AFRICAN FERTILIZER FINANCING MECHANISM

AFFM

STUDY

(Sponsored by UNECA & AFFM)

On

PROMOTION OF FERTILIZER PRODUCTION, CROSS-BORDER TRADE AND CONSUMPTION IN AFRICA

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**List of Acronyms and Abbreviations**

1. AFFM  |  Africa Fertilizer Financing Mechanism  
2. AfDB  |  African Development Bank  
3. AUC  |  African Union Commission  
4. CAADP  |  Comprehensive Africa Agricultural Development Programme  
5. COMESA  |  Common Market for Eastern and Southern Africa  
6. EAC  |  East African Community  
7. ECCASS  |  Economic Community for Central African States  
8. ECOWAS  |  Economic Commission of West African States  
9. IGAD  |  Intergovernmental Authority on Drought and Development  
10. IFA  |  International Fertilizer Association  
11. Kt  |  Thousand tonnes  
12. LAPSSET  |  Lamu Port-South Sudan-Ethiopia Transport Corridor  
13. LDC  |  Least Development Countries  
14. Mt  |  Million tonnes  
15. NEPAD  |  New Partnership for African Development  
16. NIRSAL  |  Nigeria Incentive-Based Risk Sharing System for Agricultural Lending  
17. NTBs  |  Non-tariff barriers  
18. PPPs  |  Public-Private Partnerships  
19. SADC  |  Southern Africa Development Community  
20. SDG  |  Sustainable Development Goals  
21. SSA  |  Sub-Saharan Africa  
22. SWOT  |  Strengths, Weaknesses, Opportunities and Threats  
23. TPA  |  Tanzania Ports Authority  
24. UNECA  |  United Nations Economic Commission for Africa  
25. WTO  |  World Trade Organization
Acknowledgements

Among the key decisions taken by the 3rd Governing Council (GC) of the Africa Fertilizer Financing Mechanism (AFFM) held in Addis Ababa, Ethiopia, on 16 July 2015, UNECA, working with other Council members, as part of the division of labor for the AFFM, agreed to take the lead to conduct the required analysis and unpack what needed to be done in providing a solid basis for new policies, or enforcement of existing ones. These measures would encourage the private sector to invest in the fertilizer industry in Africa, as well as enhance fertilizer distribution efficiency and cross-border trade. The coverage areas identified were as follows: Fertilizer production cluster development and the mapping of viable fertilizer plants; Identification of trade policies hindering development of fertilizer production and consumption; and the Regulatory environment.

The first study was completed by the end of 2016 and funded solely by UNECA but was recommended for update and revision by the GC. The revision and update of the study were then funded by AFFM and UNECA.

The report was prepared under the leadership of Dr. Stephen Karingi (ECA) who delegated the technical overview and supervision to Mr. Mahamadou Nassirou Ba (ECA).

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Executive Summary
Agriculture still remains a dominant sector for most African countries. However, crop productivity levels still remain the lowest in the world, a factor that poses a great challenge to meeting the growing food demand. Africa imported an average of USD 35 billion of food products in 2015, a figure that is which projected to rise to over USD 110 billion in 2025. Other challenges that African agriculture faces include declining arable land per capita, climate change risks and the effects of increased global demand for food, feed, fiber and fuel resulting from population growth. To meet the increasing food demand, agricultural production needs to grow, but to achieve that without converting additional forest or savanna to cropping, an increased utilization of key inputs is needed. These inputs include better seeds, fertilizers, and technologies, such as irrigation, but with greater use efficiency and less environmental impact, including fewer greenhouse gas emissions per unit output. Although it is not the only input, the low use of fertilizer is a key impediment to increased agricultural productivity and hence farm incomes in Africa. The continent on average is using far less fertilizer than in other regions of the developing world. To address this problem, in June 2006, the African Union Heads of States and Governments adopted the Abuja Declaration on Fertilizer for the African Green Revolution to increase fertilizer use from 8 kilograms to 50 kilograms of nutrients per hectare by 2015. The meeting resolved, among other things, to establish an Africa Fertilizer Financing Mechanism (AFFM), whose main purpose was to enhance agricultural productivity by promoting the use of fertilizers. The African Development Bank (AfDB) was given the responsibility of establishing the AFFM.

It is with this background and on the recommendations of the 3rd meeting of the AFFM Governing Council held in Addis Ababa, Ethiopia in July 2015, and as a partner
institution to the African Union Commission (AUC) and AfDB that the United Nations Economic Commission for Africa (UNECA) initiated a study of the fertilizer industry to cover the exploration of existing and production potential, cross-border trade, trade flows and consumption.

The study was conducted on a cluster basis (see figure below) and in line with the following six country clusters taking due account of established revealed geopolitical and geo-climatic comparative advantage.

- **Cluster 1**: The Arab Maghreb Union (AMU) region which includes Algeria, Morocco, Tunisia, Libya and Mauritania. We exclude Egypt because of the distance and also from a logistic standpoint, Egypt is better connected to Sudan through the Nile corridor than to AMU countries.
- **Cluster 2**: The ECOWAS Region which consists of Nigeria, Benin, Burkina Faso, Togo, Ghana, Niger, Côte D’Ivoire, Senegal, Liberia, Guinea-Bissau, the Republic of Guinea, Sierra Leone, Gambia and Mali.
- **Cluster 3**: The East African Community (EAC) which consists of Kenya, Tanzania, Uganda, Rwanda, and Burundi.
- **Cluster 4**: The SADC Region which consists of South Africa, Zambia, Zimbabwe, Mozambique, Botswana, Namibia, Malawi, Lesotho, Swaziland, Madagascar, Mauritius, and Seychelles.
- **Cluster 5**: The Central African States (ECCAS) which include Angola, Democratic Republic of the Congo, Republic of the Congo, Chad, Central African Republic, Gabon, Equatorial Guinea, and Cameroon.
- **Cluster 6**: IGAD/Horn of Africa which includes Ethiopia, Sudan, South Sudan, Eritrea, Somalia, Djibouti and Egypt. We include Egypt here because of the proximity to both land and sea.
The clusters described above are served by the following infrastructure corridors:

- **North Africa**: Kenitra-Casablanca, Tangiers (Gibraltar Detroit)-Agadir Corridor (Morocco); Greater Cairo Region Corridor (Egypt);
- **North East Africa**: Lamu Port–South Sudan-Ethiopia Corridor (Kenya, South Sudan, Ethiopia);
- **West Africa**: Dakar-Touba Corridor (Senegal); Greater Ibadan-Lagos-Accra urban corridor (Nigeria, Togo, Benin, Ghana); Great Hausa–Yoruba–Ashanti city triangle (Ghana, Benin, Togo, Nigeria); Abidjan-Bamako; Tema/Accra-
Ougadougou/Burkina Faso; Abidjan-Ouagadougou-Niamey-Cotonou; Abidjan-Accra-Lomé-Cotonou-Lagos (Côte d’ivoire, Ghana, Benin, Togo, Nigeria, Niger);

- **West and Central Africa**: Emerging Luanda-N’Djamena corridor (Angola, DRC, Congo, Cameroon, Gabon, Central African Republic, Chad);

- **East Africa Northern Corridor**: (Mombasa): (Kenya, Uganda, Rwanda, and South Sudan);

- **East Africa Central Corridor**: (Dar-es-Salaam): (Tanzania, Rwanda, Burundi); Kampala-Entebbe dry corridor; Nairobi Metropolitan Region corridor (Kenya);

- **Southern Africa**: Walvis Bay corridor (includes TransKalahari, and Trans Caprivi and Trans Curene corridors through links to regional corridors (Cape Town, Durban in South Africa; Maputo, Beira in Mozambique; and Namibia/Botswana); North-South Corridor (South Africa, Zimbabwe, Zambia) through links to regional corridors (Beira, Maputo in Mozambique) Durban, Cape Town in South Africa, Walvis Bay in Namibia; in Southern Africa: Maputo-Gauteng development corridor in Maputo (Mozambique/South Africa); Durban development corridor in Durban, South Africa;

- **South East Africa**: Beira Corridor (Mozambique/Zimbabwe) in Mozambique; Maputo-Limpopo Corridor (Mozambique /South Africa) in Maputo, Mozambique.

The study utilized a variety of analytical approaches including a cluster approach, descriptive statistics and SWOT analysis.

This study presents the main deliverables of the assignment which include (i) comprehensive literature review, (ii) mapping of viable fertilizer manufacturing plants, (iii) identification of policies influencing fertilizer production, trade, distribution and consumption, and (iv) analysis of policies and regulatory environment in the fertilizer
sector, with the objective of proposing options for sustainable fertilizer business in Africa.

From 2015-2020, the projected annual growth in fertilizer demand ranges between 2.8% and 6.8%, depending on the nutrient indicating great potential for growth in Africa tied to fertilizer use. SSA accounts for the rising percentage and the highest growth rate in demand of about 4.8% by 2020, mainly driven by Nigeria, Kenya and Ethiopia, while the growth rate in North Africa is expected to be around 2.5% during the same period, mainly driven by Egypt and Morocco. The average application rate in Sub-Saharan Africa has been growing, though still low, from 6 Kg/ha of nutrients in 2000 to about 15 Kgs/ha in 2017. It is projected to reach about 19kg/ha by 2021 which is still below the Abuja declaration target of 50kg/ha. The production of fertilizer in Africa is concentrated among six countries: Egypt, Tunisia, South Africa, Algeria, Nigeria, and Morocco. With the exception of Nigeria, these countries have a developed fertilizer industry and also a higher level of fertilizer use. A significant fertilizer capacity development on nitrogen and phosphorus is expected in Africa. These additions are mainly in Nigeria, Egypt and Algeria for urea (about 8 Mt) and Morroco, Tunisia and Egypt for processed phosphates (about 5Mt). As of 2017, Sub-Saharan Africa had a total of 59 fertilizer blending plants, 17 of which were in Nigeria. The planned bulk blending projects in the region are 19 – five in Nigeria and four in Tanzania. The consumption of fertilizer in Africa is still low (about 3% of the world total). However, the forecasted annual growth rate 2015 to 2020 is very high (3.86%) thus indicating a need for increased supply availability and distribution in the continent. Africa is largely sufficient on phosphorus fertilizers and nitrogen in the near future. At the same time all the potash needs are currently met by imports because of the lack of potash capacity, although some projects are in various developments stages in a few countries in SSA.
Given China’s zero growth policy and EU’s Circular Economy Strategy of greater recycling and re-use of various organic nutrient sources, the future world market demand for fertilizer is rather muted as other markets have matured. This suggests that Sub-Saharan Africa will be an increasingly important driver of future world demand.

On cross-border trade of fertilizer, it is limited by poor infrastructure, weak economic integration and in some instances conflicts. There are cumbersome delays in crossing borders attributed to inefficient custom procedures, bothersome roadblocks/checks and burdensome documentary requirements. Most of the major imports of fertilizer from outside Africa into Africa come from China, Saudi Arabia, Qatar, Abu Dhabi, Belarus, Chile, Jordan, Russia, and Germany. The exports from Africa composed mainly of phosphate rock, NPS, TSP, MAP, DAP and Urea go to Central Europe, West Europe, South Asia, East Asia, West Asia, Latin America, North America, Oceania and East Europe and Central Asia.

A review of literature shows constraints that limit production, trade, distribution and consumption of fertilizers. These are grouped into marketing and technical constraints. The former include: uncertain policy environment, weak and ineffective regulatory frameworks/systems, limited agro-dealer network, high inland transport costs, limited access to finance, size of commodity markets and high fertilizer retail prices. The technical constraints include: poor farmer knowledge base and extension services, unresponsive soils, limited road and railway infrastructure, and inadequate port facilities. Despite some efforts, fertilizer distribution systems in Africa are still weak even after the 2006 Abuja Declaration that all African countries should improve farmers’ access to fertilizers by developing and scaling-up input dealers and community-based networks across rural areas.
The study shows that Africa has adequate reserves of raw materials for the production of fertilizers such as natural gas, phosphate rock and potash deposits. The challenge for potash deposits is the commercial viability of the planned projects. With the exception of cluster 5 - ECCAS region - there is a significant consumption of fertilizers in the clusters thus offering a sizable market for fertilizers produced within the clusters. In all the clusters, there are already existing fertilizer manufacturing plants and planned projects. Most of these are either private or public/private partnership initiatives. Because the ultimate aim is affordable access to fertilizers, this can be from production within the clusters/neighboring clusters or imported from outside the continent. The decision on whether to import, or source from within, will vary depending on economic assessments including the extent/depth of regional integration. In each of the two options, strengthening of the distribution network is critical. In addition, even though these clusters are served by main corridors, the linkage to the smallholder farmers still remains a challenge across Africa. Therefore, African governments should make proactive measures to enhance rural infrastructure. In some instances, some of the existing plants will need to be modernized because they are small by international standards, costs are high, their technology is relatively obsolete, and they are not energy efficient in terms of converting raw materials to final products. This does not mean that all plants have to be large. Small ones serving particular markets are also viable provided they use the latest technology. In those countries with large fertilizer markets such as Nigeria, Ethiopia and Kenya, more blending plants to serve various agro-ecological zones are important. Encouraging vertical downstream partnerships for NPK and bulk blend production or other integrated fertilizer units is needed. Storage facilities by importers, distributors and hub agro-dealers are also key. They probably have the highest leverage and practicality for optimizing fertilizer delivery, availability and affordability in SSA.
In **Cluster 1** that comprises the AMU region, opportunities exist for expansion/modernization mainly for export markets both in Africa and outside. In **Cluster 2** that comprises ECOWAS and UEMOA, existing and planned projects are adequate. More production plants could perhaps be considered for exports and perhaps smaller ones to serve particular markets after further economic assessments. Some fertilizer plants are already modernizing/expanding capacity. Opportunities exist for blending plants, especially in Nigeria, Ghana, Mali, and Côte d’Ivoire. Storage facilities are also important. The most critical is strengthening distribution infrastructure. In **Cluster 3** which comprises the EAC region, the planned project for nitrogen in Tanzania is critical while the existing Minjigu phosphate mine should be expanded/modernized. Small-sized plants in Rwanda, Uganda and Kenya to serve particular markets are also worthwhile. Blending plants and storage facilities are important in the whole region. Rural infrastructure is critical to link smallholder farmers. In **Cluster 4** which comprises mainly the SADC region, expansion/modernization in South Africa and Zimbabwe; and the planned nitrogen project in Mozambique are important. Blending plants, storage facilities and rural feeder roads are key in this cluster. **Cluster 5** is largely a mining region with limited production possibilities. In this cluster, the focus would be production for exports either outside Africa or other regions in Africa, storage facilities and strengthening distribution network to meet the limited demand and increased intra-regional trade. In **cluster 6** which comprises the IGAD and Egypt, work includes expansion/modernization in Egypt for exports and the completion of the planned potash projects in Eritrea and Ethiopia. Opportunities exist for blending plants in Ethiopia and Sudan; and storage facilities in the whole region. Also, strengthening of the distribution network is critical.
Potential sources of finance are available for the private sector to invest in fertilizer manufacturing plants, blending plants, and other activities and actors along the value chains such as importation, distribution, agro-dealers and smallholder farmers. These include the AfDB’s Africa 50 fund, private equity, development partners, capital markets; local, regional and international financial institutions; African governments, microfinance institutions, private foundations and Non-governmental organizations. Because of the nature of the risk and the high investment needs for production units in fertilizer plants and agriculture in general, it is suggested that modalities of public-private partnerships be pursued. Thus, the development of innovative approaches that utilize loan guarantee funds and risk management tools can go a long way in increasing available financing for fertilizer. Due to the differential financing needs in the fertilizer value chain, evidence suggests the importance of paying more attention on trade finance (fertilizer inventories) followed by blending plants/storage facilities to improve access and affordability of fertilizers for farmers in particular to smallholder farmers.

Good fertilizer policies can raise agricultural productivity and farm income by creating a system that supplies high-quality fertilizers to farmers at affordable prices, along with information on how to use them effectively. A number of countries do not have a fertilizer policy and fertilizer law, while a multiplicity of organizations is involved in fertilizer regulations, causing some confusion. One-third of African countries have formal fertilizer policy. Several countries in Africa have fertilizer input subsidies. These are likely to remain in the foreseeable future. But challenges exist with respect to targeting, crowding out the private sector, sustainability, delayed payment and, in some instances, delayed delivery. However, with better design and implementation of the fertilizer subsidy, the private sector has the potential to invest in fertilizer value chains in Africa. Investment in complementary measures such as seeds, pesticides, irrigation,
soil conservation, research and extension; and aggregation of farmers, guaranteed access to output markets, and crop insurance are needed to raise the value–cost ratio of fertilizers. Procurement policies are now being used to enhance affordability by arranging for bulk buying. However, it is too early to know its effectiveness.

Weak regulatory systems prevail in most countries in Africa, resulting in the sale of inappropriately formulated, substandard or adulterated fertilizer. Some of the countries with rudimentary regulatory systems include Liberia, Benin, Sudan, Senegal, Ethiopia and Burkina Faso. Standards and regulations requiring long field testing, import permits, trade permits, frequent renewal, and non-participation of the private sector in the importation are a major concern. Shorter renewal periods tend to be very expensive. Quality control is poorly enforced.

Trade policies are generally liberal in Africa and most countries have removed trade tariffs on fertilizers. But it is the standards and regulations and non-tariff barriers (NTBs) that have been a major bottleneck to trade and consumption of fertilizers. NTBs such as poor port logistics, poor roads, many weighbridges, numerous police roadblocks/checks and cumbersome cross-border procedures are a hindrance.

As a way forward, it is crucial that regional economic communities not only develop uniform fertilizer strategies but also encourage their member countries to develop their own laws, policies, regulations, etc. but within the context of the regional strategy to ensure harmony and synergy. It is also crucial in the case of similar agro-ecological zones; use of fertilizer blends across countries should be allowed and supported with the necessary legal framework. It is highly recommended that regulatory enforcement capacity should be strengthened in terms of human and technical capacity.
Finally, domestic and regional transportation costs are a major component in final fertilizer prices. Measures to reduce transport costs such as road infrastructure improvements, improved logistics, and removal of anti-competitive tendencies in transport industry should be undertaken.

The study suggests the focus on distribution as the immediate task to be undertaken, followed by expansion/modernization of existing plants and/or smaller new plants to serve particular markets after an economic assessment in order to increase fertilizer use in Africa.

Therefore, to increase fertilizer use in Africa, AFFM should consider a variety of measures. Besides exploring possibilities and modalities of public-private partnerships and credit guarantees in order to expand financing opportunities for fertilizer inventories, new blending plants, storage facilities and expansion/modernization of existing fertilizer manufacturing plants, AFFM should consider:

i. encouraging the deepening of regional integration efforts that focus on regional infrastructure, trade corridors, and harmonization of fertilizer standards and regulations;

ii. strengthening of regulatory capacity and use of faster quality testing options;

iii. encouraging transport policies that increase competition in the trucking industry;

iv. encouraging procurement policies that enhance bulk buying of fertilizers once assessment shows they are effective;

v. encouraging countries to address NTBs both at the national and regional level such as weighbridges, police road blocks/checks, cross-border procedures, etc.;
vi. dealing with the demand side by supporting some form of guaranteed output markets, complementary measures such as seeds, extension, and research to improve fertilizer use efficiency and effectiveness; and

vii. Supporting improvements of rural/feeder roads that reach agricultural production zones.

With regard to financing, AFFM can:

- Facilitate the formation of investor consortia, and public-private partnerships for new blending plants, expansion/modernization of existing plants and smaller new plants to serve particular markets if need be;
- Organize credit guarantees for fertilizer importers, distributors, and agro-dealers;
- Assist/facilitate provision of finance for storage facilities/warehousing space especially at inland transportation hubs;
- Assist private traders in obtaining lines-of-credit, hedging, and equity investments from local banks; and
- Develop and promote innovative public-private fertilizer financing schemes as well as credit products.
PART 1: INTRODUCTION TO AFRICA FERTILIZER FINANCING MECHANISM IN AFRICA

1.1 Status, Trajectory and Way Forward of Agricultural Development in Africa

The world economy was expected to recover in 2017 and beyond, mostly driven by emerging and developing markets. In the medium term, annual world output expansion is projected to reach around 4% in 2021, with rates close to 2% for advanced economies and around 5% for emerging and developing economies. China’s GDP growth would stabilize at around 6%, while India’s output would rise annually by almost 8%. Southeast Asia and Sub-Saharan Africa are also projected to witness growth rates above 5% (AEO, 2018). The World Bank forecasts global economic growth to edge up to 3.1% in 2018 after a much stronger than expected 2017, as the recovery in investment, manufacturing, and trade continues, and as commodity-exporting developing economies benefit from firming commodity prices (World Bank, 2018). It expected the global growth to slow to 3% in 2019 from 3.1% in 2018 and further down to 2.9% in 2020.

Total agricultural production in Africa is projected to expand by 2.6% p.a. In contrast with past production increases, which overall were driven by area expansion, an increasing share of future production growth will come from improved productivity (OECD/FAO, 2016a). In many instances, production fails to keep pace with domestic demand, resulting in rising import dependence for many primary food products. (OECD/FAO, 2016b). This suggests more intensive use of productivity enhancing inputs such as improved seeds and fertilizers.
In Africa, yields for cereal crops are a small fraction of those in Asia or developed countries and far less than their potential (IFDC, 2015a). Furthermore, these yields have not shown any significant increase over time. In general, agricultural productivity in Africa considerably lags behind other developing regions (see figure 1 below) and unlike other regions, Africa has not benefited from the green revolution (Mbabazi, et al. 2015).

Figure 1: Cereal Yields (Kg/ha) by Region 1961-2013

Source: Mbabazi, et al. 2015
Within Africa, there are differences in yields across sub-regions with Sub-Saharan Africa having lower and relatively stagnant yields than those for other regions in the world (IFDC, 2015a). Moreover, African agriculture faces a number of challenges that require major policy reforms to deal with food insecurity, soil nutrient depletion, low agricultural productivity, declining arable land per capita and effects of increased global demand for food, feed, fiber and fuel resulting from population growth (IFDC, 2015a).

Global and domestic shocks in 2016 slowed the pace of growth in Africa, but signs of recovery were already manifest in 2017. Real output growth is estimated to have increased 3.6% in 2017, up from 2.2% in 2016, and to accelerate to 4.1% in 2018 and 2019. Overall, the recovery in growth has been faster than envisaged, especially among non-resource-intensive economies, underscoring Africa’s resilience (African Economic Outlook, 2018). Economic fundamentals and resilience improved in a number of African countries. In some, domestic resource mobilization now exceeds that of some Asian and Latin America peers (African Economic Outlook, 2018).

In recent years, the rate of growth of world agricultural production and crop yields have slowed down, prompting concern that the world may not be able to grow enough food and other commodities to feed future world population (OECD/FAO, 2013). In Sub-Saharan Africa, in particular, the challenge facing agriculture is to grow enough food to feed 1.5 billion by 2030 and 2 billion by 2050.\(^1\) This is because Africa’s population continues to grow and is expected to exert great pressure on agricultural production. Global food demand is expected to rise by 60% by 2050 when compared with 2005/2007 - the increase is projected to be much greater in sub-Saharan Africa.

(SSA) (van Ittersuma et al., 2016). Africa is also projected to become the youngest and most populous continent in the next few decades. Its labor force will rise from 620 million in 2013 to nearly 2 billion in 2063 (AEO, 2018). The projected overall population is expected to rise from 1.135 billion in 2013 to 3.095 billion by 2063 (AEO, 2018).

Sub-Saharan Africa is among the regions with the largest gap between cereal consumption and production yet its projected demand between 2010 and 2050 is much greater (3.4) than other regions (van Ittersuma et al., 2016). To meet the food demand, agricultural production needs to grow, but to achieve that without converting additional forest or savanna to cropping, there must be an increased utilization of key inputs. These inputs include improved seeds, fertilizers, and technologies such as irrigation but with greater efficiency and fewer environmental impacts, including fewer greenhouse gas emissions per unit output. Although it is not the only input, low use of fertilizer is a key impediment to increased agricultural productivity and hence farm incomes in Africa (Africa fertilizer.org, 2012).

Despite this fact, African farmers currently use far less fertilizer than their counterparts in other regions of the world. The average fertilizer use in Sub-Saharan Africa is 10kg/ha, All Africa (21kg/ha), Latin America (111kg/ha) and Asia (231Kg/ha) (see Figure 2 below).
Figure 2: Status of fertilizer use of world regions (kg/ha) in 2012

Source: IFDC and FAI, 2017

But overall growth in agricultural production in Africa has increased although fragmented (Rakshit, 2011). Arable land area has since increased from 154 million ha in 1961-63 to 213 million ha in 2006-07; while harvested area increased to 93 million ha in the same period due to arable land expansion and increased multi cropping index (Rakshit, 2011). In Sub-Saharan Africa, arable land and permanent crops rose from about 180 million ha in 2000 to about 230 million ha in 2016 and is expected to reach 240 million ha by 2020 (Heller & Prud’homme, 2018). Nevertheless, the share of food imports in total imports of most Africa is very high, making food prices high and volatile. Africa imported an average of USD 35 billion of food products in 2015 which is projected to rise to over USD 110 billion in 2025 (AfDB, 2016a). Moreover, untapped
agricultural potential has contributed to persistent poverty and deteriorating food security, resulting in a projected increase in the number of undernourished people from ~240m in 2015 to ~320m by 2025 (AfDB, 2016b).

Cereal production has remained stagnant at about 1 ton/ha for the past 50 years compared to over 4 tons/ha in developed countries (MDRE report, 2015). In Sub-Saharan Africa, a closure of the gap between current farm yields and yield potential through increased acceleration in rate yield is needed to maintain the current level of cereal self-sufficiency (approximately 80%) by 2050 (van Ittersum et al., 2016). This underscores the need to enhance productivity in Africa through the adoption of productivity-enhancing technologies such as the use of inorganic fertilizers as well as improved seed varieties. Fertilizer consumption in Africa from 1980 to 2005 on average was as low as 9 kg nutrients/ha compared to 70-150kg/ha in South East Asian countries (World Bank, 2007), pointing at very low utilization and consequent low productivity.

The low replacement rate of plant nutrients results in soil nutrient depletion reducing soil fertility and therefore incapable of sustaining crop growth. Thus, governments in Africa have been under increasing pressure to finance the provision of inputs such as fertilizer, seeds and pesticides. They are also under pressure to build critical infrastructure to ease provision of input supplies in the rural areas. The challenge is that revenue sources are limited and budget deficits are increasing. It is thus critical to create favorable business environment to allow the private sector to flourish. One critical area is the availability of fertilizers that should be affordable and accessible to farmers, in particular farmers of smallholdings.
Africa faces many challenges. The continent has varying farming systems, agro-ecological zones, amount of precipitation and soil depth among others. Climate change is also becoming a constraint on the continent (IFDC, 2015; IfDB, 2016b). The farming systems in Africa are very diverse and are about 16 in all (see figure 3 below) with diversity of nutrient needs for each suggesting a tailored approach. The soils are also widely diverse (FAO, 2014), and have evolved with a great deal of complexities following 50 years of ill-guided farming practices (land use, etc.). Environmental constraints are also diverse and these include steep slopes and mountains, dry and cold areas with low potential, erratic rainfall and cold stress risks, and poor soils² (see also figures 31-33 in the annex).

Figure 3: African Farming System Clusters

Source: Dixon, Boffa, and Garrity 2014

About 8% of the agricultural land in Africa has soils that are relatively free of natural constraints such as steep slopes, degraded soils and unreliable rainfall for agriculture (ACB, 2014).

The New Partnership for Africa’s Development (NEPAD) has declared that the vision of economic development in Africa must be based on raising and sustaining higher rates of economic growth equal or superior to 7% per year. It is at 7% that the growth rate can trigger job creation and economic prosperity for the majority. To realize this vision, in 2003, the African Heads of State and Government adopted the Comprehensive Africa Agricultural Development Programme (CAADP), which calls for a 6% annual growth in agricultural production, as a framework for the restoration of agricultural growth, food security and rural development in Africa.

This was followed by the 2006 Abuja Summit that called for increasing fertilizer use to 50kg nutrients per hectare by 2015 along with the establishment of an Africa Fertilizer Financing Mechanism (AFFM). This will require the involvement of the private sector to invest in joint ventures with governments making use of regional capacities to achieve economies of scale of fertilizer production, procurement and distribution. NEPAD established the Fertilizer Support Program to influence policy and markets at country and regional levels to encourage the development of a sustainable market for fertilizer in Africa. The program also works to improve access to fertilizer and provide incentives to farmers to make wider use of fertilizer³.

³ http://www.nepad.org/foodsecurity/fertilizer-support-programme/about, accessed on 20 November 2015
On the other hand, heavy reliance on imported fertilizers, combined with high transportation costs and the absence of suppliers in the countryside, has meant that African farmers pay between two and six times the average world price for fertilizer — when they can find it at all (IFDC, 2009), a factor that leads to low fertilizer utilization. However, we note the study was undertaken immediately after the 2007-2008 peak fertilizer price period suggesting that the extent of price increase of 2-6 fold may no longer be the case today. Nowadays, there is more competition and more players active in the fertilizer supply chain than nine years ago. The IFDC study estimated that it costs more to move a kilogram of fertilizer from an African port to a farm 100 kilometers inland than it costs to move it from a factory in the US to the port of entry in Africa. This suggests that reducing inland transportation costs is central/pivotal to increasing fertilizer access, affordability and use. With millions of African family farmers surviving on less than a dollar a day, imported fertilizer is simply unaffordable. Yet evidence suggests that even modest increases in the use of fertilizer — whether nitrogen, phosphorous, potassium or sulphur — can have dramatic results.

Although Africa has a whole accounted for 3% of world consumption in 2016 of which 2% is for Sub-Saharan Africa (FAO, 2017), the fast-rising demand from rapid population increase and food deficits offers bright future prospects. Opportunities for increased production of fertilizers in Africa abound. For example, West Africa’s vast and largely untapped natural gas resources, make the region ideally suited for the manufacture of nitrogen fertilizers. Africa also has ample deposits of phosphorus⁴ and already exports the mineral to Europe and India. If these minerals can be utilized in local production, Africa would need to import only potassium fertilizer. But even this might change with

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⁴ We note that Africa has a surplus in phosphorus. The challenge has been low intra-Africa phosphorus demand
the on-going pre-production developments of potash in Ethiopia, Eritrea and Republic of Congo.

Although fertilizer consumption in Africa is low, the targeted consumption to meet agricultural targets is much higher (see table 1 below).

**Table 1: Estimated fertilizer requirements (metric tons of products) to meet country agricultural targets**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>550,500 (2012)</td>
<td>1,200,000 (2015)</td>
<td>2.2</td>
</tr>
<tr>
<td>Ghana</td>
<td>200,000 (2012)</td>
<td>400,000 (2015)</td>
<td>2.0</td>
</tr>
<tr>
<td>Kenya</td>
<td>488,800 (2012)</td>
<td>910,000 (2015)</td>
<td>1.9</td>
</tr>
<tr>
<td>Mozambique</td>
<td>51,600 (2012)</td>
<td>225,000 (2020)</td>
<td>4.4</td>
</tr>
<tr>
<td>Tanzania</td>
<td>263,000 (2012)</td>
<td>528,000 (2015)</td>
<td>2.0</td>
</tr>
<tr>
<td>Rwanda</td>
<td>35,000 (2014)</td>
<td>144,000 (2017)</td>
<td>4.1</td>
</tr>
<tr>
<td>Uganda</td>
<td>50,000 (2014)</td>
<td>310,640 (2018)</td>
<td>6.2</td>
</tr>
<tr>
<td>Malawi</td>
<td>297,000 (2013)</td>
<td>600,000 (2016)</td>
<td>2.0</td>
</tr>
<tr>
<td>Zambia</td>
<td>250,000 (2013)</td>
<td>498,000 (2015)</td>
<td>2.0</td>
</tr>
<tr>
<td>Liberia</td>
<td>3000 (2014)</td>
<td>28,000 (2017)</td>
<td>9.3</td>
</tr>
<tr>
<td>Senegal</td>
<td>87,000 (2014)</td>
<td>239,400 (2017)</td>
<td>2.7</td>
</tr>
<tr>
<td>Mali</td>
<td>250,000 (2015)</td>
<td>550,000 (2018)</td>
<td>2.2</td>
</tr>
</tbody>
</table>

*figure arrived at country fertilizer assessments were conducted

Source: IFDC, 2015
The Malabo declaration at the African Union Summit in Malabo, Equatorial Guinea, in June 2014 also re-affirmed the principles and values of the CAADP process. The declaration called for the doubling of agricultural productivity by 2025 and what should be the basis of re-launching fertilizer use in Africa. The actions needed are to: nurture development of private businesses, allow regional harmonization to assure quality; reduce farming risks for smallholder farmers; facilitate innovation for improving small farmer productivity, improve access to commercial credits for input sector businesses and farmers; accelerate agro dealer training; encourage banks to provide loans to fertilizer importers, traders and retailers; strengthen extension services; and strengthen Africa Fertilizer market information network. A recent review of the Malabo Declaration shows that of the 47 member countries that reported progress, only 20 are on track for achieving the commitments by 2025 with Rwanda having the highest score (AUC, 2018).

Although fertilizer application rates have been increasing slowly in Africa, they are still well below the Abuja target of 50kg/ha. The rates were close to 15kg/ha by 2013 in Sub-Saharan Africa and expected to reach 19 kg/ha by 2021 (Heffer and Prud’homme, 2018). At this rate, it would take about 50 years from now for Sub-Saharan Africa to reach the Abuja target (Heffer and Prud’homme, 2016a).

1.2 Trajectory of Agricultural Development in Africa
From 2000 to 2014, the continent has seen a prolonged commodity boom, and together with improved capacity for policy research and analysis, and improved policy making this has catapulted Africa to become one of the fastest growing regions of the world. This created high hopes hence the Africa rising narrative. Africa is also rapidly urbanizing, second after Asia and is projected to be the first within 20 years (ERA,
Agriculture as a fraction of both national gross domestic product (GDP) and the total labor force has been declining over time (AGRA, 2017).

The strong economic performance of the continent has been due largely to favorable terms of trade, higher commodity prices and strong global demand for natural resources, which boosted Africa’s extractive industries. The challenge with this is that when commodity prices fall as they did since 2014, the economy falters as a result of lower export values (World Economic Forum et al.; 2017). The rising share of the services sector is problematic because most services are informal and labor-intensive with low labor productivity (AGRA, 2017). Economic growth in Africa fell from 3.7% in 2015 to 1.7% in 2016. The growth however varies between regions: East Africa at 5.5%, West Africa fell to 0.1% from 4.4% in 2015, Southern Africa at 1% from 2.5% in 2015, Central Africa at 2.4% from 3.4% in 2015, and North Africa at 2.6% from 3.6% in 2015 (ERA, 2017).

On resource governance, Ghana ranks the best in Africa with a score of 67 followed by Botswana (61), Burkina Faso (59) and South Africa (57) (NRGI, 2017). The worst are Eritrea (10), Libya (18), Sudan (21) and Equatorial Guinea (22). Others are Nigeria (42), Ethiopia (40), Egypt (39), and Morocco (52) (NRGI, ibid). Resource governance is important because resource extraction companies in countries with strong resource governance may operate with relatively less local environmental impact. With the Ibrahim Index of African Governance, the countries that have improved include Togo, Zimbabwe, Rwanda, Kenya, Liberia, Morocco and Tunisia; those that have deteriorated are Libya, Burundi, Eritrea, Gambia, Central Africa Republic, Mali, Ghana and South Africa; the best are Mauritius, Seychelles, Botswana and Namibia while the worst are Somalia and South Sudan (Mo Ibrahim Foundation, 2017).
Significant challenges remain to put African economies on stronger and sustainable growth paths and to address widening economic and social inequalities. In countries where economic growth performance is still heavily reliant on extractive sectors, commodity price volatility, such as the recent decline in oil prices, makes the economies more vulnerable to external shocks, with significant implications for fiscal and macroeconomic stability.

