besides short-term financing requirement for production / cultivation (Exhibit 8).

Exhibit 8: Financing Needs Across the Agriculture Value Chain



Source: EXIM Bank Research

Exim Bank of India (Exim Bank) has been partnering Africa in its development by financing activities in the continent across a wide range of sectors, with agriculture being one of the important ones. A key financial instrument of the Bank is the Lines of Credit (LOCs) extended to overseas financial institutions, regional development banks, and foreign governments and their agencies in Africa.

Exim Bank's Lines of Credit

Exim Bank has been extending Lines of Credit (LOC) to other developing countries, at the behest of the Government of India, to build capacities, including in agriculture sector. The Bank lays special emphasis on extending LOC as an effective tool as well as a means of development cooperation.

Exim Bank extends LOCs to overseas financial institutions, regional development banks, sovereign governments and other entities overseas, to enable buyers in those countries to import developmental and infrastructure projects, equipment, goods and services from India, on deferred credit terms.

As on March 31, 2019, Africa's share in the total value of Exim Bank's GOI-LOC program stood at US$ 9.65 billion, which constituted 39.7% of the total GOI-LOC portfolio valued at US$ 24.28 bn. Overall, 7.84% of the contracts with value aggregating US$ 737 million covered under GOI-LOCs extended to as many as 27 African countries pertain to agriculture and irrigation sector. These contracts include acquisition of tractors, harvesters, agricultural processing equipment; farm mechanisation; setting up plantation projects and processing plants; development of sugar industry; procurement of design, supply, installation and commissioning of fuel storage facilities, establishment of irrigation network, commissioning of sugar processing facility; rice self-sufficiency programme; including setting up of the agri related institutions like the Mahatma Gandhi Institute of Technology and Biotechnology Park in Cote d'Ivoire.

Select LOCs extended by Exim Bank at the behest of Government of India for the development of agriculture sector are as follows:

Case Study 1: LOC to Mali

Support for Electricity Providing Refrigeration

The economy of Mali is based to a large extent on agriculture, with an overwhelmingly rural population, many of whom are engaged in subsistence agriculture. Agricultural activities occupy 70% of Mali's labour force and provide 33% of its GDP. Cotton and livestock make up 75%-80% of Mali's annual exports alone. Small-scale traditional farming dominates the agricultural sector, with subsistence farming of cereals, primarily sorghum, pearl millet, and maize, on about 90% of the cultivated land.

In general, agricultural producers across Mali use a variety of refrigeration systems to extend the shelf life of perishable materials. Cooling not only reduces the perishability due to bacterial growth, but also reduces the humidity levels for some products. Fruits and vegetables farmers must cool their produce quickly after harvest in order to reduce wastage. This is because removal of field heat is important for maintaining produce quality and shelf life.

It is observed that while Mali has reasonable agri-export potential, the potential is not fully tapped due to poor infrastructure. Exim Bank of India, under its LOC program, supplied material for erection of interconnection transmission line and substation equipment project from Cote d'Ivoire to Mali. This also included the construction of a high voltage transmission line.

Exim Bank funded project connected the rural areas of Mali which had no access to electricity thereby increasing the total electricity accessibility (targets 41% by 2016 from 23% in 2010). The agricultural exports from the regions of Mali were expected to benefit tremendously as they critically depended upon a reliable and affordable power supply for refrigerated storage. With the implementation of the project, the earnings from export of perishable products such as fruits and vegetables are likely to be higher. Cotton growing regions of Mali are also expected to benefit as the project would help revive the cotton processing industry (electricity accounts for over a quarter of the total cost of producing cotton yarn and nearly 30% of the cost of textile production).

Setting up a plant for assembly of tractors and agricultural machinery

The importance of farm mechanisation in the quality and yield of agricultural products has been discussed in the previous chapters, extensively. The imports of farm machinery equipment by Mali which were just over US$ 6 million in 2001 grew by almost 6 times by 2010, signifying the increased awareness in Mali about the importance of farm mechanisation.

Exim Bank, under the GOI supported LOC, financed setting up of an agro-machinery and tractor assembly plant in Mali. The plant set up in 2010, was a JV between an Indian private sector company (51%), and Government of Mali. The equity of the Government of Mali was in the form of land and buildings. The arrangement was for 5 years after which the plan was to hand over the plant to a full Malian administration.

