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Creating an Enabling Environment for Private Sector Investment in Fertilizer Value Chains in Sub-Saharan Africa: Empirical Evidence and Knowledge Gaps

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Executive Summary

Raising inorganic fertilizer use in sub-Saharan Africa (SSA) is widely recognized as critical for promoting agricultural transformation in the region. It is now generally accepted by African governments that in order to develop sustainable fertilizer markets and improve farmers' access to fertilizers, it is necessary to create an enabling environment for private sector investment. The "enabling environment" consists of the policies, laws, and regulations including the institutional infrastructure that guide the conduct of stakeholders (e.g., farmers and fertilizer retailers, importers, etc.) in pursuit of their goals. However, to date, there has been no systematic stock-taking of the types of policies, laws, and regulations that promote versus hinder fertilizer business in SSA. This report describes the current status of enabling environments in the region, reviews the available empirical evidence on the topic, and highlights knowledge gaps where additional research is needed.

The report highlights four key findings. First, with the exception of South Africa, there are no current examples in SSA of countries that have competitive, transparent, predictable, and sustainable enabling environments for increased investments in fertilizer value chains. While there are some examples of countries with fairly competitive fertilizer markets but uncertain policy environments (e.g., Kenya and Tanzania), most SSA countries' fertilizer sub-sectors are still predominantly state-run or heavily state-influenced. While most of these countries allow for private sector involvement in these markets, the incentives for private sector investment are low in many cases due to heavy state control and ad hoc policy environments.

Second, while there is a large and growing peer-reviewed literature on the targeting and demand-side effects of fertilizer subsidy programs, which are used by numerous SSA governments to improve smallholder farmers' access to fertilizers, there is little rigorous empirical evidence on the supply-side effects of the programs, including program effects on private sector investment.

Third, compared to the large overall literature on the effects of fertilizer subsidy programs, there has been virtually no rigorous analysis of how other policies, laws, and regulations affect fertilizer enabling environments or the performance of fertilizer sub-sectors in SSA.

Fourth, the existing empirical evidence on the impacts of regulations on private sector participation and investment in fertilizer markets in SSA can be grouped into three broad categories: (i) literature that describes the current status of fertilizer regulations in different countries around the globe and infers or predicts the impacts thereof on the private sector and, in some cases, provides anecdotal evidence to support its predictions (a key example being the World Bank's "Enabling the Business of Agriculture" reports); (ii) studies from outside of SSA on the impacts of deregulation on technology transfer and private sector participation (mostly for products other than fertilizers); and (iii) studies from SSA on the impacts of fertilizer regulations on private sector participation in the fertilizer industry that mainly highlight correlations and descriptive relationships but do not identify the causal effects of the regulations.

Given the scant empirical evidence on the effects of laws, regulations, and policies other than subsidies on private sector investment in fertilizer value chains in SSA, there is great need for more research on these topics. The main report highlights specific areas for future research.

Creating an Enabling Environment for Private Sector Investment in Fertilizer Value Chains in Sub-Saharan Africa: Empirical Evidence and Knowledge Gaps

1. Introduction

In the 1990s in sub-Saharan Africa (SSA), some countries began to transition from agricultural markets dominated by state-run agencies to those in which the private sector plays a larger role. Accompanying these agricultural sector reforms, a discussion ensued among policy makers and researchers on how best to create conditions that encourage this development. The phrase “enabling environment” gained ground to embrace policies, strategies, support services, legislative and regulatory agendas, and other state actions that are designed or implemented to encourage increased private sector participation in value chains, business development, and growth (Christy et al., 2009).

This synthesis focuses on creating an enabling environment for the fertilizer sub-sector due to the input’s contribution to agricultural productivity and food security. Against the backdrop of the Green Revolution in Asia, a number of studies conclude that fertilizer, together with a complementary set of other improved inputs, has raised yields and labor productivity (Murgai, 2001; Restuccia et al., 2008). Using panel data and a cross-country analysis, McArthur and McCord (2017) show that fertilizer, improved seeds, and water, alongside other complementary inputs, are key for yield growth. Their results provide evidence that increases in cereal yields translate into positive economy-wide outcomes, and even more so for countries with most of their labor force in low-productivity agriculture.

For the fertilizer sub-sector, the “enabling environment” consists of the mix of policies, laws, and regulations, including the institutional infrastructure, that guide the conduct of stakeholders (e.g., farmers, traders, etc.) in pursuit of their goals.² More generally, an effective enabling environment in the fertilizer sub-sector is one that creates the conditions for private sector participation and investment in fertilizer value chains, thereby increasing competition, putting downward pressure on fertilizer prices, widening the range of quality fertilizers available in the market, and improving farmers’ access to fertilizers. Such an environment should protect consumers from poor quality or fraudulent inputs but not burden the private sector with cumbersome registration and reporting procedures or tax regimes that hurt their profitability.

