



**TRADE & INDUSTRIAL POLICY STRATEGIES**

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**TIPS REPORT FOR THE  
DEPARTMENT OF TRADE AND INDUSTRY**

**Case study on the agricultural inputs  
regional value chain in Southern Africa:  
South Africa, Mozambique,  
Tanzania and Zambia**

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**December 2017**

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## ABBREVIATIONS

AFMA	Animal Feed Manufacturers Association
AGRA	Alliance for a Green Revolution in Africa
CAADP	Comprehensive Africa Agriculture Development Programme
CAFOs	Concentrated Animal Feeding Operations
COMESA	Common Market for Eastern and Southern Africa
DFT	Distance to Frontier
dti (the)	Department of Trade and Industry
EBA	Enabling the Business of Agriculture (World Bank)
EU	European Union
FAO	Food and Agricultural Organization (United Nations)
FISP	Farmer Input Support Programme
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GMO	Genetically Modified Organism
HSRS	Harmonized Seed Regulatory System (SADC)
ICT	Information and Communications Technology
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Center
IMF	International Monetary Fund
LPI	Logistics Performance Index (World Bank)
NAIVS	National Agricultural Input Voucher Scheme (Tanzania)
NCZ	Nitrogen Chemicals of Zambia
PASS	Programme for Africa's Seed Systems
SADC	Southern African Development Community
SANSOR	South African National Seed Organisation
R&D	Research and Development
RAIP	Regional Agricultural Investment Plan
UNECA	United Nations Economic Commission for Africa
US	United States
VAT	Value-Added Tax

## EXECUTIVE SUMMARY

Agricultural transformation – that is, the transition from a mainly subsistence-based agricultural system to one that is commercially focused (production primarily for markets rather than own consumption) – is a key part of broader economic transition, particularly in countries where the majority of the population are employed in agriculture (AGRA, 2016). The agricultural sector makes up an average 24% of GDP in Africa and is central to growth and socio-economic development in most of Sub-Saharan Africa. Market-focused agriculture has the potential to absorb rural labour and to stimulate related economic activities in rural areas, both downstream (input supply) and upstream (agro-processing). A growing agricultural sector also contributes growth in the non-agricultural rural economy.

Despite the fact that a significant percentage of the world's arable land is in Africa, the continent is a net food importer, and this is expected to grow from \$35 billion in 2015 to over \$110 billion by 2025 (AGRA, 2016). Agricultural production in Africa is increasing, but most of the increase comes from an increase in land under cultivation (and thus additional labour inputs), rather than increasing yields. IFAD (2016) estimates that almost 70% of the increased output observed from 2001 to 2008 in Sub-Saharan Africa was due to an increase in the area under cultivation, and only 17% was due to additional and better use of inputs. The sector is characterised by low levels of productivity (potential yields have been estimated to be somewhere between three and five times higher than current levels in many countries), low levels of research and innovation, and low levels of use of many agricultural inputs.

The potential for increased input use is considerable: as just one example, Africa currently uses only 3% of the world's fertiliser, at an application rate that is about 1/10 of global averages. The use of capital inputs such as tractors and irrigation is also low. Key indicators such as cereal yields per hectare, value added per agricultural worker, and total factor productivity are much lower in Sub-Saharan Africa than in either Asia or Latin America (AGRA, 2016). Therefore a **significant potential demand** for additional agricultural inputs across many countries exists.

There appears to be significant long-term potential to develop the **regional** agri-inputs value chain in Southern Africa, which would be to the benefit of multiple chain participants across several countries, including South Africa. However, there is little detailed research on the **regional** obstacles to achieving this goal, or how regional policy might facilitate this outcome. In addition, some parts of the inputs value chain have been under-researched: there is quite a lot of research and information around fertiliser, but much less around other inputs.

This research project aims to identify opportunities to develop the regional value chain in agricultural inputs, and the opportunities within that value chain for regional trade. It also aims to detail policy initiatives to be undertaken by the Department of Trade and Industry (the dti) to capitalise on those opportunities in order to promote regional integration and growth and development supported by expanding regional value chains.

The study covers the following countries: South Africa, Mozambique, Tanzania and Zambia. The research aims to answer the following questions:

- a. What is the current profile of the agricultural inputs sector in each country?

- b. What are the key factors driving demand for different categories of agricultural inputs across the four countries?
- c. What are the main factors that constrain demand for agricultural inputs in each country, and in aggregate across the region?
- d. What is the current structure of the regional value chain in these inputs? How is it organised?
- e. How well is the chain functioning?
- f. What and where are the opportunities to improve the functioning of the regional value chain?
- g. What does this analysis imply for the dti's regional development policy?

To date, much of the policy around increasing input use among farmers – particularly smaller farmers – has been dominated by what could best be described as a **supply push approach**. To date, the focus has been on getting product to farmers, almost always at a subsidised price. A more sustainable, value-chain focused approach needs to consider the issue from both the demand and the supply side; that is:

- What needs to be done to ensure that demand for the product increases;
- What needs to be done to ensure that this demand is met through the development of private-sector enterprise; and
- How will this be facilitated in such a way that it benefits the **regional** economy?

In terms of defining a “regional value chain”, this can be understood as existing when the producers and the consumers of products are located in the same region. For agri-inputs, an integrated regional supply chain would be one where the majority of agricultural inputs that are used by farmers in the region are **produced** within the region. This, in turn, would be related to an integrated agricultural value chain, in which a significant percentage of agricultural output consumed in the region would also be produced in that region. This is a **whole value chain approach**, recognising the interdependence of both input and output markets in the agricultural sector.

**The initial catalyst for the development of a regional value chain is to address the main issues that impact demand for the product.** The analysis presented in this report clearly shows that the demand for agricultural inputs is determined at the intersection of two key variables:

- The cost of using the additional inputs; and
- The benefits derived from using the additional inputs.

The decision to use inputs – and the quantum of that use – is made on the basis of a present financial commitment for uncertain future rewards. This cost-benefit intersection is **the most crucial leverage point for the agri-inputs value chain**. When the benefits of using additional inputs outweighs the cost, input use will rise. The main reason for low input use in Sub-Saharan Africa is that costs of using inputs have generally outweighed the benefits of their use. This has resulted in a more or less permanent cost-benefit gap. The main focus of most input programmes in these countries has been to subsidise the cost of inputs in an attempt to close this gap. The alternative approach – which we recommend – is to adopt a multi-faceted approach to closing the gap, working on multiple factors that will reduce the costs of input use and increase the benefits obtained from that use, by operating directly on the drivers of costs and benefits

Based on our analysis, our main policy recommendations are the following:

**1. Supporting the development of regional output markets that will provide more and better market access opportunities for farmers**

Regional agricultural policy (including trade policy) needs to incorporate a careful consideration of the terms of trade on which farmers will access markets, and the impact of these terms of trade on farm-level incomes. Unless farmers are able to sustainably increase their incomes in line with growing demand for agricultural produce, they will never be a sustainable foundation for increased trade in agri-inputs. This also means that farmers need support to enter higher-value growing markets for animal products and processed food.

**2. Seed harmonisation and fertiliser harmonisation regulations in SADC need to be finalised and implemented with a sense of urgency.**

The harmonisation of these regulations, and their implementation by all the Southern African Development Community (SADC) member states, is a non-negotiable foundation for developing regional markets in agri-inputs. In addition, close communication between SADC and the Common Market for Eastern and Southern Africa (COMESA) on future plans to harmonise regulations around agri-inputs would be useful.

**3. Regional coordination of extension services and delivery platforms**

Extension services are a key factor in increasing farmers' access to information, not just around agri-inputs, but also around market access opportunities. Delivering these services using information and communications technology (ICT) platforms is growing rapidly, but many of these initiatives are uncoordinated, with significant duplication of efforts. All of this is to the detriment of the farmers who require these services. It would be helpful for a regional meeting of all major service providers in this area to be convened, with the goals of consolidating service offerings; creating greater opportunities for farmers across the region to participate in peer learning groups; and facilitating regional connections between buyers and sellers of a wide range of agricultural products. In addition, the consolidation of platforms will create economies of scale that can reduce the costs of such services and facilitate negotiations with ICT service providers to reduce the cost of both data and hand-held devices.

**4. Logistics and transport infrastructure problems must be addressed — now**

There can be no meaningful growth of regional value chains in any part of the agricultural sector until the issues around the cost and reliability of transport services in the region have been addressed. This is such a serious constraint that it may be necessary to adopt an approach within SADC that ensures the bulk of all money to be spent under the Regional Agricultural Investment Plan (RAIP) must be allocated to transport infrastructure.

**5. Current agricultural input subsidy schemes should be diversified to include additional items**

As the analysis in this report has hopefully made clear, the best way to ensure that farmers use more and better inputs is to put them in a position where they can earn sufficient income to purchase those inputs. Current funds allocated to the direct purchase and distribution of inputs would be better utilised in making soft loans or matching finance available to farmers to allow them to invest in infrastructure and capital goods that will enhance farming incomes. This includes a wide range of items, from transport vehicles, to hammer mills, to small-scale processing and packaging facilities, and irrigation infrastructure.

# 1. INTRODUCTION AND BACKGROUND

## 1.1. Introduction

Agricultural transformation – that is, the transition from a mainly subsistence-based agricultural system to one that is commercially focused (production primarily for markets rather than own consumption) – is a key part of broader economic transition, particularly in countries where the majority of the population are employed in agriculture (AGRA, 2016). This transformation process generally starts with an increase in agricultural productivity, which in turn is driven by an increase in input use and the adoption of more intensive farming practices. The (hopefully) resulting increasing net farming incomes help to stimulate the non-farm economy in rural areas. The development of value-added activities associated with increased agricultural production – such as agro-processing and retailing – further contribute to employment opportunities. For all these reasons, increasing agricultural productivity is a policy priority in much of Sub-Saharan Africa.

The most generally referenced global programme is the so-called Green Revolution in Asia, where government policies to support a massive increase in “modern” input use – particularly in areas of irrigated farmland – resulted in a significant increase in agricultural productivity and output. Rising farm incomes provided the stimulus for a general rise in national economic growth. Many governments and non-governmental organisations (NGOs) believe that replicating the Green Revolution in Africa is key to continental economic development.

The agricultural sector currently makes up an average 24% of GDP in Africa, and is central to growth and socio-economic development in most of Sub-Saharan Africa. Market-focused agriculture has potential to absorb rural labour and to stimulate related economic activities in rural areas, both downstream (input supply) and upstream (agro-processing). A growing agricultural sector also contributes growth in the non-agricultural rural economy. The agriculture sector in Africa is currently being driven by the following factors:

- Rising economic growth that increases consumer income and thus disposable income to spend on greater amounts of food, as well as more processed food and more expensive items, particularly meat and dairy products. The rising demand for meat and dairy also means an increasing demand for animal feed to be available, which in turn requires agricultural inputs, such as grains;
- Rising urbanisation. It is estimated that by 2050 more than 50% of Africa’s population will live in urban areas (AGRA, 2016). This in turn means a great deal more people who will access most of their food from markets, rather than through self-provisioning.
- Steadily rising global demand for higher-value added food products, such as fresh fruit and vegetables, which is stimulating the export of such products.

Despite the fact that a significant percentage of the world’s arable land is located in Africa, the continent is a net food importer, and this is expected to grow from \$35 billion in 2015 to over \$110 billion by 2025 (AGRA, 2016). An increasing share of these imports are likely to be made up of processed food, as well as higher value items like dairy products and meat. This further underscores the potential benefits for African economies from increasing local production to meet continental demand and take advantage of these opportunities for trade.

*Agricultural production in Africa is increasing, but most of the increase is due to an increase in land under cultivation (and thus additional labour inputs), rather than increasing yields. IFAD (2016) estimates that almost 70% of the increased output observed from 2001 to 2008 in Sub-Saharan Africa was due to an increase in the area under cultivation, and only 17% was due to additional and better use of inputs. The sector is characterised by low levels of productivity (potential yields have been estimated to be somewhere between three and five times higher than current levels in many countries), low levels of research and innovation, and low levels of use of many agricultural inputs, such as fertiliser, animal husbandry, capital equipment and post-harvest infrastructure. Additionally, soils in general in Sub-Saharan Africa are declining in fertility, because of “nutrient mining” – that is, more nutrients are being taken from the soil in the production of crops than are being replaced through the application of fertilisers. This is the main reason for the increase in land cultivation – farmers need access to better quality soils. However, increasing the land under cultivation as a means to increasing agricultural output obviously cannot continue indefinitely and there is evidence that this limit is near (AGRA, 2016). Other research indicates that there has been a significant decline in fallow land (i.e. land that is left unplanted for a season to recover). This is a further indication that the limit of increasing production through increasing the area of cultivation is probably not too far away, and that declining productivity because of generally declining soil fertility is a real possibility.*

These factors not only constrain the development of market-focused agriculture, but undermine food security among subsistence farmers. For all these reasons, there is an increased focus across Southern African countries on increasing input use – particularly “modern” input use – as the key pathway to increasing output through rising productivity.

The potential for increased input use is considerable: as just one example, Africa currently uses only 3% of the world’s fertiliser, at an application rate that is about 1/10 of global averages. The use of capital inputs such as tractors and irrigation is also very low. Key indicators such as cereal yields per hectare, value added per agricultural worker, and total factor productivity are much lower in Sub-Saharan Africa than in either Asia or Latin America (AGRA, 2016). There thus exists a **significant potential demand** for additional agricultural inputs across many countries.

The combination of domestic food insecurity in many countries, the growing world market for food, and the low level of input use has resulted in a steady increase in the number of initiatives across Africa focusing on increasing the use of agricultural inputs. Some of these entities (public and private) have also supported initiatives to grow and deepen the agricultural inputs value chain, focusing on developing new enterprises in the sector to facilitate increased trade. However, to date almost all of these have been locally-based and focused mostly on small and medium enterprises, rather than at a regional scale, and fertiliser has been the main input under consideration in these efforts.

All of these factors suggest there may be significant long-term potential to develop the **regional** agri-inputs value chain in Southern Africa, which would be to the benefit of multiple chain participants across several countries, including South Africa. Currently, however, there is little detailed research on the **regional** obstacles to achieving this goal, or how regional policy might facilitate this outcome. In addition, some parts of the inputs value chain have been under-researched: there is quite a lot of research and information around fertiliser, but much less around other inputs.



## 1.2. Aim of the Research

This research project aims to identify opportunities to develop the regional value chain in agricultural inputs, and the opportunities within that value chain for regional trade. It also aims to detail policy initiatives to be undertaken by the dti to capitalise on those opportunities in order to promote regional integration, growth and development, supported by expanding regional value chains.

In terms of defining a “regional value chain”, this can be understood as existing when the producers and the consumers of products are located in the same region. For agri-inputs, an integrated regional supply chain would be one in which the majority of agricultural inputs that are used by farmers in the region are **produced** within the region.

Despite the key role of agriculture in most Southern African economies, and the growing demand for agricultural output across the region – both as consumer items and as inputs (such as animal feed) – regional agricultural value chains in general are poorly developed, and this is particularly the case for inputs. Although individual companies – particularly from South Africa – are increasingly expanding into the region, this is not equivalent to the development of a regional value chain. This expansion is also generally motivated by the desire to increase (or establish) market share in a particular country, rather than regional **integration** itself.

The study covers the following countries: South Africa, Mozambique, Tanzania and Zambia. Covering more than four countries in such a study is not recommended. Mozambique, Tanzania and Zambia were chosen on the following set of criteria:

- Potential of the agricultural sector (including the significant presence of investors and donors in the sector).
- Reasonable proximity or logistics access to each other and to South Africa.
- Current low usage of most modern agricultural inputs. As a proxy for the potential for agricultural inputs, fertiliser use in Mozambique, Tanzania and Zambia (in kgs/hectare) is very low, ranging between 5% and 10% of averages in South African agriculture.
- Rising agricultural output, but relatively low productivity, indicating potential for increased use of inputs.
- Rising investment (by both the public and private sectors) in agriculture.
- Increasing innovation in the use of ICT in developing the agricultural value.

The research aims to answer the following questions:

- (i) What is the current profile of the agricultural inputs sector in each country?
- (ii) What are the key factors driving demand for different categories of agricultural inputs across the four countries?
- (iii) What are the main factors that constrain demand for agricultural inputs in each country, and in aggregate across the region?
- (iv) What is the current structure of the regional value chain in these inputs? How is it organised?
- (v) How well is the chain functioning?
- (vi) What and where are the opportunities to improve the functioning of the regional value chain?
- (vii) What does this analysis imply for the dti’s regional development policy?

### 1.3. Approach and Method

In defining “agricultural inputs”, a wide definition is preferred, covering all the major “inputs” required for a farmer to produce something and get it to a market. This definition encompasses (at least) the following:

- Farm-level inputs, such as fertiliser, seed, and agricultural chemicals
- Animal inputs, such as feed and veterinary supplies
- Capital equipment, such as tractors
- Irrigation
- Financial services
- Extension services

Given the complexity of the report – multiple agri-input subsectors across four countries – together with the aim of the research (to develop strategic policy recommendations for the development of the regional value chain, rather than individual markets) a particular approach has been adopted: one that focuses on identifying the key drivers of regional demand and supply that are **common** across these subsectors and study countries. This approach has also been adopted in recognition of the fact that significant and sustainable improvements in agricultural productivity – and the development of a regional value chain – require the coordinated utilisation of multiple inputs. That is, it is not effective to develop policy that aims only, for example, to grow the regional value chain in improved seed without also developing the regional value chain for related inputs, such as fertiliser and agricultural chemicals. ***Therefore, the aim of the research is to identify those policy initiatives that will facilitate and support the development of regional value chains in multiple agricultural inputs, since multiple agricultural inputs are required to significantly increase productivity.***

### 1.4. Structure of the report

Section 2 of this report provides an overview of the agricultural sector and key growth trends in each of the four study countries – South Africa, Mozambique, Tanzania and Zambia. This provides the context for the detailed discussion of the various input subsectors in Section 3.