While African countries have huge potential in the agricultural sector to diversify their economies, the sector remains largely untapped, with low productivity and countries depending largely on the export of primary produce with limited value addition. In many countries, from North to South and East to West of the continent, the challenge is to make economic growth more inclusive and more effective at reducing poverty. Africa’s growth has been uneven. Incidence of poverty remains a challenge across Africa with about 40% of the population living in extreme poverty. With such a large share of the population disconnected from the growth process, African economies face the challenge of growing discontent from disenfranchised youth, which could lead to economic, social and political fragilities. Private sector growth faces challenges to fully unlock its potential. Industrialization of the continent remains low, limiting the space to generate quality jobs. Africa’s challenge is to generate high-quality economic growth that is inclusive, sustainable and more effective in reducing poverty and addressing social inequities (AfDB, 2016c).

Generally, the pace of poverty and hunger reduction has been too slow compared with other regions of the world to prevent the rising absolute number of poor and hunger people in Africa (IFPRI, 2015). The growing vulnerability to climate change in the
continent is also likely to worsen the situation. As the figure 4 below shows, cereal yields in Africa started growing from 2000 but still much slower in comparison with other regions of the world. Within Africa, labor and land productivity improved the least in Southern Africa (excluding the Republic of South Africa) and improved the most in Eastern and Western Africa (AGRA, 2017).

Figure 4: Trends in cereal yields in Africa and Asia

Source: AGRA, 2017

The structural adjustment policies (SAPS) and government policies of keeping food prices low in support for urban consumers had a negative impact on agriculture.

Given that the agricultural sector is the mainstay of most African economies, the African Union launched the Comprehensive Africa Agriculture Development

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Programme (CAADP) in 2003 in Maputo to improve performance of the sector; namely, enhance food security, raise incomes of farmers and raise agricultural productivity by 6% per annum. CAADP is a program within the New Partnership for Africa’s Development (NEPAD) – itself a program of the African Union. Ten African countries have achieved or exceeded the target and four have achieved a 5 to 6% increase (MDRE Report, 2015).

The CAADP, 3ADI and other recently adopted AU frameworks advocate for strong linkages between public and private sectors along strategic commodities value chains and industrial clusters. In particular, the AU Heads of States, under the Maputo Declaration on Agriculture and Food Security, made a pledge to allocate at least 10% of their national budgets to agriculture and rural development. This was meant to stimulate agricultural growth, reduce poverty, and build food and nutrition security. Twelve African countries have reached or surpassed the 10% budgetary allocation target, while 13 are in the 5-10% range (MDRE Report, 2015). There has been a realization that this was not going to raise productivity, bring food security or take rural people out of poverty. What became clear, as global feed, fuel and food prices rose, was that governments alone could not solve the challenges of agriculture. With less public investment devoted to agriculture, the sector is not expected to thrive and drive growth in the future. The private sector was thus found to be an important source of the much-needed resources in the sector, especially within the context of public-private sector partnerships.

In line with the above, the African Union Heads of States and Governments adopted the Abuja Declaration on Fertilizer for the African Green Revolution to increase fertilizer
use from 8 kilograms to at least 50 kilograms of nutrients per hectare by 2015. The action plans are summarized in the text box below:

Text Box 1: Action plans of the Abuja declaration of 2006

1. Harmonize policies and regulations to ensure duty- and tax-free movement of fertilizers across regions, and the development of capacity for quality control;
2. Develop and scale up agro dealer networks to improve farmer access to fertilizer;
3. Develop and strengthen the capacity of the private sector involved in agriculture;
4. Grant targeted subsidies, with special attention to poor farmers;
5. Improve output market incentives, particularly by accelerating investment in infrastructure and strengthening farmers’ organizations.
6. Establish national financing facilities for input suppliers to accelerate access to credit;
7. Promote the establishment of regional fertilizer procurement and distribution facilities through strategic public-private partnerships;
8. Promote national/regional fertilizer production and intra-regional fertilizer trade;
9. Improve farmer access to complementary inputs (quality seeds, irrigation facilities, extension services, market information, and soil nutrient testing and mapping);
10. Establish an Africa Fertilizer Financing Mechanism.

To achieve the above, it was noted that availability and accessibility to fertilizer, access to finance and strengthening of markets are crucial and to a large extent the declaration would need the support of the private sector.

1.2 Motivation of the study

As noted earlier, agriculture has been and still remains an important contributor to growth for most African countries. However, to achieve the requisite incomes levels in the rural areas, transformation of the sector cannot be wished away. Transformations in the sector will require farmers shifting from low-yielding, extensive land practices to more intensive, higher-yielding practices, with increased use of improved seeds, fertilizers and technologies such as irrigation and other improved agricultural practices. This is because, the soils in Africa remains among the most degraded in the world, requiring continuous fertilizer use.
Soil nutrient depletion for some countries is higher than 50 kg/ha per annum, leading to soil degradation through leaching and erosion (Henao and Baanante, 1999). Soil degradation is said to affect about 65% of African farmland. On average, 600 kg N/ha has been lost from African soils during the last 30 years, from around 200 million ha of cultivated land (ACB, 2014). It is estimated that the continent loses the equivalent of over $4 billion worth of soil nutrients per year severely eroding its ability to feed itself (IFDC, 2009). Yet a majority of farmers, especially smallholder farmers have neither the access to, nor can they afford the fertilizers needed to revitalize their soils. The average fertilizer use in 2013 in Africa is estimated at about 12 kg nutrients per hectare (Heffer and Prud’homme, 2018), which is about 10% of the world average. This low use of fertilizer is partly responsible for the low food production in Africa, yet Africa represents 10% of the total global population. As the table below shows, the use of fertilizer has tremendous potential to increase yields.

**Table 2: Yield Potential with fertilizer use in Africa**

<table>
<thead>
<tr>
<th>Region</th>
<th>Crop</th>
<th>Yields (mt/ha)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Farm (Without Fertilizer)</td>
<td>Farm (With Fertilizer)</td>
<td>Experimental Station (With Fertilizer)</td>
<td></td>
</tr>
<tr>
<td>West Africa</td>
<td>Irrigated rice</td>
<td>3.0</td>
<td>6.0</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>West Africa</td>
<td>Upland rice</td>
<td>1.0</td>
<td>2.5</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>West Africa</td>
<td>Lowland rice</td>
<td>1.5</td>
<td>3.0</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>West Africa</td>
<td>Cassava</td>
<td>8.0</td>
<td>35.0</td>
<td>47.0</td>
<td></td>
</tr>
<tr>
<td>West Africa</td>
<td>Maize</td>
<td>0.8</td>
<td>3.5</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>West Africa</td>
<td>Sorghum</td>
<td>0.6</td>
<td>1.8</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>West Africa</td>
<td>Cowpea</td>
<td>0.3</td>
<td>1.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>Maize</td>
<td>1.5</td>
<td>4.0</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>Soybean</td>
<td>0.5</td>
<td>2.0</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>East Africa</td>
<td>Maize</td>
<td>1.5</td>
<td>7.0</td>
<td>8.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Bariono and Egulu (2010).
1.3 Objectives of the study

The overall objective of the study was to provide a solid background document reviewing the state of selected Africa’s fertilizer clusters and related emerging value chains and provide strategic policy options including actionable recommendations going forward and best practices towards the provision of effective and accessible funding mechanisms that support national and regional priorities in the context of ending hunger by 2025, Agenda 2063, and more specifically accelerating the establishment of the proposed 2006 Africa Fertilizer Financing Mechanism (AFFM).

The main objective of the study was to develop solid recommendation and possibly tools which AFFM can use to create a catalytic environment for investments that would lead to efficient and effective fertilizer production and consumption within Africa. Specifically, the study attempts to explore means to empower the private sector to be the main player in the fertilizer business in lieu of government interference. This would ideally be through establishing conducive and enabling environment that consists of, basically, supporting effective institutions and appropriate policies and regulatory frameworks for investment in the sector.

The specific objectives of the study were to:

(i) Review the factors affecting fertilizer market in Africa paying special attention to its linkages to established global and evolving fertilizer supply chains, proven feedstock reserves and competitive raw material sources;

(ii) In the context of envisaged CTFA negotiations, identify trade hindering development of fertilizer production, cross-border trade and consumption in and between proposed target clusters and corridors;
(iii) Undertake mapping of viable fertilizer plants in Africa (see clusters 1 to 6 country list) using a stepwise development approach to scale up sustainable and clean fertilizer production, efficient procurement and distribution system in selected target clusters of interest;

(iv) Provide policy options for sustainable and clean fertilizer production, and distribution, and consumption within and along selected targeted cluster and corridors under review;

(v) Provide a comparative review of the policy frameworks and related enforcement systems in place in the target clusters and recommend actionable reform measures to create a conducive environment for effective public-private partnerships in support of increased private sector participation and investments into the target strategic input and output clusters and their effective integration into established regional fertilizer supply chains and emerging clean and sustainable production and consumption networks;

(vi) Based on the above, provide holistic and specific solutions applicable to each of the target country cluster and focused transport corridor towards establishing a financing mechanism that effectively respond to the emerging and specific fertilizer

1.4 Scope of Work

The scope of this study is Africa wide giving special attention to agro-ecological considerations and specific and dynamic nutrient needs of target strategic clusters identified across Africa’s five sub regions cautiously starting up therein to scale in a stepwise market development manner and where economically appropriate.

The study was conducted on a cluster basis and in line with the following six country clusters (Figure 5) taking due account of established revealed geopolitical
and geo-climatic comparative advantage. The study builds upon the existing membership into regional economic communities and categorization based on the AFFM Medium Term Work Program:

- **Cluster 1**: The Arab Maghreb Union (AMU) region which includes Algeria, Morocco, Tunisia, Libya and Mauritania. We exclude Egypt because of the distance and also from a logistic standpoint, Egypt is better connected to Sudan through the Nile corridor than to AMU countries.

- **Cluster 2**: The ECOWAS Region which consists of Nigeria, Benin, Burkina Faso, Togo, Ghana, Niger, Côte D’Ivoire, Senegal, Liberia, Guinea-Bissau, the Republic of Guinea, Sierra Leone, Gambia and Mali.

- **Cluster 3**: The East African Community (EAC) which consists of Kenya, Tanzania, Uganda, Rwanda, and Burundi.

- **Cluster 4**: The SADC Region which consists of South Africa, Zambia, Zimbabwe, Mozambique, Botswana, Namibia, Malawi, Lesotho, Swaziland, Madagascar, Mauritius, and Seychelles.

- **Cluster 5**: The Central African States (ECCAS) which include Angola, Democratic Republic of the Congo, Republic of the Congo, Chad, Central African Republic, Gabon, Equatorial Guinea, and Cameroon.

- **Cluster 6**: IGAD/Horn of Africa which includes Ethiopia, Sudan, South Sudan, Eritrea, Somalia, Djibouti and Egypt. We include Egypt here because of the proximity to both land and sea.

It is understood that each agro input and related industrial cluster-based chain has different development characteristics and different competitiveness enhancement requirements, and correspondingly different requirements for private public sector
investment, specialized management competencies and specialized needs for market branding, market insider knowledge, market repositioning and trade enhancement requirements.

Figure 5: Clusters with infrastructure corridors

The clusters described above are served by the following infrastructure corridors:

- **North Africa**: Kenitra-Casablanca, Tangiers (Gibraltar Detroit)-Agadir Corridor (Morocco); Greater Cairo Region Corridor (Egypt);
- **North East Africa**: Lamu Port-South Sudan-Ethiopia Corridor (Kenya, South Sudan, Ethiopia);
- **West Africa**: Dakar-Touba corridor (Senegal); Greater Ibadan-Lagos-Accra urban corridor (Nigeria, Togo, Benin, Ghana); Great Hausa –Yoruba – Ashanti city triangle (Ghana, Benin, Togo, Nigeria); Abidjan-Bamako; Tema/Accra-Ougadougou/Burkina Faso; Abidjan-Ouagadougou-Niamey-Cotonou; Abidjan-Accra-Lome-Cotonou-Lagos (Côte d’ivoire, Ghana, Benin, Togo, Nigeria, Niger);

- **West and Central Africa**: Emerging Luanda-Ndjamena corridor (Angola, DRC, Congo, Cameroon, Gabon, Central African Republic, Chad);

- **East Africa Northern Corridor** (Mombasa): (Kenya, Tanzania, Uganda, Rwanda, and South Sudan);

- **East Africa Central corridor (Dar es Salaam)**: (Tanzania, Rwanda, Burundi); Kampala-Entebbe dry corridor; Nairobi Metropolitan Region corridor (Kenya);

- **Southern Africa**: Walvis Bay Corridor (includes TransKalahari, and Trans Caprivi and Trans Curene corridors through links to regional corridors (Cape town, Durban in South Africa; Maputo, Beira in Mozambique; and Namibia/Botswana); North south corridor (South Africa, Zimbabwe, Zambia) through links to regional corridors (Beira, Maputo in Mozambique) Durban, Cape Town in South Africa, Walvis Bay in Namibia; in southern Africa: Maputo-Gauteng development corridor in Maputo (Mozambique/South Africa); Durban development corridor in Durban, South Africa;

- **South East Africa**: Beira Corridor (Mozambique/Zimbabwe) in Mozambique; Maputo-Limpopo Corridor (Mozambique/South Africa) in Maputo, Mozambique.
Together, the outcomes of the cluster baseline specific value chains and related capacity assessments will ultimately feed into and support the AUC/NEPAD-CAADP strategy implementation plan by addressing obstacles, investment requirements, modes of industrial organization and policy reform requirements. These requirements are complementary, though different in nature, and which together can serve as a basis for bracketing the entire set of opportunities and for identifying appropriate interventions for future investments into the agriculture, agribusiness and manufacturing sectors. The ultimate goal of this study was to demonstrate what is possible when private and public resources are linked and precisely targeted to deliver greater transformative impacts on specific development goals.

1.4 Methodology

The study builds upon agro industrial clusters and value chain studies that ECA is doing to update on key issues affecting fertilizer production, and distribution and consumption in Africa paying special attention to productivity, competitiveness and sustainability issues. In particular, it has drawn heavily on desk work as well as from ongoing ECA and other partner works on the development of sustainable global supply chains, regional value chains and agro-industrial clusters.

The study builds on other studies on fertilizer production and consumption in Africa. A number of past studies have been reviewed and internet searches conducted. The intention was to obtain bottlenecks faced in the drive to increase fertilizer production, cross-border trade and consumption in Africa.

Descriptive statistics have been used to understand current use rates. The data sources are mainly from FAO, Africa Fertilizer Information Portal (Africafertilizer.org) and International Fertilizer Association (IFA).
PART 2: REVIEW AND ANALYSIS OF FERTILIZER TRADE: PRODUCTION, CROSS-BORDER TRADE AND CONSUMPTION PATTERNS

2.1. Introduction

The world demand for nitrogen (N), phosphorus (P₂O₅), and potassium (K₂O) fertilizers is projected to grow annually by 1.5%, 2.2% and 2.4% respectively from 2015 to 2020 (FAO, 2017). On fertilizer use, Africa accounted for 3% of world fertilizer consumption in 2016, and its share in world consumption of nitrogen was 3.3%, phosphate 3.5% and potash 2%(FAO, 2017). FAO further forecasts the annual growth rate in demand for nitrogen, phosphate, and potash for fertilizer to be 3.78%, 2.8%, and 6.76%, respectively, for Africa between 2015 and 2020. The share of North Africa in the world consumption of nitrogen is 1.7%, phosphate 1.5% and potash 0.5% while that for SSA⁵ is 1.6% nitrogen, 2.02% phosphate and 1.5% potash. These figures are very low compared with other regions of the world.

Table 3 below shows projected growth in fertilizer by regions between 2015-2020 with Africa showing higher potential for the three nutrient fertilizers at between 2.8-6.8% annually indicating that there is a potential for growth in Africa tied to fertilizer use.

Table 3: World and Regional Growth in Fertilizer Demand, 2015-2020

<table>
<thead>
<tr>
<th>Region</th>
<th>N</th>
<th>P₂O₅</th>
<th>K₂O</th>
<th>Total (N + P₂O₅ + K₂O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>1.54</td>
<td>2.19</td>
<td>2.4</td>
<td>1.83</td>
</tr>
<tr>
<td>Africa</td>
<td>3.78</td>
<td>2.8</td>
<td>6.76</td>
<td>3.86</td>
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<tr>
<td>North Africa</td>
<td>2.75</td>
<td>1.6</td>
<td>5.56</td>
<td>2.64</td>
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</table>

⁵ FAO projections for SSA include South Africa
<table>
<thead>
<tr>
<th>Region</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
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<tr>
<td>Sub-Saharan Africa</td>
<td>4.83</td>
<td>3.6</td>
<td>7.11</td>
<td>4.88</td>
</tr>
<tr>
<td>America</td>
<td>1.77</td>
<td>2.6</td>
<td>2.05</td>
<td>2.03</td>
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<tr>
<td>North America</td>
<td>0.37</td>
<td>0.6</td>
<td>0.54</td>
<td>0.45</td>
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<tr>
<td>Latin America &amp; Caribbean</td>
<td>4.09</td>
<td>0.0</td>
<td>0.00</td>
<td>3.70</td>
</tr>
<tr>
<td>Asia</td>
<td>1.52</td>
<td>2.1</td>
<td>2.56</td>
<td>1.79</td>
</tr>
<tr>
<td>West Asia</td>
<td>2.63</td>
<td>4.4</td>
<td>5.91</td>
<td>3.03</td>
</tr>
<tr>
<td>South Asia</td>
<td>2.49</td>
<td>4.4</td>
<td>5.20</td>
<td>3.15</td>
</tr>
<tr>
<td>East Asia</td>
<td>0.89</td>
<td>0.7</td>
<td>1.83</td>
<td>1.02</td>
</tr>
<tr>
<td>Europe</td>
<td>0.78</td>
<td>1.6</td>
<td>2.52</td>
<td>1.22</td>
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<tr>
<td>Central Europe</td>
<td>2.57</td>
<td>3.3</td>
<td>4.24</td>
<td>2.89</td>
</tr>
<tr>
<td>West Europe</td>
<td>-0.99</td>
<td>-0.4</td>
<td>1.36</td>
<td>-0.48</td>
</tr>
<tr>
<td>East Europe &amp; Central Asia</td>
<td>2.71</td>
<td>3.3</td>
<td>3.42</td>
<td>2.91</td>
</tr>
<tr>
<td>Oceania</td>
<td>1.50</td>
<td>1.3</td>
<td>0.05</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Source: FAO, 2017

Given China’s zero growth policy and the EU’s Circular Economy Strategy of greater recycling and re-use of various organic nutrient sources (Heffer et al., 2016), the future world demand for fertilizer is rather muted. This suggests that Sub-Saharan Africa will be an increasingly important driver of future world demand.

The Agricultural Outlook released by OECD/FAO in 2016 predicted an overall rise in the production of many agricultural commodities including cereals such as wheat,
maize, and rice as well as other important crops such as sugar and oilseeds (OECD/FAO (2016a).

In light of these and keeping in view of the different factors that affect fertilizer demand in the future, FAO projected that the total fertilizer nutrient (N+P₂O₅+K₂O) consumption estimated at 184 million metric tons nutrients in 2015 with a successive growth of 1.83% per year, would reach 201 million tons nutrients by the end of 2020 (FAO, 2017). SSA accounts for rising percentage and highest growth rate in demand of about 4.8% by 2020, mainly driven by Nigeria, Kenya and Ethiopia, while the share of increase in North Africa is expected to be around 2.5% during the same period, mainly in Egypt and Morocco (FAO, 2017; Heffer and Prud’homme, 2018). The increase in growth of fertilizer demand in SSA reflects the establishment of fertilizer subsidy regimes in a number of countries, growing investments by the fertilizer industry, and increasing policy support to agricultural development. The major consuming countries are South Africa, Nigeria, Ethiopia, Mali, and Kenya (Figure 6).
Figure 6: Fertilizer nutrient consumption (thousand tonnes) of selected countries in Africa in 2016

Source: Africafertilizer.org

However, we note that South Africa is a mature fertilizer market with no or little demand growth.

The next section describes the trends in fertilizer use and production in Africa, while section 3 presents constraints and opportunities for fertilizer production, use and trade in Africa with conclusive remarks following in the last section.
2.2. Trends in Fertilizer use and Production in Africa
2.2.1 Fertilizer use in Africa

Agricultural productivity increase is only possible with the use of yield-enhancing technologies like inorganic fertilizer. However, low fertilizer use is one of the factors explaining lagging agricultural productivity growth in Africa.

Compared with other developing regions, fertilizer consumption in Africa has only risen marginally (see Figure 7 below) over the 2000-2015 period.

Figure 7: Comparative evolution of regional fertilizer consumption in Mt nutrients in developing regions.

Source: IFA Statistics, 2018
The average application rate in Sub-Saharan Africa has been growing though still low (Figure 8 below) from 6Kg/ha of nutrients in 2000 to about 15 Kgs/ha in 2017 (Heffer and Prud’homme, 2018). It is projected to reach about 19kg/ha by 2021 which is still below the Abuja declaration of 50Kgs/ha.

**Figure 8:** Average Fertilizer Application Rate in Sub-Saharan Africa

Source: Heffer and Prud’homme, 2018

The application rate remained at about 12kg/ha in 2013-16 (Heffer and Prud’homme, 2018). This trend paints a grim picture for Africa’s agricultural development and its struggle with food security issues particularly from the perspective that agriculture still forms the backbone of many African economies. This contrasts with the situation in
North Africa (the AMU Region), where the average fertilizer use is 103 Kg/ha\(^6\) (Badiane et al., 2014) and 55kg/ha for South Africa (Heffer and Prud’homme, 2018).

It is anticipated that without a positive change in fertilizer use, fall in productivity and food deficits will more than triple by 2020 in the region (FAO, 2015). The fact is that, most African countries still use fertilizer far below the Abuja Declaration of 50 kg/ha except for Egypt, Mauritius and South Africa. Much effort is therefore needed to raise fertilizer use to the desired levels and thus improve productivity in Africa, and it is an opportunity for the fertilizer production in the region and to distributors.

Analysis at sub-regional levels, show that aggregate fertilizer consumption varies a lot across the five sub-regions of Africa with North Africa being the highest fertilizer consumer. In 2015, 5.5 Mt were consumed in Africa with North Africa (40%), Southern Africa (23%), Eastern Africa (19%), Western Africa (16%), and Central Africa (2%) (IFA in Harrison, 2017). In 2016, about 6.0 Mt of Nutrients were consumed in Africa with Northern Africa (38%), Southern Africa (21%), Western Africa (20%), Eastern Africa (19%) and Central Africa (2%) (IFA in Harrison, 2018). The Central African Region and the Sudano-Saharan countries (Middle Africa) consumed less fertilizer than all other regions. Fertilizer use rates also differ across Africa. Average fertilizer use per hectare is highest and growing faster in the SADC region than in the other regions, increasing from 13 kilograms per hectare in 2001–2004 to about 20 kilograms per hectare in 2009–2012 (AGRA, 2016). In Malawi, for example, over the same period, fertilizer use increased from 11 kilograms per hectare to 29 kilograms per hectare. In the other sub-regions, the figure remained relatively stable, increasing from 7.0 kilograms per hectare

\(^6\) When comparing North Africa and SSA, it is important to keep in mind that the North African average is influenced by Egypt where agriculture is 100% irrigated and where the average application rate is ~400 kg/ha. In the rest of North Africa, the average rate is <50 kg/ha
to 10.0 in COMESA, and from 11 kilograms per hectare to 12 kilograms per hectare in ECOWAS (AGRA, 2016).

South Africa, Nigeria, Kenya and Ethiopia are the major users of fertilizers in sub-Saharan Africa (IFA, 2018). In 2016, Sub-Saharan Africa consumed 3.7 Mt Nutrients with Southern Africa (34%), Eastern Africa (30%), Western Africa (33%) and Central Africa (3%) (Heffer and Prud’homme, 2018).

The figures below show regional share of projected increase in fertilizer consumption by nutrient type.
**Figure 9:** Regional and Sub-Regional Share of World Increase in Nitrogen Fertilizer Consumption, 2015 to forecasted end of 2020

Source: FAO, 2017

**Figure 10:** Regional and Sub-Regional Share of World Increase in Phosphate Fertilizer Consumption, 2015 to forecasted end of 2020

Source: FAO, 2017
Figure 11: Regional and Sub-Regional Share of World Increase in Potash Fertilizer Consumption, 2015 to forecasted end of 2020.

Source: FAO, 2017

Therefore, it is projected that the African share of world increase in consumption of fertilizer between 2015-2020 would be 8% for nitrogen, 4% for phosphates and 8% for potash.

2.2.2 Fertilizer production in Africa

As indicated above, between 2015 and 2020 the consumption of nitrogen, phosphate and potash for fertilizers is expected to increase at an annual rate of 3.78%, 2.8% and 6.76% respectively (FAO, 2017). The challenge is that most countries in Africa still remain dependent on imported fertilizers for agricultural production due to the lack of
low-cost raw materials for fertilizer production, low domestic demand, low capacity utilization\(^7\), and high capital requirements for investment in production facilities.

In terms of production capacity, Africa also compares poorly with other regions of the world with the exception of phosphorus. Urea capacity has been expanding massively in Africa since 2015, with large capacity increments in Algeria, Egypt and Nigeria, from 2015 going through 2020. The world total ammonia capacity was 174.8 million tonnes (as N) in 2015 and is likely to increase to 188.3 Mt by the end of 2020, with the main additions to capacity occurring in North America, East Europe & Central Asia, Africa, South Asia and West Asia. World phosphoric acid (as H\(_3\)PO\(_4\)) capacity was about 57.4 Mt in 2015 and is expected to rise to 64.8 Mt by the end of 2020, with 52.4% addition expected to take place mainly in Africa, 25.7% in East Asia and 18.3% in West Asia. Potash capacity was estimated at 52.9 Mt (as K\(_2\)O) in 2015, and by the end of 2020, the total capacity is expected to be 64.5 Mt, of which 30% would be in North America, 52% in East Europe & Central Asia and 14.6 per cent in East Asia, and less than 3% in Africa (FAO, 2017)

The production of fertilizer in Africa is concentrated among six countries: Egypt, Tunisia, South Africa, Algeria, Nigeria, and Morocco. These countries have a developed fertilizer industry and also a high level of fertilizer use. A significant fertilizer capacity development on nitrogen and phosphorus (Figure 12) is expected in Africa (Prud’homme, 2016). These additions are expected mainly in Nigeria, Egypt and Algeria for urea (about 8 Mt) and Morocco, Tunisia and Egypt for phosphates (about 5Mt). 

\(^7\) In a recent register of fertilizer plants in Sub-Saharan Africa, most of the plants operate between 20 to 40% of their installed capacity (AfricaFertilizer.org, 2018)
Figure 12: Fertilizer Capacity Developments in Africa 2011-2020

Source: Heffer and Prud’homme, 2017

In Africa, it is projected that by 2020, potential phosphate rock supply will reach 61Mt with most of the supply largely from Morocco followed by Algeria, Egypt, Senegal, Togo and Tunisia (Prud’homme, 2016). On potash, some projects are being developed in the Republic of Congo, Ethiopia and Eritrea but are not expected to come into production very soon (Prud’homme, 2016).

In Sub-Saharan Africa, phosphate rock production is carried out in Togo, Senegal and Mali while production of fertilizer is in Zimbabwe, Nigeria, Madagascar, Tanzania, and Kenya (AfricaFertilizer.org, 2018a). Production within these countries is carried out by
a handful of corporations; no more than four firms operate in any of the producing countries of Sub-Saharan Africa. For example, Notore Chemical Industries Plc. (500 Kt urea) and Indorama Eleme Fertilizers & Chemicals Ltd (1.4 Mt urea) comprise all the ammonia and urea production in Nigeria. In addition, Dangote Group (2.8 Mt urea) and Brass Fert are expected to start production in the near future (CRU, 2017; AfricaFertilizer.org, 2018; Heffer and Prud’homme, 2018); Sable Chemical Industries account for all Zimbabwe’s ammonia nitrate (240 Kt) while Zimbabwe Phosphate Industries Ltd produces phosphate rock (150 Kt), TSP (45 Kt), and SSP (200 Kt); Industries Chimiques (ICS) (250 Kt of phosphate rock) and Societe d’Études et de Réalisation des Phosphates (SERPM) (25 Kt phosphate rock) produce phosphate rock, phosphoric acid, DAP, Gypsum and NPK in Senegal; Kel Chemicals Ltd producing SSP (200 Kt SSP) and sulphuric acid in Kenya; Toguna Agro Industries in Mali producing phosphate rock (300 Kt); Minjingu Mines & Fertilizer Ltd in Tanzania producing phosphate rock (100 Kt), NPK (30 Kt); Société Nouvelle des Phosphates du Togo (SNPT) producing phosphate rock (300 Kt) in Togo; International Raw Materials (IRM) producing ammonium sulphate (180 Kt) in Madagascar; Nitrogen Chemical producing NPK (252 Kt) and AN (64 Kt) in Zambia; and Omnia (600 Kt CAN/NPKS), Foskor (400 Kt MAP, 640 PA, 2.0 Mt SA) and Sasol (600 Kt ammonia, 330 AN, 100 AS) in South Africa (Harrison, 2017, AfricaFertilizer.org, 2018a).

There are several on-going fertilizer development projects in Sub-Saharan Africa, including: Indorama (800 Kt and 1500 Kt phosphates) in Senegal, Dangote (2800 Kt urea) in Nigeria, Gabon Govt/Olam (1400 Kt urea) in Gabon, Elemental Minerals (2000 Kt MOP) in Republic of Congo, Danakil Potash (800 Kt) in Eritrea, Yara (600 SOP) and OCP/CIC (2300 Kt NPS, 1500 Kt urea) in Ethiopia, TPDC/Ferrostal/Topsoe/Fauji (2200
Kt ammonia, 3900 Kt urea) in Tanzania, Yara (1300 Kt urea) in Mozambique, and Sukulu mines (300 Kt SSP/TSP) in Uganda (Harrison, 2018).

There are also plants in Sub-Saharan Africa producing lime supplements, micronutrients and organic fertilizers. The companies are Safisana in Ghana and PROFEBA in Mali producing organic fertilizers; Cybernetics Nigeria Ltd in Nigeria and ABM Equipment Services Ltd and Poli General Trading & Supplies Ltd in Tanzania producing soil supplements and micronutrients (Africafertilizer.org, 2018 a).

In North Africa, the fertilizer mineral producing companies are OCP which produces phosphate rock, phosphoric acid and processed phosphates (MAP, DAP, NPS, TSP and NPK) in Morocco; El Nasr Mining Co and Misr Phosphate Co produce phosphate rock, few companies produce SSP and six companies manufacture urea in Egypt; Somiphos (phosphate rock), Sorfert and Fertial (ammonia and urea), El- Djazairia El- Omania Lil Asmid (urea) in Algeria (Prud’homme, 2016); Gafsa Phosphate Co. (phosphoric acid), Tunisian Chemical Group and Tunisian Indian Fertilizers (processed phosphates) in Tunisia; and Libyan Norwegian Fertilizer Company (Lifeco) produces ammonia/urea in Libya8. OCP in Morocco accounts for 29% of the global phosphate rock exports with a capacity of over 32 Mt; its capacity is planned to reach 55Mt with expansions in Khouribga and Gantour and a new mining complex in Essaouira region (Meskala deposit) in future. In Egypt, phosphate rock mining occurs at El Nasr Mining Co in Sabaiya and at Misr Phosphate Company (MPCo) in Abu Tartur. MPCo plans to expand mining in the New Valley area of Abu-Tartur of about 3Mt for downstream capacity and potential exports (Prud’homme, 2016). There is currently no commercial

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production of potassium anywhere in Africa except a few secondary SOP plants in Egypt that use imported potassium chloride (ACB, 2014).

The paradox still is that most fertilizers (including raw materials and intermediates) produced in Africa are exported to other continents and yet Africa still imports most of its fertilizer (finished products) requirements.

Besides fertilizer manufacturing plants, a number of fertilizer blending plants have been established or are in the process of being established in Africa (Roy, 2016; Camara and Edeme, 2014). These use pre-manufactured products to formulate products for end use and are typically blending plants (AfricaFertilizer.org, 2018a). A total of 59 fertilizer blending plants9 are in Sub-Saharan Africa, spread across Nigeria10 (14), Côte d’Ivoire (6), Ethiopia (5), Zimbabwe (4), Mozambique (4), Zambia (4), Mali (4), Ghana (3), Kenya (3) Malawi (2), Cameroon (2), Burkina Faso (1) Togo(1), Guinea (1) and Mauritius (1) (AfricaFertilizer.org, 2018a; Harrison, 2018). Most often these are established near agricultural production zones. The planned blending projects are 19 with Nigeria (5), Tanzania (4), Côte d’Ivoire (2), Ghana (1), Malawi (1), Niger (1), Rwanda (1), Uganda (1), Senegal (1), Zimbabwe (1), and Burkina Faso (1) (AfricaFertilizer.org, 2018).

2.2.3 Fertilizer Nutrient Supply, Demand and Balance in Africa

As shown earlier, the consumption of fertilizer in Africa is still low (about 3%). However, the forecasted annual growth rate is very high (3.86%) thus indicating a need for increased supply availability in the region, especially as regards potassium (see Table 4 and Figure 13 below)

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9 A full list is available on AfricaFertilizer.org
10 These figures are rapidly changing. Nigeria by April 2018 had a total of 22 blending plants (AfricaFertilizer.org, 2018b)
Table 4: Africa fertilizer forecast, 2015-2020 (thousand tonnes)

<table>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td>6201</td>
<td>7724</td>
<td>8741</td>
<td>9000</td>
<td>9100</td>
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<td>Fertilizer</td>
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<td>3641</td>
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<td>3964</td>
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</tr>
<tr>
<td>Demand</td>
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</tr>
<tr>
<td>Potential</td>
<td>2089</td>
<td>3526</td>
<td>4386</td>
<td>4460</td>
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<tr>
<td><strong>P₂O₅</strong></td>
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<tr>
<td>based on</td>
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<tr>
<td>Potential</td>
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<tr>
<td><strong>K₂O</strong></td>
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<td></td>
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</tr>
<tr>
<td>Supply</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>765</td>
<td>838</td>
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<tr>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

Source: FAO, 2017
Given that nitrogen and phosphate supplies are far exceeding regional demand as a whole, it is necessary to improve intra-African trade to meet growing national and sub-regional requirements and to enhance supply availability and distribution.

The International Fertilizer Association has also made demand projections which are rather more optimistic (Heffer and Prud’homme, 2018). The SSA demand is projected to grow by 8% annually to reach 5.5 Mt nutrients or 2.8% of world fertilizer demand by 2021. Nigeria and Ethiopia are expected to contribute 28% and 18% respectively of the regional demand growth. For Africa as a whole, the demand is projected to grow by 37% from 2016 to 2021 or by 2.2 Mt nutrients to reach 8.1 Mt nutrients (IFA in Harrison, 2018).

The projected fertilizer nutrient supply/demand balances indicate that, contrary to what is often believed, the region would strengthen its position as a major exporter of phosphate, followed by nitrogen. For potash, the region would continue to depend solely on imports (FAO, 2017), see Figure 14 and Figure 15 below.
Figure 14: Projected Surplus/deficits (thousand tonnes) of various fertiliser nutrients in Africa

Source: FAO 2017
Figure 15: Deficits and Surpluses Forecasts (Thousand Tonnes) on Fertilizer Production potential World Over in 2020

Source: FAO, 2017

2.2.4 Fertilizer Exports, Imports and Cross-Border Trade

As Figure 16 below shows, the major exports of fertilizers and raw materials are phosphate rock. This is followed by TSP and urea.
As the figure shows, the rise of urea exports comes from the increase of urea capacity in Africa between 2014 to 2016: for instances, Indorama in Nigeria in 2016 (AfricaFertilizer.org, 2017), MOPCO in Egypt in 2016, and Sorfert and AOA in Algeria in 2013 and 2015. The amount of ammonia has been increasing, though slowly. The increase of urea capacity was associated with an increase of captive ammonia capacity. But there were no merchant ammonia capacity developments.

Figure 17 below shows imports of fertilizers and raw materials to Africa. As the figures show, we have little or no imports on phosphorus rock/phosphoric acid suggesting that most of the needs are met by supply from within the continent. At the same time, most of the potash needs are met by imports because of the low capacity or lack of capacity in potash projects. At the same time, most of the urea fertilizer needs are met by imports.
For ammonia, the imports have been rising, mostly due to new processed phosphate granulation plants in Morocco, which will require more imported ammonia for producing DAP, MAP, NPS and NPKs.