The national fertilizer policies, laws, and regulations that are of greatest interest to the private sector are those that affect their ability to conduct business (production, blending, importation, and distribution of fertilizer) in an effective and efficient manner. National fertilizer frameworks often span a range of instruments, including: (i) fertilizer subsidies, (ii) macroeconomic policies (interest

² Notably, there are important distinctions among laws, regulations, and policies – three terms that will be used in the context of the enabling environment. Laws (or acts) are frequently established through a parliamentary process and create a framework for governing the market. They typically focus on a particular sector or activity along the value chain. In order to implement laws, regulations are developed, usually through administrative action. They often provide additional detail on how to apply the law. The broadest category of measures within the enabling environment is policy, which creates goals and objectives that laws and regulations should aim to accomplish in order to guide stakeholders and government officials. Unlike laws and regulations, policy ordinarily is not legally binding on its own (Kuhlmann, 2017).

rates, foreign exchange controls, exchange rate distortions, inflation, currency devaluation, etc.); (iii) trade measures (tariffs, taxes, import and export restrictions (including bans), border charges, and other non-tariff trade measures); (iv) regulatory requirements for registration of new products and companies; (v) fertilizer distribution policies; and (vi) regulations related to quality control of fertilizer products. Because of this range of measures, the enabling environment for fertilizer can be complex, and each of these instruments merits assessment, individually and in combination.

At present, the effectiveness of SSA’s enabling environments for fertilizer varies considerably across countries. As shown in Figure 1, countries can be grouped along a continuum that ranges from heavily state-run fertilizer markets that largely stifle private sector investment in fertilizer value chains at one end of the spectrum, to fairly competitive markets that are private sector-driven and competitive at the other end of the spectrum.

<p>State-run: Procurement and distribution managed by the state; very minor private investment; regulatory system state-focused</p>	<p>Nascent: <5 percent of households using fertilizer in scattered locations; mostly driven by private & small NGOs / donors projects; poor infrastructure and information; limited regulatory framework</p>	<p>Transitional: Mostly state managed with some private sector players; relies on decrees or command system from the state; heavily subsidized</p>	<p>Fairly competitive (but uncertain enabling environment): Mostly private sector driven but with significant state subsidies and ad hoc policy pronouncements and regulatory implementation</p>	<p>Competitive (transparent, predictable, & sustainable enabling environment): Private sector-run fertilizer markets; appropriate state oversight with mainly ex post regulatory control</p>
<p><u>Example:</u> Ethiopia</p>	<p><u>Examples:</u> Uganda, Mozambique</p>	<p><u>Examples:</u> Benin, Togo</p>	<p><u>Examples:</u> Tanzania, Kenya</p>	<p><u>Example:</u> South Africa</p>

Figure 1. A continuum of enabling environments for private investment in fertilizer value chains

Source: Authors adapted from several market assessments in SSA (<https://ifdc.org/country-fertilizer-market-assessments/>), Ariga and Jayne (2009), Kuhlmann (2017), and NML & AFAP (2017).

As noted, many African governments liberalized their agricultural markets in the 1990s, easing many forms of regulatory intervention (e.g., import license requirements, foreign exchange restrictions, importation and/or distribution by parastatals), and the private sector was free to engage in all activities along agricultural supply chains. Nevertheless, as reflected in their policies and regulatory frameworks or lack thereof, a number of governments continued to intervene inefficiently in agricultural input and output markets without sufficient attention to market realities. It is now generally accepted by African governments that in order to develop sustainable fertilizer markets, it is necessary to create an enabling environment for private businesses to thrive and invest in these markets (African Union Commission, 2014). A demand- or market-oriented policy and regulatory agenda is gaining ground in SSA as governments initiate efforts to reform policy, legal, and regulatory frameworks. In addition, there has been an increasingly strong drive for “smart” or improved subsidies that do not crowd out the private sector. Further, as the benefits of regional markets increasingly are appreciated, progress is occurring around harmonization of fertilizer rules at both the continental and regional levels. As discussed in more detail in subsequent

sections, this movement is evidenced by the signing of the Abuja Declaration at the African Union (AU) level and Regulation C/REG.13/12/12 Relating to Fertilizer Quality Control in the ECOWAS (Economic Community of West African States) Region in 2012. Harmonization efforts also are underway in the Common Market for Eastern and Southern Africa (COMESA) and the East African Community (EAC).