Section 3 comprises a detailed analysis of the national and regional markets in each of the following agricultural input subsectors, focusing on the key factors that drive and/or inhibit demand and supply:

- Fertiliser
- Seed
- Agricultural Equipment
- Irrigation
- Animal production inputs
- Extension services (including research and development)
- Financial services

For each of these subsectors there is an overview of its most important components; the role of the subsector in agricultural productivity; general trends in Sub-Saharan Africa; the key factors driving both demand and supply; and current value chain structures. Based on the analysis in Sections 2 and 3, Section 4 presents a summary of the key drivers of both demand and supply for agri-inputs, across the region, and across various categories on inputs. These key drivers are then compared against the existing situation in each of the four study countries and the region to develop the policy recommendations presented in Section 5.

## 2. COUNTRY ANALYSIS: THE MACRO CONTEXT

### 2.1. Introduction

Studies such as a recent analysis of poultry value chains (Ncube, Roberts and Zengeni, 2017) have highlighted the generally low level of regional integration across many agricultural value chains in sub-Saharan Africa. This is despite the many examples of “matching” production surpluses in one country and deficits in another (such as soya production in Zambia and deep-sea poultry feed imports into South Africa, highlighted in the same report).

This section includes a high-level profile of each of the study countries, focusing on the key attributes of their agricultural sectors and markets for agricultural inputs that are relevant for the analysis of the regional agri-input value chain. This context is important because it is not particularly useful to consider agricultural inputs value chains in isolation from broader agricultural value chains, or overarching factors, such as general agricultural policy. Instead, it is much more helpful to bear in mind that an agricultural input value chain is correctly one part of a much larger overarching value chain for agricultural output, and that there is a complex relationship between the two. This relationship is characterised by multiple points of intersection, influence and dependence. Interventions which aim to develop and grow the agri inputs value chain must take careful cognisance of these.

**Figure 1: Relationship between inputs and outputs**

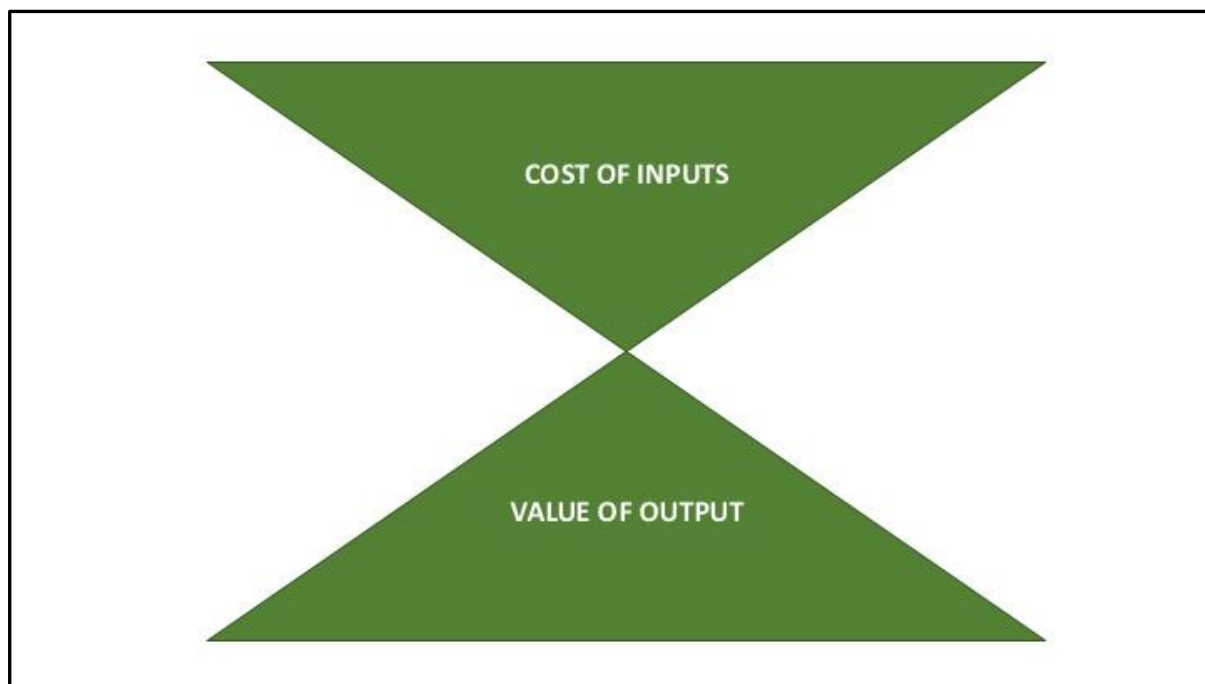


Figure 1 is a simple representation of that relationship: The purpose of using agri-inputs for any commercial farmers is to generate output – through the “funnel” of production – that can then be sold in output markets. There is thus a crucial relationship between the cost of using additional or “better” inputs, and the value of that output (which is determined by output markets). Both input and output markets are thus in a dynamic mutual relationship, each setting effective limits for the other. The better the output markets that farmers can access – in terms of price, risk and other factors – and

the easier it is for farmers to access these markets, the more they will be willing to spend on inputs, and the greater the amount of inputs that will be incorporated into production. The more productive those inputs are – that is, the greater the impact on yield – the more farmers will demand them. But the reverse is also true – poor output markets, high costs of accessing those markets, or inputs which only contribute a small increase in yields will reduce the potential for input use. The role of agri-output markets in agri-input markets, and what this implies for policy around regional value chains, is discussed in more detail in Section 4 of this report.

Table 1 summarises some of the key relevant indicators for the four countries in this study.

**Table 1: Key indicators**

INDICATOR	MOZAMBIQUE		SOUTH AFRICA		TANZANIA		ZAMBIA	
	2001	2015	2001	2015	2001	2015	2001	2015
% Rural population	70.7	67.8	42.6	35.2	77.3	68.4	65.0	59.1
% growth GDP/capita (Y/Y)	9.6	3.4	0.6	-0.4	3.2	3.7	2.6	-1.4
Agric value add per worker (2010 US\$)	205	339	4 861	8 739	453	570	826	650*
Cereal yield (kg/hectare)**	880	703	2 424	4 320	2 047	1 660	1 401	2 755

Source: AGRA 2016, World Bank, 2017

\* Estimate

\*\* Data is for 2001 and 2014

There are very clear differences between the agricultural sectors in South Africa and the other three countries – Mozambique, Tanzania and Zambia. This presents both challenges and opportunities for greater regional integration, as detailed in more detail in the country profiles that follow.

## 2.2. South Africa

South Africa’s agricultural sector is dominated by large commercial units, high levels of productivity, relatively high levels of mechanisation, and “modern” input use intensity significantly greater than the other countries in the study. This is in sharp contrast to the other three countries in the study, where smaller farms make up the bulk of agricultural units and are thus the central focus for government agricultural policy. The cultivated area of land (that is, arable land together with that under permanent crops) in South Africa is around 13 million hectares (FAO Country Profiles, online). South Africa is a semi-arid country, with average annual rainfall of 495mm, the lowest of the four countries. Almost two thirds of the country do not receive enough rainfall to ensure successful rainfed production of crops.

Agriculture is one of the smallest parts of the economy, making up between 2% and 3% of gross domestic product (GDP) (varying to a great extent with weather patterns). However, the agricultural value chain in South Africa is well developed, with significant upstream (processing and retailing) and downstream (agricultural inputs) markets. If the entire value chain is taken into account, the sector’s contribution to the economy is around 15%. In most years (the 2015/16 drought was an exception)

South Africa is a net exporter of agricultural products (including food), with about 45% of exports going to Africa. However, the country is a net importer of processed agricultural products.

The food processing and retail sector in South Africa is extremely well-developed, and in many cases highly concentrated. As a result, terms of trade for farmers in output markets have generally declined over the past 20 years. Producer prices of several key agricultural products – chicken is a good example – are higher in neighbouring countries than in South Africa, while retail prices are often lower. The squeeze on farming margins is felt downstream in the agri-inputs sector, and puts pressure on margins there – it's not easy to do business when your customers are under significant financial pressure.

The agri-inputs sector in South Africa is far more developed than in the other study countries, and its growth has been supported by a long history of government policies to support large-scale commercial farming, which mostly came to an end in 1996. Several large fertiliser companies (both local and international) are well-established in South Africa. The country is a net importer of fertiliser, and most of the raw components are also imported, to be manufactured as compounds locally, which are then sold in the market under local brand as well as exported. All the potassium used by the local industry as well as two thirds of the nitrogen required is imported. The sector is very competitive, and there are no import tariffs in place; as a result local fertiliser prices tend to track international prices very closely. The commercial maize sector is the biggest fertiliser user, and accounts for about 40% of domestic fertiliser demand.

There is some export of fertilisers (locally manufactured and blended compounds) from South Africa. Most of this trade has been with Zimbabwe, followed by Zambia. There have been limited fertiliser exports to Mozambique, and practically none to Tanzania. The main exported products are the following:

- LAN (Limestone Ammonium Nitrate), most of which is exported to other African countries – Zimbabwe and Malawi are the two biggest destinations.
- MAP (Mono-Ammonium Phosphate), once again Africa is the biggest export destination – Zambia and Zimbabwe are the biggest markets for this product.
- NPK fertilisers – mostly to Zambia, followed by Zimbabwe.
- Potassium Chloride – main markets are Zimbabwe and Zambia
- Potassium Sulphate – mostly to Zimbabwe, followed by Mozambique

Exports of South African fertiliser products have declined across all product groups over the past few years, due to adverse weather conditions in many key markets, a shortage of foreign exchange in some markets (such as Zimbabwe), and increasing competition from cheap imports from China and India. Despite this, large South African companies (such as Omnia) have been expanding into Eastern and Southern Africa in recognition of the opportunities in the agricultural sectors in the region. Zambia is generally viewed as the country with the greatest current market potential, given its rapidly growing commercial farming sector.

South Africa is one of the world's largest users of genetically modified (GMO) seeds, as a percentage of total commercially planted crops. Almost all the commercial maize planted in the country together with a significant percentage of soya is sophisticated "improved" seed. The formal seed industry has a long history in South Africa, and there is extensive regulation of the sector to protect plant breeders'

rights and to ensure that strict quality standards are consistently met. The key regulatory authority is the South African National Seed Organisation (SANSOR). SANSOR plays a key role in the certification of new varieties and the development of new legislation for the sector. SANSOR has 22 plant breeder members, made up of a combination of large multinational and South African companies. The single biggest individual category of seed by value in South Africa is hybrid maize – accounting for about 75% of the total value of the agronomy seed sector, which in turn is the largest component of the overall seed sector.

The latest available seed market data from SANSOR (for the 2014/15 year) indicates the following market values for the main categories of seed:

**Table 2: Seed production in South Africa**

CATEGORY	VALUE (Retail) – R millions
Agronomy	4 121,69
Horticulture	1 128,78
Forage and pasture crops	51 220

Source: SANSOR website – [www.sansor.org](http://www.sansor.org)

SANSOR’s membership includes 33 companies listed as “exporters”, but most of the seed produced in South Africa is consumed locally – only about 10% of seed produced (by volume) is exported. The biggest component of the export market is horticultural seeds (about 40% of local seed production in that category is exported). Seeds for forage and pasture crops are also exported, with sorghum and cow pea the most important sub-categories. Most seed exports are to Africa, and Zambia is an important market.

South Africa has the largest and most sophisticated animal feed production sector in Africa. This reflects the fact that almost all the animal food products produced in South Africa are done so in large-scale commercial concentrated feeding operations, which require such inputs. Around 70% of animal feed production is from specialist feed producers, and another 25% is produced directly by large-animal operations, such as feedlots, for their own use.

For the year to March 2017, animal feed production by members of the local Animal Feed Manufacturers Association (AFMA) totaled 6.48 million tons, suggesting total national feed production of around 9.13 million tons (i.e. including that produced by feedlots and other sources). Feed for poultry – particularly broilers – is the single biggest component of the local animal feed market and is produced almost entirely by the members of AFMA; broiler feed alone makes up more than 30% of total feed production in South Africa. The current difficulties in the domestic broiler industry thus have important negative implications for the feed sector, highlighting the close linkages between output markets for agricultural produce and input producers. Maize is the biggest input into domestic animal feed (more than 50%) followed by soya oilcake (15%). The animal feed sector currently has a negative trade balance of around R1 billion. About 4.5% of total animal feed sales are exports to SADC, most of which was broiler feed. Soya oilcake (mostly from Argentina) is the single biggest imported input for the sector.

South African feed manufacturers (most notably Tiger Brands through its Meadow Feeds division) are expanding into the region, establishing local production facilities in various countries, which is a much more cost-effective long-term strategy than exports, once a country reaches a particular level of

domestic demand to justify the capital investment, and is able to provide locally-produced inputs. Of the countries included in this study, Zambia is currently viewed as the one with the greatest potential for local manufacture of animal feeds, given the good growth prospects for its agricultural sector.

The South African agricultural sector had a very difficult time due to the severe 2015/16 drought, and this also impacted severely on many input companies, as farm incomes declined. In addition, some sectors of the local agricultural sector – most notably poultry and, to a lesser extent, dairy – have had a very difficult few years, due mostly to declining margins as a result of rising feed prices and static producer prices. This impacts the demand for a wide range of input product categories.

There are a number of government initiatives to support emerging farmers, many of which are farming smaller units of land. Part of these efforts are around increasing input use by such farmers, generally through subsidised access schemes. These have had limited success. In addition, most of the large input manufacturers (particularly the fertiliser companies) have their own in-house programme to encourage greater input use among small farmers. Many of these companies see this as an important strategy to develop the markets for their products. However, demand is limited by the challenges that most small farmers face in accessing output markets that will earn them a return sufficient to cover the cost of these inputs.

## 2.3. Mozambique

Mozambique has considerable commercial agricultural potential, given its significant areas of arable land and water supplies (and thus irrigation). The areas with the greatest potential – based on soil fertility and water – are in the north of the country. Average annual precipitation is 1 032mm, but this varies considerably across the country. The northern and central parts of the country receive average annual rainfall of between 1 000mm and 2 000mm

Mozambique is one of the poorest countries in the world, ranking in the bottom 10 countries in the World Bank Human Development Index. Although agriculture is the biggest sector of the economy (contributing about 26% to GDP and providing livelihoods for more than 75% of the population) it is largely characterised by low levels of productivity, variously estimated at about a third of potential output. Around 90% of agricultural activity is undertaken by farmers working an average of 1.1 hectares. Under Mozambique's current land tenure regime (in which most land is owned by the various levels of the state), almost none of these farmers have individual secure title to the land. However, these small farmers produce almost all of Mozambique's food, either directly as subsistence farmers, or as very small-scale commercial growers. Mozambique is generally self-sufficient in cereal production, save for rice and wheat, where a portion of domestic consumption is imported.

Most of the bigger commercial farming sector in Mozambique (which has relatively few farmers but covers about 25% of cultivated land) is producing cash crops for export – cotton, cashew nuts, sugarcane, tobacco and tea (FAO Country Profiles, online)).

Improved input use in Mozambique is generally low: fertiliser use in the country is very low, and research suggests that Mozambique is losing soil nutrients at a fairly rapid rate as a result of this (IFDC, 2012). Most of the country's small farmers are usually not in a position to afford investing in improved inputs, and most farmers do not use any chemical inputs at all. Almost all the fertiliser that is used is applied to the key cash crops – tobacco and sugarcane. Improved seed use is also very low,

with only a tiny percentage of the most commercially-focused farmers making use of such seed. Maize appears to be somewhat of an exception: maize cultivation in general in Mozambique is increasing and just under 10% of maize farmers are using improved seed, which implies that smallholder subsistence farmers may also be using such seeds. Low fertiliser use, however, suggests that most farmers using improved seeds are not using fertiliser in combination. This reduces the productive potential of such seed.

Local production of agri-inputs such as fertiliser and improved seed is practically non-existent, and the former is limited to some basic blending of imported products. China is the biggest source of fertiliser imports to Mozambique, followed some distance behind by South Africa. Fertiliser trade statistics for Mozambique provide a misleading picture, suggesting considerable demand for imported product, as well as notable exports. The reality, however, is that Mozambique – via its deep water ports – is a key destination for fertiliser from China and India, which is then transported overland to other countries such as Tanzania and Zambia. These are then recorded as “exports” from Mozambique. Almost all the fertiliser imported into Mozambique via the ports is re-exported. Most of the fertiliser used in the country comes by road from South Africa, adding considerably to its cost.

According to data collected during the interview process, the demand for fertiliser does appear to be increasing in Mozambique, but it is coming off a very low base. There is still not sufficient domestic demand to justify large-scale investment in in-country manufacturing, given that most (or all) of the raw materials must be imported. Most of the South African input companies that are expanding into Sub-Saharan Africa are currently focusing on countries other than Mozambique, which have bigger commercial farming sectors with better growth prospects.

Other agri-input markets are as limited: livestock is an important part of local agriculture – it is estimated that there are about 1.3 million cattle and four million small ruminants (i.e. goats and sheep) in Mozambique, but the vast majority are held in small numbers by small farmers and raised on grazing only. Poultry production in Mozambique is increasing in line with growing consumer demand for chicken, but most of these producers are informal, and source their feed in informal, local markets. There is practically no market in more advanced animal products, such as feed additives.

One of the key factors limiting demand for agricultural inputs in Mozambique is output markets. Agricultural output markets in this country are generally poorly developed, and the local agri-processing sector is very small. The expanding formal food retail sector makes considerable use of imported products, particularly processed food, given the general unavailability of locally processed items. This means that most farmers have a very limited choice of output markets – mostly local informal markets. Access to alternative markets is limited not only by the small number of those markets, but by the difficulties and costs of transporting produce. As a result, much of the increasing demand for food in Mozambique is being met by imports, rather than supporting local production.