The primary objective of setting up the plant is to facilitate the availability of 'Made of Mali' tractors and implements at a reasonable price, leading to import substitution and forex saving. It was probably the first of its kind, state-of-the-art tractor assembly plant in West Africa, at that time. 400 tractors including, 300 disc harrows, 50 trailers and 100 threshing machines with motors were distributed to 275 individual farmers and to some village communes. The supply of tractors and setting up of the plant was a major step in the mechanisation of agriculture in Mali. The assembly plant also gave Malians a sense of pride as this was a small but a concrete step towards industrialisation. According to the Government of Mali, agricultural production and productivity has gone up by 30%, post setting up the plant and supply of tractors.

Recently, the Government of Mali has converted the assembly facility to a regular factory with equity participation of an Indian company. Fuel-efficient tractors have transformed the way the farmers used agricultural implements in Mail. Now, with a single tractor, the farmers can cultivate, plough, harrow, haul and do many other things at a low running cost.

Case Study 2: - LOC to Senegal

Funding of Irrigation System Project:

Sengal's farm sector depends on irrigation facilities for cultivation of the following crops: (i) production of cereals dominated by paddy, intercropped with maize and sorghum; and (ii) horticulture produce with a large range of vegetables, dominated by onion and tomato. Farming of crops such as rice has become tougher in recent years in the Senegal River Valley, the country's rice heartland due to unreliable water supply. The system for delivering water to the fields was in need of upgrading, and in some areas, many farmers were abandoning their fields because of soil salinization and unreliable water supply.

Exim Bank of India, under its flagship LOC program, supported the design, manufacture, supply and installation of diesel engine pump sets in rice producing zones of North Senegal to increase production of rice in the region through better irrigation facility. The project helped the Government of Senegal to distribute pump sets (to rice farmers) and install drip irrigation systems (to horticulture farmers like mango, cashew and pineapple) in North Senegal. The supplying Indian company has also trained the local farmers, extension workers and Government staff in order to fulfil the future servicing requirements of these irrigation equipment.

With the implementation of the irrigation system under the Lines of Credit to Senegal, the country has observed a lot of benefits. The coverage area under irrigation increased substantially. Rice production witnessed a more than 200% increase in the region thereby reducing import dependency - 50% of the rice demand in North Senegal is being met by local production as compared to 19% in 2006-07. Further, the irrigation project has generated significant employment. Also, the new system has been found to be economical as their running and maintenance costs are lower than the earlier available pumps, since these can be operated for 24 hrs non-stop.

Funding of Development of Rural SMEs and Acquisition of Agricultural Machinery and Equipment

As a part of the program, tractors and implements supplied by Indian companies were distributed at subsidized price. It may be noted that tractors are being used for cultivation of peanuts, corn, banana and sorghum and the running cost of Indian tractors (consumed 64 litres of diesel for a full day operation) is lower than European tractors (which consumed 90 litres).

Further, the impact of the facility can be seen in the fact that mechanisation of farming activities by Senegalese farmers with Indian tractors has considerably reduced tillage time, cost of tillage, and thereby increased the productivity of corps. A farmer can now produce more than 100 tonnes of corn per season, as compared to the earlier 49 tonnes of corn per season. Since the arrival of the Indian tractors, the farmers who supplied cotton to SODEFITEX[29], have been able to cultivate larger tracts of land in a short span of time, resulting in additional sanction of 6000 hectares of land for cotton cultivation by the Government of Senegal. This led to a jump in cotton production from

[29]Corporation for Development of Cotton Fibre and Textiles in Senegal

the region from 8000 tons to 17000 tons. As rural areas of Senegal did not have electricity, hand pumps supplied in the region were also very useful, as farmers were able to draw groundwater for regular usage and for irrigation of farms without the use of electricity.

Case Study 3: LOC to Benin

Benin has not been food sufficient and largely relied on imported foods and agricultural products to make up the difference. In fact, while Benin's imports of agricultural products in 2017 were US$ 1.5 billion, its exports were just US$ 0.2 billion. Most of Benin's production of food items is under subsistence farming; so, only a small percent of food production turns out to be surplus and reaches the market. Benin is a transhipment hub for agricultural cargo destined for Benin's neighbours.