However, in many countries there is still little knowledge and understanding among policymakers and other stakeholders of the impacts of policy and legal and regulatory frameworks on the performance of the fertilizer industry and on smallholder farmers' access to and profitable use of fertilizers. Contributing to this challenge is the lack of available information on good practices that can support a conducive enabling environment for the fertilizer industry. While there have been several systematic reviews of the impacts of fertilizer subsidy programs in SSA (e.g., Druilhe & Barreiro-Hurlé, 2012; Wanzala-Mlobela, Fuentes, & Mkumbwa, 2013; Jayne & Rashid, 2013; Jayne et al., 2018), to our knowledge, there has been no systematic, broader stock-taking of the empirical evidence on the types of policies, laws, and regulations that enhance versus hinder an effective enabling environment for fertilizer businesses. The main objectives of this paper are therefore: (i) to synthesize this empirical evidence and distill the lessons learned with regard to how public policy can facilitate the development of sustainable and competitive fertilizer markets in SSA; and (ii) to highlight key knowledge gaps where further study is needed.

The remainder of the paper is organized as follows. Section 2 outlines the status of fertilizer policies, laws, and regulations in SSA and summarizes key lessons learned and implications. Section 3 focuses on fertilizer subsidy programs in SSA and synthesizes the available empirical evidence on the effects of these programs on fertilizer demand and on private sector engagement and investment in fertilizer value chains. Sections 2 and 3 also highlight knowledge gaps related to fertilizer policies (including subsidy programs), laws, and regulations and their impact on an enabling environment for fertilizer business. Section 4 concludes.

2. Fertilizer Policy and Regulatory Frameworks: Current Status, Evidence of Impact, and Best Practices

National fertilizer policies and regulatory frameworks serve to promote agricultural productivity and food security through improved access to quality fertilizer at the right time, place, and price. They are crucial for growing and sustaining fertilizer markets and also provide broad “rules of the game” within which supply chain actors can pursue their business interests.

National policies and regulations influence demand-side (foreign exchange, etc.) and supply-side constraints (subsidies, extension, etc.), which are important factors that impact the cost of doing business and hence investment in the fertilizer sector. These determine market outcomes and can result in flexible competitive markets or rigidly regulated state-run enterprises.

The remainder of this section summarizes the consensus in the literature regarding: (i) fertilizer policy issues that are included in most policy documents; and (ii) fertilizer regulatory issues that are included in most regulations.

2.1. Fertilizer Policy

Policy tends to provide consistent and stable direction for the enabling environment, including guidance on the development of laws and regulations, that can be relied on by public and private sector stakeholders. Fertilizer policy specifically aims to engender an environment that improves access to fertilizers by farmers in order to raise productivity, reduce hunger, and alleviate poverty. In SSA, fertilizer policy may appear as stand-alone or be incorporated into broader agricultural or development policies (or both). Regardless, it typically provides broad guidelines from which priorities, objectives, activities, and outcomes can be delineated (Benson, 2015; White, 2014), although it is non-binding in nature, in contrast to law or regulation (Kuhlmann, 2017). In general, fertilizer policy allows for the following elements or actions:

- Stakeholder Capacity Building: This policy element is often characterized by a training component on how to handle or manage fertilizers along the value chain to maintain quality and also to educate or inform participants of the benefits from using fertilizer, including agronomic aspects at the farm level.
- Increased Access to Fertilizers: This aspect of policy captures the development of marketing networks, especially agro-dealers who are the “last mile” link, to improve accessibility by and proximity to farmers by building the capacity of agro-dealers in the form of financing and knowledge or information. Financing is an important aspect of this framework, as it determines the level of and catalyzes activities throughout the value chain.
- Post-Harvest Management and Access to Output Markets: This component focuses on improving access to output markets in order to encourage demand for fertilizers and other inputs while reducing post-harvest losses and boosting farm incomes and food security.
- Complementary Nature of Agro-Inputs: This policy focus is often presented along the lines of the integrated soil fertility management (ISFM) framework, which advocates for use inorganic

fertilizer in conjunction with other improved inputs (seed, manure, etc.) and management practices to raise productivity, as crop yield response to inorganic fertilizer is affected by a number of factors including other inputs and management practices. In a broader context, there should be guidelines on quantities of fertilizer and other nutrients or inputs required to maintain soil fertility and keep the environment safe, including the need to develop more localized soil- and crop-specific fertilizer recommendations in many countries in SSA to raise crop fertilizer response and consequently fertilizer demand.