Another main factor (apart from low farm incomes) limiting the growth of the agri-inputs sector in Mozambique is the poor state of transport infrastructure, and thus the high cost of transporting goods even a short distance from the main port centres. The International Fertilizer Development Center (IFDC) has calculated that transport makes up almost 50% of the domestic costs of getting fertiliser to farmers. Mozambique has three deep-water Indian Ocean ports – Beira, Maputo and Ncala. Beira port



is where most of the fertiliser imports into Mozambique arrive. Port infrastructure is inefficient, and it often takes a long time for shipments to clear.

Another limiting issue is farmer access to information and extension services that would provide the information that they require on how to use improved inputs. Government extension services in Mozambique are patchy, and non-existent in many areas. Farmers thus have no way of knowing about the potential benefits of improved inputs or, more importantly, how to use them to the best effect. Most rural areas – particularly more remote ones – are poorly serviced by input dealers, and most small farmers cannot afford to travel to the centres where dealers are located and then transport items such as bags of fertiliser or animal feed back home.

In an attempt to promote the use of modern inputs, Alliance for a Green Revolution in Africa (AGRA) has supported a project in Mozambique around the development of agro-dealers in rural areas. This has had limited success to date (in terms of markedly increasing improved input use), but the development of these small enterprises may support longer-term market growth. The main constraints on this agro-dealer approach are those faced by the agro-dealers themselves: it is very difficult for them to access the finance that they need to be able to hold sufficient stock. In addition, while greater proximity to an agro dealer may make it easier for farmers to access information about improved inputs, on its own it does little to reduce the cost of these inputs.

## **2.4. Tanzania**

Agriculture is a key sector in Tanzania, accounting for nearly 30% of GDP and around 67% of employment. The country covers a range of different climatic zones, implying that a wide range of output is possible. The country is mainly self-sufficient in food, producing on average about 90% of its domestic food requirements, although this may decline in future as the demand for processed food grows, a demand which Tanzania is not in a good position to meet. The main food crops are cassava, bananas, maize, rice, sorghum and millet. Almost all cultivation is rainfed only.

Despite its apparent advantages, Tanzania has one of the least productive agricultural sectors in Sub-Saharan Africa, and operates at far below its own identified potential. Although crop production has increased in the last 10 years, this has been due mostly to an increase in land under cultivation, rather than significant productivity increases.

Things appear to be changing: historically the vast majority of Tanzanian farmers were very small farmers, cultivating less than two hectares. A 2016 study (Jayne et al, 2016) reviewed the change in farm size over a 10-year period in four countries – Ghana, Kenya, Tanzania and Zambia – and found that the share of farms smaller than five hectares had declined in all of them, except Kenya. Medium-sized farms (defined as those larger than five hectares, but smaller than 100 hectares) now make up around 40% of all farms in Tanzania. Larger farming units are generally positively correlated with increased input use, since they earn higher incomes and are more commercially oriented. However, it should be noted that land tenure is still a major concern for many Tanzanian smallholders (as is the case in Mozambique) and insecure land tenure is strongly correlated with low levels of on-farm investment.

The main cash crops in Tanzania are for export rather than local or regional food production – tobacco, cashew nuts, coffee, tea, cloves and sisal are the most important export crops. Tanzania's meat

production has also increased over the past 10 years. In contrast to many other countries in Sub-Saharan Africa, more than half of total meat production is beef, with chicken only making up around 10%. This latter figure may change in future – in early 2017 the poultry industries in Nigeria and Tanzania received a US\$21.4 million grant for development, to be disbursed via the World Poultry Foundation.

Outside the small commercial farming sector, agricultural productivity is generally low and improved input use very low. This latter reflects the relatively high cost of inputs in Tanzania, and the difficulties most farmers have in accessing them. The poor state of logistics across Tanzania is a key contributor to the relatively high cost of inputs. Tanzania has a significant input subsidy programme (see 3.10 for details) and there are some indications that this may be encouraging longer-term increased input use among some farmers. However, as the biggest “market” for inputs (particularly fertiliser), the subsidy programme has also had the effect of limiting private-sector investment into the input sector.

Another important barrier to private-sector investment into the inputs sector in Tanzania is the onerous and expensive regulatory system: fertiliser products must adhere to the strict requirements of the 2009 Fertiliser Act. This Act established the Tanzania Fertiliser Regulatory Authority, which reportedly has adopted a rigid approach to implementing the legislation. One example of this is its insistence that every single new fertiliser blend must undergo a three-year registration process, which involves considerable cost. This has, to date, made the market generally unattractive to new investors. Processes for new seed registration are also onerous and expensive, but this should improve once Tanzania is part of the COMESA seed harmonisation programme (see below). Processes required to register new agro-chemicals are also long and expensive. At the same time, enforcement of regulations around counterfeit products is fairly weak, which reduces the incentives for companies to go through the expense of registering their own genuine products.

Most of the fertiliser used in Tanzania is imported from the Middle East and former Soviet Union, with smaller amounts from China, either as basic product or (only a small part of the market) as premixed specialist compounds. There is some limited domestic blending of imported raw materials to create different products. A small amount of fertiliser (estimated to be around 10% of national requirements) being produced in the north of the country, where significant phosphate deposits are located.

On a more positive note, the Tanzanian government has committed to growing the local agricultural sector (and making the necessary funding available to back up that commitment). Agricultural development is likely to be assisted by the country’s generally good long-term growth prospects, supported in large part around the development of a petrochemicals complex based on the country’s large natural gas deposits. Growing national incomes will increase the demand for food, particularly meat and processed products. Tanzania is rolling out the biggest electrification programme in Africa, and greater access to electricity will have positive knock-on effects across the agricultural sector: better access to electricity will impact on issues as diverse as climate-controlled poultry houses to automated milking to agro-processing.

One important signal that things may be changing is the recent announcement of plans to build a large fertiliser (urea/ammonia) production facility in the Mtwara region (in the South of the country, not too far from the Northern border of Mozambique), using natural gas. This has variously been reported as comprising an investment of between US\$2 billion and US\$3 billion, and is a joint multinational

consortium venture in partnership with the government of Tanzania. The project has been delayed by land use and access issues, but it appears that construction may begin soon, with the plant being completed in 2020 or 2021. It is envisaged that it will have a daily production capacity of around 3 800 tons, which would make it one of the biggest facilities in Africa. Its market will be Eastern and Southern Africa, alongside aiming to fill much of Tanzania's domestic fertiliser deficit (see Table 4).

## 2.5. Zambia

Zambia's agricultural sector contributes around 20% of national GDP and is the country's biggest employer. The sector has considerable growth potential, given its significant arable land and water resources. More than 50% of Zambia's total land area is considered to be medium- to high-potential agricultural land. Average rainfall is between 800mm and 1 400mm. Maize is the single biggest crop, accounting for more than half of all cultivated area. Other important crops are groundnuts, cotton (in decline), beans and millet.

Zambia has much better developed agri-inputs, agro-processing and agricultural output markets than many other countries in the region, and government has identified agriculture as a key growth sector. Input use in Zambia is higher than in most other countries in the region and is growing, although it is still well below what is required to realise the country's full potential. It has thus become an attractive destination for many input companies (including from South Africa) looking to expand market share in Sub-Saharan Africa.

Although fertiliser use in Zambia has increased (in large part because of the government's substantial input subsidy programme), it is still low by international averages. Higher levels of fertiliser use are necessary to address the very high levels of nutrient depletion that have occurred over the past 20 years, which has reduced general soil fertility, as well as the high percentage of acidic soil across Zambia (the natural result of very high rainfall). As soil acidity increases, so it becomes both less suitable for some important crops, and the acidity also reduces the impact of fertilisers that *are* applied.

Most of the fertiliser used in Zambia is imported, much of it overland from South Africa, or from the ports in Mozambique. Zambia's landlocked status means particularly high logistics costs, and imported inputs are generally expensive. There is one fertiliser plant in Zambia – Nitrogen Chemicals of Zambia (NCZ) – which is 100% state-owned and operates a generally outdated and inefficient nitrogen-ammonia production facility, in addition to limited blending activities. There are a number of other fertiliser companies in Zambia, but they are either selling wholly imported compounds, or engaging in relatively small-scale blending of imported components.

In contrast, Zambia has a thriving (non-GMO) seed industry (largely a result of investor-friendly regulation together with the annual purchases for the government's subsidy programme) which will likely benefit further in the long-term from the harmonisation of seed regulations in COMESA, in which Zambia has participated (see 3.3. for more details). The seed sector is based on both domestic production and imported seeds (mostly from South Africa), and a mix of Zambian and foreign companies. Most seed companies' biggest focus is maize seed, which is the most commonly grown crop and part of the Farmer Input Support Programme FISP. The country exports around 18 000 tons of certified seed each year. South Africa's Klein Karoo Seeds operates a Zambian subsidiary, and is

currently the largest supplier of pasture and vegetable seeds in the country. Production costs and transport costs are relatively high in Zambia for seed companies.

Zambia has had a significant input subsidy programme in the past (FISP), focused mainly on fertiliser and seed direct distribution to those farmers least able to afford them. Eligible farmers receive pre-set amounts of seeds and fertiliser at the start of the planting season. FISP is a substantial programme – at one point it accounted for more than 50% of national fertiliser consumption. Although FISP fertiliser procurement has notionally been an open tender, the same two companies have generally benefitted. The seed procurement process under FISP has been a little more competitive, and generally between five and eight firms receive the tender contract among them.

However, FISP has been criticised because of the slow delivery of inputs to farmers, which often arrived long after they were required. It thus has not always had the intended impact on agricultural productivity. The enormous logistics challenges required to move large amounts of inputs around the country in a relatively short space of time to coincide with the start of the planting season have been the main problem. In addition, Zambia's rising budget deficit and consequent discussion around a loan facility from the International Monetary Fund (IMF) pose a serious threat to the future of the subsidy scheme, which is likely to be severely cut back under an agreement with the IMF.

Early in the year, the Zambian government announced that the existing subsidy scheme – FISP – will be replaced in the 2017/18 farming season with a new “e-voucher” scheme, in an attempt to curb corruption under FISP. This corruption most commonly takes the form of “ghost” farmers who receive seed and fertiliser under the scheme and then sell them. In addition, the programme was intended to support the “graduation” of farmers – after a few years on the programme they would graduate to buying the inputs themselves. Mostly this has not occurred, indicating that farmers cannot afford to purchase the inputs in the open market.

The likely scaling down of the Zambian input subsidy scheme will create a greater “space” for private-sector fertiliser companies in the market, but it is likely that actual fertiliser use will decline as a result, certainly in the short-term, since most small farmers cannot afford the product in the absence of the subsidy. Companies supplying maize seed to the current subsidy scheme may also come under some pressure.

The animal feed industry in Zambia is growing rapidly, supported by a growing meat industry and ready availability of inputs such as maize and soya.

One of the most outstanding features of the Zambian agricultural sector is its strong anti-GMO stance to date, to the extent that the country famously refused GMO grain food aid in the early 2000s. The main justification for the anti-GMO policy is that it creates significant economic advantages for Zambia, and this appears to increasingly be the case. There is a growing global demand for non-GMO food (South Africa food processors report increased demand from customers for non-GMO foods such as maize meal, which are not available on any significant commercial basis in South Africa.) The anti-GMO policy has meant that the market for improved seed is highly limited since many of the specialist offerings of multi-national commercial seed companies, such as Monsanto and Syngenta, are transgenic products.

There are some indications that the GMO policy of Zambia may change for non-food crops, such as cotton, but there is little clarity on exactly how this policy may change or develop over the next few years. In the interim, Zambia remains an attractive source of raw materials for non-GMO processed food.

## 2.6. Summary

There is a strong – and growing – demand for food, particularly processed food and meat, across the region, in line with both an expanding population and increasing consumer incomes. Although agricultural output has increased, the rising demand for food is also being met through increased imports, particularly of processed food and, in the case of South Africa, chicken.

There is good reason to believe that – in terms of the current dominant modes of agricultural production – the capacity for continued increases in regional output is limited. That is, unless the agricultural production model becomes more productive – i.e. greater yields are obtained from current hectares in production – the value added by the agricultural sector will begin to stagnate. Given the central role of agriculture in the economies of Mozambique, Tanzania and Zambia and its importance in employment, creating a more **productive** agricultural sector – i.e. one that can produce both more output and create more livelihoods, both directly and indirectly – must be a policy priority. Developing a robust regional value chain in agricultural inputs is key to delivering that goal, since this will create the economies of scale required to leverage private-sector investment.

The growing share of medium and larger-sized farms in Tanzania and Zambia is positive for the development of agri-input markets, since larger farming units are (i) likely to be mostly commercially oriented, and (ii) are potentially large enough to justify a greater investment in additional inputs (subject to output markets, as discussed below). However, the fact that most farm units in the region are smaller than 100 hectares also suggests that successful policy initiatives need to be focused on the particular requirements of these smaller farmers.

Many of the agricultural input markets in Mozambique, Tanzania and Zambia are specifically focused on smaller farmers, and there has been considerable innovation in many areas that would benefit similar farmers in South Africa. These innovations also offer opportunities to develop off-farm livelihoods in a regional economy.

## 3. AGRICULTURAL INPUT SUB-SECTORS

### 3.1. Introduction

This section provides an overview of the main characteristics of each of the main input sub-sectors, usage trends in the region, the main drivers of demand and supply, and the key regulatory issues that impact these in each of the four study countries. We have adopted a broad definition of “inputs”, beyond fertiliser and seed and agricultural chemicals, to include other factors that either impact directly on agricultural yields and productivity (such as irrigation) or that impact indirectly on farmers ability to make more effective and efficient use of other inputs (including factors such as access to financial services and extension services).

In addition, a brief discussion is included at the end of this section on input subsidy programmes, since this provides useful insights into the factors that drive the demand for inputs, as well as the impact of these programmes on private-sector development.

Although this section provides an individual overview of each of the most relevant agri-input market segments identified, it is important to point out three key issues with respect to agri-inputs:

1. **Multiple inputs used in a coordinated fashion are required to make significant improvements in agricultural yields:** this is a generally well-recognised fact in agronomy, but it is sometimes overlooked in policy. In line with this, the impact of certain inputs on productivity may be negligible – or even negative – if they are not used in conjunction with other inputs, in the correct manner. To make matters more complicated, this relationship is determined to a great extent by existing soil and climatic conditions, as well as the skills of the farmers using the inputs. A 2009 study of the impact on yields of various seed-fertiliser combinations used by farmers in Kenya illustrated this complexity very well (UNECA, 2010). The best results were obtained by using both hybrid seeds and fertiliser together, but significant gains in yields were also obtained when farmers used hybrid seeds without fertilisers, rather than traditional seeds with fertiliser. So farmers making the latter choice would probably not have covered the costs of this input. This result was most likely the outcome of soil conditions in the study area, which appear to have been suitable for the improved seeds. Gains in yields also occurred across most categories over time, suggesting that greater farmer knowledge and experience are also important for getting the best value from input use.

As a similar example of exactly this unpredictability, studies in Madagascar showed much higher yields of rice (3 200kg/hectare) where farmers used fertiliser, compared to 1 966kg/hectare where farmers did not use fertiliser, even though both areas were under irrigation schemes. In this instance fertiliser use was key to increased yields.

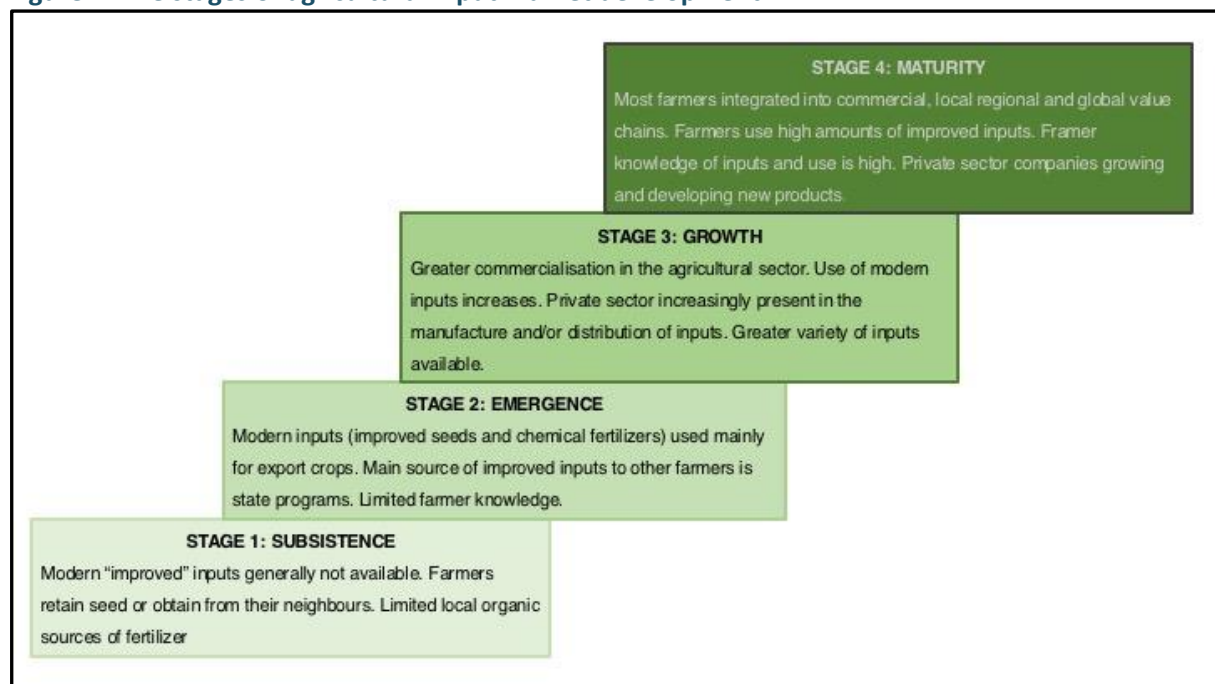
Many of the organisations that are active in promoting greater input use in Sub-Saharan Africa are aware of this, but there still tends to be a bias towards two main inputs – fertiliser and improved seed, with a particular focus on the former. From a policy development perspective, the deep interconnectedness of different agri-inputs is an important issue: for example, legislation to make it easier to implement cross-border releases of improved seed will have only a limited impact on the demand and use of that seed if the complementary inputs (fertiliser, irrigation) are

not also readily available. Not all the agri-inputs discussed in this section are ideal candidates for private-sector provision. Indeed, some of them – such as irrigation or extension services – are often best provided on a non-profit or cost-recovery basis. They are all, however, key to developing a regional value chain in which private companies can prosper, and which will attract private-sector investment. They thus all warrant the attention of policymakers.