**Figure 17:** Fertilizer and raw materials Imports from 2014-2016 to Africa (000' Metric Tonnes of Products)

Source: IFA Statistics, 2018

This suggests that Africa would be self-reliant on phosphate rock, phosphoric acid and processed phosphates while for ammonia, urea and potash, the continent relies on imports from other continents. In general, most of the fertilizers used in Africa are imported while those that are produced in Africa are exported outside the region. Nevertheless, some degree of inter-regional and intra-regional trade in fertilizers in
Africa does occur (IFDC and FAI, 2017). Much of the trade involves land-locked countries importing from and through coastal countries and other African countries.

The figure 18 below shows the exports and imports for 2016 of a few selected countries in Sub-Saharan Africa. As the figure shows, there are virtually no exports for Burkina Faso (0), Ethiopia (0) and Ghana (0). Most of the exports from Kenya, Mali, Nigeria, Tanzania and Togo are to neighboring countries thereby showing the extent/strength of cross-border trade in fertilizer and raw materials.

![Figure 18: Exports and Imports of a few selected countries in sub-Saharan Africa for 2016 in 000’ Metric Tonnes](image)

Source: AFAP & IFDC, 2017
On cross-border intra-regional trade of fertilizers, this is limited by poor infrastructure, weak economic integration and in some instances conflict. Other factors are cumbersome delays in crossing borders attributed to inefficient custom procedures, bothersome roadblocks/checks and burdensome documentary requirements. This tends to raise transaction costs and hence costs of doing business. Some studies indicate the existence of cross-border trade of fertilizers, though some of this is informal. For instance, studies show informal exports of fertilizers from Malawi to Zambia and also from Malawi to Mozambique. Rwanda also exports about 2,000 metric tonnes of fertilizer to Burundi (USAID, 2013). The problem often cited in cross-border trade is the cumbersome clearance procedures. Burkina Faso imports 95% of its fertilizer requirement from international traders and from bordering countries such as Mali and Côte d’Ivoire (Wanzala-Mlobela et al., 2013).

In COMESA, countries such as Tanzania import fertilizers from manufacturers in Egypt, South Africa and Tunisia while in West Africa, Cameroon imports from Côte d’Ivoire and Tunisia (IFDC, 2015a). Similarly; Botswana, Lesotho, Namibia and Swaziland import fertilizers from South Africa; while Uganda imports fertilizers from Kenya and South Africa (IFDC, 2015a). However, in many cases, products entering in intra-regional imports are sourced from countries outside the continent. For instance, Burundi, Rwanda and Uganda import their fertilizers from overseas via the ports of Mombasa in Kenya and Dar-es-Salaam in Tanzania (IFDC, 2015a). Sudan imports fertilizers from Libya, Egypt and Tunisia, Seychelles imports from Mauritius and South Africa, and Egypt imports from Libya and Morocco (IFDC and FAI, 2017).

In Senegal, most of the imports of fertilizers are from Russia (30.3%), Ukraine (18.2%), Morocco (16.2%), Poland (8.4%), Estonia (6.7%), France (6%), Lithuania (5.1%) and
Egypt (3.1%). The exports from this country go largely to Mali (96.8%) and Burkina Faso (2.7%) (Africafertilizer.org, 2017e).

In Nigeria, most of the fertilizer imports come from Morocco (62.5%), Russia (14.6%), Estonia (5.5%), Belgium (4.7%), UAE (4.4%), Egypt (3%), Ukraine (2.3%), and China (1.2%) (Africafertilizer.org, 2017d). Exports from Nigeria go to Brazil (52.3%), Uruguay (23.4%), South Africa (9%) and Argentina (5.6%). With Côte d’Ivoire, there is no domestic production of fertilizer with most exports being re-exports to Burkina Faso (73.3%), Mali (17.9%) and Togo (5.8%) (Africafertilizer.org, 2017b). The imports come mainly from Morocco (27.7%), Russia (25.8%), Belarus (18.4%), China (5.8%), Germany (2.7%), Poland (2.3%), Spain (2%), Finland (1.9%), and Egypt (1.6%). In Burkina Faso, there is neither domestic production nor export of fertilizers. The imports come from Mali (45.4%), Russia (14%), Côte d’Ivoire (9%) and Morocco (7%) (Africafertilizer.org, 2017a).

With regards to Ghana, all exports are re-exports because the country does not produce fertilizers. Fertilizers are mostly imported in bulk, blended and bagged before transportation. The imports are from Morocco (19.8%), Russia (13.7%), Italy (12.7%), Turkey (10.7%), Estonia (9.8%), China (7.5%), Germany (5.7%), Ukraine (4.1%), Thailand (2.8%), and the US (2.3%) (Africafertilizer.org, 2017c). As for Kenya, 52% of its fertilizer exports were exported to Uganda, 39% to Burundi and the balance of 8% to Rwanda (Africafertilizer.org, 2016).

The fertilizer flows of exports, imports and cross-border trade in Africa are best represented by the Africa Fertilizer Map 2018 (Harrison, 2018). The map (Figure 19) shows that most of the major imports of fertilizer that come from outside Africa into Africa come from China, Saudi Arabia, Qatar, United Arab Emirates, Belarus, Chile, Jordan, Russia, and Germany. The exports from Africa composed mainly of phosphate
rock, NPS, TSP, MAP, Urea and DAP go to Central Europe, West Europe, South Asia, East Asia, West Asia, Latin America, North America, Oceania and Eastern Europe and Central Asia.

Figure 19: Africa Fertilizer Map

Source: Harrison (2018)

The map also shows the major trade corridors that facilitate fertilizer trade in Sub-Saharan Africa: Mombasa (Kenya, Uganda, Rwanda and South Sudan), Dar-es -Salaam (Tanzania, Burundi, Rwanda, DRC Congo, Rwanda and Zambia), Beira (Mozambique, Malawi, Zambia and Zimbabwe), Abidjan and Dakar (Côte d’Ivoire, Mali, Burkina Faso, Senegal and Guinea), Djibouti (Djibouti and Ethiopia), Lomé (Togo, Burkina Faso, and
Nigeria), Cotonou (Benin and Niger), and Durban (Zambia, Zimbabwe, and Mozambique)

2.3. Constraints and opportunities for fertilizer production, use and trade in Africa

Past studies have classified the constraints to fertilizer supply, distribution and effective use in three broad categories; market development constraints, infrastructural constraints and technical constraints (World Bank, 2015; Kissinga, 2007 and Ochieng and Owuor, 2016). These represent challenges that Africa has to deal with effectively in order to achieve agricultural development and transformation as also outlined in blueprints such as the Abuja, Maputo and Malabo Declarations. The constraints are discussed in the following subsections.

2.3.1 Market Development Constraints

Uncertain policy environment

Liberalization and privatization efforts in many African countries have removed price and marketing controls and the private sector has made significant inroads in to fertilizer markets. However, there is a perception that the private sector is not capable of supplying inputs in a cost-effective manner, and governments do intervene directly in the marketplace. According to World Bank, (2015), Zambia bought 48,000 tons of fertilizers in 2003 out of 120,000 tons of total use in the country and distributed that to targeted farmers at half-price. Similarly, the government in Malawi, with support from donors, distributed free inputs to selected poor farmers and, in 2008, the Kenyan government offered fertilizer subsidies to cushion smallholder farmers from soaring prices.
The challenge in this is that, once farmers knew that there is a subsidy, they justifiably refused to buy fertilizers at the full price, and the fertilizer dealer had to incur losses in carryover stocks for a year because fertilizer use is seasonal. Such pronouncements not only produce an adverse impact at the micro level (agro-dealers) but also affect import planning at the macro level. It also creates a subsidy dependency syndrome that potentially negatively affects production since the subsidized fertilizers in most cases are supplied late and in inadequate quantities.

Inadequate human capital

The quantity and the quality of human capital involved in the fertilizer business are limited (Kissinga, 2007), and their linkages with wholesalers and importers are also restricted. Many of these fertilizer dealers lack proper knowledge about fertilizer products, and their proper use and storage. It is not uncommon to find retail shops where the dealers have stocked seed, fertilizer, sugar, pesticides, and flour on the same shelf. Because fertilizer is a knowledge-intensive commodity, the lack of technical knowledge on the part of dealers, handlers and users restricts the development of a more effective fertilizer business.

Limited access to finance

Fertilizer business is generally capital intensive, and access to finance is an important determinant of the importers’ and dealers’ ability to conduct their business activities. The banking sector in many African countries has limited outreach in rural areas. High interest rates and stringent collateral requirements make it difficult to access finance for business development and innovations in the fertilizer sub-sector. Although a number of fertilizer projects have been planned, constraints on financing have led to their delay in development and completion (IFDC and FAI, 2017).
Many commercial banks are risk-averse because they have lost large sums of money in agricultural lending in the past. Poor loan recovery and the lack of mechanisms for contract enforcement in rural areas also discourage the commercial banks from venturing into input business lending (Ochieng et al., 2016). Importers and dealers find the collateral and other lending terms unattractive given the seasonality of agriculture, the relatively low returns from the inputs business, and the high level of risk due to the vagaries of the weather. Moreover, there are generally a few importers per country due to the high cost and difficulty of obtaining finance (Keyser et al., 2015). Loans provided by microfinance banks are inadequate for business development. The point of emphasis is that many commercial banks in African countries have liquidity but are reluctant to advance loans to input dealers. Innovative mechanisms are therefore needed to induce banks to lend for agribusiness development. AFAP is making efforts in this regard by facilitating credit guarantees.

Lack of market information

Market information availability and flow is important for market development because it creates market transparency. This enables planning and reduces transaction costs, which facilitates long-distance trade (IFDC, 2005). Although some countries have started developing market information systems, their coverage on prices and product availability in different market segments is still inadequate; and, due to limited resources, information dissemination is weak. In many countries, the information about regional and global fertilizer markets with importers and wholesalers is seriously limited. The lack of an effective market information system poses a hindrance to the development of well-functioning input markets. Inadequate information makes it difficult; (a) for the government and the private sector to plan ahead to address shortfalls or carryover stocks in the next season, (b) for the private sector to keep abreast
of market requirements and shortages in different parts of the country and plan their marketing strategy accordingly to meet farmers’ needs and maximize their returns; and (c) for market participants to be aware of the current market situation beyond their immediate geographic area. However, there are positive developments in this with the establishment of the AfricaFertilizer.org that maintains a public website providing market information on fertilizers.

**Weak regulatory systems/framework**

In a private sector-led input marketing system, one of the critical roles of government is to protect the interests of consumers and the general public by formulating and enforcing a legal regulatory framework regarding quality, standards and measures, safety in use and disposal of inputs, and business ethics (Gregory, 2006). In countries such as Kenya, where fertilizer laws exist, the enforcement of those laws is inadequate. Proper checking and regulation are needed to ensure truth-in-labelling and quality at the point of sale. A comprehensive regulatory system is required at the country level to protect farmers from unscrupulous traders, distributors and retailers who supply substandard products as fertilizers.

**Size of commodity markets and fertilizer prices**

Demand for fertilizer depends on the farmers’ access to output markets. In Africa, markets are often uncompetitive and farmers often have to travel long distances to access them. This has led to low fertilizer consumption. The small size of national fertilizer markets in SSA pose a challenge raising unit costs as fertilizer moves through the supply chain eventually getting to farmers at twice the prices of the same products in the United States or elsewhere in the global market (Gregory and Bumb, 2006). For example, SSA accounts for about 2% of the global fertilizer market, and at the country
level, the size of the market is even smaller. However, economies of scale are possible with the creation of regional markets (IFDC, 2015a).

Domestic fertilizer prices in Africa are far above the world prices which results in a reduction in the quantity of fertilizer demanded by farmers. This means that at the prevailing fertilizer prices that most small-scale farmers cannot afford and low commodity prices, the economics of fertilizer use is unfavorable. Besides, these fertilizer markets tend to be small and fragmented, and they sell many products. In Malawi, more than 20 fertilizer products are typically available at any given time, a small country in which annual fertilizer sales rarely reach 200,000 product metric tons (World Bank, 2015).

In a number of countries, a few major importers are often multinationals. Some of these include Yara; Export Trading Group (ETG) which operate in many countries such as Kenya, Tanzania, Ghana, and Ethiopia amongst others; and OCP which has greatly expanded its reach to the fertilizer markets in many SSA countries since 2015. Some of these companies are vertically integrated into transport, storage and even setting up their blending plants (Robert and Vikilazi, 2014) thus having monopolistic/oligopolistic competition in the whole supply chain. The lack of competition in some countries is mostly due to procurement systems, which often favor a single company instead of supporting greater competition between players.

In a number of countries, the emergence of local fertilizer companies is helping to lower supply costs and improve distribution. In Ghana, for example, the number of local companies increased from 12 to 38 between 2008 and 2014 and in Tanzania, the increase was from 6 to 46 over the same period (AfDB, 2015).
2.3.2 Infrastructural Constraints

*Road and railway networks*

In many countries, such as Kenya, Zambia, Tanzania, Ghana and Nigeria, main highways and inter-city roads are well maintained, but feeder roads linking main cities to other areas are largely in poor condition and add to transportation costs and make inputs costly. Improvement in rural road networks is essential to promote social and agricultural development and reduces transaction costs (Reardon *et al.*, 2001). Moreover, poor infrastructure also explains the dampened development and delay in completion of fertilizer production projects (IFDC and FAI, 2017).

In general, the road infrastructure in Africa is limited in terms of quantity, quality, or access, and is also characterized by missing regional links (Kingombe, 2017). Less than 20% of the total length of the roads in Africa are paved and a large share of the road networks built in the 1970s and 1980s are in poor condition due to lack of maintenance (Kingombe, ibid).

Only through well-maintained roads can the isolation of rural areas be eliminated. Improvement of rural roads, though a long-term activity, is essential for socioeconomic development. Physical insecurity in rural areas also discourages the development of input business. Many input dealers, especially those operating input businesses in cities and district towns in Nigeria, Malawi, and Zambia reported that they were afraid to open a store in the village stocking fertilizer due to fear of theft (Gregory, 2006). As Gro-Intelligence (2016) argues, reducing transportation costs by 50% would increase the number of plots with profitable fertilizer use by 40%; if costs fell by 75%, then the number of plots could increase by 60%. Indeed, a lot of physical capital has been built up in Africa since the mid-2000s, but at a much slower pace than in other developing areas such as Asia (World Economic Forum *et al.*, 2017).
Intra-regional differences with regard to transport infrastructure are very large. Transport infrastructure is well developed only in South Africa; while in Morocco, the second-best in Africa, is already about 15% less sound than the OECD average, and Chad’s infrastructure is about 50% less efficient than that of Morocco, and more than 60% less efficient than the OECD average (World Economic Forum et al., ibid). Namibia, Kenya, and Ghana have average scores that are 5 to 30% lower than the level attained by Morocco (World Economic Forum et al., ibid).

Although rail transport is generally cost-effective, the network in Africa is old and dilapidated. The state of rail transport in Africa varies enormously from region to region (AfDB, 2015b). A significant number of rail lines connect inland areas with coastal areas and those in South Africa and North Africa are better and more efficient. Sub-Saharan Africa lags behind in terms of network and transportation (AfDB, 2015b). Moreover, the rail transport system is even more poorly interconnected than the roads, since different rail gauges do not allow cross-border network connectivity and usage of the same rolling stock between neighboring countries (Kingombe, 2017).

Apart from the general poor road and railway networks, the use efficiency of the existing infrastructures is poor as well. A more efficient use of the existing infrastructure can reduce transport costs through measures such as rehabilitating existing infrastructure and better budget execution (Sy, 2013). In addition, numerous weighbridges, police checks/road blocks, traffic jams and cross-border delays tend to increase transport times and costs. The development of a single and a more competitive integrated regional road transport market with harmonized policies would also be helpful in bringing coherence and complementarity (Kingombe, 2017) thus improving logistics in the transport sector.

*High transport and handling costs from the port*
Not all countries in Africa have access to the coast. Many countries (such as Mali, Burkina Faso, Uganda, Zambia, Malawi, Rwanda, and Burundi) are landlocked countries. These countries incur huge expenses for transporting goods from the ports to their borders. The mere geographic location of these countries acts against their farmers because farmers in these countries have to pay higher prices for imported fertilizers and receive lower prices for crop products. The cost of fertilizer is largely determined by the costs of importing, including all the related transport and distribution costs and the trader and agro-dealer margins (Roberts and Vilakazi, 2014). Nothing much can be done to overcome the landlocked nature of these countries. Moreover, many of the countries and regions are connected by a network of ageing infrastructure with both roads and trucks being old as in West Africa (Mulholland, 2017). Even with the coastal states, much of the highly productive crop land is located inland. But by developing business linkages with importers in coastal countries, by developing multi-country fertilizer markets, by improving transportation links (especially railways), and by exploring other innovative means, significant improvements could be made in prices and availability of fertilizers.

*Inadequate port facilities*

Poor and limited port facilities tend to raise costs and charges for unloading cargo, site occupation, pilotage, etc. (Mulholland, 2017). These costs often increase because of inefficiencies, lack of adequate maintenance, poor port logistics, and insufficient berthing capacity. The low capacity of ports along with inefficient loading and unloading procedures increases waiting and transfer times as well as processing costs (Mulholland, 2017). A number of ports in Africa cannot adequately handle large ships of more than 20,000 tons, for example, ports of Dar-es-Salaam in Tanzania (FAO and IFDC, 2017) and Beira in Mozambique. Thus, improving port logistics would likely lead
to a reduction of demurrage charges and other associated costs. The improvements of ports, for instance the port of Mombasa, Kenya are critical to increasing regional trade in the EAC with benefits that include reductions in the cost of goods of up 40% (Trade Mark East Africa, 2015). On a positive note, for the quality of seaports and roads, some African countries perform relatively well: the quality of roads in Namibia and ports in South Africa is in line with average levels in advanced economies (World Economic Forum et al., 2017).

Poor input dealer network

Resolution Three of the Abuja Declaration 2006 stated that all African countries should improve farmers’ access to fertilizers by developing and scaling-up input dealers’ and community-based networks across rural areas. Agro-dealer development is key to improving access and availability of fertilizers to farmers. These agro-dealers will make fertilizers available to numerous farm households at affordable prices, in suitable bag sizes and at sales points that are no more than 2 to 5 km from the farm-gate (Wanzala, 2012).

With a good agro-dealer distribution network, there will be increased fertilizer use by farmers due to improved availability (volume, timeliness, variety of bag sizes, range and quality of inputs); access (shorter distances); and affordability (lower retail prices). Although in some countries, such as Kenya, there are more than 3,000 input dealers, in many other countries (Malawi, Zambia, Nigeria, Uganda, Ethiopia, and Madagascar), the number of dealers serving the farming population is limited (Gregory and Bumb, 2006). Moreover, many of these dealers are concentrated in urban or semi-urban areas. Therefore, there is scarcity of dealers in the rural areas near smallholder farms. As a result, farmers must travel long distances to purchase fertilizer, seeds, and other inputs.
Compare this with Thailand where the maximum distance travelled by a farmer is less than 2 km to reach an agro-dealer (Roy, 2014). This raises the cost of inputs to farmers, either limiting the quantities they can afford to purchase or rendering them unable to purchase any inputs at all. Poor road conditions in rural areas exacerbate the situation. Nevertheless, there remains an urgent need to deepen agro-dealer networks to fully penetrate the interior parts of African rural areas.

There have been recent concerted efforts to increase the number of agro-dealers in Africa. In Rwanda, the number of trained agro dealers increased from 10 to more than 1,000; in Ghana, they increased from 2,300 to more than 4000 while in Kenya, the number increased from 1,200 to more than 7,000 over the 2005-2016 period (Roy, 2016). The African Fertilizer & Agribusiness Partnership (AFAP) has been involved in the development of 70 agro-dealer hubs in Africa to improve access for 160 million farmers. In some countries this move has led to a substantial decline in the price of fertilizer for farmers – a drop of USD 2-3 per 50 kg bag in the case of Tanzania (AfDB, 2015). This could be due to increased competition among agro-dealers.
Text Box 2: Support for Agro-dealer Networks and Farmers

The African Fertilizer and Agribusiness Partnership (AFAP) was founded in 2012 to support the work of the Comprehensive African Agriculture Development Program (CAADP), a framework for achieving ambitious agriculture development goals. AFAP builds the capacity and links Hub-Agrodealers and smallholder farmers to input and output markets. The organization also promotes the use of high quality and affordable balanced crop nutrition products, partnering with technology and equipment providers, and facilitating trade finance for fixed assets and inventory via the Agribusiness Partnership Contract (APC) mechanism. AFAP uses the hub and spoke model to reach farmers. The hubs are the larger, better resourced agro-dealers based in the main towns. Each hub agro-dealer is linked to many rural based retail agro-dealers (the spokes) who are based closer to farmers. The network created also benefit fertilizer/seeds importers, local blenders, agro-processors, food companies, financial institutions, ICT companies, and government.

The main services offered by organization include hub-agrodealers capacity development, technical advisory, value chain management, policy design and implementation, and fertilizer and agribusiness platform management. Since inception, AFAP has implemented projects/programs and advised public, private sector clients, NGOs, and donors in: Ghana, Tanzania, Mozambique, Malawi, South Africa, Cote d’Ivoire, Nigeria, Senegal, Rwanda, Kenya, Ethiopia, Democratic Republic of Congo, and Uganda.

The achievements of AFAP so far are: (i) over 5000 hub-agrodealers and retailers in more than 5 countries (ii) over 2000 fertilizers stakeholders received business advice (iii) knowledge sharing with over 3000 stakeholders (iv) 3 fertilizer companies received advice on branding (v) total value of credit facilitated (USD 264 million) (vi) total value of fertilizer financed (USD 571million) (vii) 680,000 tons as volume of fertilizer financed with credit (viii) 7 fertilizer blending plants audited (ix) 5 new fertilizer blends introduced with clients, and (x) fertilizer market assessment conducted in 9 countries.

Source: AFAP, 2018

2.3.3 Technical Constraints

Farmer’s knowledge base and extension service

Resolution ten of the Abuja Declaration aims at improving farmers’ access to quality seeds, irrigation facilities, extension services, market information and soil nutrient testing and mapping to facilitate effective and efficient use of inorganic and organic
fertilizers, while still paying attention to the environment. This helps to improve farmers’ sound technical knowledge of fertilizer products which is critical for promotion of adequate and timely supply of fertilizers in the rural areas. Poor farmer knowledge on the correct use of agricultural inputs is still a serious problem in Africa. Farmers’ perception about the potential impact of fertilizer on yields also affects their demand. Thus, access to information including extension activities, on farm demonstration plots and sharing of experiences by other farmers would enhance fertilizer use (Camara and Heinemann, 2006). Smallholder farmers growing food crops in Kenya for example, primarily use DAP; to them, DAP is the only fertilizer that works and no other can replace it (World Bank, 2007).

Updating fertilizer recommendations is needed through more regular soil sampling and testing in different agro-ecological zones and match input and output market realities faced by farmers and soil fertility requirements. Stockists could also be sensitized to stock the recommended site- and crop-specific fertilizers. In many countries, fertilizer recommendations are based on the fertilizer trials conducted in the 1970s or early 1980s. With changes in cropping patterns, crop mixtures, and continuous cropping, there is need to develop better and more current fertilizer recommendations. Currently, important steps are being taken to fine-tune fertilizers to meet the specific needs of soils and crops. In Kenya, for example, local company MEA Fertilizer & Co. has developed a special blend for grain legumes (AfDB, 2015). There are several such initiatives with products containing sulphur and micronutrients in addition to N, P and K.

Non-responsive soils
Some soils are so degraded that they do not respond to fertilizer applications. African soils have presented inherent difficulties for agriculture and land-use practices during the past several decades. Nutrient mining by crops, leaching, and inadequate erosion control has adversely affected crop productivity (World Bank, 2007).

Africa’s land degradation problems can be attributed to many causes, but the main factor has been the failure by most farmers to intensify agricultural production while maintaining soil fertility. For example, land degradation is reducing agricultural productivity by 2–3% per year in Ethiopia (Yusuf et al. 2005). African agriculture is characterized by soil nutrient loss and in 2002–04, 85% of African arable land had nutrient mining rates of more than 30 kilograms per hectare of nutrients per year, and 40% had rates greater than 60 kilograms per hectare per year (FAO, 2007).

Continuous soil testing and fertilizer trials are therefore needed to establish proper recommendations for fertilizers and lime to replace the lost nutrients and lime to improve the soil ph. Non-responsive soils require more complex interventions, including application of soil amendments (lime, organic matter, etc.) to improve soil fertility. Thus, integrated soil fertility management\(^\text{11}\) and the use of fertilizer technologies that are environmentally friendly such as urea deep placement are also encouraged (IFDC, 2015; Roy, 2016).

**Climate change and other risks**

Climate change, erratic rainfall patterns, lack of irrigation and other risks such as pest and diseases, uncertainty on the fertilizer delivery time, price uncertainty, weak and uncertain land tenure security, reduce the demand for fertilizer (Reardon et al., 1999). It

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\(^{11}\) integration of mineral and organic nutrient sources with soil management practices and cultivar selection and how to adapt these practices to local conditions, aimed at maximizing agronomic use efficiency of the applied nutrients and improving crop productivity. All inputs need to be managed in accordance with sound agronomic principles (Vanlauwe et al, 2010)
is expected that climate change will cause major African staple crops to have 8%-22% lower yields by 2050 (AfDB, 2016b). Findings in Kenya indicate that during hotter climate, farmers are discouraged from purchasing fertilizers because increasing temperatures significantly leads to stunted crop growth and also increases soil erosion, water logging, and outbreak of crop pests and diseases (Ochieng et al., 2015). This means that farmers may have both the knowledge and available resources, but unwilling to take risks of crop losses from adverse weather, pests and diseases, failure of the technology or income losses from adverse market developments.

Reducing risks is thus essential in general. Some of the options include adoption of irrigation (at least supplementary irrigation), drought-tolerant crops/varieties, crop insurance, etc. In comparison with Asia about 40% of the cultivated area is irrigated while in SSA, it is only 3-4% (Burney et al., 2013). Irrigation is the main driver of fertilizer adoption because it strongly reduces risks of crop failure and, therefore, of losing the farmer’s investment in inputs, including fertilizers.

What is needed is to increase the use of climate-smart agriculture that focuses on efficient input use, climate change resilience, and greenhouse gas emission reduction (AfDB, 2016b). We also note that climate change risk is a long-term feature, with short-term impacts.

2.3.4 Opportunities for fertilizer use and production in Africa

Fertilizer consumption in Africa is generally low compared with that of South and East Asia. Low application rate of about 21kg/ha persisted despite the continent’s potential to reverse this and increase crop productivity. However, it is possible to transform fertilizer use and production since the demand for fertilizer in Africa is the fastest growing in the world. At the same time, fertilizer consumption in Africa is the lowest at
about 3% of world fertilizer consumption in 2015. In order to meet this demand and transform, the following opportunities should be well tapped by policy makers.

*Availability of raw materials*

Africa should assess the competitive advantages in exploiting its fertilizer mineral reserves of natural gas, phosphate rock and potash. Natural gas that would be available for fertilizer production is found in Algeria, Angola, Democratic Republic of Congo, Egypt, Equatorial Guinea, Gabon, Ethiopia, Madagascar, Mozambique, Namibia, Nigeria, Tanzania and Tunisia. Numerous phosphate rock reserves abound throughout Africa with substantial deposits in Algeria, Tanzania, Morocco, South Africa, Egypt, Senegal, Togo and Tunisia. Potash deposits are found in Eritrea, Ethiopia, and Congo Brazzaville. The fertilizer nutrient supply/demand balance indicates that Africa would remain a major exporter of phosphate, followed by nitrogen. For potash, the region would continue to depend solely on import. An analysis of viable ventures is needed considering the surplus position of Africa on phosphorus (P) and nitrogen (N).

As discussed earlier, fertilizer production is currently concentrated in Morocco, Algeria, Egypt, Tunisia, South Africa and Nigeria. The countries with fertilizer blending plants include Kenya, Algeria, Burkina Faso, Cameroon, Côte d’Ivoire, Ghana, Guinea, Mali, Nigeria, Togo, Mozambique, Ethiopia, Egypt, Malawi, Mauritius, Tanzania, Zambia, and Zimbabwe (Africanfertilizer.org, 2018)

*Regional integration for fertilizer trade/Regional trading blocs*

Landlocked countries such as Uganda, Chad, Burkina Faso, South Sudan and Malawi, among others, face considerable challenges. The lack of sea access, and the isolation from world markets, with the related high transport and transit costs, have a negative effect on affordable access to fertilizers. Thus, utilization of existing intra-regional
integration, development of trade transit corridors and harmonization of fertilizer policies would assist in reaping economies of size and scope. Although the NEPAD report (2012) on the progress of Abuja Declaration shows substantial progress, inter- and intra-regional African fertilizer trade is still limited (Wanzala, 2012). Hence, regional trade needs a boost through utilizing the existing trading blocs such as ECOWAS, COMESA, SADC and EAC. The recent launch (February 2018) of the Continental Free Trade Area (CFTA) in Africa is expected that to help spur inter- and intra-African trade on fertilizers.

Enhance infrastructural investments in Africa

In Eastern Africa, an opportunity exists to utilize the ambitious infrastructural development projects (see Figure 18 - Africa Fertilizer Map 2018 for existing ports, roads and rail) aiming at improving the service provision and increasing trade in Africa. For example, the standard gauge railway (SGR) project is proposed to connect Kenya and Uganda and one to connect Tanzania, Rwanda and Burundi. The latter is expected to carry 17 million metric tonnes of freight annually and will have six stations, including a dry port at Ruvu. Other large road projects in Africa could enhance regional trade in goods and services, including fertilizers. These include the 756 kilometer stretch of electric rail line linking Addis Ababa and Djibouti launched in 2017 and the construction of the Dichoto-Galafi-Elidar Bolho road in Ethiopia (AFAP and IFDC, 2016).

Planned projects include the Dakar-Port Sudan rail12 and the 2700km West Africa Rail corridor that would connect link Côte d’Ivoire, Burkina Faso, Niger and Benin13.

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The infrastructure investments are not only supposed to be in transport but also in water and energy and all these will undoubtedly lead to more affordable access to fertilizers. The infrastructure financing needs is about USD 130–170 billion a year, with a financing gap in the range of USD 68–108 billion (AEO, 2018).

Role of Information and communication Technology (ICT)

Information access is a critical component for efficient functioning of fertilizer markets. Most African markets are still characterized by information asymmetry where traders are more informed about market prices than farmers. However, this is changing given the extensive information nowadays available on www.africafertilizer.org, a publicly available website. Mobile phones have penetrated rural Africa (being one of major markets) and this is an opportunity to enhance agricultural productivity through adoption of improved technologies such as seeds and fertilizers. For instance, mobile phone ownership among smallholder farmers in Kenya has risen from 1.3% in 2000 to approximately 86% in 2014 (Wanyama et al, 2015). Increased mobile phone coverage among smallholder farmers not only enhances communication but improves agricultural productivity through the sharing of information related to changes in weather patterns, fertilizer market prices, credit, all geared towards helping farmers make informed production and marketing decisions. New forms of farmer extension using text or voice over mobile, and video are reducing the cost and increasing the quality of training of farmers in Africa (AfDB, 2016b).

The MFarms app, developed in Ghana, is helping agro-dealers to reach more farmers through use of ICTs to create awareness of inputs and how to use them. Similar schemes are operating in Kenya, Nigeria and Rwanda (AfDB, 2015). In Nigeria, an e-

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14 The study used panel survey data from 2000 -2014 by Tegemeo Institute of Agricultural Policy and Development, Egerton University, Kenya.
Wallet system for the distribution of input subsidies created both a far more efficient platform for driving input use (AfDB, 2016b).

2.4 Concluding Remarks on Fertilizer Production, Trade and Consumption

Although the fertilizer market in Africa is small, it has been the fastest-growing market in relative terms since 2008. The continent is the major producer of phosphate products, with most being exported. Africa also has large reserves of natural gas and if the ongoing fertilizer projects are completed on time, ammonia/urea production capacity will increase tremendously. Accordingly, the continent is expected to become self-sufficient in urea/ammonia in the near future. With potash, however, the situation is different. As planned projects are likely to face delays due to financial constraints and unfavorable prices.

The production of fertilizers in Africa is concentrated among six countries: Egypt, Tunisia, South Africa, Algeria, Nigeria and Morocco. Sub-Saharan Africa has 59 existing blending plants and 19 planned blending projects. The major consuming countries are Morocco, Tunisia, Algeria, Egypt, South Africa, Nigeria, Ethiopia, Kenya, and Mali. Most of the consumption is driven by government subsidies. However, the policy environment in Africa remains uncertain: access to finance and market information is limited especially to smallholder farmers, and the enforcement of fertilizer regulations is ineffective in many countries. Limited knowledge, inadequate density and capacity of agro-dealers, non-responsive soils, climate change and variability, inadequate ports and poor ports logistics, and poor road and railway networks, along with inefficiency of use, are factors that not only affect agriculture but also fertilizer use, production potential and trade. To increase fertilizer use, production and trade in Africa, policy makers and other stakeholders have must reorient their
conduct, focus and businesses. The inherent bottlenecks in many African countries can be dealt with by:

- ensuring cohesive and consistent policy that govern fertilizer use, production and trade in the respective countries. Most of these are outlined in the Abuja Declaration and NEPAD has been tracking the progress with some countries progressing well. Most countries have fertilizer laws that have existed for more than ten years and need to be reviewed and revised as necessary. However, such policies should be in tandem with the regional trading blocs.
- reducing fertilizer sourcing and distribution costs by improving road and rail infrastructure to reducing high inland transport costs
- strengthening business finance and risk management instruments (for example, by implementing credit guarantee schemes and innovative types of insurance) to availability of finance;
- making climate change and other risk as part of national policy framework as well as encouraging farmers to optimally adapt.
- Soil sampling and testing as well as frequent fertilizer trials possibly through on-farm demonstrations to update fertilizer recommendations in different agro-ecological zones; and
- Deepening of intra-regional integration that center on infrastructure and trade corridors
  - Establishment of national/regional fertilizer trade associations and agro-dealers associations
PART 3: MAPPING FERTILIZER INDUSTRY CLUSTER DEVELOPMENT

3.1 Fertilizer Cluster Development

Africa is one of the most important emerging markets for fertilizers, having the potential to increase the value of its annual agricultural output to USD 500 billion by 2020 according to the African Development Bank (AfDB)\(^\text{15}\). The expected increase in demand of fertilizers in Africa is premised on population growth to about 2 billion in 2050 (Rakshit, 2011). The demand for food is projected to increase by 178% in Sub-Saharan Africa from its current level (Roy, 2014). The fertilizer market in Africa has been rising in relative terms. For instance, the Sub-Saharan Fertilizer market was estimated at 3.7 million tonnes (Mt) nutrients in 2016 of which are 2.0 Mt nitrogen, 1.1 Mt phosphorus, and 0.6 Mt potassium (Heffer and Prud’homme, 2018). Excluding South Africa, SSA fertilizer demand expansion averages about 8% per year since 2008, making SSA the world’s fastest growing market in relative terms (IFA, 2015).

Fertilizer is a bulk commodity traded in the world market that is subject to economies of scale at virtually every stage of the supply chain. As Adesina et al; (2014) argues, for a market size of 500,000 metric tonnes and above, local manufacturing becomes economical. An ammonia/urea production facility, for instance, can cost upwards of about USD 1-3 billion\(^\text{16}\) depending on the level of capacity to establish. Additionally, fertilizer production plants can only be established in areas with sufficient supply of quality raw material, such as natural gas, phosphate rock, or potash (Keyser et al. 2015). Blending plants that produce fertilizer from imported and/or local raw materials can be established at a much lower cost, but fertilizer production is still a business that favors

\(^{15}\) [Http://www.mining.com/african-potash-soars-on-fertilizer-trade-deal](http://www.mining.com/african-potash-soars-on-fertilizer-trade-deal)

large firms and can easily result in monopolies and oligopolies in places like West Africa where market demand is limited (Bumb et al., 2012). Where there are no raw materials present, then they can be imported implying that location at coastal ports would then be most ideal. With blending plants, the closeness to a crop production zone is critical. Thus, well-located smaller NPK blending units can also generate competitive advantages as they are serving specific needs. Opportunistic integrated partnership, for instance, current developments by OCP\textsuperscript{17} in SSA, would also be effective.