- Private Sector Engagement: Policies can be crafted to reflect that an active private sector depends upon improved competition within the sector, which subsequently benefits farmers through reduced fertilizer prices and improved access to a wide range of quality fertilizers. This can be enhanced by promotion of national fertilizer dialogue between the private and public sectors on issues affecting the industry. Policies should encourage private sector investment in fertilizer research and protection of intellectual property rights.
- Role of Fertilizer Subsidies: Policies tend to focus on demand creation including clearly spelt out targeting and exit strategies to avoid crowding out private sector participation.
- Law and Regulation: Policies will often set the stage for binding legal and regulatory measures governing the fertilizer sector, which are then achieved through separate legislative or regulatory processes and can reflect numerous market and policy objectives.

2.1.1. Status and Impact of Fertilizer Policy in SSA

As explained above, fertilizer policies tend to contain a number of elements, many of which are commonly accepted. However, most countries in SSA do not have coherent fertilizer policies; instead, current ‘policies’ consist of ad-hoc pronouncements that change from time-to-time or decrees that vary depending upon who is in charge of the ministry of agriculture or government. These factors can lead to inconsistencies within a national fertilizer framework.

The Kenyan subsidy program provides a typical example of fertilizer policy inconsistency in SSA. Every season, the program’s size or magnitude is adjusted; however, due to insufficient transparency surrounding the program, the private sector lacks information on when or how much fertilizer will be imported by the government. This uncertainty has a direct impact on business decisions and affects the industry’s growth overall. As subsidies have taken center stage in fertilizer policies across SSA, their design and implementation are important factors contributing to the condition and sustainability of the enabling environment.

Most fertilizer policy reform agendas in SSA are geared towards achieving the following goals:

- Developing more private sector-oriented markets, leading to increased competition and less expensive fertilizer products;
- Opening up the import and distribution of fertilizers to more market players and extending fertilizer financing to the entire value chain; and

- Building partnerships and establishing public-private dialogues to crystallize policy goals and frameworks by leveraging available skills, resources/funds, and expertise from the public and private sectors, including development partners.

In addition to country-level efforts to reform policies, there has been a continued push by stakeholders at the continental level to strengthen efforts across countries and regions to support a wider agenda to raise agricultural productivity. Following the Maputo Declaration of 2003 and the subsequent Abuja Declaration on Fertilizer for an African Green Revolution in 2006, a number of policy commitments were made by African governments, including increasing fertilizer use in SSA. The meetings during the tenth anniversary of the Comprehensive Africa Agriculture Development Programme (CAADP) in 2014, followed by the Malabo Declaration that same year, encapsulated the bold commitments for agricultural growth across the continent, including measures to improve farmers’ access to fertilizers and other yield-enhancing inputs to double agricultural productivity, end hunger, and halve poverty by 2025. Consequently, these shared policy goals ought to be reflected in national and sub-regional level fertilizer frameworks.

The following table (Table 1) provides a summary of the status of fertilizer policy in SSA based on a draft report shared with USAID during a policy partners’ meeting composed of several international research organization in 2016 in Washington, D.C.

Table 1. Summary of Policy Status in Select SSA Countries (2016)

Country	Status of Policy or Regulation
Rwanda	<ul style="list-style-type: none"> • Significant progress made in privatizing fertilizer market, and subsidy; • More importers now (via tender); however, ceiling retail prices are set under public-private partnership (PPP) • Fertilizer policy drafted with support of an agriculture working group • Areas needing support: 1) continued agriculture policy advocacy and reforms; 2) increased private sector involvement in the sector
Kenya	<ul style="list-style-type: none"> • Kenya is devolving hitherto central government functions to counties • Counties need sensitization and advocacy on fertilizer policy vis-à-vis devolution; there is a danger of counties interfering with the private sector by increasing subsidies for political reasons • Regional trade (input and output) restricted by dis-harmonized procedures; tariff and non-tariff barriers (T&NTBs) a problem in the region • Need to reform/update import/export regulations that delay registration of new fertilizer products • Ministry of agriculture has requested IFDC and the Tegemeo Institute do a performance evaluation of its subsidy system
Mozambique	<ul style="list-style-type: none"> • Open fertilizer market, private sector-driven; no fertilizer subsidy • Small market (low adoption of fertilizer at less than 5 percent of farm households using); most fertilizer imports through Mozambique are destined for neighboring countries • Draft fertilizer policy ready but not yet approved by parliament