2. **There is no automatic and pre-determined direct relationship between the use of additional or “better” inputs and agricultural output.** That is, it should not be assumed that farmers will always gain significantly through using additional inputs, in terms of the additional value of production, compared to the cost of the input. The relationship between input use and output is complex and highly variable. This issue is discussed in more detail in Section 4.
3. **Value chains for agricultural inputs cannot be separated from value chains for agricultural outputs.** In addition to the complexities of the relationship between inputs and yields, the relationship between the volume of output and the value of that output is also complex and variable, but the value of output is critical to input purchase decisions. This issue is discussed in more detail in Section 4, but the key point is that ***the demand for agricultural inputs is a derived demand***: it is determined almost entirely by what can be earned by the farmer who uses those inputs, and that income is, in turn, a function of access to, and rewards obtained within, agricultural output markets. Subsidised agricultural inputs may obscure or disguise this relationship, but sustainable access to output markets of a particular type are an absolute prerequisite of long-term meaningful expansion of market-based agricultural input value chains.

The IFDC has proposed that there are four stages in the development of an agricultural input supply system – Subsistence, Emergence, Growth and Maturity – as summarised in Figure 2.

**Figure 2: The stages of agricultural input market development**



Mozambique could be classified as being mainly in Stage 2, with development towards Stage 3, while Tanzania could be classified as being near the top of Stage 2, and Zambia progressing in Stage 3. South

Africa has a clear binary situation in its agricultural sector: while the commercial farming sector is in Stage 4, and the inputs manufacturing and distribution sector certainly fits the Mature Market definition, much of the smaller and emerging market sector has been left behind in a low-inputs farming model more like the other countries in the region.

It is important to note that substantial private-sector development is only visible from Stage 3: prior to that a combination of low effective demand and significant government involvement generally act as effective barriers to entry for private investors. Establishing a new manufacturing enterprise in agri-inputs – fertiliser, improved seed, agricultural equipment, or animal inputs – requires a significant capital investment. This investment will be made only if there is sufficient potential demand in the target market. A combination of low actual demand together with high levels of state provision in many input markets have created significant barriers to entry until very recently.

As the analysis below highlights, agri-input markets in three of the four study countries (South Africa is the exception) have to date been both relatively small and mainly dominated by government (via various subsidised input schemes) and/or big NGOs (such as AGRA). Private companies are limited in both number and size, with Zambia being a part exception to this. Most key modern agricultural inputs – fertiliser, improved seeds and agricultural equipment – have traditionally been imported. The regional value chains in these products are either very small, or non-existent, limited in most cases to a few big South African companies that have expanded into Mozambique and Zambia. Things are, however, changing, and changing rapidly in certain sectors, in line with growing regional demand for agricultural produce and increased investment by private companies.

The development policy challenge, however, is not just to move each individual country along the stages of agricultural input market development, as illustrated in Figure 2, but to do the same for a **regional** value chain. This challenge is considered in more detail in Sections 4 and 5.

Reference has been made in this section to the World Bank's *Enabling the Business of Agriculture* surveys, the most recent of which was conducted at the beginning of 2017 (the third survey year). The focus of this project is to measure and monitor the regulations that effect the efficient functioning of agriculture and agribusiness. The analysis covers 62 countries (thus allowing for extensive benchmarking) and covers the following areas: fertiliser, seed, machinery finance, markets, transport, ICT and water. (Land has been included as a pilot in the 2017 survey). The survey measures both legal indicators and efficiency indicators in respect of regulation: legal indicators reflect the content of the regulatory system, while efficiency indicators reflect the time and cost implications for companies of that system.

Each country is given a score for each of the indicators selected, which is then used to calculate a *Distance to Frontier (DTF)* score for each area. The DTF score is a benchmark against regulatory best practice in a market segment, measuring the *distance achieved relative to the best practice frontier*, in a positive manner – that is, a DTF score of 80 means that the country scored 80% of the best practice score. The higher the DTF score the better the country is doing. For legal indicators, the frontier is set at the highest possible score, while for efficiency indicators the frontier is set by the highest scoring country, with 100 being the frontier in each case. Countries are also allocated a ranking, out of 62.



South Africa has not been included in this survey. Mozambique was included from 2015, and Zambia and Tanzania were included from 2016. The main reason for South Africa’s exclusion is the relatively small share of national output and employment attributable to agriculture.

### 3.2. Fertiliser

Soil fertility has been identified as the number one impediment to increased agricultural yields in Africa, and fertiliser is the most commonly purchased and used agricultural input in Africa (UNECA, 2010). However, despite the importance of agriculture in most of its economies, sub-Saharan Africa currently makes up a very tiny part of the consumption of global fertiliser – less than 2% (FAO). Soil fertility across Sub-Saharan Africa is in general decline (with a few notable exceptions in commercial farming areas). This is as a result of decades of *nutrient mining* – that is, agricultural activities are removing nutrients from the soil without replacing them in sufficient quantities to maintain soil fertility. As a result, the productive capacity of significant amounts of agricultural land – mostly that being farmed by smaller and subsistence farmers – is under serious pressure. Most analysts thus agree that increased use of (mostly inorganic) fertilisers is an important key to increasing agricultural output, and fertiliser is the most component input that has been targeted in government subsidy programmes as well as NGO initiatives.

The three components of inorganic fertiliser mineral nutrients are nitrogen (N), phosphorous (P) and Potassium (K). These are either available as individual products, or – most usefully for agriculture – as premixed compounds or blends<sup>1</sup>. Different blends of N, P and K will be most suitable for particular soils and/or particular crops and/or particular varieties of seeds. In addition, agricultural lime is commonly used to raise the Ph of acidic soils. Asia is the centre of world fertiliser production (and consumption), followed by the former Soviet Union.

Nitrogen is most commonly produced by burning natural gas, and in the process extracting nitrogen from the air. Synthetic urea is produced with anhydrous ammonia. Phosphorous is produced using phosphate rock, sulfur and coal, while potassium is derived from potassium chloride (potash).

The most commonly-used fertiliser in sub-Saharan Africa is urea, which is one of the cheapest sources of nitrogen. Urea makes up about 40% of current fertiliser use in the region (Gro Intelligence, 2016). The second-most commonly used fertiliser in the region is DAP (Di-Ammonium Phosphate), a compound of phosphorous and nitrogen, which can be used across a wide variety of crops. The balance of the inorganic market is made up of various NPK compounds or blends.

Table 3 sets out fertiliser usage rates in each of the four study countries, and the comparative rates in other regions.

**Table 3: Fertiliser use (kilograms per hectare of arable land)**

	2002	2014
Global Average	104.6	138.0
East Asia and Pacific	246.1	344.3
Euro Area	197.1	164.8

<sup>1</sup> Compounds have been processed to have all the “ingredients” in one granule, while blends are exactly that. Compounds are a more accurate way to ensure that exactly the same ratio of components is applied across the entire crop. Blends are less consistent.

Sub-Saharan Africa	11.8	16.0
Mozambique	6.0	14.9
South Africa	61.2	60.6
Tanzania	3.7	8.4
Zambia	26.1	46.2

Source: FAO Country Profiles, online

Fertiliser use in Sub-Saharan Africa is the lowest in the world, and most of the countries in this study have very low usage rates. The exception is South Africa (where usage is still well below global averages), but it should be noted that there are considerable differences in fertiliser use in that country between the big commercial sector, and the smaller emerging/subsistence farmer. Although the fertiliser use data for South Africa are not disaggregated by size or type of farm, it is probable that many smaller farmers in South Africa make far less use of this input than the big commercial farmers. The significant increase in fertiliser use in Zambia is noteworthy. This is due in large part to the considerable state resources allocated to subsidising fertiliser (see below). The target under the Comprehensive Africa Agriculture Development Programme (CAADP) is 50kg per hectare of arable land<sup>2</sup>: South Africa in aggregate has exceeded that target, while Zambia is close to achieving it. Mozambique and Tanzania are still very far behind, despite the substantial subsidy programme in the latter country (see sub-section 3.10.)

The IFDC (2015b) has estimated the additional (i.e. above current consumption) quantities of fertiliser required in a number of countries – including Mozambique, Tanzania and Zambia – to meet agricultural production targets. The figures – set out in Table 4 – provide an indication of *potential* demand in those countries.

**Table 4: Estimated additional annual consumption of fertiliser required to meet national agricultural output targets (metric tons per annum)**

COUNTRY	ADDITIONAL CONSUMPTION (mt/yr)	INCREASE FACTOR*
Mozambique	225 000	4.4
Tanzania	528 000	2.0
Zambia	498 000	2.0

Source: IFDC 2015b

\* From current consumption (times)

That gives a projected additional annual consumption requirement for these three countries of more than 1.2 million tons. These numbers appear modest if we consider how low current usage is in global terms, but it is important to remember that this is simply the additional fertiliser required to meet governments' agricultural growth targets in a limited number of crops. Clearly a great deal more will be required in order to meet the full agricultural potential of these countries.

Ideally, farmers need easy access to a wide range of different fertiliser compounds (i.e. different proportions of N, P and K) so they can make a good match of the product with their specific soil and crop requirements. Outside of South Africa, and the biggest commercial farmers in the other countries, most farmers in the study region do not have this kind of choice (or indeed the detailed

<sup>2</sup> Which is not particularly helpful, since it does not take local soil requirements into account.

information about the soil nutrient requirements of their land from season to season that they need to make good choices). Instead they mostly have access to only a few compounds or blends. Those who obtain their fertiliser via government subsidy programmes generally have even less choice of product, and take what they get. These factors contribute to the slow growth in yields despite considerable expenditure on such subsidies.

There are some indications that this is slowly changing, and that there are new products on the market in Sub-Saharan Africa that have been blended with a specific crop in a specific country in mind. Examples are Yara Tanzania (a subsidiary of the Norwegian company) that has developed some products specifically for the local maize market, although all of its products are manufactured overseas and imported. Smaller companies are also starting to produce blends for the local markets in other countries, but almost all from imported materials. These blending initiatives are limited in their impact unless farmers have accurate soil mapping data at their disposal. In addition, fertiliser regulations (see below) act as an effective deterrent to large-scale blending.

South African fertiliser companies that are expanding operations regionally report that the biggest growing segment of market demand is for specialist compounds, particularly in Zambia, which has the most vibrant commercial farming sector, compared to Tanzania and Mozambique. This is likely to be the most important growth area in future.

Very little fertiliser is produced from scratch in Sub-Saharan Africa, with most of the “production” outside of South Africa effectively being blending operations, producing a limited range of relatively unsophisticated products using imported ingredients. Only a very small percentage of what is consumed in the region and only around 0.1% of global production is produced there. Most of what is produced regionally is produced in South Africa, with the remainder imported from Asia and the Middle East. The main impediments to greater regional production of compound and a wider range of fertilisers to date have been:

- Low demand (building a fertiliser plant is an expensive and long-term commitment);
- Relatively high costs of importing raw materials for production, reflecting inefficient logistics structure. There are significant potash deposits in Ethiopia, Eritrea and the DRC, but not in any of the four study countries. Rather ironically, Africa has 75% of the world’s phosphate reserves, and there are significant deposits in Tanzania.
- The cost and reliability of energy: nitrogen fertilisers in particular require large amounts of energy during their production.
- Competition from relatively cheap imports from Asia and the Middle East; and
- A “crowding out” effect from the very large fertiliser subsidy and supply programmes run by the state.

This situation appears to be changing, and there are encouraging signs of investment in fertiliser production and distribution.

Farm gate fertiliser prices in Sub-Saharan Africa (outside of South Africa) are among the highest in the world, with some studies suggesting that farmers are paying up to double what farmers in Europe are paying. The main reasons for the high costs are:

- A relatively small market which has discouraged local production and makes it very difficult for importers and distributors to achieve economies of scale; and
- High logistics costs, the most significant of which are the last 20 kilometres to the farm gate. Some studies have suggested finance, distribution and transport costs can make up between 75% and 80% of the final farm gate price of fertiliser (Gerstenmier, 2015).

The relatively high cost of fertiliser – particularly when it is compared to the price that can be obtained for outputs such as maize, is the main reason for low usage by smaller farmers, and the main justification for state- and/or NGO-managed subsidised distribution.

Although it tends to get much less attention in the literature than inorganic fertilisers, organic and “bio” fertilisers are an important contributor to long-term sustainable soil health (which then increases the efficacy of inorganic fertiliser). Most organic fertiliser used in Sub-Saharan Africa is obtained informally, from farm animals. The global market for bio fertilisers was estimated to be around US\$536 million in 2014, and the biggest share of that was nitrogen fixing products. There is general consensus that agricultural practices that combine organic and inorganic fertilisers are the most sustainable and cost-effective manner to achieve and maintain long-term integrated soil fertility (AGRA, 2016). However, the formal market in these products is practically non-existent in the study countries, and most farmers are unaware of the benefits that could be obtained from these alternative and/or complementary products. They also do not feature in any meaningful way in any of the current government programmes to increase and/or subsidise input use.

Counterfeit or sub-standard fertiliser appears to be a significant problem in many countries. The two main kinds of product that fall under this category are fake inferior products (i.e. falsely packaged as a well-known brand), and products that are “genuine” (i.e. they really are the brand they claim to be), but which do not contain the ingredients, or the volumes of ingredients, which they claim on the packaging. As a (fairly common) example of the latter, fertiliser bags will claim that the contents contain 35% nitrogen, when the actual nitrogen content is only 12% or 15%. Both these kinds of products may be considered “counterfeit” and are present in relatively high quantities throughout Africa because of a poor regulatory environment and limited funding around quality control and enforcement.

The high incidence of counterfeit fertiliser poses a serious threat to significant market expansion of manufacturers of *bona fide* products. Many farmers have used counterfeit products and, of course, generally fail to see significant results, or at the very least, results that will justify the cost of that fertiliser. This helps to create a perception that it is a waste of money to purchase fertiliser. On the supply side, fertiliser manufacturers are understandably reluctant to enter markets where regulatory control of these issues is weak: the genuine product will almost always be trading at a higher price to counterfeit goods and is thus at an automatic disadvantage. Additionally, it can be very hard to win market share in an environment where many farmers have come to the conclusion that fertiliser is not worth spending money on.

One key issue in the fertiliser market is for farmers to be able to access the product when they require it – i.e. at the start of the planting season and before the main rains arrive. The distribution issue is compounded by farmers with limited resources (and so wait until the last possible moment to purchase inputs) and the logistical challenges of moving relatively large amounts of product around a

very poor transport system. Reviews of fertiliser subsidy programmes in both Zambia and Tanzania indicated that a significant number of farmers received their subsidies (or product) too late for it to be of real use. This was due mostly to the logistical challenges.

Domestic fertiliser regulation has also hampered the development of a regional market: only fertilisers approved in a particular country may legally be sold there, and it can take up to three years of efficiency testing before a particular fertiliser is approved for release in a particular domestic market. This process has to be repeated in each country and can be extremely costly. Not only does this impose significant costs on private companies, thus discouraging investment, it also acts as an effective deterrent to the fertiliser compound development needed to address a wide range of soil requirements, since each individual blend must be approved. This is a significant contributor to the limited range of fertilisers available in the region.

Table 5 sets out the main findings of the World Bank assessment of the **regulatory environment** around fertiliser in the region. Its fertiliser indicators measure factors around the following:

- Product registration (legal requirements to register a new product, and the time and cost of doing so);
- Importing and distribution (who is allowed to import, requirements to register as an importer, requirement of import permits, and who is allowed to distribute products); and
- Quality control (labelling requirements and the control of and penalties for the sale of mislabeled products).

**Table 5: Fertiliser regulatory score and ranking**

COUNTRY	DTF	RANK
Mozambique	38.93	47
Tanzania	52.84	37
Zambia	52.29	39

*Source: World Bank, 2017*

The best-performing fertiliser country in 2017 was Bosnia and Herzegovina, which is one of the cheapest and easiest countries in the world in which to register fertiliser. It is also particularly efficient for fertiliser importation and distribution; importers are subject to a one-time registration only, with no per-shipment requirements.

Mozambique's score was undermined by the fact that there is no practice in place around the registration of a new fertiliser, or predictability around the cost of doing so (i.e. no score could be given, but we may reasonably presume that this is an inefficient and costly business). It scored middle (50%) scores for legal requirements to register new fertilisers, quality control and importation and distribution.

Tanzania scored highly for quality control, average for regulations around fertiliser registration, and below average for importation and distribution. It takes an average 578 days to register a new fertiliser in Tanzania, at considerable cost, a result of how the regulations (which are quite highly rated) are implemented.

Zambia received a similar score to Tanzania, but for different reasons: it is much quicker (210 days) to register a new fertiliser product in Zambia and considerably cheaper, but quality control is much lower than in Tanzania, as are registration regulations.

In June 2017, COMESA initiated discussions on a joint fertiliser policy and regulatory harmonisation in the region, in line with progress made on seed regulation harmonisation (see 3.3.). To date some progress has been made in COMESA to facilitate increased trade in fertiliser by value-added tax (VAT) exemption and a reduction of import duties. However, non-tariff barriers to trade in the form of divergent domestic regulations remain significant.

### 3.3. Seed

The quality of seed can have an important impact on the yields received, which may be more important than that achieved with additional fertiliser (as discussed above). For that reason, “improved” seed is a key input. There are different categories of “improved” seed: at the lower end of the scale are locally, informally bred varieties, followed by modified hybrid seed, and topped off by the transgenics – highly engineered specialty seeds produced under strict patent legislation, such as Monsanto’s Round-up Ready Maize. This latter category is usually referred to as “GMOs”<sup>3</sup>. The developers of these seeds – and many government and NGOs – maintain that they are the key to increasing yields. Much of the development of new varieties of GMOs are focused on addressing climate constraints, such as the programme to development a drought-resistant maize in Africa.