Given that Africa has substantial reserves of oil and gas besides phosphate rock and potash, great potential exists for developing fertilizer value chains with both upstream and downstream linkages. Production of fertilizers closer to the feedstock creates tremendous upstream linkages. In developed countries, large-scale petrochemical manufacturing locations have clusters of manufacturing units that share utilities and large-scale infrastructure such as power stations, storage tanks, port facilities, roads and rail terminals. They also induce industrial symbiosis as well as material, energy and utility efficiency and other economies of scale\textsuperscript{18}. Industrial clusters include petrochemical complexes and their co-reinforcing economic benefits where firms integrate their operations through offtake agreements, creating interconnected value chains worth more than the sum of their parts. In addition, countries that are large consumers of fertilizers also provide great possibilities for a market-seeking fertilizer plant.

\textsuperscript{17} Morocco’s OCP has opened up thirteen subsidiaries across Africa including subsidiaries in the Ivory Coast, Senegal, Benin, Cameroon and Ghana. It has formed partnerships with governments to supply phosphate fertilizers. OCP plans to set up a fertilizer storage and blending unit at the port of Abidjan (Ivory Coast) to serve as a sub-regional distribution center. There are also plans for the company establish up ten new “farmer house” centers across Africa by 2020. The centers which would be strategically located are meant to make fertilizers easily accessible to smallholder farmers (Mulholland, 2017).

\textsuperscript{18} Agricultural Chemical plant value chain marketing Intensive farming Agribusiness Inventions. Available at http://panooralk.blogspot.co.ke.
The important key factors for the location of a fertilizer manufacturing plant are: abundant and economic sources of raw materials (natural gas, phosphate rock and potash deposits); availability of cost-effective power and water supply; affordable manpower; adequate, economic and efficient transportation system. Availability of finance, access to other crop inputs and adequate local markets with adequate competitiveness, and/or export opportunities.

According to Alte Nburg and Meyer-Stame (1999), the key building blocks of the fertilizer value chains are: abundant sources of raw materials (natural gas, phosphate and potash deposits); transport of raw materials to processing plant either through a pipeline or by rail or road; processing plant; transport facilities and logistics to move fertilizer to distributors/wholesalers within the country and abroad (here excellent port facilities for exports and good roads/rail system for the domestic market are critical); agro-dealers/stockists; and a large consumer market. AEO (2014) is of the view that African manufacturing covers a wide variety of industries and has grown alongside increasing participation in global and regional value chains. The report also states that manufacturing activities exhibit a fairly high share of global and regional value-chain integration. The report further argues that participating in manufacturing value chains can also help improve both forward and backward linkage activities.

On-going initiatives include Boosting Intra-African Trade (BIAT) Action Plan, informed by the desire to optimize benefits from the regional integration process with seven clusters in this Action Plan, and the Accelerated Industrial Development in Africa (AIDA). The strategies under BIAT and AIDA aim at expanding cross-border trade and also facilitate value chain development across borders in specific sector and product development. These initiatives are crucial in fertilizer production cluster development.
3.2 Conceptual Mapping of Potential Fertilizer Production for Africa

Africa is a net importer of processed fertilizers, yet it has adequate potential for fertilizer production (AfricaFertilizer.org 2015). This is premised by the availability of raw materials that are necessary for fertilizer production and access to markets on a sustainable, economic basis. Africa is currently in transition and opportunities may arise in the future. Although Africa contributes a small fraction to world production of fertilizers with the exception of phosphorus fertilizers and nitrogen in the near future (see figure 20 below), the potential is very high (see also figures 26-29 in the annex).

![Figure 20: Africa’s Share of World Fertilizer Production (Nutrients) (in %) in 2016](image)

Source: *IFA Statistics, 2018*

The potential for fertilizer production in Africa is largely influenced by the following:
(a) **Recent discoveries of natural gas.** Exploration has shown that Africa has adequate reserves of natural gas that can be used in the production of nitrogen fertilizers. The countries with estimated natural gas are Nigeria (180 Tcf), Mozambique (75 Tcf), Tanzania\(^\text{19}\) (57 Tcf), Egypt\(^\text{20}\) (30 Tcf) Algeria (159.1 Tcf), Libya, Gabon, Ethiopia and Equatorial Guinea. There is on-going production of fertilizer in North Africa, West Africa, Central Africa, Eastern Africa and Southern Africa due to the presence of large deposits of natural gas (AfricaFertilizer.org, 2015). Estimates show that one tonne of urea requires about 26 million BTUs of gas to produce\(^\text{21}\). Despite the presence of natural gas deposits, less than 10% of Africa’s natural gas is used to make fertilizers\(^\text{22}\). As figure 21 below shows, only about 7.4 Mt of ammonia was produced in 2016.

![Diagram showing fertilizer production in Africa](image)

**Total production = 7.4 Mt**


Figure 21: Ammonia production in 2016

Source: IFA Production & International Trade, 2018

Besides natural gas, crude oil and coal are also sources for nitrogen fertilizer production in some countries. The African countries that produce coal are South Africa and Zimbabwe while Nigeria is known to have coal deposits. While the top oil-producing countries in Africa are Nigeria, Algeria, Angola, South Africa, Gabon, Equatorial Guinea, South Sudan, Egypt, Republic of Congo and South Sudan. Many other countries have discovered oil though they are yet to start producing. Nevertheless, ammonia production from oil is less economic and less energy efficient, while coal is not environmentally friendly.

(b) Phosphates deposits: Some of the countries include Senegal, Togo, Tanzania, Zimbabwe, South Africa, Malawi, Ghana, Morocco, Tunisia, Algeria and Egypt. Mali also has deposits of phosphate rock with a potential capacity of about 36,000 MT per year (IFDC, 2015b). Estimates of reserves of phosphorus deposits in Uganda are at about 230 million metric tons (IFDC, 2014b). About 85% of global phosphate reserves are located in North Africa with Morocco being the most important location of high-quality phosphate rock in the continent. Morocco produced 27 million metric tonnes of phosphorus in 2011 and is estimated to have reserves of 50 billion metric tonnes (see Table 5). While in South Africa, the reserves are estimated to be 1,500 million metric tonness.

23 http://venturesafrica.com/africas-coal-producing-countries-to-exploit-increasing-global-demand
24 http://www.africanranking.com/top-10-oil-producing-countries-africa
26 Morocco has started production of fertilizers exclusively for the African market. The new fertilizer plant can produce 1 million tonnes of fertilizer, 1.4 million tonnes of sulfuric acid and 450,000 tonnes of phosphoric acid annually (http://af.reuters.com/article/commoditiesNews/idAFL8N15G3YV)
Figure 22: Phosphate rock production in 2016

Source: *IFA Production & International Trade, 2018*

(c) **Potassium deposits**: Exploration and pre-development activities on potash are going on in Republic of Congo (Sintoukola); Lake Dinga; Mengo Potash; Tchitondi/Manenga), Ethiopia (Circum Minerals) (Prud’homme, 2016). Danakil reserves in Ethiopia are estimated at 4.2 billion tons \(^{27}\) while Colluli reserves in Eritrea are estimated at 1.1 billion tons.

(d) **Other factors**: Some of the most other important factors include low-cost and sustained feedstock supply, proximity to consumers, large operations for economies of scale (they could also be smaller scale to serve local isolated markets), modern technology, better business environment and appropriate infrastructure\(^{28}\). While the availability of raw materials is important in mapping production potential,

\(^{27}\) [http://allafrica.com/stories/2015051111714.html](http://allafrica.com/stories/2015051111714.html)

consumption potential “economically” can be key. Africa can learn a lot from India that is encouraging its companies to establish joint production ventures with other companies in other parts of the world. The same applies with Morocco OCP, Egyptian companies and Indonesian companies which have invested in nitrogen capacity projects since 2010. Due to constraints in the availability of natural gas in India, which is the preferred feedstock for the production of nitrogenous fertilizers, a near-total dependence on imported raw materials for production of phosphate fertilizers and full import dependence for MOP, India has been encouraging its companies to establish joint venture production facilities with buy-back arrangement in other countries, countries that are rich in fertilizer resources and to enter into long-term agreements for the supply of fertilizers and fertilizer inputs to India\textsuperscript{29}.

Table 5: Estimated reserves of fertilizer raw materials in Africa

<table>
<thead>
<tr>
<th>Country</th>
<th>Natural gas estimates (trillion cubic meters)\textsuperscript{30,31}</th>
<th>Phosphorus (thousands of tons) \textsuperscript{32,33}</th>
<th>Potash deposits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cluster 1-AMU Region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>65</td>
<td>100,000</td>
<td>None</td>
</tr>
<tr>
<td>Morocco</td>
<td>1.5</td>
<td>50,000,000 (Morocco and Western Sahara)</td>
<td>None</td>
</tr>
<tr>
<td>Libya</td>
<td>1505</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Mauritania</td>
<td>28.32</td>
<td>100,000</td>
<td>None</td>
</tr>
</tbody>
</table>

\textsuperscript{29} http://fert.nic.in/page/overseas-projects-or-joint-venture-projects
\textsuperscript{30} https://www.cia.gov/library/publications/the-world-factbook/rankorder/2253rank.html
\textsuperscript{31} https://en.wikipedia.org/wiki/List_of_countries_by_natural_gas_proven_reserves, Accessed on 13\textsuperscript{th} March,2018
\textsuperscript{32} IFDC, 2010 available at http://pdf.usaid.gov/pdf_docs/Pnadw835.PDF
\textsuperscript{33} US Geological Survey, Mineral Commodity Summaries, January 2018
<table>
<thead>
<tr>
<th>Country</th>
<th>Cluster</th>
<th>Fertilizer Production</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td></td>
<td>4505</td>
<td>2,200,000</td>
</tr>
</tbody>
</table>

**Cluster 2 – ECOWAS Region**

<table>
<thead>
<tr>
<th>Country</th>
<th>Cluster</th>
<th>Fertilizer Production</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senegal</td>
<td></td>
<td>None</td>
<td>50,000</td>
</tr>
<tr>
<td>Ghana</td>
<td></td>
<td>165</td>
<td>None</td>
</tr>
<tr>
<td>Togo</td>
<td></td>
<td>None</td>
<td>30,000</td>
</tr>
<tr>
<td>Nigeria</td>
<td></td>
<td>5246</td>
<td>None</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td></td>
<td>28.32</td>
<td>None</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td></td>
<td>None</td>
<td>60,000</td>
</tr>
<tr>
<td>Mali</td>
<td></td>
<td>None</td>
<td>12,000</td>
</tr>
<tr>
<td>Benin</td>
<td></td>
<td>1.133</td>
<td>None</td>
</tr>
</tbody>
</table>

**Cluster 3 – EAC Region**

<table>
<thead>
<tr>
<th>Country</th>
<th>Cluster</th>
<th>Fertilizer Production</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td></td>
<td>5</td>
<td>None</td>
</tr>
<tr>
<td>Uganda</td>
<td></td>
<td>None</td>
<td>230,000</td>
</tr>
<tr>
<td>Tanzania</td>
<td></td>
<td>1614</td>
<td>375,100</td>
</tr>
<tr>
<td>Rwanda</td>
<td></td>
<td>56.63</td>
<td>None</td>
</tr>
</tbody>
</table>

**Cluster 4 – SADC Region**

<table>
<thead>
<tr>
<th>Country</th>
<th>Cluster</th>
<th>Fertilizer Production</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa</td>
<td></td>
<td>400</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td></td>
<td>None</td>
<td>124,000</td>
</tr>
<tr>
<td>Mozambique</td>
<td></td>
<td>2832</td>
<td>274,000</td>
</tr>
<tr>
<td>Botswana</td>
<td></td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

**Cluster 5 – ECCAS Region**

<table>
<thead>
<tr>
<th>Country</th>
<th>Cluster</th>
<th>Fertilizer Production</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td></td>
<td>271.8</td>
<td>None</td>
</tr>
<tr>
<td>Congo –DR</td>
<td></td>
<td>0.99</td>
<td>None</td>
</tr>
<tr>
<td>Republic of Congo</td>
<td></td>
<td>90.6</td>
<td>None</td>
</tr>
<tr>
<td>Gabon</td>
<td></td>
<td>28.32</td>
<td>None</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td></td>
<td>36.81</td>
<td>None</td>
</tr>
<tr>
<td>Cameroon</td>
<td></td>
<td>135.1</td>
<td>None</td>
</tr>
</tbody>
</table>

**Cluster 6 – IGAD Region**

<table>
<thead>
<tr>
<th>Country</th>
<th>Cluster</th>
<th>Fertilizer Production</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td></td>
<td>2180</td>
<td>1,300,000</td>
</tr>
<tr>
<td>Sudan</td>
<td></td>
<td>85</td>
<td>None</td>
</tr>
<tr>
<td>Ethiopia</td>
<td></td>
<td>28.32</td>
<td>None</td>
</tr>
<tr>
<td>Eritrea</td>
<td></td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Sources: Various (USGS, 2018; USGS, 2000; IFDC 2015b; IFDC, 2010),

As has been argued earlier, it is important for countries within the defined clusters to cooperate when it comes to not only fertilizer production but also marketing. No
country, for instance, has all the required raw materials for fertilizer production. By cooperating in terms of sourcing raw materials, encouraging cross-regional trade and even cooperating in regional harmonization of both trade and fertilizer policies, they open up major opportunities for economies of scale. Moreover, regional infrastructure projects such as roads and rail networks are crucial to connect landlocked countries with the ports.

### 3.3 Mapping of Viable Fertilizer Plants in Africa

For mapping of viable fertilizer plants, SWOT analysis was used. Some of the factors considered are:

(i) **Location.** This is a very important factor. Countries with port facilities. As it has been observed, oil refineries are often located close to ports. This is to facilitate the export of the petroleum products once processing has been done. In view of this, countries with excellent port facilities and have natural gas could easily enhance fertilizer cluster development.

(ii) **State of infrastructure:** This includes roads and rail network linking the ports and the neighboring countries. For instance, although Mali has deposits of phosphate rock, poor road infrastructure and civil unrest has hindered successful market development (IFDC, 2015b). We use infrastructure ranking from the 2017 Ibrahim Index of African Governance. This index has five indicators that include transport infrastructure, electricity, digital & IT, access to improved water, and water & sanitation.

(iii) **Volume of domestic consumption of fertilizer.** Capacity improvements have occurred in areas with high domestic demand (Prud’homme, 2016).

(iv) **Proximity to and/or ownership of reserves of natural gas, phosphate rock deposits and quality of ore.**
(v) Size of the economy and conducive business environment. We use the 2018 World Bank Index of Business environment.

(vi) Political environment and governance issues: A poor political environment constrains proper market development of fertilizer to warrant a fertilizer plant. Examples of such countries are DRC Congo and Mali\(^3\). Political stability rankings were used in the SWOT analysis below.

### 3.2.1 SWOT Analysis for Cluster 1

This cluster covers the Arab Maghreb Union consisting of Tunisia, Morocco, Libya and Mauritania and is the highest in terms of fertilizer usage of about 103Kg/ha. These countries could benefit from economies of scale by expanding their fertilizer plants or exporting into countries with very limited number or no fertilizer plants where raw material exist and still unexploited.

<table>
<thead>
<tr>
<th>Table 6: SWOT Analysis of cluster 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
</tr>
<tr>
<td>Tunisia</td>
</tr>
<tr>
<td>Morocco</td>
</tr>
</tbody>
</table>

\(^3\) [https://www.theglobaleconomy.com/rankings/wbPoliticalStability/](https://www.theglobaleconomy.com/rankings/wbPoliticalStability/)

\(^3\) World Bank ranking of ease of doing business.

<table>
<thead>
<tr>
<th></th>
<th>natural gas</th>
<th>Low</th>
<th>good Port and fair road infrastructure. No. 16 (45.8)</th>
<th>45th in Africa</th>
<th>7</th>
<th>-2.28 very Unstable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Libya</strong></td>
<td>Large reserves of natural gas</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mauritania</strong></td>
<td>Low reserves of natural gas</td>
<td>low</td>
<td>No.32 (36.6)</td>
<td>24th in Africa</td>
<td></td>
<td>-0.74 Slightly Unstable</td>
</tr>
<tr>
<td><strong>Algeria</strong></td>
<td>Large deposit of phosphate rock, natural gas, and oil</td>
<td>Large domestic consumption</td>
<td>Yes, a large exporter of urea and phosphate rock, highly developed fertilizer industry</td>
<td>good Port and fair road infrastructure</td>
<td>34th in Africa</td>
<td>4th in GDP rank in Africa</td>
</tr>
</tbody>
</table>

**Overall Assessment of Cluster 1**

| Generally, has large deposits of fertilizer mineral reserves | Region has 3 countries with large domestic market (Morocco, Tunisia and Algeria) | Region has 3 countries with highly developed fertilizer industry (Morocco, Tunisia and Algeria) | Excellent ports and good access to the European market | Generally poor | Largely among top ten | Has challenges of instability though not chronic though manageable with the exception of Libya |

Most of the urea and phosphorus from this region is exported to Europe. An extensive multi-year vertically-integrated phosphate program is being implemented in Morocco in which fertilizer granulation capacity would increase by more than 10 Mt. Morocco exports a substantial amount of phosphorus rock and processed phosphates to other African countries. OCP Africa has a total of 21 offices, agronomy and foundation led projects in east, west and southern Africa and is heavily investing in several projects in Africa (Harrison, 2018). In 2017, it exported 2.5 million tonnes of fertilizers, a 50%
increase on the year before, including over 1.9 million tonnes of NPKs/NPs (Harrison, Ibid).

Other phosphate projects have been planned for Algeria and Tunisia (Prud’homme, 2016). The commissioning of Sorfert ammonia plant in Arzew, Algeria with a capacity of 730 Kt had added more capacity. Two new ammonia-urea plants of El-Djazairia El-Omania Lil Asmda opened in 2015 at Edeola/Bahwan each with a capacity of 1.15Mt urea, Fertial is expanding in Annaba and Arzew to add 330Kt of ammonia in Algeria (Prud’homme, 2016). But support could be considered for modern large plants to substitute for older and smaller ones (Prud’homme, 2016).

3.2.2 SWOT Analysis for Cluster 2

This cluster covers West Africa and hosts some of the huge agricultural production zones as well ECOWAS and UEMOA trading blocs (Table 7). It is the most viable cluster in the sense of abundance of raw materials, particularly phosphate rock and natural gas for setting up a fertilizer plant. It also has a huge demand for fertilizer that ranges from medium to large agricultural potential. Further, there are excellent ports and good road network for over 50% of the countries in the region. The political environment is, however, mixed with the current problem facing this region being instability in Burkina Faso and terror activities in Nigeria and Mali. The region also harbors some of the largest economies in Africa, such as Nigeria, Ghana, and Côte d’Ivoire. In addition, there are blending plants with appreciable capacity installed in Burkina Faso (CIPAM), Côte d’Ivoire (YARA and STEPC), Ghana (Yara, Golden Stork), Mali (SOGEFERT, Toguna Agro Industries), Nigeria (NOTORE, Golden Fertilizers, TAC Agro), Togo (WabcoCotia, SOTAGRI), and Senegal (SENCHEM) (Fuentes et al., 2011; UEMOA, 2013; Ayoola, 2014).
A concerted effort to upgrade port facilities in the region has been going on in recent years. For instance, a USD 1.5 billion upgrade of Tema Port in Ghana has commenced, aiming to triple capacity by the end of 2019. This follows upgrades at Abidjan Port in Côte d’Ivoire, started in 2015, and a planned upgrade of Conakry Port in Guinea confirmed in late 2016 (Mulholland, 2017).

Inadequate and poor land transportation adds substantial extra costs to remote inland markets. West Africa covers millions of square kilometers, much of it connected by a network of ageing infrastructure. Both roads and trucks are old and poorly maintained. Rail infrastructure where it exists – such as between Dakar and Bamako – can reduce costs when scheduling allows. Major roads are marginally more common in West Africa, but are often plagued by potholes and degraded paving. Most countries in the region do not have axle load limits, and so roads deteriorate much faster than they can be maintained. Roads can also be dotted with dozens of checkpoints that push up the delivered costs yet further (Mulholland, 2017a).

Thus, efforts that should continuously be encouraged in this cluster are therefore the investments in both roads and rail infrastructure together with opening up competition in the truck industry with a view to substantially bringing down transport costs. For countries with coastline, fertilizer could be transported by sea. There should be continuous efforts to reduce delays in the movement of goods especially at the border points.
Table 7: SWOT Analysis of cluster 2

<table>
<thead>
<tr>
<th>Country</th>
<th>Abundance in raw materials</th>
<th>Potential Domestic consumption</th>
<th>Already producing some fertilizers</th>
<th>Infrastructure available</th>
<th>Business environment ranking</th>
<th>Size of GDP</th>
<th>Political Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mali</td>
<td>Has deposits of rock phosphate</td>
<td>Large consumption potential (590,654 tonnes); 805,879 tonnes in 2017</td>
<td>Yes, phosphate rock - Toguna Agro Companies</td>
<td>No Port and poor road infrastructure. No. 22(41.4)</td>
<td>19th in Africa</td>
<td>low</td>
<td>-1.56 Unstable</td>
</tr>
<tr>
<td>Senegal</td>
<td>Large deposit of phosphate rock</td>
<td>Low consumption of fertilizer (148,652 tonnes); 212,192 in 2017</td>
<td>Yes, phosphoric acid, DAP and NPK Complex (ICS and SERPM companies)</td>
<td>Good Port in Dakar. No. 19 (44.1) and fair road infrastructure</td>
<td>18th in Africa</td>
<td>Low</td>
<td>-0.28 slightly unstable</td>
</tr>
<tr>
<td>Niger</td>
<td>No record</td>
<td>Small consumption of fertilizer</td>
<td>None</td>
<td>No port, but fair road infrastructure. No. 39 (33.9)</td>
<td>20th in Africa</td>
<td>low</td>
<td>-1.14 slightly stable</td>
</tr>
<tr>
<td>Benin</td>
<td>No record</td>
<td>Small consumption of fertilizer</td>
<td>None</td>
<td>No port, but fair road infrastructure. No.38 (34.4)</td>
<td>25th in Africa</td>
<td>low</td>
<td>0.05 very slightly unstable</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>No record</td>
<td>Moderate consumption of fertilizer (283,241 tonnes)</td>
<td>None but has blender and Dolomite (Faso Fert and Tropic Agro Chem)</td>
<td>No port, but fair road infrastructure. No.44(24.6)</td>
<td>23rd in Africa</td>
<td>low</td>
<td>-0.95 slightly unstable</td>
</tr>
<tr>
<td>Country</td>
<td>Description</td>
<td>Potential</td>
<td>Production Levels</td>
<td>Good to Excellent Ports and Roads Are Adequate</td>
<td>GDP Rank</td>
<td>Income Rank</td>
<td>Scenarios</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------</td>
<td>------------------</td>
<td>-------------------------------------------------</td>
<td>----------</td>
<td>-------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>Some crude oil and natural gas</td>
<td>Medium</td>
<td>None but has 2 blenders (OCP Africa and C. d’Ivoire Formulation)</td>
<td>Good port at Abidjan and good road infrastructure. No.11(54.2)</td>
<td>17th</td>
<td>15th</td>
<td>-0.93 Slightly unstable</td>
</tr>
<tr>
<td>Ghana</td>
<td>Large deposits of phosphate rock and oil production</td>
<td>Moderate</td>
<td>None but has blender (Glo Fert)</td>
<td>Excellent port at Accra and fair road infrastructure. No.24(40.1)</td>
<td>12th</td>
<td>11th</td>
<td>-0.16 Slightly unstable</td>
</tr>
<tr>
<td>Togo</td>
<td>Low consumer of fertilizer (61,259 tonnes)</td>
<td>Low</td>
<td>Yes, phosphate rock (SNPT company)</td>
<td>No port. No.26(39.6).</td>
<td>27th</td>
<td>low</td>
<td>-0.20 Slightly unstable</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Large oil and natural gas reserves, also has coal</td>
<td>High</td>
<td>Yes, three huge ammonia-urea complexes are under commissioning or operating (Notore, Indorama Eleme and Dangote) and several blenders</td>
<td>Excellent ports and good road infrastructure. No.41 (33.2)</td>
<td>21st</td>
<td>1st</td>
<td>-1.89 Unstable</td>
</tr>
</tbody>
</table>

**Overall Assessment of Cluster 2**

- Appreciable deposits of phosphate, natural gas and oil
- Potential medium to large consumers of fertilizer
- Moderate production levels, but with high potential
- Good to excellent ports and roads are adequate
- Good to moderate
- Among the largest economies
- All scenarios exists
Capacity developments in urea are expected to rise from 4.1 Mt in 2015 to 8.0 Mt by 2020 in Nigeria (Prud’homme, 2016). This includes Indorama Eleme (1.3Mt Urea in 2016), Dangote I and Dangote II of 1.27Mt each that are expected to be commissioned soon. Moreover, Notore is upgrading their production capacity from 500 Kt to 750 Kt while Indorama is also upgrading their capacity to 3.0 Mt (AfricaFertilizer.org, 2018b). This will increase domestic and regional supply and would tend to reduce the high dependency on imports.

Morocco’s OCP Company has been building and improving its distribution network of phosphate fertilizers in West Africa which includes a storage facility and a blender in Côte d’Ivoire (Mulholland, 2017b). The company has dedicated one of its recently completed Jorf Lasfar hubs, the “Africa Fertilizer Complex” to supplying African markets.

Overall, the region is an excellent production and consumption point. Given the existing and on-coming N and P capacity in the region, opportunities for additional bulk blend units or NPK units, and also storage facilities should be considered. The most critical is strengthening distribution infrastructure

3.2.3 SWOT Analysis for Cluster 3
The cluster is composed of Kenya, Tanzania, Uganda, Rwanda and Burundi. This cluster exhibits small/moderate to large consumption of fertilizer but with appreciable deposits of phosphorus and natural gas. The cluster has excellent ports in Kenya and Tanzania and provides major transport corridors to the hinterland countries using two main road corridors i.e. the Tanzania-Burundi-Rwanda and the Kenya-Uganda-Rwanda. The stability and level of industrialization in the cluster provide a major asset
for establishment of a production point, with Kenya being one of the most industrialized in the region and with high demand levels (See Table 8 for more details).

**Table 8: SWOT Analysis of Cluster 3**

<table>
<thead>
<tr>
<th>Country</th>
<th>Abundance in raw materials</th>
<th>Potential Domestic consumption</th>
<th>Already producing some fertilizers</th>
<th>Infrastructure available</th>
<th>Business environment ranking</th>
<th>GDP ranking</th>
<th>Political Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>Oil reserves</td>
<td>Large consumer of fertilizer (621,000 tonnes); 802,416 tonnes in 2017</td>
<td>Yes, SSP and sulphuric acid (Kel Chemicals LTD) but 4 blending plants (ETG, MEA, ARM and Toyota Tsusho) are operational</td>
<td>Excellent port and road network. No.13 (52.4)</td>
<td>4th in Africa</td>
<td>9</td>
<td>-1.42 Unstable</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Large deposits of phosphate rock and natural gas (57 Tcf), has oil reserves</td>
<td>Moderate consumer of fertilizer (289,687 tons); 349,491 tonnes in 2017</td>
<td>Minjingu fertilizer and blending plants (Export Trading Company and OCP Africa, Life Support Systems, Tanzania Mbolea)</td>
<td>Excellent Port and medium road. No.34 (36.1)</td>
<td>15th in Africa</td>
<td>13</td>
<td>-0.41 slightly unstable</td>
</tr>
<tr>
<td>Uganda</td>
<td>Oil reserves, though yet to be exploited, Large reserves of</td>
<td>Low Consumption of fertilizer (61,000 tons)</td>
<td>None but has blender (Grain Pulse Ltd)</td>
<td>No Port but good transport corridor of</td>
<td>13th in Africa</td>
<td>17</td>
<td>-0.72 slightly unstable</td>
</tr>
<tr>
<td>Country</td>
<td>Deposits of phosphates</td>
<td>Low Consumption of fertilizer (40,000 tons); 45,000 tonnes in 2017</td>
<td>None but there is a planned blender project</td>
<td>No Port, but excellent roads. No. 17 (45.3)</td>
<td>2nd Ranked business environment</td>
<td>Low Consumption of fertilizer (47,000 tons); 50,127 tonnes in 2017</td>
<td>None</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------</td>
<td>-------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td><strong>Rwanda</strong></td>
<td>Limited deposits of phosphates</td>
<td>Low Consumption of fertilizer (40,000 tons); 45,000 tonnes in 2017</td>
<td>None but there is a planned blender project</td>
<td>No Port, but excellent roads. No. 17 (45.3)</td>
<td>2nd Ranked business environment</td>
<td>Low Consumption of fertilizer (47,000 tons); 50,127 tonnes in 2017</td>
<td>None</td>
</tr>
<tr>
<td><strong>Burundi</strong></td>
<td>No records</td>
<td>Low Consumption of fertilizer (47,000 tons); 50,127 tonnes in 2017</td>
<td>None</td>
<td>No port but transport corridor to DRC Congo. No. 42 (32.4)</td>
<td>33rd in Africa</td>
<td>Low</td>
<td></td>
</tr>
</tbody>
</table>

Kenya is mainly favored because of the huge fertilizer market and the planned infrastructure project of LAPSSET that seek to connect South Sudan, Uganda, Ethiopia and the Lamu port when completed. A large fertilizer blending plant in Kenya by Toyota Tsusho Fertilizer Africa Limited (TTFA)\(^6\) is already in operation. In 2017, MEA began construction of its granulation plant in Nakuru while ETG blending plant in Mombasa is now operational (Africafertilizer.org, 2018c). The SGR rail line from Mombasa to Nairobi opened in May 2017. A fertilizer blending plant was installed by

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Grain Pulse during 2017 in Uganda. The Tororo Phosphate project has been slowed by land settlement issues. The completion date is unclear (AFAP & IFDC, 2017).

However, at the same time, Tanzania has large reserves of natural gas and is served by the transport corridor to southern Tanzania, Rwanda, DRC Congo and Malawi. In 2016, the construction of the Tanzania-Rwanda-Burundi railway began with Phase I, 205 km from Dar-es-Salaam to Morogoro to be completed by October 2019. Phase I is expected to carry 17 million metric tonnes of freight annually and will have six stations, including a dry port at Ruvu. In 2017, the Tanzanian government introduced a federal policy (Bulk Procurement System) in which the government will arrange for the tender and importation of major fertilizer commodities into Tanzania. The year 2017 was a trial one in which the government consolidated orders for urea and DAP. Under the Bulk Procurement Scheme (BPS), TFRA will assess demand, conduct competitive bidding, award tenders, and enforce regulations of the bulk procurement act, which includes setting and policing end-user pricing (AFAP & IFDC, 2017). A large ammonia-urea complex (1.3 Mt) as a consortium of Tanzania Petroleum Development Corporation (TPDC), Ferrostaal, Haldor Topsoe and Fauji Fertilizer Company is being considered in Tanzania and is planned to start production in 2021 (Prud’homme, 2016). Moreover, Tanzania also has phosphates deposits. To date, Tanzania produces Minjingu fertilizer from rock phosphates in quantities of about 100 Kt of phosphate rock and 30 Kt of NPKs per annum (Harrison 2017). Lime supplement production in Tanzania is by ABM equipment Services Limited and Poli General Trading and Supplies Limited (Africafertilizer.org, 2018c). In addition, the country plans to build a bigger port at Bagamoyo.
In this cluster the planned large fertilizer project and the existing Minjingu in Tanzania, the planned small project in Uganda and the existing small fertilizer plant in Kenya can serve the cluster. What is needed are storage facilities and blending plants that are strategically located and the expansion/improvement of rural infrastructure in addition to deepening of regional integration.

### 3.2.5 SWOT Analysis of Cluster 4

This cluster covers South Africa, Zimbabwe, Zambia, Mozambique, Botswana, and Namibia. It exhibits appreciable deposits of phosphorus and natural gas. There is a large production of nitrogen, phosphate and NPK fertilizers in South Africa with limited production in Zimbabwe and Zambia. The cluster has huge potential for consumption from medium to large consumers such as Zambia, Zimbabwe, Malawi and South Africa (see Table 9).
Table 9: SWOT Analysis of Cluster 4

<table>
<thead>
<tr>
<th>Country</th>
<th>Abundance in raw materials</th>
<th>Potential Domestic consumption of fertilizer (1,950,000 tons)</th>
<th>Already producing some fertilizers (large)</th>
<th>Infrastucture available (large)</th>
<th>Business environment ranking (large)</th>
<th>Size of GDP (large)</th>
<th>Political Environment (large)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa</td>
<td>Large reserves of phosphorus and some natural gas deposits</td>
<td>Large consumption of fertilizer</td>
<td>Yes, many fertilizer plants. Have highly developed fertilizer industry</td>
<td>Excellent ports, roads. No. 7 (63.4)</td>
<td>6th in Africa</td>
<td>2</td>
<td>-0.13 slightly unstable</td>
</tr>
<tr>
<td>Zambia</td>
<td>None</td>
<td>Moderate consumption of fertilizer (437,000 tons)</td>
<td>None but has blenders (Yara fertilizer Zambia, Nitrogen Chemicals of Zambia) producing N and NPK fertilizers</td>
<td>No Port but transport corridor. No. 27 (39.3)</td>
<td>7th in Africa</td>
<td>18</td>
<td>0.18 Stable</td>
</tr>
<tr>
<td>Malawi</td>
<td>Moderate consumption (342,000 tons)</td>
<td>Has blenders (Farmers World Malawi, Malawi Fertilizer, and Optichem 2000)</td>
<td>No. 28 (38.6)</td>
<td>10th in Africa</td>
<td>Low</td>
<td>-0.06 very slightly unstable</td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Phosphate rock, Pyrites, Coal, Coal bed and Methane.</td>
<td>Moderate consumption of fertilizers (good market) 407,000 tons</td>
<td>Ammonium Nitrate (Sable Chemical Industries Ltd), phosphate Rock, sulphuric Acid, SSP (Zimbabwe Phosphate Industries Ltd) and</td>
<td>No port, but Transport corridor. No. 35 (36)</td>
<td>28th ranking</td>
<td>Low</td>
<td>-0.61 slightly unstable</td>
</tr>
<tr>
<td></td>
<td>Deposits</td>
<td>Consumers of fertilizer</td>
<td>Production and potential for expansion</td>
<td>Ports and transport corridor</td>
<td>Assessment of Cluster 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
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<td>----------------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mozambique</strong></td>
<td>Large reserves of oil and natural gas. Has also huge phosphate deposits</td>
<td>Low (87,000 tons)</td>
<td>Yara urea project and has 4 fertilizer Blenders (Omnia, Mozambique fertilizer company, Yara Fertilizer Mozambique, Etc. Adubos)</td>
<td>Excellent port facilities. No.33(36.2)</td>
<td>16th Low -1.08 unstable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Botswana</strong></td>
<td>Has reserves of natural gas</td>
<td>Low</td>
<td>None</td>
<td>No port but good roads. No. 5(64.3)</td>
<td>5th Low 1.09 Stable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Namibia</strong></td>
<td>Has offshore phosphate sediments and nodules</td>
<td>Low consumption of fertilizer</td>
<td>None but there are two planned projects on phosphate rock</td>
<td>Good Port at Walvis bay and road network. No. 3(69.1)</td>
<td>9th Low 0.84 Stable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overall Assessment of Cluster 4</strong></td>
<td>Deposits of Potash and phosphate</td>
<td>Limited production but potential for expansion</td>
<td>Excellent Ports and transport corridor</td>
<td>Moderate Medium Stable system</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The offshore phosphorus reserves in Namibia are estimated at 133 Mt and one of the planned fertilizer projects is by Namibian Phosphate Company (IFDC and FAI, 2017). South Africa, a member of SADC, has well-developed industries in the fertilizer sector and could provide incentives for technological transfer. Cluster 4 is well served by rail and road networks, with proximity to large ports in Mozambique and South Africa. Moreover, Mozambique has large deposits of natural gas while Malawi has phosphorus deposits. ETG commissioned a blender in 2017 in Zimbabwe (IFAP and IFDC, 2017). This cluster (4) can easily be served by fertilizers either imported or manufactured in South Africa. However, we are of the view that the production could be expanded and modernized in South Africa and Zimbabwe and complete the planned fertilizer project in Mozambique. There are opportunities for blending plants and storage facilities appropriately located throughout the cluster. Finally, distribution system should be improved.