Exim Bank has extended a Government of India supported Line of Credit of US$ 15 million to the Government of Benin for financing Tractor Assembly Plant and Farm Equipment Manufacturing Unit in Benin. The contract consisted of supply of 60 tractors and other agricultural equipment and accessories and installation and commissioning of tractor assembly plant with capacity of 2000 tractors per year, in Benin. The plant was commissioned and inaugurated by the President of Benin in 2014.

As a possible impact of this facility, Benin is expected to become self-sufficient in tractors in the years that followed. Some 80% of Benin's 10.3 million people earn a living from agriculture, mostly on subsistence farming, and the introduction of tractors will provide them opportunities to increase productivity and production.

Case Study 4: LOC to Ghana

Sugar is an important agriculture produce in Ghana in terms of meeting the domestic consumption demand, which is growing rapidly. The West Africa sub-region, to which Ghana could export duty-free, is also projected to experience more rapid growth in sugar consumption than any other region in the coming years. Further, Ghana imports substantial quantities of sugar and is the fourth largest food import after rice, fish, and poultry. In 2017, the country spent US$ 246 million to import sugar, up from US$ 100 million in 2008. Exim Bank has sanctioned a LOC of USD 35 mn, extended to the Government of Ghana for refurbishment of Komenda Sugar Factory in Ghana. The plant is expected to increase the production of sugar and its related products for local consumption and exports. The sugar plant is also expected to create 1300 direct jobs and about 5000 auxiliary jobs in Ghana.

Case Study 5: LOC to Togo

Agriculture sector in Togo employs two-thirds of the active population, who predominantly work on small land holdings. Food crops (mainly cassava, yams, maize, millet, and sorghum) account for two-thirds of production, and are mostly used domestically. Togo's cash crops are mainly cocoa, coffee, cotton, and to a lesser extent, palm oil. Togo exports almost US$ 700 million of agricultural products and imports almost over double the value.

Under the Exim Bank's of LOC of USD 13.095 million to the Government of Togo, agricultural equipment like bulldozers, excavators, wheel loaders, submersible pumps & drip irrigation kit have been supplied for improving agriculture cultivation and productivity.

Due to the implementation of the project, each farmer in the region now owns half a hectare of land which he or she cultivates. A training centre has also been established to train the youth in operating the agricultural equipment.

Overseas Investment Finance

Exim Bank, through its Overseas Investment Finance (OIF) program has also been supporting Indian companies' overseas expeditions, including that of in the African region. In the field of agriculture, Exim Bank has facilitated investment by many Indian companies in Africa.

Case Study 6: OIF in Ghana

Park Agrotech Ghana Limited (PAGL), a subsidiary of Skylark Hatcheries Private Limited (SHPL), was supported by Exim Bank for setting up of integrated farming of corn, soybean and poultry project in Ghana. The project involves, 1000 acres irrigated and mechanised farm for producing corn and soybean; setting up of a commercial layer poultry farm with a capacity of housing 100,000 layer birds; and setting up of a poultry breeding farm with a capacity of 12000 female birds along with feed-mill and hatchery for captive requirement.

There are substantial opportunities for increased maize and soya utilization for feed mills. In Ghana just around 10% of maize supplies go into the poultry feed industry, while the demand is much greater than this supply. In 2008, the government granted special import permits for more than 26,000 metric tons of yellow corn to supply the poultry feed industry. Limited supply of both maize and soya for feed production leads to constraints in the growth of the poultry industry.

Exim Bank's support is expected to help in catering to this capacity challenges which Ghana faces in terms of availability of corn and soybean.

Case Study 7: OIF in Mauritius

Mauritius is a net food importer, with an overall self-sufficiency ratio of less than 30%. Mauritius imports 100% of its edible oil requirements, traditionally from countries like Argentina and Brazil. In 2017, Mauritius imported 29,656 metric tons of crude soybean oil, crude sunflower oil and palmolein, worth US$ 24 million. Of this, crude soybean oil accounted for 66%, sunflower oil comprised 17% and palmolein amounted to 16%. There are two refineries for edible oil operating in Mauritius, which supply 90% of the market with refined edible oil. The remaining 10% is supplied by importers of refined edible oil and sold directly to supermarkets.