The adoption of improved seed (across all definitions) has increased in Africa over the past 20 years, but still lags far behind the global average. The outstanding exception to this is South Africa, where most of the big commercial crops – like maize and soya – are cultivated using transgenic seeds.

*It is important to highlight the difference in national approaches to GMO seed across the region, since this impacts not just the potential for the development of a regional value chain in these products, but also has important implications for the development of regional output markets in products produced using GMO inputs. Around the world there are considerable differences of opinion on the pros and cons of using GMOs, with a growing consumer base looking for “GMO-free” products. The debate extends into the donor/NGO space: certain NGOs (most notably those that would like to emulate the Asian Green Revolution in Africa) are strongly in favour of GMOs, and farmers who participate in their programmes are strongly encouraged to use such seeds. Other NGOs are strongly opposed to the use of GMOs by African farmers and encourage the use of other seed varieties among their beneficiary farmers. In recent years, imports of certain GMO foods and feedstuffs have been permitted as imports into the European Union (EU), but there are very strict regulations that must be complied with before these products are approved for importation. It is difficult to farm GMO and non-GMO crops close, due to the risk of cross-crop contamination. Only a handful of GMO crops are permitted to be grown in the EU under strict control, and European consumers have a strong preference for non-GMO products.*

*For these and other reasons some countries have taken a strong anti-GMO stance in agricultural policy, on the basis that this is the best way to guarantee access to high-income markets. The important*

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<sup>3</sup> Technically speaking, many hybrid seeds that have been around for a long time are also “genetically modified”, but are not considered so in the heated debate around GMOs (genetically modified organisms). What are generally referred to as GMOs would be more accurately called “transgenics”.

*country with respect to this policy is Zambia, which has maintained an extremely strict no GMO stance to date, and imports of GMO grains (i.e. most of the maize from South Africa) is strictly prohibited. This is thus an important issue to consider in policies to develop regional value chains that include Zambia. Against that should be considered the reported growing preference for non-GMO food in South Africa, and thus non-GMO inputs into the agro-processing sector.*

Most smaller farmers in the other three countries obtain the bulk of their seed in informal systems – by saving a portion of their harvested grain each year, sharing seed with their neighbours, or buying seed on the local informal market. They are discouraged from purchasing improved seed by a lack of knowledge about how to use the seed most effectively and what yields to expect in return for the purchase price. They generally only get access to improved seed once they participate in a subsidised seed distribution programme under a government or NGO initiative.

The main obstacles to greater purchases (demand) of improved seed are the following:

- The cost of these seeds relative to the benefits of using them (i.e. the value of the marginal output). Cost is impacted by both the limited size of the market, which reduces the opportunities for suppliers to achieve economies of scale, and the cost of transporting seed to the farmer. Transport costs are slightly less important for the cost of seed than for that of fertiliser, given that a lower weight per hectare is required.
- The availability of seeds. Few seed dealers supply remote rural areas, and the national availability of seeds has in many instances been limited by onerous national regulation around the release of seeds. These issues are now being addressed to some extent, as discussed below.
- Farmer knowledge about the available improved seed options and which of these would be the best choice for their particular farm, as well as what other inputs (such as fertiliser) are required to get the best outcomes.

There is, however, a clear potential demand for improved seed varieties, as illustrated in the behavior of farmers who have participated in schemes that provide subsidised packs of seeds and fertilisers: a significant number of these farmers continue to purchase the improved seed once the subsidy has been discontinued; far more than continue to purchase fertiliser (see the discussion on Tanzania's subsidy scheme in 3.9.). It thus appears that participation in subsidy programmes provides an important demonstration effect for these farmers (and possibly those of their neighbours who do not receive subsidised seed.) Many NGOs in this area have also noted the importance of demonstration plots in giving farmers first-hand exposure to the effects of using improved seed. Demonstration plots are also sites where these farmers can obtain information about exactly how to plant and manage the new seeds. Given the observed linkages between demonstration plots and increased purchases of improved seeds, many agro-dealers have been encouraged and supported to operate such plots in NGO initiatives, such as those run under AGRA.

Alternatively, larger farmers who are successfully using improved inputs are supported to become agro-dealers, since their own farms provide the best examples of the benefits of using these inputs. This “diffusion of innovation” strategy is linked to research indicating that the most effective way to get people to adopt a new innovation is it being used by people whom they admire or aspire to. Larger,

more successful commercial farmers would certainly fit this bill, and studies in the EU have shown that imitation of these kinds of farmers is one of the most important ways in which innovations in agriculture are adopted by smaller farmers.

Many NGOs are actively involved in encouraging the development of a local seed industry across Sub-Saharan Africa. AGRA’s Programme for Africa’s Seed Systems (PASS) initiative was established in 2007 to support domestic seed companies in developing and certifying seed – mostly for staple crops – compatible with local agricultural environments. PASS has worked with 80 seed companies in 16 African countries. The initiative has contributed to additional improved seed varieties being available, but scalability to date (i.e. the ability of these companies to release the seeds in other countries, thereby improving returns on investment) has been limited by onerous domestic seed regulation legislation (which is now changing – see below), as well as poor distribution systems.

Studies have shown that **smaller packages** of both fertiliser and improved seed can increase long-term use of these inputs (Gerstenmier, 2015), particularly among smaller and poorer farmers, even if the unit cost of these items is increased by the additional packaging requirements. Smaller packs are not only affordable for these farmers, they also allow “experimentation” with new products on a separate piece of land a lower cost and risk than purchasing the standard size items. In terms of seed, 25kg and 10kg packs are the “standard” sizes, but there would be more demand for packages of 1kg and 500g (Gordon, 2000). The main impediment to the wide-scale distribution of such packs is that most seed companies are not geared towards the production of these, and so they must often be packed manually, which is extremely cost-inefficient.

As with fertiliser, there are also problems with counterfeit seed in many countries, although the extent of the problem appears to be a little less than with fertiliser. However, the impact is much the same – creating an impression among farmers that it is not worthwhile to spend money on “improved” seed because they have first-hand experience that “it does not work”. The availability of counterfeit seed reflects a poor compliance and enforcement regulatory environment across most of Sub-Saharan Africa.

Table 6 sets out the World Bank seed regulatory ranking for Mozambique, Tanzania and Zambia. The seed component measures the following legal factors (together with time and cost efficiency indicators):

- Plant breeding (protection for plant breeders and access to inputs for plant breeding);
- Variety registration (legal requirements to register new seeds); and
- Seed quality control

The Netherlands was ranked as the best scoring country in terms of the strongest and most efficient seed regulation system.

**Table 6: Seed regulatory score and ranking**

COUNTRY	DTF	RANK
Mozambique	65.68	23
Tanzania	68.91	17
Zambia	69.36	16

Source: World Bank, 2017



All three countries scored significantly higher on the seed index than on the fertiliser index. Mozambique received a high score for plant breeding and variety registration, and an average score for seed quality control. It takes an average of 582 days to register a new seed variety in that country.

Tanzania has the lowest relative cost to register a new variety out of the three countries, and is the quickest place to do so by a significant margin – 333 days. The country scored high for plant breeding, but did not do so well on either variety registration or quality control.

Zambia scored particularly well on the seed index, particularly plant breeding, variety registration and quality control. It takes an average 544 days to register a new seed variety in Zambia.

South Africa appears to have a significantly more efficient seed registration system than the three other study countries, with a far higher number of commercial varieties released each year in major commercial crops. The average time for the regulatory approval of the release of a new variety is around 365 days, significantly less than in the other countries. Research also suggests that the country has a relatively high-quality seed framework and quality enforcement system (Tasai, 2015).

Until recently there have been significant regulatory barriers to **regional trade** in many improved seed varieties, since each country has traditionally had its own set of (usually complex) set of regulations governing the process whereby such seed is officially approved for use. National variations in these regulations have meant that seed which is available for farmers in one country (like Mozambique) may not be available in a neighbouring country for many years, until it has passed that country's own registration requirement. This not only reduces the range of seeds that are available to farmers in any particular country, it also acts as an effective barrier to the development of a private-sector seed market, due to the duplication of regulatory costs. It is very difficult for seed companies to obtain economies of scale in this regulatory environment.

As a result, there has been a concerted effort in both SADC and COMESA to harmonise seed regulations, which would effectively mean that a seed approved in one country could also be released in another, on the basis of non-border criteria, such as climatic region. Progress on achieving such regulatory harmonisation has been more rapid in COMESA than in SADC. COMESA developed Harmonised Seed Regulations in 2014, together with a 2014-2010 implementation strategy to get the 19 member countries to adopt these regulations. (Prior to that, Kenya, Tanzania and Uganda had already agreed among themselves to facilitate more open trade in a small number of seed varieties.)

The process of “domestication” of these regulations commenced in 2015 in Burundi and Rwanda, followed by Kenya, Zimbabwe and Uganda, all of which have now completed this process. In June of 2017, COMESA officially launched its harmonised seed regulations, in a process which now includes Zambia and Malawi, aimed to have their domestic alignment before the end of 2017. The harmonised regulations aim to bring about “consistent domestication, application, monitoring and improvement in seed certification, quarantine and phytosanitary measures and in the evaluation and release of seed varieties among COMESA member countries”. The new regulations are expected to support the development of the private seed sector, and to reduce the amount of counterfeit seed on the market. COMESA has also developed standardised seed labels and certificates to be used for cross-border trade in seed in the region. They became available in 2017. These labels identify seeds that meet the COMESA harmonised seed regulations.

SADC has developed a Harmonized Seed Regulatory System (HSRS), approved by SADC ministers, and the SADC Seed Centre ([www.sadcseedcentre.org](http://www.sadcseedcentre.org)) is responsible for its implementation. An MOU in was agreed to by 11 member states in 2013. The HSRS aims to facilitate the commodity seed trade in the region, through a set of commonly agreed standards and regulations around the following:

- Variety release (through the establishment and maintenance of a Seed Variety Catalogue and Database).
- Seed certification and quality assurance.
- Quarantine and phytosanitary measures.

For these objectives to be achieved, all SADC member states are required to harmonise their national regulations to the common standards. Progress on this has been very slow. There are currently only 24 varieties of seed (all maize) listed in the SADC Seed Variety Catalogue – seven each owned by Monsanto and Syngenta, six owned by Seed Co of Zambia, and four by Pannar.

One of the obstacles to regulatory integration is to get regulators to agree and compromise on one set of procedures, which will inevitably cause disruption in their own domestic regimes.

### **3.4. Agricultural Equipment**

Mechanisation – from tractors, to harvesting equipment, to automatic animal feeding to dairy equipment, and borehole pumps – is generally viewed as an important factor in increasing agricultural productivity, through the entire process of production, from planting to harvesting to processing. In the study region, mechanisation has generally been limited to large-scale commercial farms (particularly in South Africa), while smaller farming operations are generally labour intensive. The main reason is the comparative cost of labour versus mechanisation. Agricultural labour outside of South Africa is particularly cheap, and most smaller farmers cannot afford to purchase agricultural equipment and/or struggle to get access to such finance. However, as agricultural markets develop and demand for food increases, demand for a wide range of agricultural equipment across the region is growing.

There is little debate that the use of agricultural equipment in sub-Saharan Africa is significantly lower than in other regions (with the notable exception of South Africa's big commercial sector, which has tractor usage rates above 100 per 10 000 hectares), but there is no single up-to-date data source of this data. The Food and Agricultural Organization (FAO) stopped collecting data on agricultural equipment after 2009 (and no data for Mozambique was collected in the year). Intensity of tractor usage is the most commonly used indicator of levels of farm mechanisation, given the role of tractors in the use of a range of other equipment (such as planters, sprayers, harvesters, balers). Tractor use in Zambia and Tanzania appears to have increased over the past 10 years, and is probably somewhere around 30 to 40 tractors per 10 000 hectares in the latter, and 20 to 25 per 10 000 hectares in the former. This can be compared to a global average of around 100, and 350 in Europe. Interestingly, tractor use in East Asia is relatively low, notwithstanding the Green Revolution, but this is due to the nature and location of many farms, which often makes tractor use a poor option. This is not the case in most of Southern and East Africa.

However, the specific requirements and circumstances of the region's farmers – mostly smaller farmers with limited financial resources – need to be kept in mind when considering the opportunities

for developing a regional value chain in agricultural equipment. These challenges revolve around the following Ratolojanahary (2016):

- Acquisition of equipment (mostly the cost of purchase)
- Utilisation (expensive equipment like tractors can be extremely useful for farmers, but they do not need them every day all year, and so the unit cost per “use” is often extremely high).
- Maintenance (this is an often-forgotten cost, but one that is essential for farmers obtaining the full value of the equipment over its life. Poor maintenance and/or the inability of equipment owners to be able to afford maintenance is the main reason for the failure of many programmes that have provided small farmers with agricultural equipment, particularly tractors). This constrain includes the ready availability of spare parts (and people who know how to fit them).

Given these factors, it is unreasonable to expect that there is meaningful potential in the subsistence or very small farmer segment of the market. Growth in the demand for agricultural equipment will come from medium- and larger-sized farming units, focused on commercial production, as well as innovative ideas around how to make equipment such as tractors more affordable. Ideas on how the facilitate this include:

- Group usage of big-ticket items, such as tractors and harvesters. This allows the cost to be spread among a group of farmers. Models include group ownership (such as a collective) or voucher schemes, in which the equipment is owned by a third party who then sells usage vouchers to farmers that they can redeem. The main challenge to be addressed in these models is that most farmers need access to equipment at the same time of the year.
- Variations on this model include renting certain equipment (such as tractors and trailers) to non-agricultural users in the fallow season for uses such as road maintenance. This increases the use of the equipment, and thus reduces the per unit cost of each rental by farmers. Partnerships with local authorities can be particularly useful in this regard.
- The development of smaller, more cost-efficient machines, such as smaller tractors and equipment more suited to small land units, as well as multi-functional machines, that can be used for different farming activities across a farming season. It should be noted that there have been many innovations in Mozambique, Tanzania and Zambia with respect to the development of agricultural equipment designed primarily for smaller farmers with limited financial resources. Many of these innovations would be useful for smaller farmers in South Africa, who have generally been ignored by the mainstream agricultural equipment market, given the large size of the big commercial sector. These include small-scale tilling tools, hand-held harvesters and innovative animal husbandry applications.

Almost all big-ticket agricultural equipment in the region is imported. The potential for greater demand for tractors and similar equipment in the region has been recognised by a growing number of international companies. Mahindra (Tanzania, South Africa) is the world’s largest tractor company by volume of sales. Fendt (Germany) officially launched its machines in South Africa in May 2017 and indicated that it believes this will provide the basis for future market expansion into other African countries. AGCO (a US company which owns the Massey Ferguson brand, among others) increased its

African presence at the beginning of 2017 by establishing a new regional headquarters in Johannesburg. The company is optimistic about its ability to benefit from increased agricultural activity in sub-Saharan Africa and is planning a shared use/voucher scheme as a way to make tractor use more affordable for smaller farmers.

One key factor necessary for the sustainable development of regional markets in agricultural equipment is a network of service agents in rural areas, that can service equipment and supply spare parts. Additionally, a more effective regional value chain is dependent on a more effective regulatory environment. According to the World Bank (2017), countries with the highest tractor penetration tend to score high in three areas:

- Ease and cost of importing equipment.
- Processes around obtaining approval for agricultural tractors.
- Operations: registration of tractors, road-worthiness processes, cost and availability of spares and service.

The World Bank scoring of each of the study countries with respect to machinery is summarised in Table 7.

**Table 7: Agricultural machinery regulatory score and ranking**

COUNTRY	DTF	RANK
Mozambique	34.58	47
Tanzania	44.38	40
Zambia	35.01	46

*Source: World Bank, 2017*

All three countries scored relatively low on the machinery index, due mostly to very low scores for operations, reflecting the generally poor service and maintenance environment. They all did well on the machinery import score. Tanzania has reduced import duty on agricultural machinery and equipment to zero (along with fertiliser and pesticides) and made the category VAT-exempt. Locally-manufactured farm implements are also zero-VAT rates. In Zambia, productive machinery for agriculture (along with veterinary supplies, seeds and fertilisers as well as certain bulk chemicals) may be imported duty-free. However, VAT is levied, together with a Carbon Emission Surtax on motor vehicles. In 2016 Mozambique also announced new zero import tariffs on a range of agricultural inputs, including certain categories of farm equipment, fertiliser, seeds, breeding cattle and irrigation systems.

Time to register a tractor varied from three days in Tanzania to 16 days in Zambia and 20 days in Mozambique. Zambia is the (relatively) cheapest country of the three in which to register a tractor, but scored very low for tractor testing and standards.

In contrast to fertiliser and seeds (see 3.10. below) there are practically no subsidies to farmers to purchase agricultural equipment, even though this could make a significant difference to farmers' ability to increase their productivity and returns. One of the equipment distributors interviewed highlighted an incentive scheme in Botswana that provided a 50% subsidy for hammer mills. This significantly increased the demand for hammer mills in that country, and this equipment allows farmers to move up the grain value chain, thereby increasing their farming income.

### 3.5. Irrigation

Most references to Asia's Green Revolution focus on the massive increases in fertiliser application and the use of improved seed varieties, alongside increased mechanisation. These accounts generally neglect the important role of irrigation in generating the spectacular increases in output. The main focus of the Green Revolution was, in fact, in areas which had existing irrigation schemes. Only less than 10% of cereal production in Africa is irrigated, compared to up to 40% in those areas where the Green Revolution was considered the greatest success.

Most studies highlight the importance of predictable water availability – i.e. under an irrigation scheme – in obtaining the full value of additional input use, but agri-input policies generally tend to downplay the central importance of irrigation.