Country	Status of Policy or Regulation
	<ul style="list-style-type: none"> • Areas needing support: 1) sensitization on fertilizer use to farmers, improved extension; 2) policy advocacy; 3) soil maps/tests to identify right fertilizers for crop/soils to help scale up use of fertilizer
Uganda	<ul style="list-style-type: none"> • Like Mozambique; nascent fertilizer use, low demand • Draft policy by Policy Research Center (PRC, Makerere University) awaiting stakeholder validation and then parliamentary approval • Planning to introduce fertilizer subsidy for the first time • Areas needing support: similar to Mozambique above; also need assistance to design and implement subsidy based on best practices (IFDC workshop, February 2018, was a response to this request from the ministry)
Malawi	<ul style="list-style-type: none"> • No specific “fertilizer” policy (some strategy in place); ad-hoc public directives provide guidelines to fertilizer market • State-run input and output agencies dominate distribution of inputs and procurement of maize, deterring private investment • Smallholder subsidy program constitutes large part of national budget, non-sustainable; now allowing select larger-scale distributors to accept fertilizer subsidy vouchers
Tanzania	<ul style="list-style-type: none"> • Has replaced subsidy program with bulk procurement of fertilizers (ongoing); need M&E to measure interim progress
Nigeria	<ul style="list-style-type: none"> • The Growth Enhancement Support (GES) program (2012-2015) was largely discontinued, which introduced an aggressive subsidy agenda under the Agricultural Transformation Agenda. However, some states are implementing subsidies but with no consistency.
Ghana	<ul style="list-style-type: none"> • Fertilizer policy in place • Soil fertility recommendations drafted by a number of organizations for the ministry in 2015 (MSU/IFPRI/IFDC/IITA/USAID-APSP)
Ethiopia	<ul style="list-style-type: none"> • Government-driven fertilizer sector from import to distribution • No private sector to speak of currently, as state has stake/intervention throughout value chain and support services • Need gradual liberalization of fertilizer market; need to support efforts geared to encourage private investment

Source: Authors based on various fertilizer market assessments; International Fertilizer Development Center (IFDC) <https://ifdc.org/country-fertilizer-market-assessments/>, Kuhlmann (2017), NML & AFAP (2017), and the African Fertilizer and Agribusiness Partnership (AFAP).

It is not surprising that there have been very few fertilizer policy impact studies in SSA (other than on fertilizer subsidy programs, discussed below), as it is difficult to track the “same” policy for sufficient time to do reliable analysis. The ever-changing policy environment creates problems of attributing outcomes to specific policies. However, some studies have made an attempt to estimate the impact of changes in fertilizer policy using both quantitative and qualitative measures. Sheahan et al. (2016) and Ariga and Jayne (2009) show that Kenya experienced an impressive rise in

fertilizer use following a series of input market reforms in the early 1990s. In this period, the government reduced its role in the fertilizer market and focused on establishing a conducive environment for private sector investment, including increasing public investments in rural roads. These reforms led to decreasing marketing margins and distances between farmers and fertilizer dealers. The studies estimated demand and supply functions and found that between 1997 and 2010 there was a 27 percent reduction in real fertilizer prices that can be attributed to falling marketing margins associated with market reforms, leading to a 36 percent increase in nitrogen use on maize fields and a 9 percent increase in maize production as a result of both yield and acreage effects.

2.2. Fertilizer Laws and Regulations

2.2.1. Why Regulate Fertilizers?

From an economic theory perspective, regulation is justified when there is imperfect market information and moral hazard, both of which can limit or prevent transactions. Under those circumstances, a third party, normally a government regulatory agency, should step in to ensure that adequate information is available to guide or facilitate market transactions or to enforce standards that ensure safe consumption of the product by the public and/or environmental safety.

In the case of fertilizer, regulation is justified if its use has a risk of externalities, such as dangers to the health of farmers or consumers, or hazards to the environment arising from high levels of dangerous metals like cadmium.

A second economic justification is predicated on the fact that inadequacies in purchased fertilizers are difficult or impossible for the consumer/farmer to recognize until after planting or, even later, at harvest. Further, any inadequacies detected may be difficult to ascribe. For example, the yield response to fertilizer use could be poor due to a number of reasons, including (1) inadequate land preparation by the farmer, (2) poor quality seed, (3) improper storage of fertilizer by the agrodealer, (4) high soil acidity or low soil organic matter, (5) late fertilizer application, or (6) adulterated fertilizers/low nutrient content due to poor fertilizer production standards by the manufacturer.