Exim Bank facilitated Natural Oil Ventures Company Limited (NOVCL), Mauritius, to part finance equity investment in/on lending to its subsidiary, S&P Energy Solutions PLC, Ethiopia (SPES), for carrying out agricultural activities including cultivation and export of oilseeds for edible oil and bio-diesel. This was expected to not only help in increasing the farm produce, but also create more jobs in the process along the value chain.

SETTING UP A DEDICATED INDIA-AFRICA AGRICULTURAL FUND

Agricultural investments are generally of long gestation, and so are the funding requirements. Besides, many interested players may not have significant experiences in undertaking agricultural activities abroad, and may not have adequate collaterals to meet the requirements of host country lenders.

An independent fund/Special Purpose Vehicle to finance such projects could be created.

Government may consider setting up of an independent fund to finance the overseas expeditions of Indian companies in the agriculture sector. Besides allocating finance for establishment of this fund, the Government also needs to establish an appropriate institutional mechanism for the management of this fund. It is here that the role of India's one of the vital financial institutions, viz. Exim Bank could gain significance since it has been actively promoting overseas direct investment over the last three decades, and supported several such projects.

It is suggested that a Special Funding Vehicle could be created with an initial corpus of US$ 10 bn allocated out of the country's foreign exchange reserves. The funds could be utilised to extend medium to long term foreign currency finance to Indian enterprises planning to invest in the African agriculture and allied sector. The country's reserves are in the region of US$ 413 bn. The proposed amount of US$ 10 bn constitutes less than 3% of the reserves, and would not dent the foreign exchange reserves position; on the other hand, the funds would be utilized for promoting investments in African agriculture and would create tremendous goodwill. The institution administering the fund would need to ensure adequate earnings for the RBI for its pledging of forex funds, at least similar to that of their current average yield on investment of foreign exchange reserves. Further, there will be no monetary policy implications unlike in the case of on-shore swap, when corresponding Rupee funds would be pumped into the domestic market.

Alternatively, the corpus of the Special Funding Mechanism could come from the Government of India's budgetary resources