**Irrigation is not just an input that impacts directly on agricultural productivity – it is also an important indirect driver of the demand for other agri-inputs.** The risk associated with unpredictable rainfall is an important factor that undermines increased input use, because farmers are not certain whether or not they will be able to recoup the cost of improved inputs (Gordon, 2000). The fewer the assets of farmers, the less able they are to take the chance of purchasing inputs that may not pay off. Increasing the area under irrigation across the region is thus an important step towards increasing the demand for agri-inputs.

Outside of South Africa, there is enormous potential to increase land under irrigation, from the regions considerable river and lake resources, as well as groundwater (FAO, Aquastat, online). Historically, land under irrigation has decreased until fairly recently, mainly due to a lack of maintenance of infrastructure. Mozambique currently has less than 200 000 hectares of land under irrigation, and the FAO has estimated that irrigation potential is around 3.1 million hectares. Zambia's irrigation potential is estimated at 2.75 million hectares in terms of water availability, although the economically profitable part of that is probably significantly less. This is considerably more than the current area under irrigation of less than 50 000 hectares. Irrigation potential in Tanzania is estimated to be around two million hectares, about 10 times the current irrigation area.

The main constraints on the development of irrigation are the lack of funding (FAO estimates that it can cost as much US\$18 500 per hectare to develop new irrigation infrastructure in the region, and donors are increasingly reluctant to finance irrigation schemes given their historically high failure rate) as well as problems with operating models – who pays for the water and how much do they pay? Traditionally many small farmers believe that water should be free, and they are often reluctant to pay market costs for water.

In addition, insecure land tenure in many areas is a strong disincentive to private-sector investment in irrigation. Significant expansion of irrigation thus depends on developing new financing models – both for upfront costs and the ongoing cost of water and maintenance – that can underpin more sustainable solutions than in the past.

Table 8 sets out the World Bank rankings of Mozambique, Tanzania and Zambia for water regulation. The two indicators measured are the country's integrated water management (regulation) and the systems in place for managing and allocating water resources.

**Table 8: Water regulatory score and ranking**

COUNTRY	DTF	RANK
Mozambique	63.36	21
Tanzania	62.67	22
Zambia	67.93	16

Source: World Bank, 2017

Zambia scored particularly highly for its integrated water resource management.

South Africa is in a very different situation: the FAO estimates that irrigation potential is around 1.45 million hectares, but current irrigation schemes already exceed this by some 200 000 hectares. This is unsustainable, and there is thus no real potential to expand irrigation any further unless additional water can be sourced. In addition, access to irrigation is a disputed issue in South Africa, with most emerging black farmers unable to access existing irrigations schemes.

Large-scale irrigation schemes require a significant investment in infrastructure, as well as requiring a significant reliable (i.e. perennial) water source. To irrigate one hectare of crops with 20mm of water, more than 200 000 litres of water (200m<sup>3</sup>) is required. All irrigation systems operate at less than 100% efficiency rates, due to evaporation, wind dispersion and other waste factors. Irrigation for cereal crops and pasture is usually delivered in the form of large pivots, either high-pressure sprayers which disperse the water across the lands, or more water-efficient low-pressure systems that spray the water directly down onto the fields. Smaller areas of horticultural produce (vegetables) can be irrigated using efficient drip irrigation systems.

In a large commercial farming project – such as those envisaged for the farm blocks in Zambia, the initial investment in irrigation infrastructure will be significant. Multiple source dams/reservoirs together with water piping for irrigation to individual farm units will be required, since such an extensive area cannot be serviced by only one water source or set of distribution pipes.

It is also important to have sufficiently delineated infrastructure that individual farmers can be accurately billed for water (and electricity<sup>4</sup>) that they use. All irrigation systems will also require an investment in pressure pumps to move the water from the water source to the irrigation site, and to manage the pressure at which water enters the system, as well as extensive piping from the water source.

Centre pivots can irrigate areas between 4.5 and 24 hectares, and generally require a reliable energy source to drive them (as well as to manage any automated water management system that goes with them.) Smaller pivots are more mobile than very big ones, which means that they can be shared among more than one farmer where the plots of land are relatively small. Large (24 hectare) centre pivots cost about US\$50 000 to US\$60 000 each (excluding the costs of getting them on site), while smaller mobile pivots cost around US\$15 000 to US\$20 000. This excludes the costs of any associated water automation systems.

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<sup>4</sup> Operating energy costs can be significant, particularly for high pressure systems.

### 3.6. Animal production inputs

One of the fastest growing segments of the agricultural sector in Sub-Saharan Africa is meat and dairy products. This reflects growing local economies, rising incomes, and a corresponding dietary shift to incorporate larger amounts of animal products. The most significant animal products are poultry (meat and eggs), beef and dairy. As the market for animal products develops, so bigger commercial operations will be established, and all of these require specialised inputs, such as feed and additives, veterinary inputs and associated equipment to manage commercial operations. This, in turn, implies that there is likely to be a significant growing regional market for these products. This will, in turn, increase regional demand for cereal grains that are the main inputs into animal feed, and thus the agri-inputs required to produce them.

The market for poultry production in the region outside of South Africa is currently dominated by smaller farmers, but growing demand for their product means that they are upscaling relatively quickly. The industry is estimated to employ around 80 000 people in total. Producer prices for chicken are generally higher in Zambia than in South Africa, which makes it an attractive market. There is also a very well-developed informal market for “village” chickens, which attract a relatively high price.

A number of South African companies – most notably Tiger, via its Meadow Feeds Division (the biggest animal feed producer in Africa) and Astral (via Tiger Chicks) – are established in Zambia, which is the most rapidly growing animal production country – and thus the biggest regional market for animal feed after South Africa – compared to Tanzania and Mozambique. Annual per capita chicken consumption in Zambia is around 6kg per year, about a fifth of that in South Africa, which indicates significant market potential, particularly against the background of the growing Zambian economy.

Zambia is also home to Zambeef – the biggest vertically integrated food company in the country and listed on both the London and Lusaka stock exchanges. Zambeef is involved in the production, processing, distribution and retailing of beef, chicken, pork, dairy products, eggs, animal feeds and flour. The company has about 16 500 hectares under crop production, about half of which is irrigated, and also has operations in Ghana and Nigeria. Profit after tax in the 2016 financial year was US\$14.5 million. Zambeef’s animal feed division – Novatek – is one of the biggest feed producers in Zambia, with a capacity of 14 000 metric tons per month. About one third of output is used within the group.

Zambeef recently completed work on a US\$1.5million milking facility, which can milk up to 2 500 cows a day, producing 60 000 litres a day. Milk produced at this facility will be processed at Zambeef’s own nearby facilities, which has a daily processing capacity of 100 000 litres.

The poultry market in Tanzania is much less well developed: more than half of the national broiler population is so-called “backyard” produced and sold into informal markets, often as live birds. Almost all the chicken available in rural areas is from this source. However, Tanzania’s rapidly growing economy implies there is enormous potential for the poultry industry in this country. In the past few years a number of new hatcheries have been set up and the Tanzanian Poultry Breeders Association was established. However, the animal feed industry in that country (as in Mozambique) is quite small, dominated by informal and smaller producers, using relatively small plants and outdated equipment. Greater demand for more specialised animal feeds in these countries will depend on greater

formalisation of poultry production into larger operations, where feed quality and specialist premixes become important criteria for commercial success.

Establishing formal feed producers' organisations in Tanzania and Mozambique is another prerequisite for scaling up those markets, since these organisations are key in negotiating the regulation of the industry.

In addition to Zambia, Astral also has a relatively long history with Mozambique, based on the significant potential to increase chicken consumption (which is currently very low compared to other countries in the region). The company has followed a strategy of entering the market through the distribution of feed premixes and concentrates, followed by local feed production and then breeding and hatcheries (this is currently their offering). The longer-term strategy is focused on broiler production and processing, as the market matures. They produce an average of 12 000 tons of feed a year – additives and specialist concentrates are imported from South Africa, while the bulk of the feed inputs are sourced locally.

The fact that poultry production outside of South Africa is dominated by smaller producers offers other opportunities. Commercial agriculture is often energy-intensive, particularly with animal farming operations. In the poultry sector, reliable electricity allows small-scale farmers to run more effective chicken houses, and electricity facilitates automated milking operations in the dairy sector. Electricity is necessary to run borehole pumps that supply irrigation systems. Demand for affordable and appropriate renewable energy systems in small-scale agriculture is likely to grow over the next decade.

As animal production becomes more intensive in response to higher consumer demand for animal products, more farmers are likely to invest in establishing concentrated animal feeding operations – CAFOs. This includes large poultry houses, pork production units, and feedlots (for both cattle and, increasingly, sheep). Concentrated chicken and pork production units generally require more upfront investment than feedlots, since the animals are kept indoors at all times. Initial investments for large-scale broiler/layer facilities range between R5 million and R10 million.

Feedlot establishment for cattle and sheep requires less initial capital investment. Capital outlays include setting up the fenced feedlot and installing an automated feeding system. The latter cost between R250 000 for a relatively small unit (1 000 sheep) up to R5 million for very large cattle feeding operations. In addition, feedlots require investment in feed storage and mixing facilities, including suitable buildings and heavy machinery. The establishment of an abattoir and meat packing/processing facility will incur capital costs of at least R5 million.

Large-scale automated dairy facilities (i.e. automated milking and cooling) that can milk 120 cows an hour require initial capital investment of around US\$450 000 (excluding the cost of getting the equipment to site and installation). This facility would be sufficient to milk up to 700 cows, three times a day, which is a relatively large herd size.

### **3.7. Extension Services**

There is no simple or predictable relationship between the use of agricultural inputs and agricultural output. As is discussed in more detail in each of the country analyses below, the use of improved inputs generally results in a wide range of productivity outcomes, not all of which are sufficient to



ensure that the cost of purchasing the inputs is covered by the marginal output produced. Two main factors influence the productive impact of additional input use. The first is the agricultural potential of the land (which includes the amount of rainfall and/or access to irrigation). Increased input use will generally yield better outcomes in areas with high-value land that receive adequate rainfall. The second factor is how well the inputs are used, and in what combinations. Fertilisers need to be applied in the right amounts (given the particular needs of that soil), at the right time and in the correct manner. Combining several inputs – improved seeds, fertilisers, agricultural chemicals and irrigation – is the most effective way to maximise productivity, but that knowledge is not always readily available. With specialised chemicals – such as pesticides, fungicides and herbicides – incorrect application can have devastating effects on crops.

Farmers tend to rely on informal information sources (family, friends, neighbours), NGOs working on agricultural projects in their areas, or what they can access in the public domain, such as radio and television programmes for farmers, or articles in the newspaper. They also receive some information on the packages of inputs that they purchase. But many farmers do not have access to the detailed knowledge they need to make optimum decisions about the use of improved inputs. This undermines their ability to make the best use of these inputs, and this often discourages repeat use. They also seldom have access to detailed information about the composition of the soils on their farms.

All these gaps can be filled with comprehensive and responsive extension services, and they are thus a critical factor in supporting farmers in the use of improved inputs. In particular, it has been shown that farmers are most likely to adopt the use of new inputs when they have had close experience of the effect of these inputs, mostly through access to demonstration plots. These plots not only provide first-hand “evidence” of the impact of improved inputs, they also are a place where farmers can study the application and use of these inputs, as they are being used.

The reality, however, is that extension services are often not available to farmers as they require them. Farmers in more remote areas, or smaller farmers, may be badly serviced by extension officers. The quality and reliability of extension services is often problematic (this is particularly the case in South Africa), and thus they do not support the adoption of more input-intensive farming methods. One of the ways in which governments and NGOs have attempted to address this is to enable agro-dealers to provide extension services, generally related to the use of those products supplied by the agro-dealers. Similarly, many input suppliers often extension services, and companies that support contract farming generally supply a wide range of extension services to their contract farmers. Despite these initiatives, a significant percentage of smaller farmers are unable to access the services that they require.

The most promising initiatives around addressing this gap are around increased use of ICT, which includes computers, the internet, mobile telephones, geographical information systems (GIS), radio and television (Gerstenmier, 2015). Of particular interest are those applications that deliver a range of services using mobile phone technology. These initiatives are gaining greater traction as mobile telephone networks – particularly data networks – increase their coverage, although **the cost of data and the reliability of networks in remote rural areas is still an impediment**. The greatest advantage of ICT in this arena is that it enables farmers to get rapid feedback to queries, and it also allows for the

“pooling” of scarce skilled resources, since many farmers in different areas can be serviced by one centrally located person.

Smartphone adoption rates are growing – GSMA, which represents mobile operators worldwide, forecasts that almost 60% of mobile phone users will be making use of smartphones by 2020. The greater the use of smartphones, the greater the potential to deliver remote extension services. Table 9 sets out the number of mobile phone users and market penetration rates in each of the four study countries.

**Table 9: Mobile phone usage (2017)**

COUNTRY	UNIQUE SUBSCRIBERS (MILLIONS)	PENETRATION RATE
Mozambique	13.8	47%
South Africa	37.5	68%
Tanzania	23.7	42%
Zambia	9.0	53%

Source: GMSA, 2017

We can assume that mobile phone usage is higher in urban areas, and that the penetration rates indicated above are probably lower (perhaps significantly so) in rural areas, and among smaller farmers. Much the same conclusions could be drawn with respect to the use of smart phones.

There has been a significant increase in the number of ICT-based extension service offerings over the last five years, funded mostly by NGOs in the agricultural sector. However, their combined impact is still limited. Many of the developments have failed to take into account the real requirements or challenges of farmers, while many of the applications are limited in reach to those farmers who are working with a particular NGO. The real potential of all this development of new platforms is yet to be realised.

### 3.8. Financial Services

Having access to financial services, in a particular form and at a particular cost, can assist farmers in purchasing improved inputs. The most important of these are credit and insurance. One of the main factors that limits framers’ ability to purchase inputs is the nature of cash flows in most agricultural sectors, particularly the cultivation of cereal crops. Inputs are required at the beginning of the growing season, which is usually the time when farmers have the least amount of cash available. Credit – available at an affordable cost, and which takes into account the realities of farmers’ cash flows – can be important in facilitating the purchases of inputs. The other factor which often dissuades farmers from purchasing expensive inputs (and may also make credit unpopular) is uncertainty over crop outcomes: most grain farmers in Sub-Saharan Africa are at the mercy of unpredictable weather – too much or too little rain can destroy a significant part of a crop. Under these circumstances, how will they repay loans taken out to purchase inputs? Insurance against adverse outcomes would provide greater security for farmers, and thus support greater investment in inputs.

Given the relatively high share of farms in the region that may be classified as small or medium, effective and efficient solutions to the finance constraints will be key to realising potential demand for agri-inputs. That is why some of the most successful programmes around increasing agricultural output have been based on an integrated contract grower/outgrower scheme, where a large buyer of

produce (normally a processor) agrees to purchase output from as well as to subsidise inputs from small-scale producers. These kinds of arrangements address farmers' cash flow requirements as well as the risk that they will not be able to find a market for their output or that the future price for that output is highly unpredictable.

One of the keys to encouraging innovation in the design and delivery of the kind of financial services that smaller farmers require is regulation, particularly the kind of regulation that allows for the blurring (even crossing) of the traditional hard lines between banking, retailing and mobile telephony (World Bank, 2017). Other relevant regulation is that around collateral: in much of the region private individual land title is not possible, which means that farmers cannot use their biggest "asset" to raise funds. This is a significant barrier to increased access to finance.

It is not only small farmers that require access to finance, but also all smaller businesses that want to participate in the agri-inputs market, particularly the smaller agro-dealers that are so important in increasing access to input markets in rural areas. These dealers' ability to grow sales is dependent on large part on being able to keep reasonable stock levels of a variety of inputs and (in the case of agricultural equipment) to maintain a showroom of one sort or another. Achieving these goals requires access to finance, which they are often not able to access in either the amounts or on the terms required. This, in turn, makes it difficult for bigger manufacturers to establish effective distribution networks to reach potential customers.

The table below sets out the World Bank Enabling the Business of Agriculture (EBA) rankings in the area of finance for Mozambique, Tanzania and Zambia. The following indicators measured:

- Whether the regulatory framework facilitates the development of effective non-bank lending institutions.
- Branchless (remote) banking, including e-money
- The ability to use movable collateral (such as warehouse receipts) for loans.

**Table 10: Finance score and ranking**

COUNTRY	DTF	RANK
Mozambique	55.1	25
Tanzania	84.85	5
Zambia	66.22	14

*Source: World Bank, 2017*

Tanzania scored particularly high: the country earned very high scores for its regulations of micro-finance institutions, as well as its warehouse receipt regulations. The country also earned high scores for its e-money regulation (Zambia also did well in this area).

This suggests that there is high potential in Tanzania (and to a lesser extent, Zambia) to develop and implement innovative financing solutions that will facilitate greater demand for agri-inputs.

### 3.9 Post-harvest storage

Post-harvest storage is a key factor in increasing total farm productivity, particularly for smaller farmers, who are most vulnerable to post-harvest losses. Post-harvest losses among smallholder farmers have been estimated to be as high as 40% of the overall harvest, with figures highest among

perishable items such as vegetables. There is little point in supporting farmers to increase output through increased use of improved seeds and fertilisers if this extra output is lost after harvest and before it can be converted to cash (or food).

The term “post-harvest storage” covers a range of storage modes and options, from grain bags to store cereal crops for smallholders, to large grain dams and silos for larger cereal producers, and a variety of cold-storage and packing facilities for horticultural crops (vegetables and fruit) and temperature sensitive products, such as milk and meat. The greater the distance to market the latter products have to travel, the greater the risk of loss through product spoilage, and the greater the investment required in effective post-harvest storage.

There has been considerable donor investment in post-harvest storage solutions for smallholders, particularly subsistence cereal producers. Innovations in this area include small hermetically sealed bags, such as the Purdue Improved Crop Storage (PICS) bag, which cost around \$1 and can be used multiple times.

Grain storage solutions for larger farmers include relatively price-competitive grain dams, although these have a limited lifespan. These dams are generally about 2m in depth and range from 7m to 9m in length, and cost in the region of R15 000 each. A more robust 5 000-ton grain bunker requires a capital outlay of between R600 000 and R750 000. Capital investment required to construct large-scale silos and grain elevators is considerable, well into several tens of millions of Rands.