3.2.3 SWOT Analysis for Cluster 5
Cluster 5 consists of Equatorial Guinea, Cameroon, Gabon, Angola, Republic of Congo and DRC Congo. There is generally low consumption of fertilizers (about 2% share in Africa) in the cluster, generally poor infrastructure, moderate business environment and low industrialization. The cluster is basically a mining region with the exception of Cameroon. We expect much of the demand of fertilizers to be in Cameroon. The demand of fertilizers in the other countries within the ECCAS region is not expected to be significant unless palm oil and biomass develop in Central Africa. Angola has great agricultural potential, like the Cerrados in Brazil. We do expect most of the fertilizers produced in this cluster to be for exports and a small fraction to be used within the region. The threats facing the region are the Boko Haram in part of Cameroon and the political instability in DRC Congo.
Already there are on-going efforts in setting up fertilizer plants in Gabon, Republic of Congo, and DRC Congo. For instance, in Angola, a Japanese consortium is preparing plans to construct a 1.75 Mt urea plant (IFDC and FAI, 2017), DRC Congo has signed a joint-venture agreement with South Africa to produce phosphate fertilizer from shallow deposits near Boma at the mouth of the River Congo\textsuperscript{37}. Gabon is also in the process of setting up a fertilizer plant\textsuperscript{38} as a joint venture between the government of Gabon and OLAM International for 1.4Mt urea plant (see Table 10).

Table 10: SWOT Analysis of Cluster 5

<table>
<thead>
<tr>
<th>Country</th>
<th>Abundance in raw materials</th>
<th>Potential Domestic consumption</th>
<th>Already producing some fertilizers</th>
<th>Infrastructure available</th>
<th>Business environment ranking</th>
<th>Size of GDP</th>
<th>Political Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equatorial Guinea</td>
<td>Has some reserves of natural gas</td>
<td>Low</td>
<td>None</td>
<td>No.43(26.5)</td>
<td>Low/small</td>
<td>20</td>
<td>-0.19 slightly unstable</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Has natural gas reserves</td>
<td>Low Consumption of fertilizer</td>
<td>None but has 2 blenders (Solevo, Yara Cameroon)</td>
<td>Port at Duala, with fair roads. No. 30 (37.5)</td>
<td>32\textsuperscript{nd} ranking</td>
<td>16th in GDP</td>
<td>-0.95 slightly unstable</td>
</tr>
<tr>
<td>Gabon</td>
<td>Large reserves of oil and natural gas</td>
<td>Low Consumption of fertilizer</td>
<td>A planned project 1.4 Mt of Urea</td>
<td>Some small port.No. 14(50.3)</td>
<td>35th ranking</td>
<td>19th in GDP</td>
<td>-0.07 very slightly unstable</td>
</tr>
<tr>
<td>Congo-Brazzaville</td>
<td>Has deposits of potash</td>
<td>Low Consumption of fertilizer</td>
<td>None</td>
<td>Poor roads. No. 21(42.3)</td>
<td>41\textsuperscript{st} in Africa</td>
<td>14</td>
<td>-0.57 slightly unstable</td>
</tr>
</tbody>
</table>

\textsuperscript{37} But the country is very huge suggesting that other parts of the country may not benefit from the fertilizer plant. The cost of transporting fertilizer from other DRC provinces to the Katanga is so high that, in the near future, the copper-belt will not benefit from the country’s moves towards domestic production of fertilizer. Therefore, Katanga farmers using chemical fertilizers buy imports. However, a site near Likasi provides limestone, which may be used to increase the pH of acid soils. (http://acdivoca.org/sites/default/files/attach/technical-publications/acdivoca-leo-assessment-drc-agricultural-market-systems.pdf).

\textsuperscript{38} Projects in Gabon (with Olam and OCP) are currently on hold.
<table>
<thead>
<tr>
<th>Country</th>
<th>Natural Resources</th>
<th>Consumption of Fertilizer</th>
<th>Mainly Mining and Oil Region</th>
<th>Inadequate/Small Ports</th>
<th>Poor Business Environment</th>
<th>GDP</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRC Congo</td>
<td>Has reserves of natural gas</td>
<td>Low Consumption of fertilizer</td>
<td>None</td>
<td>No port and fair road network. No. 52 (15.4)</td>
<td>43rd in Africa</td>
<td>Low</td>
<td>-2.21 very unstable</td>
</tr>
<tr>
<td>Angola</td>
<td>Large reserves of oil and natural gas</td>
<td>Low Consumption of fertilizer</td>
<td>None</td>
<td>Good Port facilities and fair roads. No. 45(24.5)</td>
<td>39th</td>
<td>5</td>
<td>-0.39 slightly unstable</td>
</tr>
</tbody>
</table>

Given the very limited consumption in the region, then a combination of blending plants and storage facilities are adequate. The planned urea project in Gabon is for exports. The poor distribution network in the region in terms of road networks should be improved.

### 3.2.2 SWOT Analysis for Cluster 6

This cluster covers major economies in the Horn of Africa (Sudan, South Sudan, Eritrea, Ethiopia and Djibouti) and Egypt in the North. The cluster faces threats from instability and terrorism. The largest economies in this cluster are Egypt and Ethiopia. This is an excellent region for production as well as consumption with regards to Egypt and Ethiopia. These countries have large demand for fertilizers, and in particular Egypt has some of the excellent ports that connect Africa to Europe and other continents, and in fact Egypt exports fertilizer to Europe. In addition, Ethiopia has potash and natural gas while Egypt has natural gas and phosphates deposits. The cluster could also take advantage of the proposed Lamu Port-South Sudan-Ethiopia Transport (LAPSSET) infrastructural project which links the hinterland to the Lamu Port in Kenya (Table 11).
### Table 11: SWOT Analysis of Cluster 6

<table>
<thead>
<tr>
<th>Country</th>
<th>Abundance in raw materials</th>
<th>Potential Domestic consumption</th>
<th>Already producing some fertilizers</th>
<th>Infrastructure available</th>
<th>Business environment ranking</th>
<th>Size of GDP</th>
<th>Political Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>Large deposit of potash and natural gas</td>
<td>A large consumer of fertilizer (867,000 tonnes); 1,390,535 tonnes in 2017</td>
<td>Plans to build potash fertilizer plant and has 5 blenders (Merkeb, Enderta, Melik, Gibe Dedesa, Becho Wolliso), large OCP urea project in Dire Dawa.</td>
<td>No port but fair roads and railway line to Djibouti. No. 30(37.5)</td>
<td>29th in Africa</td>
<td>10th ranking</td>
<td>-1.74 Unstable / Fluid</td>
</tr>
<tr>
<td>Eritrea</td>
<td>Large deposit of potash</td>
<td>Low</td>
<td>None</td>
<td>No. 54(6.2)</td>
<td>47th in Africa</td>
<td>Low</td>
<td>-0.89 slightly unstable</td>
</tr>
<tr>
<td>Djibouti</td>
<td>None</td>
<td>Low</td>
<td>None</td>
<td>Excellent port. Handle imports and exports of Ethiopia. No. 20(43.6)</td>
<td>27th</td>
<td>Low</td>
<td>-0.63 slightly unstable</td>
</tr>
<tr>
<td>Sudan</td>
<td>Oil reserves</td>
<td>Low consumer of fertilizer</td>
<td>None</td>
<td>Good port facilities</td>
<td>36th in Africa</td>
<td>Low</td>
<td>-2.47 unstable</td>
</tr>
<tr>
<td>South Sudan</td>
<td>Oil reserves</td>
<td>Low consumer of fertilizer</td>
<td>None</td>
<td>No port</td>
<td>46th</td>
<td>Low</td>
<td>Unstable</td>
</tr>
<tr>
<td>Egypt</td>
<td>Large reserves of natural gas and</td>
<td>A large consumer of fertilizer</td>
<td>Large producer of fertilizer. many</td>
<td>Excellent port facilities and road</td>
<td>14th in Africa, Proximity to</td>
<td>3rd rank in GDP</td>
<td>-1.55 unstable</td>
</tr>
</tbody>
</table>
Capacity developments in urea are expected to rise from 5.3 Mt in 2015 to 7.1 Mt by 2020 in Egypt (Prud’homme, 2016). Mopco II and Mopco III located in Damietta came into production in 2016. KIMA’s new urea plant with a capacity of 530 Kt in Aswan, Egypt is expected to start production in 2019. The 756 km stretch of electric rail line linking Addis Ababa and Djibouti was expected to start full commercial operations in October 2017. The construction of Dichoto-Galafi-Elidar Bolho road, which began in 2016, is expected to be completed in 2019. In 2016, OCP signed a deal with Ethiopian firm Chemical Industries Corporation (CIC) to construct a USD 3.7 billion fertilizer plant in Dire Dawa town, eastern Ethiopia (IFAP and IFDC, 2017). The Zohr natural gas reserves located at about 190 kms off the Egyptian coast are estimated at 30Tcf (Prud’homme, 2016).

In this cluster, Egypt (nitrogen and phosphorus), Ethiopia (potash and urea) and Eritrea (potash) would be focal points for fertilizer production given the abundant domestic
resources and a huge domestic demand. However, there have been concerns about the economic viability of potash projects (Prud’homme, 2016). New potash mine projects in Eritrea and Ethiopia have been delayed until after 2021 owing to financing difficulties and low potash prices (USGS, 2018). We emphasize that improvement/strengthening of distribution channels/networks is very critical in this region in order to increase access to cost-effective fertilizers by smallholder farmers. There are opportunities for storage facilities and blending plants in this cluster.

3.3 Overall Conclusion

Adequate economic reserves of mineral fertilizer raw materials exist in the clusters. The chapter has highlighted possibilities of potential fertilizer plants, blending plants and even storage facilities. The establishment of viable fertilizer plants in each cluster would merit to be fully assessed in consideration of competitive production advantages, economic feasibility with adequate sustainable profitability, critical mass of domestic consumption and potential demand growth, optimized distribution systems and options for partnership. In all the clusters, some private and public/private partnership initiatives are already in place for the construction of fertilizer plants in many places in Africa. Some of the existing plants could be expanded and modernized as they are small by international standards, costs are high, their technology is relatively obsolete, and they are not energy efficient in terms of converting raw materials to final products. There is also a need to encourage vertical partnerships for NPK and bulk blend production or other integrated fertilizer units.

The extent of regional integration is also important especially for cross-border trade. The regional economic communities have differential scores according to the Ibrahim

39http://ssa.foodsecurityportal.org/content/full-summary-fertilizer-dialogue
Index of African Governance (IAAG): EAC is 76.1, ECOWAS (65.0), ECCAS (61.8), SADC (57.8), CEN-SAD (56.8), COMESA (56.7), AMU (50) and IGAD (46.9) (Mo Ibrahim Foundation, 2017). Measures are therefore needed to deepen regional integration in all clusters.

Thus, there should be continuous efforts to reduce delays in the movement of goods especially at the border points across all the clusters as demand for fertilizer is time-specific. In addition, even though these clusters are served by main corridors, the linkage to the smallholder farmers still remains a challenge across Africa. Therefore, governments in Africa should make pro-active measures to enhance rural infrastructure.

We are of the view that the main ultimate goal is increasing fertilizer use in Africa in order to raise agricultural productivity. This can be achieved by increasing supply and improving availability from both locally produced and imported fertilizer. These two options would only make fertilizers relatively more affordable if the distribution network is greatly improved. Whether a country would use fertilizer produced locally or from the same cluster or other clusters in Africa or from outside the continent would depend on cost-effectiveness analysis and other mutually-agreed arrangements.
PART 4: FERTILIZER INDUSTRY FINANCING

The global fertilizer demand is forecast to increase from 184 Mt in 2015 to 201.7 Mt nutrients by 2020 (FAO, 2017). In SSA, the demand for fertilizer is projected to increase to 5.5 Mt of nutrients by 2021 (Heffer and Prud’homme, 2018), accounting for 2.8% of the world total. This projected demand means it critical to bring the private sector on board to set up viable fertilizer plants, blending facilities and other operations along the fertilizer value chain.

This brings on the challenge of how to finance the sector. Financial constraints have frequently been cited as a major hindrance to the increased consumption of fertilizer in Africa, particularly among smallholder farmers. Recognizing this, the Abuja Declaration called for a number of interventions at the national and regional level. Most clearly articulated (Resolution 11) was the creation of an Africa Fertilizer Financing Mechanism (AFFM). The AFFM’s framework describes it as being a “key instrument in the implementation of NEPAD’s CAADP”, and identifies priority areas as: providing financing for developing Africa’s manufacturing capacity (including the funding of pre-investment and feasibility studies); providing credit guarantees for fertilizer importers and distributors; establishing regional fertilizer procurement and distribution facilities; policy work; and institutional, research and capacity-building initiatives.

According to AfDB (2015), the agricultural sector in Africa employs or provides livelihoods to 60% of the population while contributing 20-30% to Africa’s GDP and yet it typically attracts less than 5% of lending from financial institutions on the continent. This leaves farmers and agricultural enterprises starved of the capital they need to operate and grow their businesses. By making possible investments in, e.g., productivity-enhancing farm inputs such as fertilizer or agro-processing equipment,
increased productivity, higher-value products, and broadened diversity of agricultural production can be achieved.

Therefore, a key component of fertilizer use is the question of available financing options. Moreover, financing is not only needed in establishing fertilizer manufacturing plants and blending plants. Importers, agro-dealers and farmers, in particular, smallholder farmers need financing too. So, both the supply and demand side of the fertilizer industry need finance. The fertilizer business is tends to be capital intensive. For instance, a trader buying some 1,000 tons of fertilizer products would need approximately USD 300,000 or more (World Bank, 2007b). Access to affordable capital is a critical factor in private entry and investment in the agricultural sector (Jayne et al., 2015).

Inadequate infrastructure is a cross-cutting barrier to fertilizer use and agricultural sector growth that can be addressed through innovative financing. Investments in transport and market infrastructure are critical to improving returns and productivity in the agriculture sector, and necessary complements to private investment in fertilizer manufacturing and processing plant establishments. High transport costs are a significant constraint where production is dispersed in relatively under-connected rural communities. Inadequate rural road infrastructure creates fragmented markets. The public good nature of this infrastructure, and the typically high initial cost of building it, leads to under-investment that dampens agriculture sector growth. Public-private partnership (PPP) models for agriculture-enabling infrastructure are promising but relatively unproven in Africa to date (AfDB, 2016 b).
Finance, transportation and distribution costs account for between 75% and 80% of the total cost of fertilizer in the domestic supply chain in West Africa (Bumb et al., 2012). In another study, Wanzala and Groot (2013) also showed that transportation costs account for a high percentage in retail prices, for instance, 32% in Mali and 22% in Tanzania. Thus, it is important also to consider financing access roads as critical components of the distribution infrastructure.

Funding sources are discussed under three sections: manufacturing and blending plants, other players in the fertilizer supply chain, and farmers.

4.1 Manufacturing and Processing (Blending) Plants

To involve the private sector, there must be viable financing options that they can tap into in order to invest in fertilizer manufacturing and blending plants. In a number of countries in Africa, the private sector is already involved in the production and blending of fertilizer. For example, MEA Ltd is involved in fertilizer blending in Kenya, Industrial Company of Agricultural and Tradable Productions (CIPAM) manufactures fertilizer in Burkina Faso, and Indorama Eleme Fertilizers & Chemicals Ltd is one of only two plants producing urea in Sub-Saharan Africa (Wanzala-Mlobela et al., 2013, Mulholland, 2017 and AfricaFertilizer.org, 2018). To build fertilizer plants to meet cluster demand, substantial financial resources are needed. As it has been argued, raising capital for investments is one of the biggest challenges facing many African entrepreneurs and economic operators as commercial banks charge high interest rates and have high collateral requirements (UNECA, 2015).

Some of the proposed funding sources are discussed below.
4.1.1 AfDB Africa 50 Fund and other AfDB sources

The AfDB Africa 50 Fund was established with the aim of financing infrastructure development in Africa. This is in response to the 2012 African Heads of States meeting in their Declaration on the Program for Infrastructure Development in Africa (PIDA) in which they called for innovative solutions to facilitate and accelerate infrastructure delivery in Africa. Africa50 is an Investment Bank for Infrastructure in Africa that focuses on high-impact national and regional projects in the energy, transport, ICT and water sectors. Infrastructure financing enhances fertilizer distribution channels and therefore central to the AFFM. Moreover, the AfDB has supported strategic investments in private sector projects and PPPs, notably through the Africa50 fund for infrastructure and the Grow Africa partnership platform (MRDE, 2015).

Although the Africa50 is meant for infrastructure such as energy, ICT, transport and water; there is no reason why the fund cannot be used also to fund private sector investment in fertilizer plants especially if there are guarantees from African governments or under public-private partnership, especially with regard to bankable projects. With an initial share capital contribution of USD 830, the fund has 25 shareholders (AEO, 2018). The Africa50 aims to attract a variety of investors, including African states, international financial institutions, pension funds, sovereign wealth funds and private sector entities. This is in line with the African Agenda 2063 that seeks to finance African development from its own domestic sources.

Apart from the Africa50 fund, there are also potential opportunities offered by the AfDB’s Financial Sector Development and the Private Sector Departments. For the

former, AfDB plans to increase access to financial services and to broaden and deepen Africa’s financial systems, working with both public and private sector clients. For the latter, AfDB participates in private sector development of Regional Member Countries (RMCs), through lending, equity participation, guarantee and technical assistance related to the financing of private sector projects and programs, including small and medium-sized enterprises and privatization. The Department plans, organizes and carries out the activities related to private sector project identification, preparation, appraisal, implementation and portfolio management. It also conducts studies on the investment climate of RMCs as well as other private sector related issues, with a view to identifying investment opportunities and contributing to the creation of an enabling environment for private sector development. From its private sector window, AfDB extended loans to the value of USD 500 million to the Indorama Eleme Fertilizer & Chemicals Limited (IEFCL) and Dangote Industries Limited.\(^{42}\)

### 4.1.2 Private Equity Markets/Funds

Private equity is a source of investment capital from high net worth individuals and institutions for the purpose of investing and acquiring equity ownership in companies. Partners at private-equity firms raise funds and manage these monies to yield favorable returns for their shareholder clients, typically with an investment horizon between four and seven years.

In Africa, private equity is becoming a growing part of the financial sector, especially for long-term finance (Beck\textit{ et al.}, 2011). There is a growing number of seasoned and regionally experienced fund managers, an increasing number of investment opportunities because of improving macroeconomic environment, sustained growth,

and significant regulatory reforms, and improved exist opportunities. Africa continues to attract private capital because of its improved business environment and increasing positive corporate sentiment ratings such as the “Doing Business” regulatory improvements observed in Mauritius and Rwanda (ERA, 2015).

FDI is the second largest source of external private equity inflows. FDI increased from USD 56.6 billion in 2013 to USD 61.1 billion in 2014 and is projected to increase to USD 66.9 billion in 2015, equivalent to 3.9%, 4.1% and 4.2%, respectively, of GDP (ERA, 2015). FDI accounts for about 70% of private capital flows to Africa (AEO, 2018).

Private equity could enhance domestic financing, given the high bank interest rates and weaknesses in financial intermediation in most of Africa (ERA, 2015). Private equity investment has risen sharply in Africa over the past decade—albeit from a very low base—with average annual growth of 26%, which reflects an improved business environment (ERA, 2015). This is a potential source of funds for the private sector to tap into in order to invest in the fertilizer business. As UNECA (2015) argues, over USD 200 billion has been raised by private equity firms, with Kenya, Nigeria and South Africa being the major beneficiaries. To tap into this market, developing countries need to improve infrastructure, strengthen banking systems, develop capital markets by accelerating the pace of privatization and broadening the domestic investor base, and formulate an appropriate regulatory framework and a more liberal investment regime (Chea, 2011).

In Nigeria, for instance, the Dangote group of companies intends to invest in the largest fertilizer plant in Nigeria. Dangote plans to build a fertilizer plant with a capacity of 2.8
million metric tonnes of urea. The company uses a partnership approach in investments. The group seeks other companies to jointly invest in a project before going to the capital market. By bringing other partners onboard, even from abroad, the private sector in Africa can raise adequate sources of funds to set up fertilizer plants in the continent. Similarly, the Norwegian fertilizer company Yara International is looking for equity partners to support a USD 740 million potash mining project in Ethiopia. In 2014, Indorama acquired a 78% majority stake in Senegal’s ICS operation, the country’s only phosphate fertilizer plant (Mulholland, 2017b).

In the same vein, global chemical producer Indorama Corp. Pte Ltd. and African polyolefins producer Indorama Eleme Petrochemicals Ltd. have signed a financing package to construct a USD 1.2 billion greenfield urea fertilizer project in Nigeria. Of the whole of USD 1.2 billion, USD 400 million is in equity. In Algeria, there are two large complexes in operation with funding from Egypt-European companies and the other from Oman, along with partnership with local entities. Beyond South Africa, Sub-Saharan Africa is being considered as a new frontier where many fertilizer and mining projects are under consideration in the form of South-South partnerships or direct foreign investment from large fertilizer producers in developing countries (IFDC and FAI, 2017).

4.1.3 African Governments
African governments can be a source of funds for the private sector investment in fertilizer manufacturing and processing plants. This can be through public-private partnership or offering of long term loans. For instance, the Dangote group of

44 http://www.law360.com/articles/621563/yara-seeks-equity-partners-for-740m-ethiopian-potash-mine
companies that wishes to invest in oil refineries and fertilizer plants in Nigeria is being financed with a loan from the Central Bank of Nigeria[^46]. Governments in collaboration with the private sector can help pool funds that can be used to finance fertilizer business. For instance, the Fund for Agricultural Finance in Nigeria (FAFIN) is an innovative public–private investment fund that crowds in private capital to the agriculture sector.

Governments can raise money for lending to the private sector through expansion of the tax bracket, from the sale of natural resources, and from foreign aid. Governments can also raise money through floating/issuing of bonds in the international market and also diaspora bonds (Chea, 2011, AEO, 2018). Remittances from Africans abroad continue to be a significant source of funds. Remittances rose from 4.4% of GDP in 2013 to 4.5% of GDP in 2014, and they are expected to further increase to 4.6% of GDP in 2015, as more African expatriates seek to invest in their home countries. In absolute terms, remittances for 2013, 2014, and 2015 translate to USD 62.9 billion, USD 67.1 billion and USD 71.8 billion, respectively. The African Economic Outlook 2018 reports that remittances in Africa are about USD 60 billion (AEO, 2018). To leverage increasing remittances, the continent must decrease the cost of sending them back and develop financial instruments to channel them towards developmental programs (ERA, 2015).

Total government revenue excluding grants has increased by approximately 70.9% between 2000-2014. There has been a significant reduction in the number of countries collecting less than 15% of GDP in domestic public revenue (MDRE, 2015). Africa collects about USD 500 billion in tax revenue every year (AEO, 2018).

[^46]: [http://www.ft.com/intl/cms/s/0/5f32eb62-8131-11e4-896c-00144feabdc0.html#axzz3tiduW65Y](http://www.ft.com/intl/cms/s/0/5f32eb62-8131-11e4-896c-00144feabdc0.html#axzz3tiduW65Y)
Another avenue for African governments for raising money is to undertake measures aimed at reducing illicit financial flows. These financial outflows through trade mispricing are widespread in resource-rich economies, estimated at close to USD 60 billion a year and grew by 32.5% over 2000–2009. Cumulatively, the outflows over that period were equivalent to nearly all the Official Development Assistance (ODA). Policy interventions through tax incentives and close monitoring could help curb illicit financial outflows (ERA, 2015). These funds could then be used for lending to the private sector to invest in viable fertilizer plants and also in the whole fertilizer value chain including agro-dealers.

African governments can also partner with private companies from abroad in the setting up of viable fertilizer plants. For instance, Tanzania Petroleum Development Corporation in a joint venture with a consortium of Ferrostaal Industrial Projects GmbH, Haldor Topsoe A/S and Fauji Fertilizer Company Ltd plan to build a fertilizer plant in Tanzania. In Ethiopia the government has partnered with the private sector to establish four blending plants (AFAP, 2017). OCP in partnership with Ethiopian firm Chemical Industries Corporation (CIC) plan to construct a USD3.7 billion fertilizer plant in Dire Dawa town, eastern Ethiopia (AFAP & IFDC, 2017).

National governments are ideally the largest source of funds for agriculture. Table 14 below shows the share of agricultural expenditure in total public expenditure in some selected regions in Africa. The share for Africa as a whole and for COMESA, EAC, IGAD and SADC declined from 2003 to 2014. The only exception was ECOWAS and ECCAS. The table also shows that, as a whole, no region has allocated 10% of their aggregated budget to agriculture although individual countries may have. This

suggests a decline in funds allocation to agriculture. Nevertheless, governments remain the largest sources of funds for investment in Agriculture.

Table 12: Share of Agricultural Expenditures in Total Public Expenditure (%) in Regional Economic Communities in Africa

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<tbody>
<tr>
<td>Africa</td>
<td>3.31</td>
<td>3.63</td>
<td>3.54</td>
<td>2.97</td>
<td>2.93</td>
</tr>
<tr>
<td>COMESA</td>
<td>5.62</td>
<td>5.25</td>
<td>4.79</td>
<td>3.67</td>
<td>3.59</td>
</tr>
<tr>
<td>EAC</td>
<td>4.79</td>
<td>5.05</td>
<td>4.40</td>
<td>4.56</td>
<td>4.07</td>
</tr>
<tr>
<td>ECCAS</td>
<td>1.70</td>
<td>1.47</td>
<td>2.13</td>
<td>2.32</td>
<td>2.12</td>
</tr>
<tr>
<td>ECOWAS</td>
<td>4.05</td>
<td>3.84</td>
<td>4.25</td>
<td>4.50</td>
<td>4.61</td>
</tr>
<tr>
<td>IGAD</td>
<td>6.01</td>
<td>6.47</td>
<td>6.91</td>
<td>5.21</td>
<td>4.45</td>
</tr>
<tr>
<td>SADC</td>
<td>1.91</td>
<td>2.50</td>
<td>2.66</td>
<td>2.38</td>
<td>2.22</td>
</tr>
<tr>
<td>UMA</td>
<td>3.84</td>
<td>4.02</td>
<td>3.68</td>
<td>3.06</td>
<td>3.27</td>
</tr>
</tbody>
</table>

Source: Resakss (http://www.resakss.org)

As a share of total credit in the economy, credit to agriculture is estimated at less than 1%. Government spending on agriculture, as a percentage of total government expenditure, remains, on average, systematically below 5% over the years, and is much lower in the ECOWAS region than in the other sub-regions (AGRA, 2016).
Table 13 below also shows the share of agricultural expenditures as a percentage of total expenditures in selected African countries. As the table shows, Burkina Faso, Ethiopia, Malawi and Mali have had on average, a higher share of their budgets expenditure in agriculture.

Table 13: Share of Agricultural Expenditures in Total Public Expenditure (%) in selected African Countries.

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</thead>
<tbody>
<tr>
<td>Burkina Faso</td>
<td>25</td>
<td>18</td>
<td>23</td>
<td>33</td>
<td>20</td>
<td>12</td>
<td>20</td>
<td>16</td>
<td>14</td>
<td>9</td>
<td>11</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>10.4</td>
<td>4.0</td>
<td>5.6</td>
<td>8.4</td>
<td>13.6</td>
<td>16.5</td>
<td>17.5</td>
<td>14.6</td>
<td>11.7</td>
<td>17.5</td>
<td>21.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ghana</td>
<td>3.2</td>
<td>4.7</td>
<td>6.9</td>
<td>5.8</td>
<td>8.8</td>
<td>9.8</td>
<td>10.3</td>
<td>9.9</td>
<td>10.2</td>
<td>9.0</td>
<td>9.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kenya</td>
<td>6.8</td>
<td>6.6</td>
<td>5.4</td>
<td>4.1</td>
<td>5.1</td>
<td>6.6</td>
<td>5.9</td>
<td>4.4</td>
<td>4.8</td>
<td>3.9</td>
<td>4.6</td>
<td>8.7</td>
<td>6.8</td>
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<tr>
<td>Malawi</td>
<td>8.8</td>
<td>4.9</td>
<td>8.7</td>
<td>6.6</td>
<td>7.0</td>
<td>11.1</td>
<td>11</td>
<td>13.2</td>
<td>31.6</td>
<td>24.7</td>
<td>28.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mali</td>
<td>8.9</td>
<td>12.8</td>
<td>8.9</td>
<td>9.6</td>
<td>11.4</td>
<td>15.5</td>
<td>10.6</td>
<td>11.0</td>
<td>12.7</td>
<td>16.9</td>
<td>13.9</td>
<td>23.9</td>
<td>-</td>
</tr>
<tr>
<td>Nigeria</td>
<td>1.6</td>
<td>6.0</td>
<td>3.5</td>
<td>1.9</td>
<td>3.1</td>
<td>3.4</td>
<td>4.1</td>
<td>4.4</td>
<td>4.6</td>
<td>5.3</td>
<td>5.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rwanda</td>
<td>-</td>
<td>6.2</td>
<td>8.6</td>
<td>3.9</td>
<td>4.0</td>
<td>3.4</td>
<td>3.3</td>
<td>5.5</td>
<td>5.6</td>
<td>6.4</td>
<td>6.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tanzania</td>
<td>-</td>
<td>-</td>
<td>4.5</td>
<td>6.8</td>
<td>5.7</td>
<td>4.7</td>
<td>5.8</td>
<td>5.8</td>
<td>2.5</td>
<td>6.7</td>
<td>6.8</td>
<td>6.8</td>
<td>-</td>
</tr>
<tr>
<td>Uganda</td>
<td>2.6</td>
<td>1.6</td>
<td>2.6</td>
<td>2.3</td>
<td>2.1</td>
<td>2.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.2</td>
<td>4.5</td>
<td>3.8</td>
<td>3.1</td>
<td>4.5</td>
</tr>
<tr>
<td>Zambia</td>
<td>8.6</td>
<td>6.2</td>
<td>5.2</td>
<td>6.1</td>
<td>6.1</td>
<td>7.2</td>
<td>9.3</td>
<td>13.2</td>
<td>12.5</td>
<td>9.3</td>
<td>10.2</td>
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</tbody>
</table>

Source: AGRA, 2013
A recent review shows that only 10 countries have met the target of allocating at least 10% of their budgets on agriculture namely: Angola (14.8%), Burkina (10.5%), Egypt (14.0%), Equatorial Guinea (10.5%), Ethiopia (16.8%), Malawi (17.6%), Mali (12.4%), Mauritania (13.0%), Senegal (11%), and Sudan (13.4%) (AUC, 2018).

Sovereign wealth funds (SWFs) could also be used to fund private sector investment in fertilizer industry. SWFs are state-owned funds that invest sovereign revenues in real and financial assets, typically with the aim of diversifying economic risks and managing intergenerational savings. African SWFs represent a small but growing share (20-plus funds) amounting to around USD 1.6 billion (AEO, 2018). SWFs often have an explicit mandate to manage intergenerational savings, so they typically also have a much longer investment horizon than other investors. As a result, they are in principle better able to invest in illiquid assets with longer maturities and reduce the volatility of capital flows to the markets in which they invest.

In Africa, only ten such countries have this type of fund. These include Nigeria, Angola, Botswana, Libya, Senegal, Algeria, Ghana, Gabon, Mauritania and Equatorial Guinea.48

4.1.4 Pension funds and Insurance Companies

Pension funds are a potentially reliable source of financing for development projects that generally find it hard to attract long-term financing (UNECA and AU, 2014). Within a framework of public-private partnerships (PPP) to shield pension funds from facing considerable investment risk, these funds can be a source of finance for investment into fertilizer plants and also for transport infrastructure.

However, the pension market in Africa is underdeveloped (apart from in Botswana, Kenya, Mauritius and South Africa) and is dominated by state-owned schemes (UNECA & AU, 2014).

Long-term funds can also be obtained from the insurance sector especially for longer
term life and savings products. Even though insurance markets remain thin, the sector
has the potential to provide capital for longer-term projects given that insurance growth
on the continent outstripped economic growth between 2000 and 2011 (UNECA & AU,
2014). Pension and insurance funds are expected to rise from USD 500 billion in 2012 to
USD 1,545 billion in 2020 (AEO, 2018).

4.1.5 Local, Regional and International banks
Financing Africa’s development requires significant amounts of long-term investment—
especially in key sectors such as fertilizer industry. Local financial institutions are
increasingly stepping up to meet long-term investment, in many cases able to provide
more capital and at longer maturities than they could before. Local and international
banks are able to provide the required finance as long as adequate collateral is available.

As Mukonyora and Bugo (2013) argue (see figure 23), the share of agricultural lending
from commercial banks has been lower, perhaps signaling the risks that the sector faces.
In 2008, the share of commercial bank lending was 6% for Gambia, 4% for Ghana, 4%
for Kenya, 15% for Malawi, 8% for Mozambique, 1% for Nigeria, 12% for Tanzania and
6% for Uganda.
Figure 23: Agricultural Lending as a Share of GDP in selected African countries

Source: Mukonyora and Bugo, 2013

Commercial bank lending to agriculture is about USD 660 million per year, out of a total of USD 14 billion per year, or 4.8% of annual lending (AfDB, 2016).

In order to increase commercial banks’ lending to the agricultural sector, Governments can partner with commercial banks to introduce risk-sharing and guarantee lending schemes. A good example is the Nigeria Incentive-Based Risk-Sharing System for Agricultural Lending (NIRSAL) briefly described in the text box below.
Text Box 3: Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL)

NIRSAL was established in 2011 and was designed to encourage the growth of bank lending to the agricultural sector by providing risk mitigation, financing, trading and strategic incentives and technical assistance to Agribusiness with a start-up capital of N75 billion provided by the Central Bank of Nigeria in partnership with the Alliance for a Green Revolution in Africa (AGRA). It is meant to benefit all major stakeholders along the nodes of agricultural value chain such as input producers, farmers, agro-dealers, agro-processors, industrial manufacturers and exporters. NIRSAL guarantees up to 75% of agriculture bank loans. It pays about 50% of losses incurred to large farmers and roughly 75% to small and medium scale farmers. The scheme has five pillars: Risk sharing; Insurance facility; technical assistance so that banks can lend sustainably and at the same time equipping producers to borrow and use loans more effectively; holistic bank rating (mechanism that is based on the effectiveness of their agricultural lending and its social impact) and Bank Incentive Mechanism (which offers banks additional incentives to build their long-term capabilities to lend to agriculture).

NIRSAL’s goal is to increase agricultural loans from 1.4 to 7 percent of Nigeria’s total bank lending, amounting to some US$3 billion within ten years.

NIRSAL has provided Credit Guarantees for over 454 Agricultural projects valued at N61.161 billion. It has also paid out over N753.36 million as interest rebate to borrowers who paid back their loans in good time. Furthermore, NIRSAL has through its technical assistance scheme trained over 112,000 farmers across the country on best practice farming techniques and business management.


Although banks are the most important source of long-term finance for firms in developing countries, they tend to lend at significantly shorter maturities than those in high-income countries, and so they are not able to compensate for market failures and policy distortions. Low inflation, country risk, strong institutions, and a contestable banking sector all seem to be significantly correlated with a higher share of long-term bank financing.49

Regional banks and international institutions such as PTA bank, the African Development Bank, the Africa Import-Export bank, and the International Finance Corporation (IFC) can also provide both loans (debt financing) and equity financing in the establishment of viable fertilizer plants. The same applies to the New Development Bank, and the Asian Infrastructure Investment Bank (AEO, 2018). For instance, in 2011, IFC provided a USD 215 million loan to the Jordan-India Fertilizer Company (JIFCO) to support the construction of a phosphoric acid plant in Jordan which is mainly exported to India where phosphorus fertilizers are produced. The European Development Finance Institution also provides co-financing for building fertilizer plants with the private sector in Africa.

4.1.6 Development Partners

Donor funds are also a source of funds for the governments and the private sector that can be used to invest in the fertilizer value chain. The amount of donor funds dedicated to agriculture forestry and fishing (see Figure 24) increased from USD 1.28 billion to USD 3.57 billion between 2002-13 (2013 constant prices) (MRDE, 2015).

Even within Africa, the disbursements were uneven with some countries receiving more than others (Mukonyora and Bugo, 2013). The German Development Bank also provides private equity funds (AfDB, 2015) that can be used to finance fertilizer business in Africa. KfW’s Africa Agriculture and Trade Investment Fund (AATIF) is an innovative public–private investment funds that crowd in private capital to the agriculture sector (AGRA, 2016).