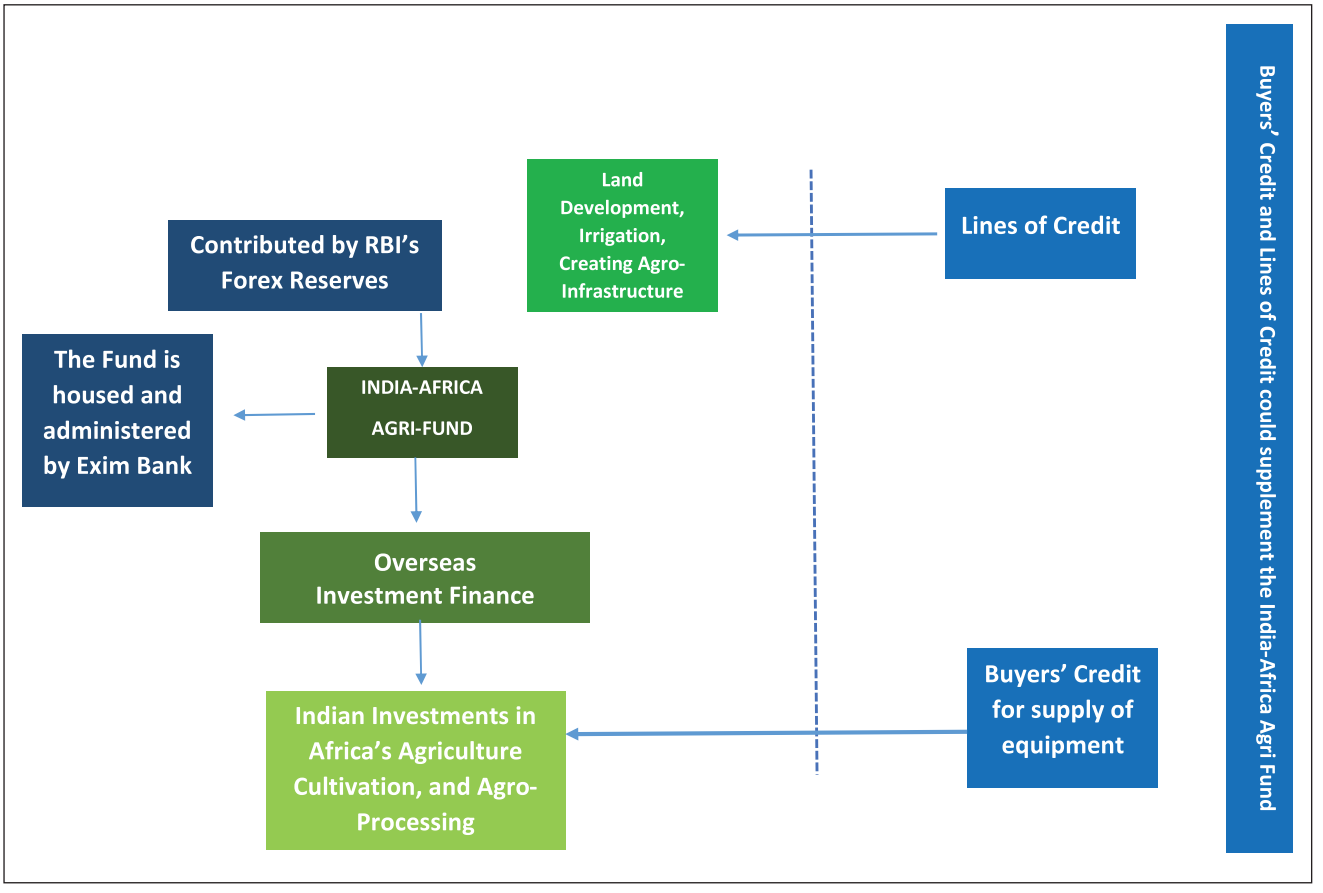
Equity investments by Government / its agencies could also be considered to promote such ventures. This mechanism would help mitigate the problem of high cost of funds in India or in these countries, and stimulate such investments by Indian companies in the African agriculture. The Government of India support would also be crucial towards strengthening of Bilateral Investment Protection Agreements, facilitating investors to enter into investment protection agreement with the host Governments.

Even though the potential exists for agriculture lending overseas, such lending is inherently risky. To mitigate the risk, the services of ECGC (Export Credit Guarantee Corporation of India Limited) could also be pooled in, which has an Overseas Investment Insurance (OII) Policy that provides Political Risk Insurance (PRI) cover for the investments made by Indian corporates in their overseas Joint Ventures or their Wholly Owned Subsidiaries (WOS), either in the form of equity or loan. The risk of war, expropriation and restriction on remittances, are covered under the scheme.

A multi-department Working Group representing the Ministry of Agriculture, the Ministry of Finance, the Ministry of External Affairs, and Exim Bank could be set up for the approval and monitoring of projects, funded through the Independent Fund.

In sum, the key focus shall be to create an economic opportunity for private Indian entities by facilitating investments in agriculture in Africa. Providing access to finance at internationally competitive rates and risk insurance is the first step in this direction. Even without mandatory buy-back or right of first refusal for food-grains produced there, the economic linkages and spin-offs of such investments will be beneficial for the country.

Exhibit 9: India-Africa Agricultural Fund



Source: EXIM Bank Research

Annexure 1

List of HS Codes considered under Agriculture Trade

HS 2-digit code	Description
06	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage
07	Edible vegetables and certain roots and tubers
08	Edible fruit and nuts; peel of citrus fruit or melons
09	Coffee, tea, maté and spices
10	Cereals
11	Products of the milling industry; malt; starches; inulin; wheat gluten
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit
13	Lac; gums, resins and other vegetable saps and extracts
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats
16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
19	Preparations of cereals, flour, starch or milk; pastry cooks' products
20	Preparations of vegetables, fruit, nuts or other parts of plants
21	Miscellaneous edible preparations
22	Beverages, spirits and vinegar
23	Residues and waste from the food industries; prepared animal fodder