In the case of perishable crops, such as most vegetables and fruit, rapid cooling in the fields or immediately after harvest is required. Small-scale solutions (such as portable cooler boxes) are available for smaller farmers, but larger operations require packhouses where produce can be sorted, washed, stored at the appropriate ambient temperature and packaged.

Transportation to market is an important part of post-harvest management for commercial farming operations of all sizes. There are considerable economies of scale that can be obtained if farmers are able to share transport, particularly smaller farmers.

### **3.10. Subsidised input programmes: what can we learn about input markets?**

In recognition of the low level of input use, and the barrier presented by the cost of these inputs for many farmers, all four study countries have embraced input subsidy schemes – almost always around fertiliser and seeds – to a greater or lesser extent. Some of these have had positive impacts not only on agricultural productivity, but also in greater adoption of inputs even when the subsidy has been removed. However, many others have not had such a positive impact, and may be responsible for a significant “crowding out” of private investment. Most governments are reconsidering their input subsidy schemes with a view to assessing how these funds might be better used in investing in an enabling environment for private-sector investment (such as improved logistics and agricultural infrastructure), but budgetary allocations to subsidies – particularly in Tanzania – remain relatively high. The summary below of the Tanzania subsidy scheme provides some useful insights into the drivers of input use and long-term adoption of those inputs, particularly by smaller farmers.

Of all the study countries, Tanzania is the one with the largest input subsidy scheme and thus the country where government plays a considerable role in the inputs sector (to the discouragement of

some investors). The **National Agricultural Input Voucher Scheme (NAIVS) in Tanzania** was launched in 2009 as a “smart subsidy” scheme, with the aim of increasing rice and maize output to ensure domestic food security. The programme has focused on small farmers, providing them with an average 55% subsidy on a combined seed and fertiliser “package” sufficient for one acre (or 0.4 hectares – 1 hectare is 2.47 hectares) of land. The subsidy is delivered via a voucher scheme (three vouchers – one for seed and two for fertiliser), which can be redeemed at agri-retail outlets (the farmer pays the 50% cost balance in cash). The 50% cash payment requirement implies that the subsidy was not aimed at the poorest subsistence farmers, but specifically those that had some assets to invest in agriculture.

The scheme was designed with the express intention of “graduating” farmers to permanent use of inputs. The initial idea was that the subsidy would be available to farmers for a limited time (three years) after which it was assumed that the benefits of the inputs would have been sufficiently demonstrated, and that farmers would earn sufficient extra income from the extra production that they would be able (and want) to cover the full purchase price of the inputs (World Bank, 2014). It is worth unpacking in some detail the progression of this scheme as well as its impact on farmers, since this highlights a number of important issues that need to be taken into careful consideration in the development of policies that aim to grow the regional value chain in these products.

Significantly more maize farmers participated than rice farmers, simply because there are many more maize than rice farmers in the beneficiary areas. The NAIVS was an apparent success in its early years in increasing agricultural output: subsidised maize farmers increased yields by an average 433kg/acre and subsidised rice farmers increased yields by 263kg/acre, although there were quite high variances in result, reflecting the underlying productive potential of the land, the availability of other inputs (particularly water), as well as the skills of the individual farmers. One important point is that yields appeared to rise over the length of the programme; that is, programme graduates had higher yields than those in the first year of the programme. This could reflect that farmers become more experienced as to how to use the inputs efficiently. In line with the increased yields, farmers’ revenue also increased (although this also varied). Maize farmers in the initial areas obtained additional revenue per acre of between TSh115 326 and TSh261 810<sup>5</sup>, while rice farmers reported lower additional revenue (bit much larger variations) – between TSh98 033 and TSh579 568<sup>6</sup>

However, three caveats should be noted. First, that these increases in production reflect the fact that the programme was initially rolled out in identified high-potential areas (including high rainfall). It has subsequently been expanded in lower potential areas, where gains in output are much more modest. Second, it appears that around 60% of recipients are not graduating from the programme but continue to receive the vouchers on the basis that they cannot afford to purchase these inputs without them. **In the 2016/17 budget, the Tanzanian government has allocated TSh25 billion to the agri-inputs subsidy programme.** It thus remains an important part of national agricultural policy.

Third, and most importantly, the additional revenue earned through the improved inputs in many instances did not cover the costs of these inputs. Table 11 sets out the costs of the inputs, and the subsidy and own payment portions. Beneficiaries received three vouchers – two for fertiliser and one for improved seed (from the selection below) in the southern highlands in the 2012/13 year.

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<sup>5</sup> At current exchange rates, this can be equated to between R666 and R1 513.

<sup>6</sup> At current exchange rates, this can be equated to between R567 and R3 350.

**Table 11: value of subsidy and costs for farmers – 2012/2013 (TSh)**

Item	Value of subsidy (voucher)	Cash payment by farmer	Total input cost
DAP (50kg) or Minjingu Mazao (100kg)	50 000	30 000	70 000
Urea (50kg)	40 000	35 000	75 000
Seed: Hybrid Maize (10kg)	20 000	20 000	40 000
Seed: OPV* Maize (10kg)	10 000	15 000	25 000
Seed: OPV Rice (15kg)	12 000	15 000	27 000

Source: World Bank, 2014, p 23

\* Open Pollinated Variety

The NAIVS did have some positive impacts in terms of input use once the voucher period ended (which is what the programme aimed to achieve):

- For households that did **not** use improved inputs prior to this programme, around 64% that no longer received vouchers were reported to be purchasing improved seeds, but only 50% were purchasing fertiliser. The survey did not record for how much of their land they were purchasing the inputs.
- Third-year programme participants were asked if they purchased improved inputs (i.e. for the rest of their land, since the subsidised package was only sufficient for one acre).

The question of why repeat purchases **of fertiliser** are so much lower than seed is not well explained, but the most likely explanation is the cost per acre (compared to seed) is such that many households cannot afford to buy it, given the fact that additional revenues did not always cover the cost.

The Kenyan study referred to above (UNECA, 2010) indicated that hybrid seeds without fertiliser increased yields well above the use of traditional seeds with fertiliser. It may very well be that Tanzanian farmers have witnessed much the same event and have come to the conclusion that they get more yield per unit of spend with hybrid seed on its own, rather than paying for fertiliser as well.

Based on the information Table 11, we can calculate the cost of three “packages” of inputs – two for maize farmers and one for rice farmers – with each package containing the two fertilisers and one of the seed packages.

**Table 12: Cost to farmer of purchasing fertiliser/seed “package”**

PACKAGE	COST (TSH)
Package 1 – Maize	195 000
Package 2 – Maize	180 000
Package 3 – Rice	182 000

Clearly, many of the farmers were not earning sufficient additional revenue to cost the cost of the subsidy. The World Bank (2014) calculated that maize would be profitable for (some farmers) in seven of the 10 programme regions without the subsidy, but that rice would be profitable in only one of the five regions without the subsidy. As for individual farmers, only those able to achieve the highest returns – the World Bank report suggests higher than one ton per acre, or 2.47 tons per hectare – can

justify paying the full commercial cost of improved inputs. To put this figure in context, consider the data in Table 1 above, which showed that the average cereal yield for Tanzania in 2014 was 1.67 tons (0.7 tons in Mozambique). Zambia, in comparison, had average cereal yields in the same year of 2.7 tons per hectare, and South Africa 4.3 tons per hectare. The challenge in Tanzania, therefore, is to get farmers onto a higher base through the better use of ALL inputs.

(The gap between the cost of inputs and the value of those inputs to farmers has also been clearly illustrated in South African experiences of subsidised inputs. In the 2013/14 agricultural season, government subsidised the inputs for around 6 500 hectares of maize in the Eastern Cape, in a joint scheme: government contributed R5 800 worth of inputs per hectare, while farmers “contributed” R1 800 per hectare, in the form of labour and mechanisation, giving a total input “cost” of R7 600/hectare. The value of the maize produced was R4 064/hectare. Even if we leave out the farmer contribution, the gap between inputs contributed by government and income received is a hefty R1 734 per hectare (before any return for the farmers). The yield obtained by the farmers (1.75t/hectare) was significantly lower than the national average, which begs the question of how suitable the inputs were or how well their application was managed. However, what is clear is that a very different input cost – output income ratio is required to support such input use.)

The fact of the significant difference between post-programme seed purchases and fertiliser purchases in the Tanzanian programme is important, for at least the following reasons:

- It clearly suggests that the gains from the additional output were not sufficient to cover the full cost of purchasing all the inputs, or that participating farmers did not believe that the profit margin earned was sufficiently high to justify the up-front cash payment for fertiliser (which must be purchased at the start of the season, while gains are only realised at the end – and may in fact not materialise if there is a drought or other severe weather). This is clear evidence that the relationship between inputs and outputs cannot simply be assumed to be a positive one.
- However, it is also clear that farmers are eager to use improved inputs, subject to a better cost-benefit outcome. (The factors that can impact on the costs-benefit outcomes of increased input use are discussed in more detail in Section 4).
- This outcome also suggests that many farmers may not have not been made aware of the importance of using the inputs in combination to achieve the best results, or alternatively, that they have disregarded this information. They may also be prepared to see lower yields, as long as the marginal revenue earned is sufficient to cover the marginal cost of the seed.

In any event, it is clear that the majority of programme participants have seen sufficient benefits of input use to support post-programme purchases. This demonstrates the potential benefits to the development of agri-inputs markets of relatively well-designed subsidy programmes (most notably, targeting farmers in higher-potential agricultural areas as well as better-off farmers with existing assets).

Surveys suggest that 47% of those who had never used improved inputs prior to participating in the programme continued to buy the improved seed, but only 19% of the same group continued to buy fertiliser. In addition, around 70% of beneficiaries had used some kind of improved inputs in the past (although it was not clear how much or how this had been sourced – i.e. whether it had been

purchased or received as part of a donor programme). The continued use of inputs after graduating from the programme was higher for this group – 57% continued to purchase improved seed, and 37% continued to purchase fertiliser.

There were other benefits in the agri-inputs value chain, notably for smaller agro-dealers who now had higher sales, and fertiliser and seed companies that supply the subsidy programme, although it is extremely likely that at least a portion of existing sales were “replaced” by the subsidy scheme.

In summary, while subsidised inputs may support subsistence farmers in producing enough food to feed themselves, they do not appear to be the best way to support sustainable and meaningful increases in input use, beyond a minimal “demonstration” effect. Critics of subsidy schemes maintain that the vast resources allocated to these schemes could be much better utilised in addressing the main structural reasons why farmers cannot afford the purchase the inputs in the first place. A more detailed discussion of the macro factors that impact these costs – and thus what a more appropriate regulatory response could be – is contained in the next section.



## 4. THE KEY DRIVERS OF DEMAND AND SUPPLY FOR AGRI-INPUTS

### 4.1 Introduction

The development of a sustainable regional value chain in agri-inputs requires that policymakers address both the factors that inhibit regional **demand** for inputs and the regional **supply (production)**<sup>7</sup> of those inputs. It is the production, rather than just the supply, of inputs that should be the focus of policymakers, since this is where the greatest opportunities for economic growth and employment are located. Based on the analysis in Sections 2 and 3, what are the key factors that will stimulate the growth of a regional value chain in agri-inputs?

Although both demand and supply of inputs are necessary for their use, the demand side of the equation is the most important. ***A sustainable increase in farmer demand is the catalyst required to generate the economies of scale that are the pre-requisites of meaningful private-sector investment in the production and distribution of agri-inputs.*** A growing market requires that farmers are prepared to purchase inputs, and if they do not believe that inputs will add value, they will not do so, no matter how easily accessible they are. What key factors impact this decision-making process?

- The impact of increased input use on **yields** – how much extra output will be produced if the inputs are used. Yields, in turn, are impacted by a wide range of factors, not all of which are farmer-dependent, such as whether or not it rains that season. But farmer knowledge and skills are a very important determinant of yields, and thus suitable extension services – backed up by relevant research and development (R&D) – are crucial for increased yields. Farmers who have accurate information about their soil requirements, about the best way to use the inputs, and the best combinations in which to combine them are much more likely to see substantial marginal yield benefits from increased input use.
- The **risk** of achieving these yields: farmers who farm in areas with highly unpredictable rainfall (or other severe weather conditions) will know that there is a reasonable risk each planting season of having a failed crop. Inputs represent a present cash outlay in return for a future reward: the greater the risk that that future reward will not materialise, the more “expensive” the current outlay will appear, due to the likelihood that it will never be recovered. There are many small farmers in the region who simply cannot afford that risk.
- The **value** of the additional output that is produced, which is critically determined by the price that they receive for the additional output produced. If the additional yield produced cannot be sold for sufficient additional income to cover the costs of the inputs and to earn the farmer some kind of profit, then it will not make sense to continue using the input. The value that the farmer earns is a function of the price that can be earned in an output market, after deduction of the cost of accessing that market. There is also a risk consideration: if the value that can be earned is highly unpredictable, it may reduce the amount of money that farmers are willing to invest in inputs.

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<sup>7</sup> As discussed in Section 2, there is limited access to the raw materials required for fertiliser production in the region, but there is some availability. The definition of “production” in this case will also include the local production of fertiliser compounds from imported components. Most other inputs are already, or are potentially, available as regionally-produced products.

- The cost of the inputs *at the farm gate*, which is determined by the underlying price of the item, together with the cost of getting it to the farmer. The lower the cost of the input, the more likely that its use will contribute to a positive outcome for the farmer.
- The accessibility of **all** inputs. That is, are there easily accessible outlets where farmers can choose from a range of inputs? Given the importance of using a combination of inputs, all of these should be available. The availability of one type of input will often stimulate additional demand for another.
- The **quality** of inputs: farmers will not use inputs that do not deliver in terms of increased productivity. The quality of inputs is determined both by investment in R&D and legislation that prevents counterfeit products from reaching the market.
- Access to financial services, in the form that is required by farmers, and at a cost that they can afford. This includes credit and insurance.

From this analysis we can draw out three macro strands that are critical for the development of a more robust regional value chain, through their impact on both demand for and supply of inputs:

1. Output markets
2. Logistics
3. Policy and regulation

Each of these is discussed in more detail in the following sub-sections.

## 4.2. Output markets

The real potential for the growth of a regional value chain in agri-inputs, and a thriving private-sector trading in these inputs, lies in the development of large numbers of commercially-oriented farmers, whose focus is to produce output for sale in output markets. Achieving this depends critically on the growth and development of suitable and accessible output markets: the single most important spur to increased commercial production is when farmers know about and can access attractive markets. Programmes that aim to encourage increased production in the absence of such an incentive can never be sustainable.

Growing output markets are also key to creating meaningful economy-wide benefits from increased agricultural productivity, through greater levels of economic activity and new employment opportunities.

Output markets for farmers include agro-processing, retailers and exporters<sup>8</sup>. It is not just the *availability* of (any) output markets that is important; most of the farmers in the region are smaller farmers, and they have very specific requirements in the kinds of markets they need to generate the returns needed to support robust regional markets in inputs. Specifically, they need access to markets that have the following characteristics:

- (i) Pay a price sufficiently high that farmers can cover the costs of additional inputs, and earn a higher net income than before (i.e. be an incentive for input use);

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<sup>8</sup> The greatest regional benefits will be obtained through the development of regional markets for agricultural output. Given the forecasts of rapidly rising demand for higher value-added agricultural products across Southern and East Africa, there is clearly a great deal of potential to achieve this goal.

- (ii) Provide a certain level of predictability and stability in demand and price. Although all agricultural markets are inherently unpredictable, instruments such as futures contracts or outgrower schemes or long-term supply contracts can ameliorate much of this risk; and
- (iii) Be accessible in a cost-effective manner. This is a key impediment for many farmers, located in remote rural areas where there is very little output market (including agro-processing) infrastructure. Having to transport goods long distances to markets almost always erodes marketing margins.

If farmers are unable to access such markets then it is unlikely that they will either significantly increase their demand for inputs or that agriculture will become a catalyst for wider economic development. The growth of agro-processing (a sector which has generally been slow to develop in the region, with the result that significant volumes of processed food are imported into many African countries) is a key factor in developing attractive output markets for farmers, as well as creating employment. At the same time, agro-processing can only thrive in an environment in which there is a reliable and adequate supply of agricultural produce. This “chicken and egg” situation has inhibited the development of large-scale agro-processing.

Despite the critical importance of output markets of a particular kind in stimulating demand for inputs, many programmes that aim to increase input use either ignore the role of output markets entirely – or fail to grasp how important it is to differentiate between markets where farmers can reliably earn enough to justify additional input expenses, and those where they cannot.

The development of **regional output markets** will be a key factor in growing regional value chains: regional markets will address the problem of sub-optimal market size in many products, and will offer a range of marketing options to farmers. There are many regional examples where products produced in one country could be used to fill deep-sea imports in another (chicken). However, this strategy will only realise the intended benefits if it is *specifically designed* to prioritise the requirements of farmers over market intermediaries.

Market development that results in the long-term decline in terms of trade for farmers is not a sustainable solution in an environment in which the majority of producers are medium- and small farms, and this kind of market development cannot support a robust or thriving agri-inputs regional value chain. What this means in practice is that the process of market development in South Africa – which has resulted in a significant deterioration in the terms of trade for smaller farmers – acts as a cautionary tale for how *not to develop agricultural markets*. Many of the regulatory responses that South Africa is now investigating to address the imbalance of power in agricultural markets – such as investigations of the power of retailers, and the supply chain practices of big retailers and processors – could inform regional market development policy so as to avoid these pitfalls.

### 4.3. Logistics

Logistics and the associated costs of getting items from one point to another are a critical cross-cutting issue affecting the entire integrated agricultural value chain, from inputs to outputs:

- **The retail cost of inputs:** Studies by the IFDC have indicated that the single biggest component of domestic fertiliser costs (i.e. the costs that are added to the landed cost of imports) are transport and distribution. Transport costs affect the final selling price of all agricultural inputs, and are particularly high for overland transport of goods. If these costs were lower,

the retail price of these inputs would also be lower. Domestic transport costs are the main reason why fertiliser in much of Africa is much more expensive than it is in Europe.