In sub-Saharan Africa, fertilizer regulation also is justified based on the existence of a host of existing market failures. In many SSA countries, farmers are not aware of the benefits and/or correct use of fertilizers; or, where they are, they may not have access to soil testing kits to identify the right type of blends for their soils and crops. In other cases, government soil nutrient maps are out of date and the private sector lacks complete information needed to prepare suitable fertilizer blends (Tripp & Gisselquist, 1996).

Given the importance of fertilizer regulation, justified by some of the reasons listed above, weak regulatory systems coupled with a lack implementation and enforcement capacity can leave fertilizer stakeholders vulnerable to unscrupulous or incompetent actors that can discourage farmers from buying fertilizers and throw the entire industry into disrepute (see Kuhlmann, 2017).

2.2.2. Common Regulatory Elements in SSA Countries

Typically, countries regulate fertilizer through some combination of measures, often consisting of a fertilizer policy (discussed above), acts, and regulations, which work together but perform distinct functions. While fertilizer policies tend to establish broad guidelines for the sector and establish related programs, such as capacity building and subsidies, Fertilizer Acts set forth a legally-binding framework that governs activities along the fertilizer value chain, such as obligations concerning manufacturing, importation, distribution, marketing, storage, trade, and use of fertilizers. Acts also prescribe regulatory and governance structures and create enforcement measures with penalties for failure to comply with their provisions. Typically, regulatory bodies are given administrative authority under an Act, and implementing regulations and supporting guidance (such as guidelines) elaborate on how the general obligations embodied in the Act will be applied in practice. It is important to understand the distinctions between policy, law, and regulation in the context of fertilizer market development, and, as noted above, more comprehensive study of approaches is needed (see Kuhlmann, 2017; NML & AFAP, 2016).

Legal and regulatory systems may function largely *ex ante* (i.e., impose controls prior to market entry, such as registration of fertilizer) or *ex post* (i.e., focus on enforcement to ensure quality of goods and services already in the market, such as unannounced inspections of wholesale or retail premises). In general, a shift towards *ex post* regulation is considered to be a more market-conducive aspect of the enabling environment, but many countries lack sufficient enforcement capacity and institutions, including accredited laboratories with sufficient equipment and trained staff (Kuhlmann, 2017).

Broadly speaking, laws and regulations are designed based on several important objectives, such as: (i) promoting consumer safety through the use of quality control mechanisms; (ii) boosting confidence in fertilizer quality among fertilizer suppliers and consumers; (iii) increasing transparency and non-discrimination in the design and application of fertilizer measures; and (iv) establishing clear communication strategies between regulators and market participants. The common components of fertilizer regulation in SSA are registration of products and businesses, setting of standards, quality inspection, and penalties and enforcement, as elaborated below (see, e.g., NML & AFAP, 2016).

- *Registration of fertilizer products:* In many SSA countries, fertilizer products must be registered before they can be sold commercially. Governments turn to fertilizer registration as an *ex-ante* approach to increase control over what types of fertilizers enter the market, increase market oversight or supervision, and help assure farmers that the fertilizer products they obtain in formal markets are both of good quality and safe. Registration of fertilizer products should allow new and innovative products to enter the market while maintaining safety and quality.
- *Registration and licensing of fertilizer businesses:* Allowing the private sector to freely engage in domestic fertilizer markets can result in more efficient markets and lower prices. More private sector participation in the market increases fertilizer access and use, which in turn raises crop yields and reduces national food import bills (World Bank, 2017). Besides registering their products, fertilizer traders are required to register their businesses with government offices for tax purposes, which can also facilitate their inclusion in a subsidy

program if the need arises. When transparently applied, registration as a fertilizer trader with the ministry of agriculture can provide benefits. It can form a legal bond between the regulatory authority and the fertilizer trader, ensuring that the trader respects fertilizer regulations (such as quality measures and truth-in-labelling standards), and providing a channel for enforcement if that trust is broken.

- *Fertilizer standards:* The implementation of marketing grades and standards for fertilizer is of paramount importance for the flow of goods and services along a supply chain. Standardization refers to grading, standards of identity, standardization of containers and packaging, standardized quotations, price posting, and product tests. Without standardization of respective formulations and nutrient content, trade can be constrained, and the true value of the products will not be apparent. In addition, lack of or poor labeling and branding reduces competition and denies farmers the information they need to make purchase decisions, which raises the costs of transactions.