4.1.7 Capital Markets
Capital markets are also another source of funds. A number of firms have been able to raise some capital for investment from the capital markets. Some of these capital markets attract sources of funds from abroad and also from the domestic market. Partnerships/consortiums are very important when it comes to expensive investments. Some investment companies in Africa can form partnerships with those from abroad before listing in the stock exchange. Before listing on the stock exchange, the Dangote
group of companies invited partners as a way of spreading risk before listing on the capital market\textsuperscript{52}.

The private sector in Africa could therefore try to form partnerships with companies from India, Brazil and other countries in order to pool resources to undertake investment in the fertilizer industry. Even though the stock market in Africa is still young with the exception of the Johannesburg Stock Exchange, it is growing. Market capitalization rose from USD 300 billion to USD 1.2 trillion between 1996 and 2007 (UNECA, 2015).

4.2 Importers, Distributors and Agro-dealers
This group of players along the fertilizer value chain is important in making fertilizers accessible to farmers. Given the high costs of fertilizer importation, companies require finance to be able to import in bulk to be cost effective. Once imported, the fertilizer is to be distributed to stockists and agro-dealers. This process requires trucks which in the case of land-locked countries involves cross-border movement. Some of the importers and distributors are international companies such as Yara and ETG. Storage facilities in the form of warehouses, go downs, etc. are needed by importers, distributors and agro-dealers. These are probably the most important supply factors with the highest leverage and practicality for optimizing fertilizer delivery, availability and affordability in SSA.

Rural areas are thin with respect to functional agro-dealers (one-stop shops where farmers can get the inputs they require) because they tend to concentrate in cities and other big towns that are far away from the farmers, hence making fertilizers inaccessible

to farmers (Jayne et al., 2013; Sheahan et al., 2013). In most countries, farmers are over 20 km away from the closest input shop (Roy, 2016). Another factor contributing to this constraint is that the agro-dealers sometimes fail to stock the required types and quantities of fertilizers needed by farmers, especially at the start of planting season (Jayne et al., 2013). They also lack business management skills, knowledge of good agronomic practices, and financial planning to advise well on the use of inputs.

Because there are often high climatic production risks – normally associated with rainfall uncertainty – complementary incentives are needed to lower such risks, including the development and implementation of [indexed] crop/weather insurance. These instruments can help farmers hedge against the inherited risks associated with agriculture production and to protect financial institutions’ lending portfolios (IFDC, 2015b). Most developing countries lack sufficient financial instruments and risk-mitigating tools to increase access to credit. Where such financial services exist, agro-dealers and farmers are often excluded as a result of banks’ perceived risks associated with agricultural activities (IFDC, 2014a).

The sources of finance for importers, distributors and agro-dealers include governments, the AfDB, commercial banks and value chain financing. These sources of finance have already been discussed above. Recently (12 April 2018) the African Development Bank extended a soft commodity finance facility (SCFF) of USD 100 million to Export Trading Group (ETG). This loan will provide pre- and post-shipment finance along various stages of ETG’s commodity value chain operations in the 17 countries expected to benefit from the initiative. The intervention will help local farmers and soft commodity suppliers to increase their revenues and produce quality crops for
export. The facility will be used to finance the procurement of identified agricultural commodities from over 600,000 farmers53

4.3 Farmers
The concern for smallholder farmers is that they are the dominant producers of agricultural produce/output in Sub-Saharan Africa. Financing smallholder farmers is basically demand financing. This is critical because fertilizer demand is derived demand. Therefore, access to affordable finance by smallholder farmers to buy key inputs such as fertilizers is critical. Despite the presence of formal and informal sources of finance in Africa, ample and suitable financial services especially for agricultural production and agribusiness development have been limited (AGRA, 2017). There has been a general unmet demand for finance, especially for smallholder farmers in Africa. These farmers have been regarded as risky and costly to reach due to the dispersed nature of the rural population and limited collateral. Policy measures that are being undertaken to increase access to finance include mandatory lending quotas, interest rate caps, and credit guarantee schemes (CGS), and matching (AGRA, 2017).

The sources of finance are briefly discussed below.

4.3.1 Non-governmental organizations and foundations
Fertilizer businesses at all stages of the supply chain face enormous constraints to accessing loans due to high interest rates, prohibitive collateral requirements, and limited access to domestic financing. In Africa, an importer will commonly pay nominal interest rates of 20-30% and provide collateral of over 100% in order to obtain a letter of credit. Without affordable credit, businesses must purchase orders in small amounts

and incur additional transport and labor costs through frequent trips to replenish supplies.

Non-governmental organizations and foundations can mitigate the high cost of business finance by collaborating with local commercial banks to create credit guarantee funds. For instance, the Alliance for a Green Revolution in Africa (AGRA) is working with financial institutions to make low-interest loans available to key agro-dealers, fertilizer wholesalers and seed companies (Salami et al., 2010; Adesina et al, 2014). Other opportunities for financing may include warehouse receipt systems, farmer groups and agro-processing facilities. AGRA, for example, in partnership with Equity Bank, the International Fund for Agricultural Development (IFAD) and the Kenyan Ministry of Agriculture, created a loan facility of USD 50 million, which was backed with a USD 5 million cash guarantee fund. As a result, affordable credit was made available to 2.5 million farmers and 15,000 agricultural value chain operators, such as rural input shops, fertilizer and seed wholesalers and importers, grain traders and food processors. A similar loan facility was established with the National Microfinance Bank in Tanzania. AGRA currently supports nearly 100 programs and partnerships in 13 African countries: Burkina Faso, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Tanzania, Uganda and Zambia.  

There have been on-going efforts at both the national and regional levels to engage the private sector in fertilizer business. Some of these initiatives are being promoted by African Fertilizer and Agribusiness Partnership (AFAP). The signing of the memorandum of understanding between COMESA and AFAP would facilitate the

54 http://www.fao.org/docrep/016/k7443e/k7443e.pdf
training of private sector and PPP participants, targeted credit and grant facilities, and initiatives to increase the value-cost ratio for farmers.

Innovative solutions pioneered by the Africa Fertilizer Agri-business Partnership (AFAP), piloted in Ghana, Mozambique and Tanzania since 2012, have taken a three-pronged approach involving offering credit guarantees for fertilizer suppliers, matching grants for agro-dealers and providing technical support for farmers’ cooperatives and agro-dealers (AfDB, 2015).

Private foundations such as the Bill & Melinda Gates Foundation, the Mo Ibrahim foundation, the Clinton Foundation, Howard Buffet and Rockefeller among others and non-governmental organizations can provide finance for the smallholder farmers and agro-dealers in the context of poverty reduction and therefore ultimately increase fertilizer demand. This is because providing finance to small-scale farmers has been a challenge for a long time (Rahman and Smolak, 2014). Rural finance has moved from a supply-driven subsidized credit approach to a market-oriented approach. Yet access to formal finance is still very low for smallholder farmers (Rahman and Smolak, 2014).

As discussed earlier, governments can also partner with commercial banks in the provision of credit to agro-dealers and smallholder farmers. Thus, the development of innovative approaches that utilize loan guarantee funds and risk management tools can go a long way in increasing available financing for fertilizer.

4.3.2 Governments/Public Institutions

Most of the developing countries established agricultural development banks in the 1960s and 1970s. The funds were obtained from African governments and donors and often supplied farmers through cooperatives and farmers associations (Mukonyora and Bugo, 2013). In most countries, these banks have been restructured to serve a wider
cliente of urban and non-agricultural clients, and the use of credit subsidies has been reduced, but not eliminated. However, many of these institutions have collapsed and are no longer effective in increasing financial access to smallholder farmers (Campagne and Rausch, 2010). The role of agricultural development banks is very limited and far from sufficient to satisfy agricultural credit demand (Manen, 2012). Nevertheless, they still remain useful in offering loans to both smallholder farmers and agro-dealers.

For instance, the government of Mali established a fund through the Malian National Agricultural Development Bank (BNDA) based on a bank pool which combines funds from private and public banks to finance agricultural activities by lending to farmers. The fund was created to finance purchase and marketing of cotton and was eventually linked to the financing of input/fertilizer supply (IFDC, 2015b).

4.3.2 Microfinance Institutions and others

Microfinance institutions were established in the 1990s as a potential panacea to the failure of the agricultural banks and financial liberalization (Mukonyora and Bugo, 2013) following the Grameen banking model. Microfinance proved to be more effective at targeting of the poor (in both rural and urban areas) with market-determined interest rates and better loan recovery through scheduling loan repayment in a manner that imposed minimum financial strain on poor households (basically requiring weekly repayment of very small amounts).

MFIs can successfully serve smallholder farmers in rural areas if there is commitment combined with a sound in-house knowledge of agricultural value chains and the flexibility to adapt loan terms and lending procedures to the particularities of agriculture (Röttger, 2015). In a number of countries in Africa, there are favorable regulatory frameworks for deposit mobilizing MFIs such as financial cooperatives, rural banks, and microfinance deposit taking institutions. These countries
are Kenya, Ethiopia, Ghana, Nigeria, Tanzania, Uganda and countries in CEMAC and WAEMU regions (Williams and Isern, 2012).

An AfDB study in East Africa found that the share of commercial banks’ loans to agriculture has been very low compared with manufacturing, trade, and other services sectors, hampering expansion and technology adoption (Salami et al., 2010). For example, in Kenya, the lack of capital and access to affordable credit is cited by smallholders as the main factor behind the low productivity in agriculture. Inputs such as improved seed, agrochemicals, and fertilizer require capital in the form of short-term credit. Yet available credit is often captured by larger producers while the poorer farmers may have little or no access to it because of institutional barriers (Chisasa and Makina, 2012). Poor farmers often have difficulty obtaining credit and financial institutions are typically biased against smallholders, particularly women farmers. Informal sources of finance, value chain financing, group financing and other innovative financing options can be used (Adesina et al., 2014). Other sources of finance are cooperative societies; credit unions and savings association (Wichern et al. 1999, AGRA 2017), and value chain financing. In Ethiopia, cooperatives and microfinance institutions (MFIs) are the two major sources of rural finance (Abate et al., 2015). A similar situation exists in Mali where a network of rural micro financial institutions provide credit to distributors to procure fertilizer and also to producer organizations to purchase fertilizer (IFDC, 2015b).

The Warehouse receipt system (WRS) is another source of finance for smallholder farmers and has been tried out in Ethiopia, Kenya, Tanzania, Zambia, Nigeria, Ghana, Niger, and Burkina Faso among others (AGRA, 2016). The system also provides secure places to aggregate and store commodities in the process of securing storage and marketing credit.
4.4 Financing requirements
There financing needs or levels in the fertilizer value chain differs. For instance, building a new fertilizer manufacturing plant requires about USD 1-3 billion. Blending plants require a much smaller amount. For instance, the Toyota Tsusho blending plant in Eldoret, Kenya required USD 20 million\textsuperscript{56} to construct. Steam granulation plants can be more expensive, about 3-4 times than bulk blenders. Compared to trade finance for fertilizer inventories, the ratio between capital investments for a blending plant and trade finance for fertilizer inventories can be 1:10. Thus we have:

(i) Big capital investments - Fertilizer production facilities
(ii) Small capital investments - Blending plants, storage facilities (warehouses, go downs)
(iii) Trade finance - for fertilizer inventories

As we have seen in section II, because the forecast demand is lower than supply, most of the focus should concentrate on blending plants, storage facilities and trade finance. New big capital investments ought to receive a lower priority first due to costs involved and second because of current overcapacity once the planned projects are completed.

The above suggests the importance of paying more attention to trade finance for fertilizer inventories followed by blending plants / storage facilities (warehouses, etc.) to improve access and affordability of fertilizers to farmers especially smallholder farmers.

4.5 Overall Summary
Several sources of funds are available to the private sector and governments for both the supply and demand of fertilizers. The sources of fertilizer supply finance are the AfDB Africa 50 fund, equity capital, pension funds & insurance companies, capital

markets, development partners, African governments, private foundations/non-governmental organizations, and debt financing from African governments and local/international banks. The money would be used to build fertilizer plants, blending plants, facilitate bulk importation of fertilizers, build storage facilities and enhance the capacity of distributers and agro-dealers. For fertilizer demand finance, the sources are private foundations/non-governmental organizations, governments/public institutions, microfinance institutions and value chain financing. But it is becoming increasingly clear that some arrangements of public-private partnership would be required given the fertilizer market risk on both the supply and demand sides. The already ongoing fertilizer manufacturing and processing plants and the fertilizer projects in the clusters involve the private sector from Africa and abroad in collaboration with state–owned companies. This suggests that with fertilizer manufacturing and blending plants, the public-private partnership seems to be the most preferred arrangement with the private sector pooling resources through private equity and capital markets. International and regional financial institutions have also provided funding holding a certain level of equity in these fertilizer plants. It is clear that the development of innovative approaches that utilize loan guarantee funds and risk management tools can go a long way in increasing available financing for fertilizer.

With regard to financing needs, evidence suggests the importance of paying more attention to trade finance followed by blending plants/storage facilities to improve access and affordability of fertilizers farmers, in particular to smallholder farmers.
PART 5: REVIEW AND ANALYSIS OF POLICIES AND REGULATIONS
HINDERING OR FAVOURING FERTILIZER PRODUCTION, CROSS-BORDER
TRADE AND CONSUMPTION IN AFRICA

The chapter centers on discussions about production-based policies, input subsidies, regulations, trade-based policies, tariff measures, non-tariff measures and analysis of transport costs.

5.1 Agricultural production and fertilizer related Policies
The goal of fertilizer sector policy is to raise agricultural productivity and farm incomes by creating a system that supplies high-quality fertilizer to farmers at the right time and at affordable prices, along with information on how to use it effectively57. For instance, Ethiopia has a revised fertilizer policy and law that awaits promulgation (Simtowe, 2015a). Both the national fertilizer policy and law explicitly state the need to regulate the quality of fertilizer imported and produced locally. In the case of Malawi, the country does not have a stand-alone fertilizer policy document (Simtowe, 2015b). However, it has a fertilizer strategy. The country has only a draft fertilizer law that is yet to be promulgated by parliament (Simtowe, 2015b).

As for Tanzania, the country does not have a specific policy focusing on fertilizer although there is a fertilizer law (Simtowe, 2015c). Mozambique does not have both fertilizer policy and fertilizer law (Simtowe, 2015d). The pattern of fertilizer laws and policies across Africa is varied (AFAP, 2017). In general, about one-third of African countries have formal fertilizer policy and regulatory frameworks to guide the fertilizer sector, while the rest govern their sectors by administrative decree (IFDC, 2015a). However, some of these are old and outdated (Ariga, 2017). They need to be revised to

handle the emerging national and international environments. In Senegal, there is no specific fertilizer law. The importation, sale and distribution of fertilizers is regulated under chemical products which include agro-inputs (IFDC, 2014c).

In most African countries, fertilizer policies whether in draft form or completed encourage private sector involvement in fertilizer manufacture and blending to ease access and reduce cost of fertilizers. The policies also encourage or call for the harmonization of policies with those at the regional levels58. They also encourage periodic soil analyses and fertilizer trials in order to update fertilizer recommendations. While soil testing and fertilizer trials are crucial, they are expensive to carry out in all the agro-ecological zones within a country. This is an area where donor support or private sector involvement or PPPs is necessary. A few countries have undertaken soil mapping. For instance, Ethiopia has recently completed soil mapping (Simtowe, 2015 a, Africafertilizer.org, 2016). The same applies to Kenya (IFDC, 2015a). Soil mapping by the African Soil Information System (AfSIS) is ongoing in Tanzania and Nigeria. Companies such as OCP are also engaged in mapping the soils of some countries.

As IFDC (2015a) argues, there is a need to stimulate farm level fertilizer demand as this is what ultimately leads to higher consumption. This can be done by allocating more funds to research and extension and also address problems of weak output markets and low returns to fertilizer use. As stated earlier, agriculture is an important contributor to GDP in many African countries. In order to contribute to growth and to feed the increasing African population, agricultural policies in Africa call for the increased use of modern inputs with improved seeds, fertilizers and pesticides. In general, a more holistic and sustainable approach aimed at increasing fertilizer use should consider

supply and demand side (or farm-level) aspects in both input and output markets (Cameron et al., 2017).

Procurement policies in some countries also can enhance fertilizer trade. For example, in 2017, the Tanzanian government introduced a Bulk Procurement System (BPS) in which the government imports all the major fertilizer commodities into the country. In this policy, the Tanzania Fertilizer Regulatory Authority (TFRA) consolidates orders for urea and DAP, conducts competitive bidding, award tenders, and enforces regulations of the bulk procurement act, which includes setting maximum retail prices (AFAP and IFDC, 2017). This system is premised on the procurement of petroleum products in many African countries. However, it is too early to determine the effectiveness of bulk procurement in reducing fertilizer prices given the challenges of poor port logistics and the associated disincentives to private sector participation (FAO & IFDC, 2017). Ethiopia has been undertaking bulk procurement of fertilizer (AFAP, 2017) as the private sector does not participate in importation.

5.2 Fertilizer Input Subsidies

Following the rise of global food and fertilizer prices in 2007 and 2008 and also following the Malawi experience/”miracle”, many countries in Africa have implemented input subsidies. Other reasons that have contributed to the rise in input subsidies in Africa include: Heavily Indebted Poor Countries (HIPC) initiative, shift from conditionality59 to budget support, and also shift in the World Bank perspective as it supports “smart” subsidy program (Jayne, 2013). However not all countries have a national fertilizer subsidy, a good example is Uganda (IFDC, 2014b).

Fertilizers are very costly to smallholder farmers, so they find it difficult to get enough fertilizer (AGRA, 2014a). As a result, most African governments have implemented

59 http://ssa.foodsecurityportal.org/content/full-summary-fertilizer-dialogue
subsidy programs. However, these programs absorb large proportions of budgetary allocations to agriculture (AGRA, 2014b). For example, since the mid-2000s, ten African countries spent a total of roughly USD 1 billion annually on subsidy programs, amounting to 28.6% of their public expenditures on agriculture (Jayne and Rashid, 2013). Recently, the expenditures of the same ten countries have ranged from about USD 600 million to USD 1 billion per year, representing about 14-26% of their combined annual public expenditures on agriculture (Jayne et al., 2018). Kotschi (2013) argues that some African countries (e.g. Malawi, Ghana, and Zambia) are spending 40-70% of their entire agricultural budgets on fertilizer subsidies leaving little for agricultural research and extension amongst others important activities. The programs also account for 30-40% of total imports (IFDC and FAI, 2017). The involvement of the state in fertilizer production is often driven by food security rather than business principles. Fertilizer subsidy programs can also lead to late delivery of fertilizer, due to delays in budgetary approvals and funding shortfalls (Keyser, 2015).

Most evaluations of subsidy programs point out that they have increased fertilizer use, although at a high cost and with no assurance of sustained fertilizer purchase and use without a continued subsidy program (Ariga, 2017; AGRA, 2014b). There are also allegations of fertilizer diversion into secondary markets, untargeted subsidies (with subsidized fertilizer going to users who do not need subsidies), administrative allocation of fertilizer import licenses (inviting the risk of corruption), non-transparent fertilizer allocation and distribution practices; and delayed delivery (Ariga, 2017). The resurgence of fertilizer subsidies brings the risk of the curtailment or restriction of private sector participation in fertilizer markets (Wanzala-Mlobela et al., 2013). While subsidy programs were found to increase food production, regional food self-
sufficiency in and of itself will not guarantee more stable food prices (Jayne and Rashid, 2013).

Despite the above limitations, fertilizer input subsidies have generally increased the consumption of fertilizers and thus agricultural production (Jayne and Rashid, 2013). Some of the recent gains in agricultural production have been recorded in West Africa because of spending on subsidy programs, although total nutrient use still remains well below the level needed to transform agriculture production (NEPAD, 2011). However, fertilizer use in North Africa was 103 kg/ha during 2003–2012 period (Badiane et al., 2014) which is largely influenced by high application rates in the Nile Valley in Egypt, where the average application rate is about 400kg/ha. As subsidy programs expand food production, governments often face political pressure to support food prices for producers through marketing boards and discretionary trade policies (Jayne and Rashid, 2013).

In 2016, the percentage of subsidy volume (Figure 25) ranged from 12% in Zimbabwe, 28% in Malawi, 69% in Burundi, 92% in Rwanda and 100% in Ethiopia60 (IFAP and IFDC, 2017).

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60 However, we note that all specialty fertilizers going to cut flower (as well as some fruit and vegetable) production to the export market are not included therefore the overall percentage is likely to lower than 100.
However, a number of countries are struggling to sustain fertilizer subsidies. In Nigeria, the Growth Enhancement Support (GES) scheme was discontinued in 2016 because it had accumulated a huge debt and had not achieved its objective of better targeting of beneficiaries. In Ghana and a number of other African countries, fertilizer subsidy rates have been revised downwards. Nigeria has recently launched a “Presidential Fertilizer Initiative” expected to increase crop yields and save USD 200 million in foreign exchange by increasing the production of soil- and crop-specific NPKs by 1.5 million metric tonnes (Mt) in 2017 (IFA, 2017; IFDC and FAI, 2017; Heffer, 2016).

Fertilizer subsidies do provide an opportunity for the involvement of the private sector depending on how they are designed or implemented. Recent experience suggests the growing involvement of the private sector in fertilizer subsidies. In Ghana and Nigeria,
for instance, the state is actively promoting private sector involvement in the procurement and distribution of subsidized seed and fertilizer (Keyser et al., 2015). Mali and Burkina Faso are also moving to a private sector approach in their subsidy programs, at least for fertilizer distribution (Keyser et al., 2015).

Market-friendly orientations towards “SMART” subsidies have the potential to support the development of private fertilizer markets in Africa and increase the availability and accessibility of fertilizers to poor smallholder farmers. Some African governments have tried to implement market-friendly subsidies by introducing at least some of the basic attributes of “SMART” subsidies (Wanzala-Mlobela et al., 2013). Some countries have used input voucher system while others have used electronic transfer/e-wallet systems using mobile phone system as is the case in Kenya and Nigeria but redeemable at private fertilizer stockists. However, concerns have been raised about delays in government payments, which greatly increase finance costs and the risks of doing business (Keyser et al., 2015; USAID-EAT, 2012). Hence, the need to continuously redesign the input subsidy program delivery and implementation to remove all the existing bottlenecks.

About the future of fertilizer subsidies in Africa, it may be difficult to comprehend the direction in the light of WTO trade policies. However, evidence has shown that they have led to consumption of more fertilizers and therefore more agricultural output. Jayne and Rashid (2013) are of the view that input subsidy programs are likely to remain for a long time to come since they enable governments to demonstrate tangible support to their constituents. A recent review of fertilizer subsidies found that although they are unsustainable and inefficient, they will continue to be an important feature of agricultural policy in Africa for the foreseeable future (IFDC and FAI, 2017, Jayne et al., 2018). Given their social capital and capital mileage, the focus should be on
the improvement of the design, implementation and performance (IFDC and FAI, 2017). It is, however, possible for African countries to reduce fertilizer subsidies if there is great improvement of road infrastructure, reduction of port and other related charges, reduction of non-tariff barriers to trade, improved access to finance and increase of agro-dealers network, which will make prices of fertilizer to generally come down. In addition, as Wanzala-Mlobela et al., (2013) argue, governments could view subsidy programs as an investment in the agriculture sector, contributing towards making the agricultural sector self-sustaining. If governments accept that subsidies will remain a part of the government budget for the foreseeable future, they should aim to make this expenditure as productive as possible by also investing in complementary measures to raise the productivity of fertilizers (Wanzala-Mlobela et al., 2013).

Given that fertilizer alone cannot raise crop productivity, complementary measures are therefore needed. These include (i) better seeds (ii) knowledge transfer to farmers and (iii) updated fertilizer recommendations amongst other measures.

Most fertilizer recommendations are outdated. New soil tests according to agro-ecological zones are thus required so that farmers can only apply what the soils need. Accompanying soil and water conservation measures are equally critical, as well as credit access, extension service, pesticide support and market access. All these tend to raise the value–cost ratio of fertilizers and therefore raise fertilizer demand (Jayne et al., 2015). It should be noted that output markets are the ultimate driver of fertilizer demand. Input subsidies on fertilizers appear to have focused on giving farmers more fertilizer and less on efficient and profitable use of fertilizers (Jayne et al., 2018).

Investments and policy reforms that lower fertilizer supply distribution costs, while improving market performance, do not guarantee a dramatic increase in demand for fertilizers without other complementary investments on the demand side. For example,
a critical demand side constraint is the lack of adequate access to technical support services such as research extension and market information. Teaching the proper use of fertilizer with improved crop varieties for higher fertilizer response, and expanding the existing market information systems, can also lead to greater agricultural intensification and increase the use of agro-inputs including fertilizer – especially among non-organized farmers located outside the main production zones (IFDC, 2015b).

The expected changes in the design and implementation of subsidy programs would entail the use of e-vouchers. Nigeria already has them and they are being piloted in Kenya and Zambia. These to be used rather than paper vouchers, and other measures should include the expansion of coverage to include extension services, credit, irrigation and access to output markets, and the greater involvement of the private sector (Jayne et al., 2018; IFDC and FAI, 2017). Also, there should be geographic targeting for areas where private input markets are less active (Jayne et al., 2018). This constitutes a holistic approach in raising agricultural productivity in Africa that includes greater use of complementary inputs and management practices and increased use of inorganic fertilizers as the way forward (Jayne et al., 2018).

5.3 Standards, Regulations, Institutions and Enforcement
Standards and regulations are important as they bring both economic and social benefits and also help facilitate international trade. As ECOWAS (2012) rightly put it, fertilizer standards are established in order to (i) protect the welfare of farmers against nutrient deficiencies, adulteration, misleading claims, and short weight; (ii) safeguard the interests of fertilizer enterprises and contribute to the creation of an enabling environment for private sector investment in the fertilizer industry; (iii) protect the natural environment and its population against the potential dangers associated with inappropriate fertilizer use; and (iv) facilitate inter and intra-states trade in fertilizers,
through implementation of principles and rules mutually agreed at the regional level to dismantle trade barriers. Standards that are either incorrectly defined or with zero or little compliance rate can lead to abuses such as improper or misleading labelling and underweight bags, which increase investment risk for farmers and may dissuade them from using fertilizer in the future (USAID-EAT, 2012).

The components of regulations comprise of registration of firms and products, inspection and sampling, analysis of samples, enforcement and penalties /sanctions for non-compliance (Gregory, 2006). Many of the member states in each of the six clusters either have draft regulations or have finalized them while some have established fertilizer regulation authorities such as Tanzania. Others have outdated regulations (IFDC, 2015a) while others do not have specific laws on fertilizer, Senegal being an example (IFDC, 2014c). However, efforts to harmonize policy and regulatory frameworks are continuing with technical support from IFDC, the African Fertilizer and Agribusiness Partnership (AFAP), and other organizations (Ariga, 2017).

In order to be consistent with global recognized fertilizer standards, regional economic communities often tend to have their regulations anchored on internationally recognized standards. For example, the regulations of the ECOWAS commission and the member states are anchored on internationally recognized standards, which include standards set by the AOAC and ISO with EU regulations as an alternative (Keyser et al., 2015).

However, SADC regional economic community is yet to develop harmonized regional guidelines on the use of fertilizers. Even though COMESA has not yet developed a common fertilizer strategy, jointly with AFAP, in November 2014, they launched a fertilizer harmonization program with the overall aim of encouraging COMESA member states to enhance supply and use of fertilizer among smallholder farmers.
Through the Alliance for Commodity Trade in Eastern and Southern Africa (ACTESA), member states were to undertake harmonization of national policies, laws and regulations to enhance the flow of fertilizer trade in the region.61

Fertilizer trade primarily revolves around quality control procedures including the verification of container weights and declared chemical components. Good storage conditions especially for blends are required to avoid caking, water damage, and other types of losses (Keyser et al., 2015). Before fertilizers are traded or imported they must be registered. Product registration is customary to ensure the product is safe and effective to use given the country’s own agro-climatic conditions (Keyser, 2015). Registration at the regional level should be encouraged to reduce registration cost, which can be an obstacle to making a range of fertilizer products meeting site- and crop-specific conditions available to farmers.

The main challenge with fertilizer trade is that quality problems can arise anywhere along the supply chain. Complaints abound about underweight bags and grossly adulterated products - even to the point where ash and pure sand are sometimes being sold as fertilizer (Ayoola, 2014). Enforcing fertilizer standards in Africa is a great challenge given the capacity constraints. Internationally-recognized test certificates and inspections at seaports or inland border crossings, place of manufacture, or even in local warehouses, may give little indication as to the final quality of the product sold in the market or distributed to farmers, as adulteration may occur at the point of retail.

For example, an assessment of fertilizer quality in Côte d’Ivoire, Ghana, Nigeria, and Togo commissioned by the ECOWAS Commission as it embarked on the harmonization

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61 www.afap-partnership.org
process (Sanabria et al., 2013), found serious problems with the quality of blended fertilizers and granular compounds in all the countries covered. Of the blended products, 51 to 96\% of the samples analyzed did not comply with tolerance limits for nutrients content set by ECOWAS. Compound fertilizers manufactured by global suppliers did better with only 15\% of the samples found to be deficient in nutrients although problems with underweight bags and inadequate storage were still common. In Nigeria, 41\% of the bags sampled did not meet the ECOWAS tolerance limits for weight (Sanabria et al, 2013). The same applies to Uganda where incorrect labelling, adulteration, underweight and high moisture content are common problems during repackaging to smaller quantities to fit the requirements of smallholder farmers (Mbowe et al., 2015). However, one of the constraints with enforcement is the logistics involved in quality control. Controllers have to visit hub agro-dealers and retailers, take samples, send samples to the lab, and wait for the results. The results are received weeks after taking the samples and by that time, the fertilizer would already have been sold and applied to the land. To facilitate enforcement, faster options are needed, e.g. the use of spectrophotometric tools that can provide an immediate assessment of fertilizer quality.

One of the regulations that has often hampered trade in fertilizers is related to blending regulations. First, it takes time and money before the blend is approved. For instance, requiring three seasons of testing under government supervision of ‘new’ fertilizer mixes, even when they are only slightly different from current formulations, is excessive and unnecessary regulation (AGRA, 2014 b). Malawi requires productivity data (field trials) for three consecutive agricultural seasons before any new product can be introduced to the market (AFAP, 2017). The fee a private firm must pay to test a new fertilizer (USD 10,000 per season in Tanzania) to cover the costs of government testing
at research stations and on farms is considered far too high by the private sector and beyond the reach of smaller importers and fertilizer mixers (AGRA, 2014b). It is encouraging to note that the Tanzania Fertilizer Regulatory Authority (TFRA) has reduced new product trial time to four months, with an additional 1 month for result analysis and report writing and six months for registration and approval in at least two agro-ecological zones (Africafertilizer.org, 2016). This revision will have the registration and adoption of new fertilizer products reduce in costs by approximately 70% (Africafertilizer.org, ibid).

However, there is not much fertilizer blending underway in most African countries, but it is increasing and the capacity that exists is for physical as opposed to chemical blending. There are currently 59 blending companies in Sub-Saharan Africa (Africafertilizer.org, 2018). There is also virtually no soil testing on farms, so farmers are unaware of precise nutrient requirements for their soils and crops (AGRA, 2014b). In addition, unless it is registered in a country, that particular blend cannot be traded. Moreover, all the importers and traders have to be registered and also obtain imports and trading permits. A closer observation of agro-ecological zones in a number of clusters shows lots of similarities implying that a number of fertilizer formulations/blends could easily be used in a number of countries.

Nevertheless, the World Bank argues that the African fertilizer market tends to be very fragmented selling very many fertilizer products. In Malawi, for example, over 20 different types of fertilizer products are sold yet the total annual consumption rarely reaches 200,000 product tons (World Bank, 2007b). It is further argued that there is no need for such a large number of similar fertilizer products.

However, Heffernan (2013) has a different view. He argues that many blends are better because they can address crop and soil specific nutrient requirements. The large
diversity of crops and soils observed in Africa (larger than in Asia) requires a diversity of fertilizer products to meet crop- and site-specific conditions. However, requiring a blend to be tested and registered before it can be produced is very limiting. It should be noted that it is not economically feasible to field test tens or hundreds of specific blends before release. Such regulations render a commercial blending operation financially unviable.

Once a product has been approved, annual fees have to be paid for one to remain in the fertilizer business. In Zambia, importers must register each type of fertilizer they plan to import with the Zambia Environmental Management Agency each year at a cost of about USD 325 per product (Keyser, 2015). Similarly, in Ghana, fertilizer importers must pay almost USD 1,600 every two years to re-register each approved fertilizer product they wish to import (Keyser, 2015). Problems with duplicate testing are also common. Nigeria, for example, requires all fertilizer imports be held at the port of entry until a domestic laboratory confirms that the product matches the manufacturer’s claims regardless of other international test results or certificates of authenticity (USAID-EAT 2012).

A comparison of fertilizer regulations among countries shows that the countries, from lowest to highest, with the worst performance on the fertilizer indicators include Liberia, Benin, Senegal, Ethiopia, Sudan, and Burkina Faso, along with Niger (World Bank 2017). These countries have rudimentary regulatory frameworks for registering fertilizer. Countries that performed poorly with respect to regulations for importing and distributing fertilizer are primarily located in Sub-Saharan Africa and the Middle East and North Africa regions, where the renewal period for importer registrations are shorter and import permits are expensive and valid for a shorter period of time (World Bank, 2017).
On the same note, Ethiopia received the lowest score on importing and distributing fertilizer because the private sector is prohibited from engaging in any such activities. The lowest scores in the quality control indicator, also found predominantly in the Sub-Saharan Africa region, are driven by the absence of laws prohibiting mislabeled and open-bag fertilizer, the lack of appropriate penalties and the absence of labelling requirements in at least one of the official languages of the country (World Bank, Ibid).

Of the countries which require field testing, the majority are in Sub-Saharan Africa (7). Countries with field testing procedures tend to have longer times and higher costs to register fertilizer products (World Bank, 2017). The average time to register a new fertilizer product in countries requiring field testing is 536.35 days, in contrast to 125.1 days in countries without this requirement. In this regard, Tanzania is the most expensive, averaging 1,064.5% of income per capita, due to high costs for field testing, which alone costs 1,050% of income per capita and takes 570 calendar days (World Bank, 2016).

Kenya is one of the very few countries whose regulations allow all entities including the private sector, non-governmental organizations and producer organizations to import fertilizers (World Bank, 2017). On the same note, Morocco is one of the countries that has regulations that prohibit the sale of mislabeled and open fertilizer bags and impose penalties on those who fail to comply with set regulations (World Bank, 2017).

Several countries in Africa (Cameroon, Côte d’Ivoire and Kenya) do not require an import permit and thus serve as good examples for other countries (World Bank, 2017). Burundi and Sudan require a pre-shipment import permit with a two-month validity, whereas Tanzania require a pre-shipment import permit that expires within a month.
Nigeria imposes a different kind of restriction by requiring pre-shipment import permits with a particular volume quota that is valid for 12 months. Senegal requires a blank permit that is valid for 48 months and Benin’s blank permit is valid for 24 months (World Bank, 2017). In Burundi and Mozambique, although the private sector is permitted to register new fertilizer products, no products were registered in 2016. In Ethiopia and Kenya, the law permits only the public sector to register new fertilizer products. Malawi has the fourth lengthiest and the most expensive fertilizer registration process, taking 913 days and 3030.48% of income per capita to register. In Sub-Saharan Africa, both Kenya (a lower-middle-income country) and Rwanda (a low-income country) are among the best performers globally, offering good examples to other countries in the region that are not performing as well (World Bank, 2016). All studied countries except Ethiopia allow domestic companies to import fertilizer products for their sale (World Bank, 2016). Ethiopia only allows domestic companies to import fertilizer products for self-consumption, a practice only carried out by large agro-industries. Bangladesh, Cambodia, Ethiopia, Myanmar, the Philippines and Sudan are the only countries that prohibit foreign companies from importing fertilizer products (World Bank, 2016).

It is time consuming to complete the process of exporting agricultural goods in Sub-Saharan African countries, taking six days on average, and the documents are most expensive in South Asia and Sub-Saharan Africa (World Bank, 2017).