- **Farmers' affordable access to a range of inputs:** There is a cost involved for farmers when they travel to purchase inputs and transport them back to the farm. If these costs are excessive, they may erase the benefits of a lower retail price for inputs. Farmers in most Sub-Saharan countries are at least 20 kilometres away from their nearest source of agri-inputs, and in most cases this source does not stock all their requirements (Gerstenmier, 2015). Smaller and poorer farmers generally do not have access to their own source of transport suitable for moving items such as backs of fertilisers.
- **The cost of accessing output markets:** If farmers travel long distances over difficult terrain to reach output markets, the associated cost will erode their marketing margins, and thus reduce the marginal benefit that they derive. This, in turn, will reduce their willingness to incur the marginal cost of additional inputs.
- **Food processors and retailers' ability to transport product to customers:** The cost and ease of distributing products around the region is a key factor that will impact the development of output markets.

One commonly cited example of the impact on trade and value chain development of poor inland logistics is that it costs twice as much (R100 000) to send a 4-foot container by road from South Africa to Tanzania than it does to send that same container by sea from China. It is well-researched and documented that logistics – both at ports and inland – is generally in a poor state across most of the region outside of South Africa. Inefficiencies at ports and border posts, the general decline of the regional freight railways infrastructure, and the poor state of much of the road infrastructure have been repeatedly highlighted in research and policy over the past 20 years.

In terms of the *general* state of logistics, the World Bank's Logistics Performance Index (LPI) is particularly helpful source of information on trade logistics. The domestic LPI assesses the logistics environment within a particular country, using four major determinants:

- Logistics infrastructure;
- Logistics services;
- Border procedures and time; and
- Supply chain reliability.

Each of these is assessed in terms of two indicators – the environment and institutions, and actual performance – to reach a final assessment. Importantly, the data collected is a combination of both qualitative and quantitative sets. This approach means that the assessments of the system by those who are currently operating within it are prominent.

Table 13 provides a regional summary of selected indicators from the World Bank survey, illustrating the relative performance of Sub-Saharan Africa, on the set of questions around the operation of domestic logistics. What is interesting to note is that Sub-Saharan Africa does not seem to have the worst infrastructure in the world (although South Africa may distort those figures a bit), but it seems to have the most *expensive* transport rates out of all the regions. This is particularly the case for road transport, which is the way in which the bulk of trade moves through the region. It is thus little wonder that so many agri-inputs are so expensive. (The region also scored very low for the "solicitation of informal payments", in contrast to general opinions.)

**Table 13: Regional Rankings – Logistics (2016): Selected Indicators**

Question	Response (% of respondents)	East Asia/Pacific	Europe/Central Asia	Latin America/Caribbean	Middle East, North Africa	South Asia	Sub-Saharan Africa
Port Charges	High/very high	42	51	52	53	49	70
	Low/very low	7	7	15	25	6	8
Road Transport rates	High/very high	50	6	59	27	42	59
	Low/very low	19	50	13	29	12	3
Rail Transport Rates	High/very high	33	27	28	26	18	39
	Low/very low	22	28	43	50	33	18
Quality of port infrastructure	High/very high	23	27	21	33	18	25
	Low/very low	35	29	45	35	25	33
Quality of road infrastructure	High/very high	20	24	12	24	5	39
	Low/very low	45	36	53	32	53	18
Quality of rail infrastructure	High/very high	21	22	3	20	3	17
	Low/very low	54	49	86	64	63	61
Quality of service: roads	High/very high	27	35	17	34	16	22
	Low/very low	33	24	49	10	27	30
Quality of service: rail	High/very high	21	16	4	11	4	16
	Low/very low	53	35	74	67	50	59
Quality of service: customs	High/very high	33	38	18	29	34	46
	Low/very low	26	17	43	25	33	20

Source: World Bank, 2017

From 2007 to 2016, there were some changes in the overall LPI Rankings. South Africa (the highest rated of the four, although it scores quite badly on cost) improved from rank 24 to 20. Mozambique also improved, from position 110 to 84. Tanzania was by far the best relative performer, moving from position 137 in 2007 to 61<sup>st</sup> in 2016. Zambia, however, slid in performance, from position 100 to 114. The country scored particularly badly in terms of timelines.

The World Bank’s EBA 2017 report also included a section on transport, measuring the following:

- Trucking licenses and operations – which includes transport regulations specific to agriculture and food
- Cross-border transportation, including cross border licensing arrangements

**Table 14: Finance score and ranking**

COUNTRY	DTF	RANK
Mozambique	54.91	33
Tanzania	65.13	25
Zambia	66.59	23

Source: World Bank, 2017

No data are included in the EBA around the costs of transporting goods.

The most commonly cited reasons for why there has not been a significant improvement in **regional** logistics over the past 10 years is the cost of the investment required. In this context, it is useful to consider that, over the past 10 years, billions of US dollars have been spent on subsidising the cost of agricultural inputs, when one of the main reasons those inputs are so expensive is because of poor logistics.

#### 4.4. Policy and regulation

Policy and regulation within countries and across a region play an important part in either facilitating or hindering the development of a vibrant regional value chain in agri-inputs.

The most important of these are the following:

- National and regional policy around output markets
- Subsidisation of inputs
- Tariff and non-tariff barriers to trade
- Domestic agricultural policies

##### ***National and regional policy around output markets***

This is one of the most important areas of policy, given the importance of output markets in facilitating the demand for agri-inputs. Many countries in the region appear to have as a priority **national** food security, rather than the development of a vibrant regional trade in agricultural output. Although there are good reasons for aiming to achieve national food security, increasingly urbanised populations will mean that employment, rather than national food production, increasingly becomes the key factor that impacts food security. This implies that achieving national food security is closely linked to the development of employment opportunities in the agricultural sector. It is regional markets that offer the economies of scale to encourage private-sector investment and create employment on a large scale.

This means that domestic policies that encourage a parochial “buy local” agenda are in fact not operating in the best long-term interests of the development of their own economies.

What is required is national and regional policies that encourage the free flow of agricultural produce around the region, that encourage investment in agricultural processing facilities, and (most importantly) that focus policy on ensuring fair terms of trade for farmers in the wider agricultural system are the foundation on which a thriving and prosperous agricultural sector will be built. This is an absolute pre-condition for the growth of a regional value chain in agri-inputs.

SADC’s Regional Agricultural Investment Plan has a significant allocation to value chain development, through its ***Sub-Programme 2.2: Improve infrastructure for access to markets and trade of agricultural products with a focus on strengthening agricultural value chains***. It is important that the development of initiatives under this sub-programme keeps a pro-farmer focus.

### ***Subsidisation of Inputs***

Public-sector subsidies in various forms have been a key factor supporting input use – particularly fertiliser – in all the study countries, with the notable exception of South Africa (although some subsidisation of inputs does occur in this country as part of the land reform/small farmer support programmes).

Subsidies are designed to address the key reasons why farmers do not use inputs, particularly affordability. The key idea underpinning these subsidies is that a national benefit will be realised – in the form of higher agricultural productivity and output – in return for the cost of these subsidies. There is also an assumption that subsidies can assist in “introducing” farmers to the benefits of increased input use; that farmers will be more willing to purchase the inputs themselves once they have witnessed firsthand the benefits of their use.

Those who oppose subsidies list the following as their main concerns:

First, that they undermine and constrain the “space” for private-sector investment in the inputs market. Our interviews as part of this research supported this assessment; that the high level of government involvement in certain countries (Tanzania was most commonly mentioned) functioned as a very effective barrier to both their entry into the market, as well the general growth of that market.

The second criticism of input subsidies is that the funds in question could be better used to address the underlying factors that drive input costs beyond the reach of farmers (such as inefficient logistics) and/or reduce their ability to earn a good income from the extra production (such as remote or unsuitable output markets).

Third is the criticism that many subsidies are reaching the “wrong” people (Baltzer and Hansen, 2011), in that they do not always reach the poorest and neediest farmers. The current move to so-called “smart” subsidies appears to have been only a partial solution to this challenge.

Finally, it is clear that decades of input subsidies, involving a great deal of public expenditure – admittedly not always in a very effective manner – have not resulted in a significant increase in non-subsidised input use, most noticeably among smaller and subsistence farmers. This suggests that the

subsidies themselves are, at the very least, incompatible in their current state with the long-term sustainable increased use of inputs.

***In addition, the high prevalence of subsidised inputs has stifled the growth of non-farm employment in rural areas, by reducing opportunities for private enterprise.*** All these factors suggest that these funds would be better used in addressing the underlying structural impediments to greater input use, such as logistics. However, the funds currently allocated to subsidies would also be better used if they were directed toward improved market infrastructure, such as improving access to finance for small-scale processing facilities and on-farm value-added activities (such as the example of hammer mills in Botswana referred to in sub-section 3.4 (Agricultural equipment)).

However, it is also clear that agricultural subsidies are a politically sensitive issue: many farmers have been receiving these subsidies for so long that it has become a “right” to which they believe they are entitled. Striking a balance between meeting these farmers’ expectation and supporting the development of infrastructure that will facilitate the kinds of markets that will allow farmers to purchase inputs themselves is not going to be an easy task.

To make matters more difficult, there is a great deal of NGO activity in the region that is effectively engaged in subsidising input use, usually through the free or very-low cost distribution of seeds, fertilisers and other inputs. Although these organisations may be having a short-term positive impact on agricultural output, they are undermining the long-term development of commercially-oriented agriculture. These funds also would be better used in addressing the structural impediments to farmers earning a better living from farming, such as improving access to post-harvest storage facilities, small scale processing, transport to markets and access to irrigation.

#### ***Tariff and non-tariff barriers to trade***

As discussed above, there are actually very few tariff barriers to trade in agricultural inputs, particularly fertiliser. At present that works largely to the detriment of regional companies, since they cannot compete on price with deep-sea imports that are not subject to import tariffs or (in most cases) VAT. However, a number of significant non-tariff barriers to trade are in place, particularly with respect to the domestic regulation of seed, fertilisers and agricultural chemicals, which also work against regional companies. There are plans in SADC to address the seed regulations, but these are progressing extremely slowly, and way behind the progress that is being achieved in COMESA. Unless this process improves, SADC is going to be left far behind.

There is an urgent need to harmonise fertiliser regulations across the region, and once again the pace of development in SADC in this respect is extremely slow.

#### ***Domestic agricultural policies***

Domestic agricultural policies can have a significant impact on the development of agri-input markets. The most obvious issue is that of subsidised inputs, as discussed above. However, there are other components of agricultural policy that are important for the way in which agricultural production and agricultural markets develop, and thus the way in which input markets develop. Some of the most important components are the following:



1. **Land Tenure:** When farmers have secure title to land they are more likely to make investments in productive infrastructure. In addition, secure title means that farmers can use that land as collateral to access finance.
2. **Irrigation:** Increasing the amount of farmland under irrigation is a key factor in both increasing output and reducing the drought-associated risks of farming, and thus putting farmers in a better position to purchase agri-inputs. Successful irrigation policies require sustainable planning on who will be responsible for maintaining infrastructure and covering the operational costs of the schemes.
3. **Output market strategy:** It is crucial that agricultural policies do not only focus on how to achieve production targets, but also on how to achieve farmer income targets. This requires the incorporation of clear market access strategies into domestic agricultural policies.
4. **Extension services and R&D:** These are crucial services for farmers, and an important part of increasing agricultural productivity.
5. **Clear strategies to reduce post-harvest losses:** Reducing the post-harvest losses suffered by farmers is the quickest and most immediate way to increase farm incomes. Post-harvest losses can be reduced through better access to better storage options, as well as easy access to processing facilities that can be used for produce that cannot immediately be sold, or which is below standard for fresh produce.

## 5. DEVELOPING REGIONAL VALUE CHAINS IN AGRICULTURAL INPUTS

### 5.1. Summary of Key Findings: What are the critical levers in markets for agri-inputs?

To date, much of the policy around increasing input use among farmers – particularly smaller farmers – has been dominated by what could best be described as a **supply push approach**. That is, the focus has been on getting product to farmers, almost always at a subsidised price. A more sustainable, value-chain focused approach needs to consider the issue from both the demand and the supply side; that is, what needs to be done to ensure that demand for the product increases, what needs to be done to ensure that this demand is met through the development of private-sector enterprise, and how will this be facilitated in such a way that it benefits the **regional** economy?

In terms of defining a “regional value chain”, this can be understood as existing when the producers and the consumers of products are located in the same region. In terms of agri-inputs, an integrated regional supply chain would be one in which the majority of agricultural inputs that are used by farmers in the region are **produced** within the region. This, in turn, would be related to an integrated agricultural value chain, where a significant percentage of agricultural output consumed in the region would also be produced in that region. This is a **whole value chain approach**, recognising the interdependence of both input and output markets in the agricultural sector.

**The initial catalyst for the development of a regional value chain is to address the main issues that impact demand for the product.** The analysis presented in the first section of this report clearly shows that the demand for agricultural inputs is determined at the intersection of two key variables:

- The cost of using the additional inputs; and
- The benefits derived from using the additional inputs.

The decision to use inputs – and the quantum of that use – is made on the basis of a present financial commitment for uncertain future rewards. This cost-benefit intersection is **the most critical leverage point for the agri-inputs value chain**. When the benefits of using additional inputs outweighs the cost, input use will rise. The main reason for low input use in Sub-Saharan Africa is that costs of using inputs have generally outweighed the benefits of their use. This has resulted in a more or less permanent cost-benefit gap. The main focus of most input programmes in these countries has been to subsidise the cost of inputs in an attempt to close this gap.

The alternative approach – which we recommend – is to adopt a multi-faceted approach to closing the gap, working on multiple factors that will reduce the costs of input use and increase the benefits obtained from that use, by operating directly on the drivers of costs and benefits, as illustrated in the figure below:

Cost Drivers	Benefit Drivers
Physical access to input markets	Yields
Logistics costs	Physical access to markets
Difficulty in obtaining information	Prices received
Inability to access affordable credit	Predictability of prices
Regulatory costs	Risk of crop failure

*A better (i.e. more sustainable) cost-benefit situation for farmers can be obtained through the reduction of costs and/or the raising of benefits, with the optimum outcome being both sustainable lower input costs and higher benefits. At the same time, it is important to remember that private-sector providers of inputs such as fertiliser also have a cost-benefit breakeven point: if the **net price** of their product that they receive declines, this may make the products more affordable for farmers to use, but the erosion of profit margins will drive companies out of the market. Input suppliers will thus also benefit from structural interventions that reduce the cost of their product for farmers relative to its benefits, without eroding their profit margins. Therefore, structural adjustments that increase farmer returns and reduce the costs of getting product to them will benefit both farmers and the suppliers of inputs. This is the basis on which sustainable regional value chains are best built.*

## 5.2. Policy Recommendations

Based on our analysis, our main policy recommendations are the following:

### 1. Supporting the development of regional output markets that will provide more and better market access opportunities for farmers.

Regional agricultural policy (including trade policy) needs to incorporate a careful consideration of the terms of trade on which farmers will access markets, and the impact of these terms of trade on farm-level incomes. Unless farmers are able to sustainably increase their incomes in line with growing demand for agricultural produce, they will never be a sustainable foundation for increased trade in agri-inputs. This also means that farmers need support to enter higher-value growing markets for animal products and processed food.

In practice, achieving this goal will require the following:

- That the RAIP programme explicitly include the regulatory goal of ensuring that the terms under which farmers engage with output markets include the consideration of the impact on sustainable farm incomes. Of course, farmer interests must also be balanced against regional food security requirements. There are many regulatory examples in this regard from various regions and countries, including Brazil and the EU. Ideally, this would result in the harmonisation of supply chain regulations across SADC in a similar project to the harmonisation of seed regulations.

- That regional programmes to expand agro-processing activities specifically include initiatives to ensure that smaller farmers are in a good position to benefit from the growth of these activities.
- In line with these recommendations, a portion of the funds that will be made available to develop value chains need to be directed specifically at facilitating farmer access to opportunities higher up the value chains, such as processing.

**3. Seed harmonisation and fertiliser harmonisation regulations in SADC need to be finalised and implemented with a sense of urgency.**

The harmonisation of these regulations, and their implementation by all SADC member states, is a non-negotiable foundation for developing regional markets in agri-inputs. In addition, it would be useful if there was close communication between SADC and COMESA on future plans to harmonise regulations around agri-inputs.

**3. Regional coordination of extension services and delivery platforms.**

Extension services are a key factor in increasing farmers' access to information, not just around agri-inputs, but also around market access opportunities. The delivery of these services using ICT platforms is growing rapidly, but many of these initiatives are uncoordinated, and there is significant duplication of efforts. All of this is to the detriment of the farmers who require these services. It would be helpful for a regional meeting of all major service providers in this area to be convened, with the goals of consolidating service offerings; creating greater opportunities for farmers across the region to participate in peer learning groups; and facilitating regional connections between buyers and sellers of a wide range of agricultural products. In addition, the consolidation of platforms will create economies of scale that can reduce the costs of such services and facilitate negotiations with ICT service providers to reduce the cost of both data and hand-held devices.

**4. Logistics and transport infrastructure problems must be addressed – now**

There can be no meaningful growth of regional value chains in any part of the agricultural sector until the issues around the cost and reliability of transport services in the region have been addressed. This is such a serious constraint that it may be necessary to adopt an approach within SADC that ensures the bulk of all money to be spent under RAIP must be allocated to transport infrastructure.

**5. Current agricultural input subsidy schemes should be diversified to include additional items**

As the analysis in this report has hopefully made clear, the best way to ensure that farmers use more and better inputs is to put them in a position where they can earn sufficient income to purchase those inputs. Current funds allocated to the direct purchase and distribution of inputs would be better used in making soft loans or matching finance available to farmers to allow them to invest in infrastructure and capital goods that will enhance farming incomes. This includes a wide range of items, from transport vehicles, to hammer mills, to small-scale processing and packaging facilities, and irrigation infrastructure.

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