Annexure 2

List of Agro-Machinery Equipment

HS 6-digit code	Description
843290	Parts of agricultural, horticultural or forestry machinery for soil preparation or cultivation
843280	Agricultural, horticultural or forestry machinery for soil preparation or cultivation
843221	Disc harrows for use in agriculture, horticulture or forestry
843210	Ploughs for use in agriculture, horticulture or forestry
843229	Harrows, scarifiers, cultivators, weeders and hoes for use in agriculture, horticulture
843231	No-till direct seeders, planters and transplanters
843239	Seeders, planters and transplanters (excl. no-till machines)
843230	Seeders, planters and transplanters for use in agriculture, horticulture and forestry
843241	Manure spreaders (excl. sprayers)
843242	Fertiliser distributors (excl. sprayers and manure spreaders)
843240	Manure spreaders and fertiliser distributors for use in agriculture, horticulture and forestry
843390	Parts of harvesting machinery, threshing machinery, mowers and machines for cleaning, sorting
843359	Harvesting machinery for agricultural produce (excluding mowers, haymaking machinery, straw
843351	Combine harvester-threshers
843360	Machines for cleaning, sorting or grading eggs, fruit or other agricultural produce
843311	Mowers for lawns, parks or sports grounds, powered, with the cutting device rotating horizontally
843352	Threshing machinery (excluding combine harvester-threshers)
843320	Mowers, incl. cutter bars for tractor mounting
843340	Straw or fodder balers, incl. pick-up balers
843330	Haymaking machinery (excluding mowers)
843353	Root or tuber harvesting machines
843319	Mowers for lawns, parks or sports grounds, powered, with the cutting device rotating vertically
843420	Dairy machinery
843490	Parts of milking machines and dairy machinery, n.e.s.
843410	Milking machines
843510	Presses, crushers and similar machinery used in the manufacture of wine, cider, fruit juices
843590	Parts of presses, crushers and similar machinery used in the manufacture of wine, cider, fruit
843699	Parts of agricultural, horticultural, forestry or bee-keeping machinery, n.e.s.
843610	Machinery for preparing animal feeding stuffs in agricultural holdings and similar undertakings
843691	Parts of poultry-keeping machinery or poultry incubators and brooders, n.e.s.
843621	Poultry incubators and brooders
843680	Agricultural, horticultural, forestry or bee-keeping machinery, n.e.s.

HS 6-digit code	Description
843780	Machinery used in the milling industry or for the working of cereals or dried leguminous vegetables
843710	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables
843790	Parts of machinery used in the milling industry or for the working of cereals or dried leguminous vegetables
843890	Parts of machinery for the industrial preparation or manufacture of food or drink, n.e.s.
843880	Machinery for the industrial preparation or manufacture of food or drink, n.e.s.
843830	Machinery for sugar manufacture (excluding centrifuges and filtering, heating or refrigerating)
843810	Bakery machinery and machinery for the industrial preparation or manufacture of macaroni, spaghetti
843820	Machinery for the industrial preparation or manufacture of confectionery, cocoa or chocolate
843860	Machinery for the industrial preparation of fruits, nuts or vegetables
843840	Brewery machinery (excluding centrifuges and filtering, heating or refrigerating equipment)
843850	Machinery for the industrial preparation of meat or poultry (excluding cooking and other heating)
870193	Tractors, of an engine power > 37 kW but <= 75 kW (excl. those of heading 8709, pedestrian-controlled)
870192	Tractors, of an engine power > 18 kW but <= 37 kW (excl. those of heading 8709, pedestrian-controlled)
870190	Tractors (excluding those of heading 8709, pedestrian-controlled tractors)
870130	Track-laying tractors (excluding pedestrian-controlled)
870120	Road tractors for semi-trailers
870191	Tractors, of an engine power <= 18 kW (excl. those of heading 8709, pedestrian-controlled tractors)
870194	Tractors, of an engine power > 75 kW but <= 130 kW (excl. those of heading 8709, pedestrian-controlled)
870110	Pedestrian-controlled agricultural tractors and similar tractors for industry
870195	Tractors, of an engine power > 130 kW (excl. those of heading 8709, pedestrian-controlled tractors)

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