Even if a country has good regulations, they are only as good as the capacity of the regulatory authority to enforce implementation. Regulatory institutions are critical in

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62 If an import permit is required, the least burdensome option are blank permits with no volume, shipment or time limits that are affordable and simple to obtain (World Bank, 2017)
ensuring that farmers access high-quality fertilizers. The reason is that farmers are sometimes confronted with an under-regulated influx of commercial products whose true benefits cannot be vouchsafed. An effective and conducive regulatory environment can unlock the use of fertilizers in Africa\textsuperscript{63}.

The challenges with regulations in most countries revolve around inadequate legislation, inadequate enforcement capacity and weak implementation where rules exist. Although the situation is similar across countries, some countries can be described as having completed the process of developing regulatory systems, others as having interim or work in progress frameworks and yet others with no regulatory frameworks (Keyser et al., 2015). Most countries in Africa fall in the category with unfinished or interim frameworks where regulatory frameworks remain mere drafts or are dissimilar, thus impeding implementation efforts and therefore rendering poor facilitation of production, distribution and use of fertilizers. Others fall in the category of countries with fully developed regulatory frameworks such as in Uganda where regulations were developed in 2012 (Mbowe et al., 2015) but are affected by inadequate human, financial and material resources, weak institutional arrangements and overlapping mandates. For example, a majority of African countries do not have adequate number of inspectors and thus fewer or no inspectors at the point of sale, where the risk of adulteration is high.

In many countries, the fertilizer regulatory environment is cumbersome and confusing as core duties are duplicated due to the involvement of multiple institutions with similar and/or overlapping mandates (AFAP, 2017). For instance, three agencies in Nigeria including the Federal Fertilizer Department (FFD), the National Agency for

Food and Drug Administration (NAFDAC), and the Standards Organization of Nigeria (SON) each claim responsibility for different and sometimes overlapping aspects of fertilizer control (Keyser et al, 2015). Countries should establish a single fertilizer regulatory authority which adopts a one-stop shop model whereby fertilizer suppliers can register their products and businesses and acquire import permits, transit permits and trading licenses at one institution.

The situation is not different when examined from a regional perspective with some regional blocks having fully developed their regulatory frameworks (e.g. ECOWAS), while others either continue to work on theirs or have none in place.

Moreover, even where farmers attempt to use fertilizers correctly, their efforts are hampered by outdated fertilizer recommendations. Consequently, they use fertilizer grades and quantities that are not suitable for their soils and/or crop mix. This continuous cultivation without proper and adequate use of fertilizers has resulted in severe soil infertility and degradation problems in Africa. Consequently, crop yields and profitability are much lower than what is required to achieve food security and increased incomes.

A key reason for the outdated fertilizer recommendations and poor farmer knowledge regarding correct fertilizer use in Africa is that many of the extension and research systems are defunct or, if they exist, they are under-staffed and under-equipped. The idea of involving private practitioners in both extension and fertilizer production is becoming increasingly popular. More recently, some policy makers have started to reconsider the prevailing thinking about promoting fertilizer. Noting that private firms have not always stepped in to fill the vacuum left by the withdrawal of state agencies
from the fertilizer sector, they have called for the re-engagement of the public sector in the importation and distribution of fertilizer.

Although fertilizer laws exist in Nigeria, Ghana, Burkina Faso, and Mali, national regulatory services lack sufficient resources to implement them at the point of sale or enforce them. Different standards in various countries also prevent the movement of product from one country to another. In the framework of the implementation of its Common Agricultural Policy (including its fertilizer strategy following the Abuja Declaration), ECOWAS is trying to address these shortfalls. For example, it has embarked on a process to develop and adopt a regional regulatory framework on fertilizer quality control, as well as other necessary supporting regulations.

The presence of unnecessary government regulations at the import level can also add costly delays, such as quality control inspections that are unnecessary when international inspection companies have already done so prior to shipping. It should be underscored that quality is generally more of an issue for blended NPK than for straight products like urea and DAP that are imported and sold in 50 kg bags, (AGRA, 2014b).

As indicated in AGRA (2014a), some fertilizer on sale is inappropriately formulated, substandard or adulterated. These problems often come during repackaging into smaller quantities and blending. Issues to do with incorrect labelling, adulteration, underweight and high moisture content often crop up during repackaging to smaller quantities to fit the requirements of smallholder farmers (Mbowe et al., 2015).

Fertilizer quality standards cover both physical and chemical characteristics. The physical characteristics (i.e. packaging; moisture content; and weight of the bags) are indicative of the quality of fertilizer (Mbowe et al., 2015). The chemical characteristics
include the nutrient content of the fertilizers. The practice of agro-dealers at retail level to re-pack fertilizers into smaller weights (1-2kg), most often increases moisture levels. The stockists are compelled to repackage because fertilizers are imported in weights which smallholder farmers cannot afford.

The practice of not having uniform fertilizer standards across the regional economic communities coupled with different formulations that are country based makes cross-border fertilizer trade very difficult. Thus, strengthening the regulatory capacity, upgrading of testing laboratories, enactment of fertilizer laws and regulations and harmonization within regional economic organizations would be the best way forward. However, there is a need for a cautious approach on benchmarking using international recognized standards. Although standards set by international bodies are highly effective as quality control instruments, they are technically demanding and require specialist skills, advanced laboratory equipment and other resources to implement that are generally lacking in Africa (Keyser et al., 2015). Even in relatively advanced countries, quality control systems are greatly overstretched (Keyser et al., 2015).

The ECOWAS in conjunction with UEMOA appears to be ahead in developing fertilizer regulations and instruments for control with the support of USAID under the West Africa Fertilizer Program (WASP). Countries are being encouraged to develop regulations and policies that are in line with the regional regulations.

If fertilizer policies are harmonized at a regional level, regional inspection of fertilizer would allow for shipments to be approved once upon entry into a region. Because of a lack of harmonization, fertilizer is currently subject to mandatory pre-shipment inspections at ports and border crossings, which introduces delays in shipment due to multiple inspections. Fertilizer also faces incompatible packaging and product
specifications for accepted fertilizer compounds across countries. In SADC, for instance, the main NPK fertilizer compound used in Zambia cannot enter Malawi because it does not meet Malawi’s specifications. In Uganda, new fertilizer products must undergo a mandatory three seasons of field testing (typically three years) before approval, even if the product is registered and used in neighboring Kenya in the same agro-ecological zone (USAID-EAT, 2012). A regional certification scheme would facilitate the product approval process by recognizing a product has been approved in one or more countries in the region. This could be accomplished by simply recognizing another country’s approval procedures or by reducing the required seasons of mandatory field tests for a product that has been approved by a neighboring country. Regional certification would avoid duplicative testing and compliance costs and allow for the redistribution of fertilizer across borders as demand develops throughout the season. Achieving regional standards for certification, however, requires support to countries without adequate existing capacity for inspections, laboratory testing, and regulatory enforcement (USAID-EAT, 2012). In Kenya, each shipment of imported fertilizer must carry a quality certificate from the exporting country’s bureau of standards and is further subjected to pre-shipment inspection (Keyser 2012). In Zambia, traders must submit fertilizer samples to the Bureau of Standards 90 days prior to shipment arrival. Yet, in most countries in Africa, in spite of the controls, counterfeit fertilizers circulate widely, in large part because the adulteration takes place on the domestic market whereas controls are mainly at the border.

Although different soils and crops naturally need different amounts of nutrients for optimal growth, a recent study by the International Fertilizer Development Centre and the International Food Policy Research Institute shows that product differentiation in West Africa has taken place for non-technical reasons (Bumb et al., 2011). As a result,
different blends must be custom made for each country on a very small scale, which adds unnecessarily to production cost and price. By harmonizing fertilizer blends across countries and encouraging local blending capacity, West Africa could realize estimated savings of at least USD30–USD40 per ton (USD1.50–USD2.50 per 50kg bag).

Similar constraints and opportunities exist in eastern and southern Africa where most countries insist on their own granulated formulations and therefore incur high costs to manufacture and ship relatively small amounts.

5.3.1 Human health risk assessment, management and security

Health regulations are meant to protect workers and consumers from exposure to toxic dust, radiation, and fumes amongst others. The fertilizer production companies themselves have also put in place safety guidelines. These include SHE (Safety, Health and Environment) management procedures and HAZOP (Hazard and Operability)\(^\text{64}\). International Fertilizer Association (IFA) members for instance has proposed “Protect & Sustain” certification system which is a practical framework for implementing product stewardship practices and covers management system, product development and planning, sourcing and contractor management, manufacturing techniques, supply chain to customer, as well as marketing, sales and application. Most countries that manufacture fertilizers have introduced regulatory initiatives to reinforce safety over the years.

Manufactured fertilizers, animal manures, bio solids and recycled industrial waste may all contain heavy metal impurities. These can accumulate in the soil since they are not subject to chemical decomposition. Cadmium is the metal of greatest concern because of potential adverse effects on kidneys and bones. With regard to human health and

\(^{64}\)Http://www.fertilizer.org/SHE-accessed on 4 December 2014
safety, guidelines for Nitrogenous Fertilizer Production identifies the most significant health and safety hazards as being: process safety; chemical hazards; fire and explosion hazards; and ammonia storage. The European Fertilizer Manufacturer’s Association (Fertilizers Europe) has developed guidelines for Best Available Techniques (BAT) for Pollution Prevention and Control for ammonia and urea production. The most significant community health and safety hazards relate to: management, storage and shipping of hazardous products (e.g. ammonia) with potential for accidental leaks/releases of toxic and flammable gases; and disposal of wastes. Nitrogen and other chemicals present in the fertilizers can also affect the ground water and water that is used for drinking.

In South Africa, regulations allow only certain maximum levels of harmful elements permitted in fertilizers such as mercury, lead, zinc, arsenic, chromium, cobalt, boron, and fluorine. However, it should be noted that zinc and boron are also essential plant nutrients. So, regulations should protect against overuse but should not prevent the use of these nutrients where their deficiency in soils can impact crop yield.

In Africa, ministries of health are responsible for accessing the harmfulness of not only imported products but also those that are produced locally. But with imported fertilizers that have already been certified, what is required is simply some routine checks. However, this will become an important issue as blending and local manufacturing picks up. All African countries could benefit from risk assessments carried out in the rest of the world.

In Nigeria, strict restrictions on the movement of urea in the north in order to control distribution and prevent illegal use for producing improvised explosive devices negatively affects the supply and demand of fertilizers (Prud’homme, 2016).

5.3.2 Environmental Risk assessment and Management (Use and disposal of waste)

Inappropriate use of fertilizers or the overuse of fertilizers can cause environmental degradation. Fertilizers may contain compounds/metals that maybe harmful to the environment. Therefore, dealers who may want to engage in fertilizer production, through establishing manufacturing or blending plants are required to prepare an Environmental Action Plan to be verified and approved by the Environment Protection Agency of each country.

The production and usage of fertilizers can have negative effect on the environment, but the adoption of best available technologies (BATs) in production and of best management practices (BMPs) in agriculture minimizes those impacts. The emissions have contributed to a great extent to the quantity of greenhouse gases present in the environment. This in turn is leading to global warming and climate changes. In fact, nitrous oxide, which is a nitrogen compound, is the third most significant greenhouse gas, after carbon dioxide and methane. Fertilizer production accounts for about 1% of all the global greenhouse gas emission and consumes about 1.2% of World’s total energy (Andresen, 2017).

inappropriate use of fertilizers could also have a negative effect on the environment such as leaching to underground water sources. With respect to climate change, the inappropriate use of N fertilizers is identified as a significant source of greenhouse gas emissions. It has been argued that using acidifying fertilizer can lead to a reduction in

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soil quality by increasing the acid levels\textsuperscript{68}. N and P losses can also lead to eutrophication of surrounding water bodies and therefore can affect the health of aquatic organisms. It is thus important to use the right fertilizer source at the right rate, at the right time and in the right place (4Rs) and this can be done through carrying out periodic soil studies\textsuperscript{69}(Bruulsema, 2018; IFA et al., 2016). These principles connect management of crop nutrition to sustainable crop production. The IPNI program in North Africa, for instance, is focusing on the implementation of the concept of 4R Nutrient Stewardship by conducting research platforms on the efficient use of fertilizers through the evaluation of fertilizer sources and their application rates and time in dryland and irrigated agriculture under Mediterranean climatic conditions (El Gharous and Boulal, 2016). The approach is the integrated plant nutrition approach which seeks to improve nutrient-use efficiency, to build up nutrient stocks in the soil, and to limit losses to the environment. Other mitigation measures include emission capture systems during manufacturing and the use of slow- and controlled-release and stabilized fertilizers. IFDC (2015) is of the view that an integrated soil fertility management system (ISFM) that varies by agro-ecological zones and availability of organic inputs, etc. should be adopted. For instance, Urea Deep Placement (UDP) is a practice that can be part of an ISFM package specific for lowland transplanted rice.

When it comes to the production of fertilizers, environmental protection agencies are often involved through environmental impact assessments. In such a situation, a plethora of agencies get involved besides those involved in fertilizer regulations. The environmental impact assessment covers both human health and environmental risks and how these could be mitigated.

\textsuperscript{68} http://www.environment.co.za/environmental-issues/how-do-fertilizers-affect-the-environment.html-accessed on the 4 November 2015

\textsuperscript{69} http://www.environment.co.za/environmental-issues/how-do-fertilizers-affect-the-environment.html-accessed on the 4 December 2014
Factories involved in fertilizer manufacturing and also the location of blending facilities for fertilizer are subjected to environmental impact assessment and that is when environmental regulations often affect the fertilizer business. For instance, for the proposed potash mining in Ethiopia, an environmental and social impact assessment study was carried out and confirmed that future activities comply with Ethiopian environmental legislation and international standards. However, with the distribution and sale of fertilizers, there is little involvement since it is assumed that testing and certifying bodies will have dealt with such issues. Given that the application rates of fertilizers are low in Africa, no serious environmental problems arise from their use.

But effecting national environmental policies on industry emission can foster plant efficiencies (Prud'homme, 2016). In the global context, the recent negotiations on the Sustainable Development Goals (SDGs) and on climate change (COP21) may have an indirect impact on fertilizer use with reference to improve nitrogen use efficiency to reduce the impact of nitrogen losses to the environment (Heffer et al., 2016). The developments in other areas will also influence Africa. The EU recently adopted the Circular Economy Strategy that focuses on greater recycling and the re-use of various organic nutrient sources which is beneficial to the environment. On the other hand, China adopted the “zero-growth’ policy which seals fertilizer demand expansion at 1% per year between 2015-2020 (Heffer et al., 2016).

5.4 Trade Based Policies

Trade-based policies can either favor or hinder fertilizer trade and consumption in Africa. First, most African countries are either signatories of WTO agreements or are under observer status. Protectionist policies are discouraged under WTO agreements as countries open up their domestic markets to goods and services from other countries.

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70 http://www.law360.com/articles/621563/yara-seeks-equity-partners-for-740m-ethiopian-potash-mine
The adherence to WTO agreements therefore should encourage the trade and consumption of fertilizer in Africa.

Secondly, there are on-going efforts of enhancing trade among African countries. This is through the Tripartite Agreement that aims to form a free trade area between EAC, COMESA and SADC regional economic communities and the Continental Free Trade Agreement (CFTA) (launched in February 2018) that intends making Africa a free trade area. The elements of these agreements are geared at promoting free trade among all African countries. The realization of these agreements is likely to enhance cross-border fertilizer trade and consumption.

Third, most African countries have liberalized their economies. In Africa, the trade policy is mainly a mixture being liberal with elements of restrictiveness to protect some sensitive domestic sectors of the economy (ERA, 2015). But some countries have different objectives when it comes to trade policies. These range from tax revenue maximization (ERA, 2015), increasing GDP growth and reducing poverty among others.

However, opportunities for regional trade especially for fertilizer are severely constrained by countries insisting on their own unique product formulations and by lengthy product-testing requirements. Some Zambian firms have started to export locally blended fertilizer to the Democratic Republic of Congo but say this is not possible in other markets where tighter controls exist (Keyser, 2015). To the extent that African suppliers are able to provide quality inputs geared to local conditions and at better prices than can domestic or world suppliers, trade barriers at the input supply stage of an agricultural value chain can have an even greater effect on farmer productivity, incomes, and competitiveness than can barriers to trade of food staples themselves (Keyser, 2015).
Most of the trade policies in East Africa are more liberal in nature (i.e. trade liberalization). Kenya’s National Trade policy for instance is anchored on the principles and objectives of the WTO. The country is committed to gradual reduction of tariff and non-tariff barriers and progressive liberalization of trade in services. The country is also a member of Regional Trade Economic blocs (COMESA and EAC, among others) and has also signed several bilateral and preferential trade agreements (Republic of Kenya, 2009). In East Africa, the region has both a common market and a customs union. Recently, the East Africa Legislative Assembly enacted the Non-Tariff Barriers (NTBs) Act setting the stage for a more concerted effort against the negative effects of NTBs on intra-regional trade. NTBs are restrictions that make importing or exporting goods more difficult or costly as a result of measures taken by governments that are not tariffs in nature. Such measures could take the form of government laws, regulations, policies, conditions, restrictions or specific requirements, private sector business practices, or other measures to protect local industries from foreign competition. Principally, the enacted NTB Bill provides a legal framework for enforcing the removal of Non-Tariff Barriers through the establishment of dispute resolution mechanisms with the possibility of sanctions against offending states.

The Bill according to the Council seeks to give effect to Article 13 of the Protocol on the Establishment of the EAC Customs Union in which Partner States agreed to remove, with immediate effect, all existing NTBs to the importation into their respective territories of goods originating in the Partner States. At the same time, this would have the effect of not imposing any new NTBs. The Council Bill also sought to establish a
mechanism for identifying and monitoring the removal of NTBs within the Partner States\textsuperscript{71}.

Adoption of harmonized trade rules is a well-established and popular approach to trade facilitation that has helped many countries around the world save on trade costs and improve their competitiveness position. The European Union (EU) and Organization for Economic Cooperation and Development (OECD), for example, already operate well-established harmonized systems for seed trade. Harmonization with international norms, however, is not the only option for improving trade and can potentially create new bottlenecks if the harmonized rules are set too high for users to afford and/or if the requirements are too difficult for countries to implement. Picking the right approach to trade facilitation is therefore an important part of improving farmer access to quality inputs and West Africa’s prospects for agriculture development more generally (Keyser \textit{et al.}, 2015).

Regulatory barriers to international trade which require that each blend must be tested and approved for use in each country should be removed (Minot, 2013). He also argues that governments should regulate fertilizer ingredients rather than fertilizer blends. Consequently, governments should not test and approve each blend as it would slow the introduction of new fertilizers. These barriers to trade can be reduced by approving ingredients rather than blends and by automatically recognizing ingredients approved in neighboring countries (Minot, 2013)\textsuperscript{72}.

The clusters mentioned are basically in the SADC, EAC, COMESA, ECCAS and ECOWAS customs unions. Goods and commodities originating from unions or have

\textsuperscript{71} Http://www.eatradehub.org/eac_makes_milestone_in_non_tariff_barriers_ntbs_legislation
\textsuperscript{72} https://agrilinks.org/sites/default/files/resource/files/Document\%204\%20Summary\%20of\%20Presentations_0.pdf- accessed on 14th December 2015
undergone substantial value addition are zero rated. The amount of fertilizer produced in these countries can easily be moved to the neighboring countries without attracting any duty. Moreover, following the Abuja Declaration, most countries have removed import tariffs on fertilizers. The exceptions are Burkina Faso, Senegal, DRC Congo and Senegal. Thus generally, the rules of origin seem not to have hindered the production, cross-border trade and consumption of fertilizer in Africa.

The ongoing efforts on trade facilitation in SADC, EAC, COMESA, ECCAS and ECOWAS (UNECA et al., 2013) would also encourage cross-border trade and consumption of fertilizer. Some of these include one-stop border posts (OSBP), investment in infrastructure, and the application of single window among other measures.

What possibly hinders regional trade in fertilizer is the lack of harmonized quality of fertilizer used in the regions with the exception of ECOWAS. For instance, many of the fertilizer blends are meant for national markets and unless registered in the other countries, they cannot be traded. It has to take some efforts for the fertilizer regulatory authorities meeting frequently under the auspices of the regional economic communities to harmonize and accept the certification done in individual member countries. Affecting consumption of fertilizer indirectly is the periodic export bans of agricultural staples that some countries often impose due to food security concerns (Keyser, 2015). This often leads to lower prices for farmers which is a disincentive to fertilizer use.

5.5 Tariff barriers

Progress has generally been made in removing import tariffs on fertilizers in most African countries. In any case, this does not just refer to fertilizers alone. For instance, in the SADC, EAC and COMESA economic communities, due to having a customs union,
there are zero import tariff zones with respect to goods that originate from member countries or those that have undergone substantial value addition (UNECA et al., 2013). But with fertilizers with respect to the Abuja Declaration, many countries have removed fertilizer tariffs. Nevertheless, not all countries have removed import tariffs on fertilizers. Wanzala (2011) argues that one-third of the countries have import duties and half the countries levy some form of tax on fertilizers. For instance, although fertilizer is exempt from a “common external tariff” of 5% on all imported goods in the ECOWAS region, some member states have not exempted fertilizer from this tax (AGRA, 2014b). Other countries in the region in addition, impose a value-added tax in the range of zero to 18% and other levies. Both Ghana and Mali impose shipper and council tax. These taxes raise the final retail price and also add unnecessary burdens in processing paperwork which leads to delays in unloading and transporting fertilizer. Other countries that have not removed import taxes according to AGRA (2014b) include Burkina Faso that still charges import taxes on fertilizers at 8.5% of the import value and also other duties. Others include Democratic Republic of Congo and Senegal. Kenya and Mozambique levy a refundable value-added tax (VAT) on services and materials used in relation to the handling of fertilizers during importation. The problem is the time taken to refund this tax, which leads to additional finance costs to importers. For Uganda, importers are charged withholding tax, which can be deducted (or not deducted) from taxes when importers eventually do their tax returns and find that they were over (or under) charged (IFDC, 2015a).

At the regional level, EAC has a common external tariff for all imported fertilizers, and fertilizer trade within the EAC attracts zero tariffs. In the ECOWAS region there are no taxes or tariffs on fertilizers being imported into the region, but importers pay related administrative fees. For COMESA, recommendations for zero external tariffs on
fertilizer have been approved and the next step is domestication through the alignment of national legislation (IFDC, 2015a).

5.6. Non-tariff barriers

Non-tariff barriers to trade are what constitute the most significant trade barriers not only for fertilizers but also of other goods and services. NTBs, whether protectionist in intent or not, raise trade costs and inhibit regional trade (Engel and Jouanjean, 2013). For instance, Trade and logistics costs limit the benefits of trade on the economies of the EAC. These barriers cost the EAC economies between 1.7% (Rwanda) and 2.8% (Kenya) of GDP and reduce the trade potential of the EAC when both the barriers affecting intra- and extra-regional trade are considered (Gasiorek et al., 2017). Even though as explained earlier, most regions are taking steps to address NTBs, they still remain a major obstacle. Since most of the fertilizers have to be imported, the distribution of the fertilizer from the port most often on poor roads raise considerably, distribution costs. According to AGRA (2014a), import permits, road barriers/blocks, road tolls and other non-tariff barriers raise considerably the costs of fertilizer. Border delays and weighbridges alone cost 0.4% and 0.2% of Kenyan gross domestic product (Gasiorek, 2018). Regional economic communities and bilateral trade agreements/discussions provide a forum for removing non-tariff barriers. It is through this that a number of police road blocks or police checks have been reduced in the main transport corridors, for instance from Mombasa in Kenya to Uganda.

Annual registration fees also constitute a barrier to fertilizer trade. Once a product has been approved whether imported or from domestic producers, annual fees typically also apply for re-registration. In Zambia, importers must register each type of fertilizer they plan to import with the Zambia Environmental Management Agency each year at
a cost of about USD 325 per product. In Ghana, fertilizer importers must pay almost USD 1,600 every two years to register each approved fertilizer product (Keyser, 2015).

There is also a dilemma with policy interventions as they have raised transaction costs between farmers and consumers, and the policy environment has permitted limited competition at key points along the value chain. Such policies lead to a large gap between producer and consumer prices and entail that the benefits of previous reforms and investments, such as tariff removal and better-quality roads, may not have accrued to either farmers or consumers, but rather to those providing services along the chain, such as transport and distribution (World Bank, 2012).

In some cases, the policies restricting trade are deliberately protectionist, but in other instances the lack of regulations limits the development of regional markets, such as in the case of fertilizers. In many cases the issue is to define appropriate regulations and create better institutions to implement them.

It is also argued that trade facilitation was not working for all producers and traders in the same way. Large firms have access to more resources to ensure their cargo is treated more promptly. Smaller firms, however, are more exposed to delays and higher costs. Therefore, interventions need to consider how to facilitate trade in particular for small and medium traders, producers or firms (Calabrese and Mendez-Parra, 2016).

There are ongoing efforts in eliminating non-tariff barriers. Non-tariff barriers are being eliminated with the help of an online reporting scheme for COMESA, EAC and SADC. The Non-tariff Barrier Reporting can then be resolved bilaterally (UNECA et al., 2013). In Tanzania, foreign-registered cargo trucks are required to pay USD 500 to the
Tanzania Revenue Authority (TRA) on each entry, in addition to annual fees of USD 600\textsuperscript{73}.

Crossing border points also present a significant non-tariff barrier to trade. The multiplicity of clearing/certification agencies operating on both sides of the same border doubles the bureaucracy at border posts, which translates into congestion and delays (the waiting time for a container/truck to cross a border post in Africa can range from 3 minutes to 2.8 days). The cumbersome procedures entailed in customs processing can cost a consignment about USD 185 for each day of delay (Barker, 2012). North African region has generally improved in cross-border trade (see Table 16 in the annex). Improvements have been observed with the establishment of one border posts. For example, in East Africa, 12 out of the 15 one border posts are now operational using integrated border management system. This has reduced crossing time by about 60% (TMEA, 2018). Overall, as a result of trade facilitation measures such as operationalization of Single Customs Territory (SCT), it takes much shorter time (almost by half – ten days) moving goods from Mombasa to Kampala (Eberhard-Ruiz and Calabrese, 2017).

As UNECA (2013b) argue, trade document requirements are particularly burdensome by internationally recognized standards with an average of eight documents needed for exports and nine for imports. In Africa, import procedures (including document preparations, customs, terminal handling and inland transport) take 22% longer than exporting ones and are 25% costlier relative to export procedures

Other non-tariff barriers to trade include port infrastructure deficits resulting in slow offloading of cargo, long delays and high cost of port operations; poor road and rail

\textsuperscript{73}https://www.trademarkea.com/projects/ntb-national-monitoring-committee
infrastructure, unavailability of appropriately-sized trucks for hauling fertilizer; poor storage and warehouse infrastructure; and limited networks of agro-dealers amongst others\textsuperscript{74}. Although rail transport is potentially 30\% cheaper than moving fertilizers by road, it is unreliable due to badly-maintained railway lines (IFDC, 2015 a). As Langyintuo (2013) argues, the scope for negotiating bulk purchases and arranging bulk shipments is limited by the lack of port facilities capable of handling large volumes. Most fertilizer imported into Africa is shipped via 10,000-ton vessels because of limited capacities at the ports, especially those outside of South Africa. This limits the size of bulk orders and entails a shipping cost premium of 10\%–15\% over medium-size vessels. Due to port inefficiencies, fertilizer prices ex-port are typically at least USD 200 higher than the free-on-board prices on the world market (Wanzala and Groot, 2013).

In addition to taxes, regulatory measures do not allow the movement of products from one country to another because they do not meet country-specific product specifications (AGRA, 2014b). Other non-tariff barriers include border fees and import permits\textsuperscript{75}. Another issue to consider is whether the registration certificates of traders and certification in one country can be accepted in another country.

On the status of elimination NTBs in EAC by December 2014 shows that seventy-eight (78) NTBs were reported cumulatively resolved, eighteen (18) reported unresolved while four (4) new ones were reported as of December 2014 (EAC, 2014).

Some of the resolved ones include (i) Varying application of axle load specifications (EAC Axle load bill was enacted into law in May, 2013 and is awaiting assent by Heads of State) (ii) Delays at the ports of Mombasa and Dar-es-Salaam, which affect imports

\textsuperscript{74} www.afap-partnership.org/media/.../wafsf_web_special_report__1__pdf
\textsuperscript{75} Http://ssa.foodsecurityportal.org/regional-sub-portal-blog-entry/sub-saharan-africa/506
and exports through the ports (These ports are implementing national single window systems to redress delays at the ports (iii) inadequate police escort mechanism (all Partner States are providing police escorts). Some of the unresolved NTBSs include (i) lack of coordination among agencies involved in testing of goods (ii) existence of several weigh bridges instead of the recommended two (iii) border management institutions working hours not harmonized (iv) non-harmonized road user charges/tolls (v) weighing of empty trucks in the Central Corridor (Tanzania), re-introduction of county transit fees (For example Kwale and Kajiado counties in Kenya). Some of the newly reported NTBS are (i) payment of USD 300 by Rwanda to Tanzania as national park transit fee (ii) Tanzania Port Authority (TPA) is charging USD 90 as way leave fees for transit container of 20 feet and 140 USD for container of 40 feet for transit trucks.

The on-going trade facilitation efforts seem to be bearing fruit. The charges to import a container into Kampala through the port of Mombasa had declined significantly over the past five years, from USD 4,000–USD 4,500 to USD 3,000–USD 3,500 including clearance, port and transport charges (excluding sea freight charges) (Eberhard-Ruiz and Calabrese, 2017). Removal of the remaining trade facilitation barriers between Mombasa and Kampala could result in additional cost savings of up to 23% per transported tonne (Eberhard-Ruiz and Calabrese, 2017).

In COMESA, about 95.9% of all the reported Non-Tariff Barriers to regional trade in COMESA have been resolved since the introduction of the online system of reporting, monitoring and elimination in 2008. In an effort to reinforce the current initiatives to eliminate the remaining NTBs, COMESA has now developed NTB Regulations to provide an efficient mechanism to address these barriers. The Regulations which have been circulated to Member States outlines the steps that concerned parties should go through. Specifically, the Regulations require Member States to establish National Focal
Points as well as National Monitoring Committee on NTBs. According to the Regulations, the initial stage of resolving the NTB is the exchange of information regarding an NTB between the imposing and recipient Member State. If the parties fail to resolve the NTB at this stage, they will engage a facilitator to provide factual information aimed at resolving the matter. The outcome of these proceedings will be enforced under article 171 of the COMESA Treaty that provides for sanctions. The new Regulations followed a decision of the 33rd COMESA Council of Ministers meeting held in Zambia in December 2014 that sought to break the existing stalemate in resolving NTBs. They are also aimed at enforcing Article 49 (1) of the COMESA that calls on Member States to eliminate all existing non-tariff barriers and to refrain from imposing new ones76.

Non-tariff barriers tend to raise costs of doing business and Western Africa is no exception. Therefore, efforts to facilitate trade in the region must also aim to address NTBs. In ECOWAS, Hoppe and Aidoo (2012) argue that Ghanaian manufacturers believe the key barriers to increasing trade with Nigeria include substantial informal payments and delays — regardless of whether documentation is complete — transit charges, and requirements for product registration. Compliance with standards remains burdensome, and there have been reports of standards being used as disguised protectionist measures. Products need to be registered before landing in Nigeria, and certification and registration require that a product sample has to be imported into Nigeria. This in turn requires an additional import license prior to the importation of the sample. Products can then only be registered by a locally-registered subsidiary company or a local partner, who needs to have the power of attorney from the producing company, and that can create legal problems.

With regard to the West Africa region, Harris et al (2011) argue that there are gaps between regional agreements, national legislation and implementation; limited private sector knowledge of free trade protocols; strong incentives for informal trade; non-compliance with existing tariffs; the widespread imposition of non-tariff barriers (NTBs); the non-functioning of the Inter-States Road Transit (ISRT) regime; non-recognition of certificates of origin and non-compliance with truck axle loads; and the challenges of joint membership for members of both ECOWAS and UEMOA. The pace of liberalization and integration and fears of inadequate protection for local producers has facilitated the proliferation of NTBs in the region (Harris et al.; 2011). One of the overarching problems in this regard is the prevalence of informal practices that exacerbate transport and shipping costs. Because of high trade barriers, producers in Nigeria and Senegal face among the highest prices for nitrogen-based fertilizers paying more than three times as much as those in Kenya or India (World Bank, 2012).

Focusing on Ghana, Mali, Nigeria and Senegal, Bumb et al (2011) map out the relevant supply chains and argue that regional markets in fertilizers have not emerged partly because individual countries usually specify their own fertilizer blend and specialty products. This adds to the cost of production and therefore increases the market price of fertilizer. This is also complicated by country-specific subsidy programs: for example, in Senegal, farmers face uncertainty about whether they will in fact receive the half of their fertilizer requirement promised by the government; in Nigeria subsidies impede the development of an efficient supply chain. Finally, there is the risk of market disruptions when there is a change in policy.
As IFDC (2015a) argues, there are barriers to market entry in various countries including restrictions on fertilizer importation, restrictions on who can sell fertilizers in certain districts within a country and state involvement in importation and distributions. A recent assessment of policies, regulations and standards in East and Southern Africa shows that the fertilizer industry is controlled by the public sector in Ethiopia and importation is mainly done by the Agricultural Inputs Supply Enterprise (AISE) (Simtowe 2015a). The private sector can only be allowed to import quantities of at least 25,000 tons and since they cannot afford this, the task is mainly undertaken by the government. In Malawi both the government and the private sector are involved in importation and distribution of fertilizers (Simtowe 2015b). Even though the private sector is active in Tanzania, most of the fertilizer supply chain is controlled by Yara international (Simtowe, 2015 c).

5.7 Review of analysis of transport cost in fertilizer trade
The major transport corridors in the six clusters have fairly good infrastructure. That means transport from ports to major cities and towns have fairly adequate infrastructure. The use of roads and railway transport has a significant impact on transportation costs. Besides improved roads, transport costs are influenced by regulations and fuel prices thus the higher the regulation, the higher the transport costs (AGRA, 2016). The challenge with the railway transport however is the limited distribution network. Strengthening railway infrastructure in most regional economic communities would greatly help improve logistics and reduce transport costs. What may then largely influence the costs is likely to be the nature of competition in the transport industry. It has also been argued that the market for transport services is not competitive and thus higher distribution costs for fertilizers (Ncube et al., 2015). This is also the same situation with importers and distributers as they are dominated by few multinational companies such as Yara, ETG and Louis Dreyfus. This is compounded by
the distribution of fertilizer to the consumer end points that are likely to be in far flung areas that are not only having poor roads but also have a thin network of agro-dealers. Moreover, the product is likely to be moved in much smaller quantities using low capacity trucks/lorries and thus not benefiting from economies of scale. This suggests that investments in good rural feeder roads would improve delivery of inputs and open access to output markets (AGRA, 2016).

Ncube et al., (2015) examine the transportation of fertilizer in Tanzania, Malawi and Zambia using the major road transport corridors. The authors find that competitive outcomes in road freight in the context of fertilizer trading are driven by the interrelationships between large transporters and users of transport, cross-border rivalry, and both small and large regulatory interventions to enhance outcomes in road transport. They argue that it is the lack of competition for transport services with regard to the transport for fertilizer that explains the high fertilizer prices to the final consumers. Similarly, Ward & Barreto (2011) found that high costs are driven by industry structure and low levels of competition between service providers; low productivity in the trucking industry due to infrastructure constraints; and, regulation of regional and international trade in transport services. The level of regulations may thus explain why transport costs are higher in West and Central Africa than they are in East and Southern Africa (Livingstone et al., 2011) suggesting little competition in the truck industry in West and Central Africa.

Landlocked countries incur between USD 50-USD 100/ton/km for transporting goods between their borders and ports (Ncube et al., 2015). This also compares for instance with USD 42/ton for the full cost of port handling at Dar-es-Salaam which includes off-loading, stevedoring, bagging, de-stuffing containers, and clearing to the port gate
(Ncube et al., 2015). A recent study on the composition of fertilizer prices in Zambia supports the tentative conclusion that there are issues with transport competition in Tanzania (IFDC, 2013a). Similar final prices in Zambia of USD 665/ton in Lusaka and USD 760/ton in Lundazi are realized despite higher costs of landing, transport and delivery reflected in USD 502/ton CIF prices in Beira and transport costs of USD 120-USD 210/ton associated with the distances and border crossing. Lusaka is 1048km from Beira, while the delivery to Lundazi is an additional 753km further. While the landed price in Beira is higher than Durban, this appears to be compensated by the shorter distances such that traders take both Durban and Beira as sources of fertilizer for Zambia although most actually comes through the port of Durban.