The main body responsible for implementing and monitoring the regulatory framework for standards in a country is the Bureau of Standards (BS), which inspects the quality of fertilizers imported and distributed locally and enforces standards. Approaches to standards regulation can involve government-mandated standards and quality control procedures as well as labelling requirements that require that products be labelled to accurately reflect the content inside containers to protect consumers. Producers will often adopt a “truth-in-labelling” approach to further guarantee trust between buyers and sellers. Quality standards are set by the country and can also depend upon internationally accepted standards. In some cases, regional standards apply, which facilitates easy movement of blends and other fertilizer products within a region and harmonizes laboratory capacities (NML & AFAP, 2017). A typical inspection process checks for the following quality parameters: (i) uniform particle size; (ii) moisture content; (iii) nutrient content for compound fertilizers; (iv) presence and levels of heavy metals like cadmium, selenium, mercury, and arsenic; (v) proper documentation; (vi) integrity (reliability) of bags; and (vii) proper and correct labeling.

In general, product specifications and standards are operating well in the fertilizer sub-sector in SSA, mostly based on world market standards or benchmarks. Quality standards allow for ease of trade across space and time without physically viewing the products first before an order is made. This enables buyers to purchase sight-unseen, reducing transactions costs, as standards or grades are documented and known by both parties. While some SSA countries have labelling standards, few markets have yet to move to a complete truth-in-labelling approach, relying instead upon government interventions before product reaches the market. Regardless of the regulatory approach, it is critical that government ensure standards are enforceable with appropriate penalties for violations. For example, market surveillance techniques should include spot checks and inspections at multiple points along the value chain such as at blending factories, distribution centers, and retail shops.

- *Control of counterfeit fertilizer:* Many countries in SSA face challenges with adulterated, low quality, and counterfeit products on the market, which adversely affects fertilizer demand and private sector investment in the industry. Adulterated fertilizer also leads to

low crop response to fertilizer and, hence, adversely affects farm incomes, food security, and the environment. Regulations should target preventing poor quality fertilizers from reaching the market. Measures can include labelling requirements, rules on the sale of open and mislabeled fertilizer bags, practices for monitoring fertilizer quality, and enforcement of rules.

As noted, application of quality standards should be judicious and avoid burdening traders with unnecessary procedures and costs. A shift to a truth-in-labelling approach can help to ease government administrative costs and foster transactions based on trusting the nutrient content information on the bag.

- *Penalties and enforcement of regulations:* Fertilizer laws and regulations also include penalties for violating the stated provisions. An agency will be designated as responsible for monitoring quality control, and procedures for sampling and inspections as well as recourse for damages by any affected party will often be established. Inspections are not restricted to imports but can also be conducted at other points in the value chain. In most of SSA, the inspection capacity is limited (poor or no equipment and few trained inspectors), and, therefore, having a well-articulated regulatory framework is useful. This will allow the limited number of inspectors to do spot checks on suspect areas or non-compliant points along the value chain. Since there is demand from smallholder farmers for small quantities of fertilizers, it is important to allow sale from open bags. Regulations should allow this since it serves markets efficiently, with enforcement for non-compliance with fertilizer standards. However, whether bags are open or closed, focus on truth-in-labelling and enforcement is a more effective regulatory approach. Well-enforced labelling systems reduce the time and cost for companies to get products into the market, which allows farmers access to a greater array of quality fertilizer products at lower prices (Gisselquist & Van Der Meer, 2001).

2.2.3. Current Status of Fertilizer Regulatory Frameworks in SSA

The majority of countries in SSA do not have standalone Fertilizer Acts and accompanying regulations. Instead, the fertilizer industry is often regulated by ad-hoc government decrees, which are not binding and are subject to frequent change. For those countries that do have Fertilizer Acts in place, these Acts often cover other agrochemicals as well (e.g., pesticides and veterinary products); are severely outdated (e.g., as in Zambia and Zimbabwe); do not encompass new fertilizers and new fertilizer production technologies; and do not recognize or support the many changes that have occurred in the fertilizer industry (Sanabria et al., 2013). However, there are a number of countries that have updated or completely rewritten their Fertilizer Acts and/or regulations (e.g., Mozambique and Tanzania), and there are others that have embarked upon this process (e.g., Nigeria and Malawi). Consequently, governments in Africa demonstrate a wide range of regulatory frameworks (See New Markets Lab, 2017).

A number of countries have fertilizer standards, which are spelled out in more general Standards Acts or their respective fertilizer acts and policies. For example, fertilizer standards in Kenya are prescribed in the Standards Act, while in Ethiopia, Tanzania, and Uganda, they are contained in the fertilizer legislation. In many cases fertilizer standards are found in various statutes, which can confuse enforcement agencies and investors alike. Enforcement can be improved by capturing

standards under a single regulation that is framed by consistent criteria and benchmarks, including international benchmarks (White, 2014).