A study conducted in Tanzania (IFDC 2012b) shows that by late 2011, the actual procurement of fertilizer from world markets was about 60-70% (based on DAP and Urea) of the final consumer prices. Freight /transport charges amounted to 14-19% of the total cost structure split evenly between vessel costs and in country transportation costs for each product. Port charges took about 7% of the total costs. The financial costs along with letters of credit, insurance and gross margins for importers and wholesalers took about 6-7% while bagging of fertilizer took about 2-3% of the remaining costs. Thus, distribution costs add between one half to two thirds of the wholesale price of fertilizer (IFDC, 2012b).

Robert and Vilakazi (2014) argue that transport costs add substantially to the cost of fertilizer products, often accounting for 50% of the delivered price to farmers when including all the related costs and margins. They argue that overland transport is very crucial for landlocked countries such as Malawi and Zambia. Even in Tanzania, a coastal state, the best arable land is found inland. The authors’ main argument is that
the nature of competition in transport and fertilizer trading is what ultimately determines the price the farmer ultimately ends up paying. Another factor explaining the high transport costs in Africa is the road density (Roy, 2016). As figure 34 in the annexe shows, compared with developed countries such as China, Mexico, India and even Zimbabwe and France, many African countries have low road density thus contributing to the high transport costs.

Farmers in coastal countries in Africa generally enjoy better prices for fertilizer. For example, prices in South Africa are a little over USD 600 and in Kenya less than USD 500 (World Bank, 2012). In addition, poor roads add to transportation costs, which may comprise up to one-third of farm-level costs in countries such as in Zambia, compared to less than 5% in the USA (World Bank, 2007 b). In addition, inadequate and inefficient port infrastructure adds to costs in African countries. Such inefficiency for instance in ports handling can add up to 10-15% of the costs of fertilizers (Adesina et al; 2014).

Farmers in African countries, especially in the landlocked countries, face higher prices for fertilizers than farmers in other developing countries. Landlocked countries, such as Burundi, Malawi, Zambia, and Uganda, contend with prices that are as much as ten times higher than other developing countries. Farmers in Burundi pay USD 2,700 for a ton of fertilizer, while farmers in Malawi, Zambia, and Uganda pay USD 1,500, USD 1,400 and USD 1,100 per ton of nutrients, respectively. These prices far exceed those of farmers in countries like Argentina and Brazil, where the price of fertilizers is between USD 250 and USD 500, respectively (World Bank, 2012). The retail price of fertilizer in Thailand and Tanzania are 50% and 80% lower respectively than prices in Mali (Roy, 2014). All the cost components in Thailand are lower due to economies of scale, intense competition and developed service industries (Roy, 2014).
Transport costs remain the highest in the world in Africa. For example, to ship a 20-foot container from Durban to Lusaka costs USD5,000—far more than the USD 1,500 it costs to ship the same container from Japan to Durban (Trade Mark Southern Africa, 2011). The cost of moving goods in Africa is high, transit times uncertain, and delays exceptionally long. Studies have estimated that the costs in Africa are between USD0.04–0.10 per km-ton for long-distance road transport and USD0.10–0.40 per km-ton for shorter-distance transport. This is much higher than road transport in OECD countries, where the estimated costs are USD0.03–0.04 for road transportation (World Bank, 2012). But transport costs differ across the continent, with southern Africa having significantly lower costs than western and central African (Rashid and Minot, 2010). As earlier discussed, this is due to the level of competition in the trucking industry.

In Africa, fertilizers are usually shipped in bulk or containers up to coastal ports and in bags with inland transportation after bagging at the ports. Road freight costs in West Africa are among the highest in the world (Bromley et al., 2011) and various studies show that transportation from coastal ports to inland locations easily accounts for 20 to 40% or more of total value excluding distribution to the farm gate (Bumb et al., 2012; Diakite et al., 2013; Wanzala and Groot, 2013). Taken together, these factors provide a strong argument for producing or blending fertilizer as close as possible to where it is needed but can also mean that well-established global companies with low cost structures may be the most competitive source of supply, particularly in coastal areas.

In Kenya, For instance, domestic transport costs of DAP and UREA fertilizers account for 33% of all the domestic costs of moving fertilizer from the port (Mombasa to Nairobi). Port charges and internal transport costs take a relatively high proportion of domestic costs (IFDC, 2012a). Other costs include finance (about 22%),
port/bagging/warehousing (about 26%). Gross margins account for about 19.5% (IFDC, 2012a).

With Rwanda, being a landlocked country, the transport costs are rather high. The fertilizer transport costs are USD 160 per ton whether from Dar-es-Salaam or Mombasa as the distance is the same (1,700 kms) (Gisselquist, 2013). The costs associated with moving the product from Dar es Salaam to warehouses in Kigali add roughly 34% to the ex-Kigali cost (IFDC, 2014a). Movement of fertilizer through the distribution system beyond Kigali adds another 18% to the total cost, for an overall cost increase of about 45% from port to regional warehouses in Rwanda (IFDC, 2014a).

With Uganda, inland transport costs add significantly to the cost of fertilizer. Transport accounts for a substantial portion of fertilizer costs from the port of Mombasa to Kampala at around 40% (IFDC, 2014b).

In Mozambique, domestic transport costs account for over 45% of the total domestic costs of moving fertilizer from the port of Beira to Sofala. Port charges and internal transport costs take a relatively high proportion of domestic costs (IFDC, 2012c). Bagging costs include bags and labor (about 8%); warehousing consists of transport to warehouse and storage (about 8%); and finance and overhead costs are about same (about 18%). It is also important to note that margins are about 15%.

World Bank study (2012) estimates the wholesale (retail) cost of NPK 12:24:12 and urea at USD 41.35 (USD 56.65) and USD 37.59 (USD 51.15), respectively, per 50kg bag in the main agricultural production zones (Maniac and Sofala) for the 2010/11 cropping year. The study estimates that the transport cost per ton per kilometer on a 30-ton capacity truck along the Beira Corridor on a trunk road is USD0.09-0.14.
The timely availability and cost of fertilizer in Malawi are greatly influenced by the choice of entry port in neighboring countries. The main ports of entry are Beira and Nacala in Mozambique and Dar-es-Salaam in Tanzania, respectively. Each of these ports offers different cost structures as a result of their level of efficiency on product loading/unloading and the distance to delivery points in Malawi. Land transportation costs are one of the largest cost components of the fertilizer supply chain in Malawi (IFDC, 2013b). Currently, a high percentage of imports pass through the Beira port and transport through Mozambique by land to Lilongwe. Port costs at Beira are estimated at USD 9 per metric ton, but bagging costs are high at USD 30 per metric ton. Despite Beira’s good road link to Lilongwe through Blantyre, especially during the dry season, Beira port is limited by insufficient depth at the entrance channel. This limits cargo vessels to a maximum of 10,000-15,000 tons, which increases the per-unit shipping costs by 3 to 5% compared with 25,000 metric ton ships (IFDC, 2013b).

In Zambia, Lusaka is 2,000 km from the Port of Beira in Mozambique, and Lundazi is 770 km from Lusaka. Transport costs, margins and loading/unloading costs contribute 26%, 10% and 0.6%, respectively, of the farm gate price of USD 760/ton at rural Lundazi. The balance consists of international costs (IFDC, 2013b). For instance, domestic transport costs account for between 74% and 81% of domestic costs of moving fertilizer from the port to these locations within Zambia. Total domestic costs amount to USD 258 at Lundazi, where the farm gate price is USD 760/ton (IFDC, 2013b). Clearly, these costs illustrate the need to invest in strengthening road/railway infrastructure.

In Ghana, the costs, including wholesale gross margins, from the port to a location in the hinterland (Kumasi) were added together (port, bagging and warehousing) (25%), domestic transport (about 22%), finance (about 24%) and margins (about 28%), and each item expressed as a percentage of the total to give an indication of its contribution.
Transport costs are a function of a number of factors including the level of competition among truck firms, distance and road conditions (IFDC, 2012 d). A recent workshop held by ECOWAS in July 2015 echoed the fact that it costs far much less to move products from Europe to Lagos and Accra than to ferry products from one of the two West African cities to the other⁷⁷.

In Senegal, transport costs range from 27-30% of the total domestic costs (IFDC, 2014c). In Ethiopia too, Inland transportation is a major operational consideration in the importation of fertilizer. Farmer prices can range above ex-warehouse prices by USD 74.4/MT for DAP. The total average cost/price increase from port to farmers for DAP is USD 152. Inland transportation takes up to 74%, followed by insurance, bank commissions and administration costs at 19% and clearing cost, inspections, re-bagging and spillage losses at 7% of total inland cost up to the warehouses (IFDC, 2012e). A recent study (Rashid et al., 2013) shows that depending on the region, transport costs alone account for 64–80% of price differentials between landed costs and farm gate.

Although there are few backhaul cargo opportunities in Ethiopia, that can help cut costs, inland freight rates are of about USD 0.06 /ton per kilometer (km). Trucks can carry a load of up to 40 tons with costs between USD 42.89/ton and USD 73.22/ton, depending on the port-to-warehouse distances. Short-haul freight (importer warehouses to unions and cooperatives) ranges between USD0.10 mg/km to USD0.13 tons/km. The average distance is between 100 and 160km.

It has also been observed that fertilizers that Katanga importers in DRC Congo buy from Zambia in fact come from South Africa or from the world market through South African ports, particularly Durban. In contrast, imports of fertilizers via Tanzania are

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⁷⁷ http://www.ecowas.int/ecowas-development-partners-consolidate-economic-integration-cooperation-programme
expensive, more than USD 200/t above FOB prices on the world market, due to high-cost deliveries in small vessels (15,000 tons) and to port inefficiencies. Operators of the Mozambican port of Beira are constructing an 8,000 tons/day dedicated fertilizer terminal, handling 30,000 ton vessels, designed to serve the Zimbabwean and Zambian markets, in direct competition to Durban\textsuperscript{78}. Katanga is at the end of supply chains from ports, so costs of supplying fertilizer to farmers are higher than elsewhere. Distances to Kasumbeleza from major Indian Ocean ports are: Durban 2,600 km, Dar-es-Salaam 2,280 km and Beira 1,850 km. Despite the long distances, these routes are tarred so trucks can run quickly along them, and the diversity of sources engenders competition not only between ports but between trucking fleets. Trucks typically carry loads of 40 tons, more if they tow a trailer, thus bestowing economies of scale on this supply route\textsuperscript{79}.

The average cost to transport a container within west and central Africa is USD 2.43 per kilometer which is 1.5 and 2.2 times the freight rates applied in South Africa and the United States. For landlocked countries transport costs represent on average of 45\% of the value of imports and 35\% of exports. This is much higher than the global averages of 5.4\% (of imports) and 8.8\% (of exports) (Willemien, 2016)

Despite the better capacity use of trucks in Eastern and Southern Africa, problems with high transport costs are a significant constraint in this part of Africa as well. Roadblocks mounted by police, customs, immigration, trade unions, forest authorities, health authorities, and municipalities are not as big a problem as in West Africa but do still exist and can impose significant delays and costs on regional transporters. Problems

\textsuperscript{78} http://acdivoca.org/sites/default/files/attach/technical-publications/acdivoca-leo-assessment-drc-agricultural-market-systems.pdf

with cross-border movement of foreign-registered trucks have been a particular problem in Kenya, where Ugandan and even Zambian truckers have complained that border authorities routinely prevent foreign vehicles with four or more axles from entering the country despite regional agreements on the free movement of freight (Keyser, 2015).

Less than half of Africa’s rural population has access to an all-season road. In these conditions, transport costs grow as fertilizer moves deeper into the market, closer to the farm gate and in even small quantities.

Rail transport is much cheaper than road transport, but rail infrastructure is the least developed in Africa. It is poorly maintained for the most part, and offers a poor service resulting in a significant reduction in usable track (AfDB, 2015b; Gerstenmier, 2015). It is noted that in South Africa and North Africa, the railway infrastructure is bigger and efficient. The rail transport market share in most countries on the continent is below 20% of the total volume of freight transport (AfDB, 2015b). However, this is changing with the on-going and planned heavy investments in rail infrastructure in sub-Saharan Africa. The SGR in Kenya is expected to reduce the cost of transportation to USD0.08 per ton per km from USD0.20 per ton per km (Business Daily, 2016).

The examples given above are excellent case studies (see Table 14 for a summary) demonstrating the role of inefficiencies in distribution, transportation, and port logistics over the comparable ex-port and delivered prices in Africa.
Table 14: Transport Costs Comparisons

<table>
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<tr>
<th>S. No</th>
<th>Source</th>
<th>Context and Remarks</th>
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<tbody>
<tr>
<td>1</td>
<td>Ncube et al., 2015</td>
<td>Market for transport not competitive, far flung areas have poor roads and thin network of agro-dealers, use smaller trucks/lorries</td>
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<td>2</td>
<td>Ward &amp; Barreto (2011)</td>
<td>High costs are driven by industry structure and low levels of competition between service providers; low productivity in the trucking industry</td>
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<td>3</td>
<td>Livingstone et al., 2011; Rashid and Minot, 2010</td>
<td>Transport costs are higher in West and Central Africa than they are in East and Southern Africa due to higher regulation</td>
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<td>4</td>
<td>Ncube et al., 2015</td>
<td>USD50-100/ton per Km between border posts and ports for landlocked countries, USD42/ton for the full cost of port handling at Dar es Salaam</td>
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<td>5</td>
<td>IFDC 2012b</td>
<td>In Tanzania, freight/transport charges of DAP and Urea amounted to 14-19% of the total cost structure split evenly between vessel costs and in-country transportation costs for each product. Port charges took about 7% of the total costs. Distribution costs add between one half to two thirds of the whole sale price of fertilizer.</td>
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<td>6</td>
<td>Robert and Vilakazi, 2014</td>
<td>Transport costs often account for 50% of the delivered price to farmers when including all the related costs and margins in Malawi and Zambia</td>
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<td>7</td>
<td>Roy 2016</td>
<td>Low road density cause of high transport costs in Africa</td>
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<tr>
<td>8</td>
<td>World Bank, 2007b</td>
<td>Poor roads add to transportation costs, which may comprise up to one-third of farm-level costs in countries such as in Zambia, compared to less than 5% in the USA</td>
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<td>9</td>
<td>Adesina et al; 2014</td>
<td>Inefficiency in ports handling can add up to 10-15% of the costs of fertilizers</td>
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<td>10</td>
<td>World Bank 2012</td>
<td>Landlocked countries pay more: Farmers in Burundi pay US$2,700, Malawi USD 1,500, Zambia USD 1,400, Uganda USD 1,100 per ton of nutrients; road transport cost USD0.04–0.10 per km-ton for long-distance and USD0.10-0.40 per km-ton for shorter-distance transport in Africa – OECD USD0.03 –0.04</td>
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<td>11</td>
<td>Roy 2014</td>
<td>The retail price of fertilizer in Thailand and Tanzania are 50% and 80% lower respectively than prices in Mali</td>
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<td>12</td>
<td>Trade Mark, 2013</td>
<td>USD 5,000 to ship a 20-foot container from Durban to Lusaka—far more than the USD 1,500 it costs to ship the same container from Japan to</td>
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<td></td>
<td>South Africa</td>
<td>Durban</td>
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<td>13</td>
<td>IFDC 2012a</td>
<td>In Kenya, domestic transport costs of DAP and UREA fertilizers account for 33% of all the domestic costs of moving fertilizer from port of Mombasa to Nairobi</td>
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<td>14</td>
<td>Gisselquist, 2013</td>
<td>USD 160 per ton from Mombasa or Dar-es-Salaam to Kigali, Rwanda</td>
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<td>15</td>
<td>IFDC, 2014a</td>
<td>Cost increase of about 45% from port to regional warehouses in Rwanda</td>
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<td>16</td>
<td>IFDC, 2014b</td>
<td>Transport Mombasa – Kampala accounts for 40% of fertilizer costs</td>
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<td>17</td>
<td>IFDC, 2012c</td>
<td>In Mozambique, domestic transport costs account for over 45% of the total domestic costs of moving fertilizer from the port (Beira to Sofala)</td>
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<td>18</td>
<td>IFDC, 2013b</td>
<td>Limited depth of Beira port limits cargo vessels to a maximum of 10,000–15,000 tons, which increases the per-unit shipping costs by 3 to 5% compared with 25,000 metric ton ships</td>
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<td>19</td>
<td>Rashid et al., 2013</td>
<td>In Ethiopia depending on the region, transport costs alone account for 64–80% of price differentials between landed costs and farm gate.</td>
</tr>
<tr>
<td>20</td>
<td>IFDC 2014c</td>
<td>In Senegal, transport costs range from 27-30% of the total domestic costs</td>
</tr>
<tr>
<td>21</td>
<td>Willemien, 2016</td>
<td>The average cost to transport a container within west and central Africa is USD 2.43 per kilometer which is 1.5 and 2.2 times the freight rates applied in South Africa and the United States. Transport costs for land-locked countries represent about 45% of the value of imports and 35% of exports.</td>
</tr>
<tr>
<td>22</td>
<td>Business Daily (2016)</td>
<td>Reduces costs from USD 0.08 per ton per km from USD 0.20 per ton per km</td>
</tr>
</tbody>
</table>

Given that farmers are dispersed, and that agro-dealer density is a major concern, transport costs are likely to be much higher than indicated in this section. Thus, reducing inland transportation cost in Africa both at the regional level and nation level is more relevant than building fertilizer manufacturing plants, except where there is a competitive advantage.
5.8 General Conclusions

The general trade regime in Africa is liberal. In fact, in most countries with the exception of Senegal, Burkina Faso and Mali, fertilizers attract zero tariff. It is the periodic export bans of agricultural staples which often lead to lower produce prices that may have a negative effect on fertilizer consumption. The fact that some countries insist on their own fertilizer brands/formulations even though differences are not major hinders cross-border fertilizer trade. But non-trade barriers such as road blocks, weigh bridges, and border crossings continue to hinder cross-border trade and inland distribution though efforts are continuing to address these issues. The main issues arising from this chapter are as follows:

(a) Fertilizer policy subsidies have increased the use of fertilizer with a consequent increase in agricultural production. These policies are likely to remain for some time. Continuous improvement in design and implementation should be undertaken to reduce leakages, maximize effectiveness, reduce impacts on national budgets and needed long-term investments in agriculture and infrastructures, and encourage private sector participation.

(b) Complementary crop production input services such as seeds, soil and water supply, conservation and effective extension services, amongst others, should be provided so as to raise the value-cost ratio of fertilizer usage and other crop inputs.

(c) Removal of trade regulations that blends must be tested and approved before used in a country. There should be mutual recognition of fertilizer ingredients approved in a neighboring country.
(d) Market access is a major issue. It is not just enough to raise agricultural production. Farmers have to be able to get competitive prices for their agricultural products. For smallholder farmers, they should be encouraged to form cooperatives or producer groups in order to get better bargains. The recent World Trade Organization (WTO) agreement on LDC preferential access to developed countries markets is a move in the right direction.

(e) Even though major road corridors are generally in good conditions, the roads that ultimately reach the majority of farmers that are dispersed are still in poor conditions. This together with limited competition in the truck industry and low road and railway density makes transport costs rather high.

(f) With the exception of the ECOWAS fertilizer regulations, other regions are yet to develop regional and harmonized fertilizer regulations. In addition, the multiplicity of regulatory agencies such as National Standard bodies, environmental protection agencies, and fertilizer regulation authorities (some in the process of being formed) creates multiplicity and overlapping mandates. Moreover, these agencies are also constrained in terms of financial and human capacity for effective enforcement of regulations.

(g) Generally non-tariff barriers to trade substantially limit cross-border trade. These include transit documents, poor port logistics, roadblocks/police checks, weighing bridges, and border posts as they increase both time and costs.

(h) There are barriers to market entry in various countries including restrictions on fertilizer importation, restrictions on who can sell fertilizers in certain districts within a country and state involvement in importation and distributions.
(i) Transportation and distribution costs of fertilizers are a major component of landed fertilizer prices. This can be dealt with by increasing competition in the truck industry, improving rural access roads, and expanding storage and warehousing systems and removing burdensome administrative procedures.
PART 6: SUMMARY OF FINDINGS, CONCLUSIONS AND POLICY RECOMMENDATIONS

6.1 Summary of Findings
This report provides a background document aimed at shaping fertilizer cluster and value chains policy framework, or enforcement of existing ones that would encourage the sustainable production, procurement and distribution, cross-border trade and investment; sustainable consumption of fertilizer products in Africa. The ultimate aim is to increase affordable fertilizer access to farmers and hence meet the 2006 Abuja Declaration target of 50kg of nutrients per hectare. It cuts across Africa’s six geographic sub regions and several key thematic issues that include agricultural development, marketing and distribution, finance, tariff and non-tariff barriers, regional value chains, investment policies, regulatory and enforcement; and incentive schemes. The key findings are summarized as follows:

- **Production, Consumption and cross-border trade**
  Africa accounted for 3% of world fertilizer consumption in the year 2016 and its share in the world consumption of nitrogen was 3.3%, phosphate 3.5% and potash 1.9%. The projected annual growth rate estimates in demand for nitrogen, phosphate, and potash for fertilizer are 3.8, 2.8, and 6.8%, respectively, between 2015 and 2020. For Sub-Saharan Africa, the projected annual growth rate for the 2015-2020 is 4.8% for nitrogen, 3.6% for phosphorus and 7.1% for potash. Given China’s zero growth policy and EU’s Circular Economy Strategy of greater recycling and re-use of various organic nutrient sources, the future world demand for fertilizer is rather muted as other markets have matured. This suggests that future world demand growth is likely to be increasingly driven by Sub-Saharan Africa.
The major consuming countries in SSA with the exception of South Africa are Nigeria, Ethiopia, Mali, and Kenya. The average application rate in Sub-Saharan Africa has been growing though still low from 6 kg/ha of nutrients in 2000 to about 15 kg/ha in 2017. It is projected to reach about 19 kg/ha by 2021 which is still below the Abuja Declaration target of 50 kg/ha. The application rate in South Africa it is 55 kg/ha. Fertilizer also differs across regions in Africa. In 2016, about 6.0 Mt of Nutrients were consumed in Africa with Northern Africa (38%), Southern Africa (21%), Western Africa (20%), Eastern Africa (19%) and Central Africa (2%). There are a total of 59 fertilizer blending plants in Sub-Saharan Africa with Nigeria having 14 of them as of 2018. Planned blending projects in SSA number 19 with Nigeria (5) and Tanzania (4).

Cross-border trade in fertilizer is limited. The causes are poor infrastructure, weak economic integration and, in some instances, conflicts. Many constraints exist that limit the production, distribution and consumption of fertilizers. They are basically marketing, technical, and financial constraints. Market constraints include: uncertain policy environments, weak and ineffective regulatory systems/frameworks, limited access to finance, size of commodity markets and high fertilizer prices, limited agro-dealer network and poor road and railway infrastructure. The technical constraints include: farmers’ knowledge base and extension service, unresponsive soils, and poor road and railway infrastructure. The financial constraint is basically limited access to finance.

- **Fertilizer Cluster Development**

The findings show that Africa has adequate reserves of natural gas, phosphorus, and potash that may be used in the production of fertilizers. Other factors are availability of cost-effective power and water supply; affordable and trained manpower; adequate, economic and efficient transportation system, availability of finance, access to other
crop inputs and adequate local markets with adequate competitiveness, and/or export opportunities. Although the fertilizer production business favors large firms, well located smaller production and NPK blend units can also generate competitive advantages as they could be serving specific needs. Opportunistic integrated partnerships are also effective. Storage facilities by importers, distributors and hub agro-dealers are also key. They probably have the highest leverage and practicality for optimizing fertilizer delivery, availability and affordability in SSA.

Most of the clusters have the potential for production. Most of the countries listed in the clusters are either current producers or have planned projects. For others, developments will be a matter of convergence of competitive factors, adequate economic and infrastructure, and access to market and knowhow.

In Cluster 1 that comprises AMU region, opportunities exist for expansion/modernization mainly for export markets both in Africa and outside. In Cluster 2 that comprises of ECOWAS and UEMOA, existing and planned projects are adequate. More scope might be possible for export projects and perhaps for smaller ones to serve particular markets after economic assessment. There are opportunities for blending plants especially in Nigeria, Ghana, Mali, and Côte d’Ivoire. Storage facilities are also important. The most critical task is strengthening distribution infrastructure. In Cluster 3 which comprises of the EAC region, the planned project for nitrogen in Tanzania is critical while the existing Minjigu mine should be expanded/modernized. Blending plants and storage facilities are important in the whole region. Rural infrastructure is critical to link smallholder farmers. In Cluster 4 which mainly comprises the SADC region, expansion/modernization in South Africa and Zimbabwe and the planned project in Mozambique are important. Blending plants, storage
facilities and rural feeder roads are key in this cluster. Cluster 5 is largely a mining region with limited production possibilities. In this cluster, the focus would be production for exports, storage facilities and strengthening the distribution network to meet the limited demand and intra-African trade. In cluster 6, which comprises the IGAD and Egypt, expansion/modernization in Egypt for exports and the completion of the planned projects in Eritrea and Ethiopia. There are opportunities for blending plants in Ethiopia and Sudan and for storage facilities across the whole region. Also, strengthening of the distribution network is critical.

- **Private Sector Financing**

Sources of finance for investment in fertilizer manufacturing plants, blending plants, importation, storage facilities, and agro-dealers capacity are available from the AfDB Africa 50 fund, private equity, development partners, capital markets; local, regional and international financial institutions; African governments, microfinance institutions, private foundations and non-governmental organizations. For farmers, the sources include national governments, commercial banks, NGOs/foundations, and micro-finance institutions. However, due to the risk involved and the size of capital required, some arrangements of public-private partnerships should be considered. With regard to financing needs, the evidence suggests the importance of paying more attention to trade finance followed by blending plants and storage facilities to improve access and affordability of fertilizers for farmers, in particular for smallholder farmers.

- **Policies and Regulations**

Good fertilizer policies can raise agricultural productivity and farm income by creating a system that supplies high-quality fertilizers to farmers at affordable prices, along with information on how to use them effectively. Liberalization and privatization in most
countries have transformed fertilizer markets in Africa. One-third of African countries have a formal fertilizer policy. Most countries have fertilizer input subsidies, and these are likely to stay for the foreseeable future. There are the challenges of targeting, sustainability, crowding out of the private sector, delayed payment, and delayed delivery. However, with better design and implementation of the fertilizer subsidy, the private sector has the potential to invest in fertilizer value chains in Africa. Investment in complementary measures such as seeds, pesticides, irrigation, soil conservation, research and extension, aggregation of farmers, and guaranteed access to output markets, finance and crop insurance are needed to raise the value–cost ratio of fertilizers. Procurement policies are now being used to enhance affordability by arranging for bulk buying. However, it is too early to gauge its effectiveness.

There are weak regulatory systems in most countries in Africa, and the situation has led the sale of inappropriately formulated, substandard or adulterated fertilizer. Some of the countries with rudimentary regulatory systems are Liberia, Benin, Sudan, Senegal, Ethiopia and Burkina Faso. Standards and regulations requiring long field testing, import permits, trade permits, frequent renewal, and non-participation of the private sector in the importation are a major concern. Poor enforcement of quality control is also a matter for concern. Standards and regulations need to be harmonized to promote the cross-border trade of fertilizers.

Trade policies are generally liberal in Africa and most countries have removed trade tariffs on fertilizers. Standards and regulations, and non-tariff barriers (NTBs) have been a major bottleneck to trade and consumption of fertilizers. NTBs such as poor port logistics, poor roads, weighbridges, police roadblocks, roadside checks and cumbersome cross-border procedures are a hindrance.
Moreover, a number of countries do not have a fertilizer policy and fertilizer law while a multiplicity of organizations is involved in fertilizer regulations thereby creating confusion. Harmonization of regional policies would potentially increase fertilizer trade among African countries. In addition, different tax regimes and non-tariff barriers (NTBs) in some countries hinder robust inter- and intra-country trade distorting prices and raising costs of business. Other findings show that, apart from ECOWAS, fertilizer regulations in other regions are yet to be developed and harmonized at the regional level. Regional and national transport costs account for a major fraction of the final fertilizer prices. These are linked to the poor road and railway infrastructure and the limited competition in the truck industry. Lowering trade barriers, adopting common quality standards, and harmonizing approval processes to increase the size of markets, and improving road and rail infrastructure will reduce distribution costs.

6.2 Conclusions
The study has shown that a combination of large and smaller fertilizer production plants, blending plants and storage facilities strategically located but even more so, much better inland distribution systems, freer trade and reduced non-tariff barriers, open transport competition, optimized administrative procedures, improved port logistics, and harmonization of product certification and import licensing would greatly increase fertilizer trade and consumption in Africa. The study also provides much clearer opportunities for higher efficiencies and potential measures to ensure huge improvements in fertilizer accessibility and affordability.

Despite some efforts, fertilizer distribution systems in Africa are still weak even after the 2006 Abuja Declaration that all African countries should improve farmers’ access to fertilizers by developing and scaling-up input dealers’ and community-based networks across rural areas.
Potential sources of finance are available for the private sector to invest in fertilizer manufacturing plants, blending plants, and other activities and actors along the value chains such as importation, distribution, agro-dealers and farmers. These include the AfDB Africa 50 fund, private equity, development partners, capital markets; local, regional and international financial institutions; African governments, microfinance institutions, private foundations and non-governmental organizations. However, the modalities of public-private partnerships should be explored due to the risks of the business. With differential financing needs in the fertilizer value chain, evidence suggests the importance of paying more attention to trade finance followed by blending plants /storage facilities to improve access to and affordability of fertilizers for farmers, in particular smallholder farmers.

Most countries have fertilizer input subsidies, and these are likely to stay for the foreseeable future. There are challenges of targeting, sustainability and crowding out of the private sector. However, with better design and implementation of the fertilizer subsidy, the private sector has the potential to invest in fertilizer value chains in Africa. Investment in complementary measures such as seeds, pesticides, irrigation, soil conservation, research and extension; and aggregation of farmers, and guaranteed access to output markets, and crop insurance are needed to raise the value–cost ratio of fertilizers.

The study also shows that there are weak regulatory systems in most countries in Africa, which have allowed for sale of inappropriately formulated, substandard or adulterated fertilizer. At the same time, where regulatory frameworks exist, they are often characterized by poor quality control systems, and limited implementation capacity due to human resource and financial constraints.
Finally, lowering trade barriers, adopting common quality standards, and harmonizing approval processes to increase the size of markets, improving road and rail infrastructure will reduce distribution costs.

6.3 Policy Recommendations

Since the Abuja Declaration on fertilizer in 2006 by African Head of State, some countries have made good progress while others have not. Based on this study, to increase fertilizer use, production and trade in Africa, policy makers and other stakeholders in fertilizer industry have to rethink and stop doing business as usual. The following are some of the recommendations:

- Deepening of regional integration is key especially in the context of the recent launch of the Continental Free Trade Area (CFFTA).
- Given that fertilizer subsidy programs are unlikely to stop, there is need for continuous improvement in their design and implementation to reduce leakages, maximize effectiveness of fertilizer subsidy programs, reduce impact on national budgets, and enhance private sector participation.
- Restrictions on international trade in fertilizer should be relaxed or eliminated as stipulated in the Abuja Declaration. This includes the removal of duties on imported fertilizer and the elimination of regulatory barriers/NTBs to international trade in fertilizer.
- Strengthening and enhancing the regulatory capacity and efficiency, upgrading of testing laboratories, use of faster testing tools, enactment of fertilizer laws and regulations and also harmonization within the regional economic organizations would be appropriate.
• Utilizing opportunities presented by ambitious infrastructural development projects in some countries to improve service provision and increase fertilizer trade in the continent.

• Ensuring reliable policy and efficient regulatory framework that govern fertilizer use, production and trade in the respective countries while also ensuring compliance to rules. Most of these are outlined in the Abuja Declaration and only requires implementation.

• African countries need to ensure that fertilizer distribution systems are efficient by developing and scaling-up input agro-dealers’ and community-based networks across rural areas to ensure that farmers have access to fertilizers.

• Transportation of fertilizer constitutes a substantial component of final fertilizer prices. It is thus important that anti-competitive tendencies in the truck industry be dealt with and rural roads are upgraded or improved and new rural feeder roads constructed to reduce transport costs. The improvement of rail infrastructure and upgrading equipment can have an impact in reducing overall costs of distributing fertilizer and for providing output access to domestic and foreign markets. Also, procurement policies that encourage bulk importation or purchase should be considered if assessment proves its effectiveness.

• Governments with the support of donors and private sector should undertake periodic comprehensive soil mapping so as to continuously update fertilizer recommendations. In addition, investment is needed in complementary measures such as improved seeds, extension, soil and water conservation, irrigation, integrated soil fertility management, and access to finance and crop
insurance in order to raise the value-cost ratio of fertilizers thereby raising demand.

- Exploring the possibilities and modalities of public-private partnerships for the financing of investments in fertilizer inventories, blending plants, storage facilities and expansion/modernization of existing fertilizer plants in Africa.

Therefore, to increase fertilizer use in Africa, a variety of measures should be considered by AFFM. Besides exploring the possibilities and modalities of public-private partnerships and credit guarantees in order to increase financing opportunities for expansion/modernization of existing fertilizer manufacturing plants, new smaller plants, blending plants, importers, storage facilities and agro-dealers; AFFM should seek to:

i. encourage the deepening of regional integration efforts that focus on regional infrastructure, trade corridors, and harmonization of fertilizer standards and regulations;

ii. encourage transport policies that increase competition in the trucking industry;

iii. encourage procurement policies that enhance bulk buying of fertilizers if an assessment shows it is effective;

iv. encourage countries to address NTBs both at the regional level such as weighbridges, police road blocks/checks, cross-border procedures, etc.;

v. deal also with the demand side by supporting some form of guaranteed output markets, complementary measures such as seeds, extension, and research to improve fertilizer use efficiency and effectiveness; and

vi. Support improvements of rural/feeder roads that reach agricultural production zones.

With regards to financing, AFFM should consider:
• Facilitating the formation of investor consortia and public-private partnerships for new blending plants, smaller new fertilizer manufacturing plants serving particular markets and expansion/modernization;
• Credit guarantees for fertilizer importers, distributors, and agro-dealers
• Assisting/facilitating the provision of finance for storage facilities/warehousing space especially at inland transportation hubs;
• Assisting private traders in obtaining lines of credit, hedging, and equity investments from local banks;
• Developing and promoting innovative public-private fertilizer financing schemes as well as credit products
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8. ANNEXES

Total = 7.8 Mt

Figure 26: Urea production in Africa in 2016

Source: *IFA Production & International Trade, 2018*
Total = 7.2 Mt (MAP, DAP, TSP)

Source: *IFA Production & International Trade, 2018*

**Figure 27:** Processed phosphates production in Africa in 2016
**Figure 28:** Main fertilizer consuming countries in Africa in 2015

Source: *IFA Production & International Trade, 2018*
Figure 29: Expected fertilizer consumption in Africa

Source: Rakshit, 2011
Figure 30: Intensity in fertilizer use in selected countries in Africa in 2012.

Source: AGRA, 2013
Table 15: Cross-border trade indicators in selected sub-regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Documents to export (number)</th>
<th>Time to export (days)</th>
<th>Cost to export (USD per container)</th>
<th>Documents to import (number)</th>
<th>Time to import (days)</th>
<th>Cost to import (USD per container)</th>
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<tbody>
<tr>
<td>SADC</td>
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<td>8.4</td>
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<td>31.6</td>
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<td>2,808.8</td>
<td>10.8</td>
<td>44.0</td>
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<td>NORTH AFRICA</td>
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<td>EAST ASIA &amp; PACIFIC</td>
<td>6.4</td>
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<td>4.9</td>
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<td>1106.3</td>
</tr>
</tbody>
</table>

Source: Barker, 2012
Figure 31: Soil and terrain constraints for low input farming in Africa

Source: Dixon, Boffa, and Garrity 2014
Figure 32: Major environmental constraints in Africa

Source: Dixon, Boffa, and Garrity 2014
Figure 33: Major Agro-ecological zones in Africa

Source: Dixon, Boffa, and Garrity 2014
Figure 34: Low Road Density Contributes to High Transport Cost: Kilometer Paved Roads/million capita

Source: Roy (2016)