The majority of countries allow private sector entry into the fertilizer market, and some countries, such as South Africa, have allowed private companies to introduce new agricultural technologies with minimum interference. Others have extended input regulations, which have limited private participation in the fertilizer sector. In yet other countries, such as Ethiopia, the fertilizer industry is exclusively controlled by government through its quasi-government institution, the Agricultural Input Supply Enterprise (AISE) (Gisselquist & Grether, 1998; Sanabria et al., 2013). Over the last 15 years, a small but growing number of countries have eased regulations to facilitate private introduction of new agricultural technologies.

Regulations on registration of new products vary in SSA. In general, most countries require registration of new fertilizers, which may present an obstacle to private sector participation in the fertilizer industry. The majority of countries in SSA maintain a list of fertilizer products that traders are allowed to sell based on official ideas about plant response to different nutrients. Any new fertilizer products must go through a registration process, even if they are globally traded products with well-known properties and well-known risks associated with their use. The registration process typically includes testing for three years on trial plots at a prescribed number of trial sites (in Tanzania this requirement was recently reduced to one year). Further, any alteration in fertilizer composition, formulation, type, quantity, or quality triggers a new registration process. This means that even small changes in the formulation of a registered fertilizer can require a completely new registration. This regulation may negatively affect blends, because blends would be considered new and would be required to undergo the registration process even if there is only a change in formulation of nutrients already known in the market (New Markets Lab, 2017).

In addition to registration, many countries require import licenses and individual import permits (issued per consignment) to then bring in the products. In some countries, for instance Zimbabwe, importers need an import permit that is sourced from the Ministry of Agriculture. In Tanzania, fertilizer importation licenses are free; the application takes three days if it is fully supported with relevant documents for each consignment of registered product; and the license is issued for two consecutive years. For countries in the Southern African Development Community (SADC) region, a number of documents are required when importing fertilizer such as invoices, bills of landing, and certificates of origin, all of which are enforced by the Customs Agency (Sanabria et al., 2013).

Fertilizer quality control remains a hurdle in the fertilizer industry in SSA. Enforcement of regulations in many countries is left in the hands of the ministry of agriculture, and dedicated departments of fertilizer or quasi-governmental institutions have been developed for enforcement of fertilizer regulations, with a strong reliance on resources from the ministry (Sanabria et al., 2013). Inspection, pre-shipment inspection, and taking of samples at the port are common practices among SSA countries. Once the fertilizer leaves the port, inspection for quality may be conducted, but the inspection capacity at this stage is extremely low. According to the 2011 Status Report on the implementation of the Abuja Declaration on Fertilizers, 77 percent of the respondents carry out fertilizer inspection at the point of sale. However, the number of inspectors is too low relative to the need: for example, Burundi reportedly only had 4 inspectors, Lesotho had 2, Cote d'Ivoire 40, Kenya 80, and Ghana 30. Mali had increased the numbers of fertilizer inspectors from 12 to 31, while Uganda increased its number of inspectors from 35 to 70. Further, most of these

inspectors are not well-trained and are under-equipped. Moreover, a major bottleneck arises with the accreditation of testing laboratories. To date, many countries have established testing laboratories that must cater to a range of purposes (including fertilizer, soil, and animal feeds testing), but most are not internationally accredited. This can reduce the authority of test findings and limit the power a regulatory authority has over firms that are trading in non-compliant products. In countries such as South Sudan and Tanzania, which do not have accredited laboratories, samples are sent to other countries for testing (White, 2014).

Although the discussion above showcases some regulatory approaches within SSA, the situation in ECOWAS bears some emphasis. In 2012 ECOWAS passed regional fertilizer regulations (Regulation C/Reg.13/12/12 Relating to Fertilizer Quality Control in the ECOWAS Region). Within ECOWAS, regional rules are supranational and become a direct part of countries' domestic legal systems upon gazetting, although Nigeria and Ghana (which are Common Law jurisdictions in contrast to most of ECOWAS, which follows a Civil Code system) follow additional steps for ratification (New Markets Lab, 2017; see also Kuhlmann & Zhou, 2016). In addition, in order to fully domesticate the regional regulations, countries in the region will have to revise or in some cases completely rewrite their Fertilizer Acts in order to comply with the ECOWAS regulation, particularly if there are conflicts between the ECOWAS Regulation and national law. In some cases, national law may be completely silent on a topic that is covered under the ECOWAS Regulation; in a Civil Code country the latter would be assumed to prevail, although the discrepancy could still create confusion in the market. For example, in Burkina Faso's current Fertilizer Act, there is no mention of the validity of approval of a business license (although the ECOWAS regulation stipulates a period of three years); there is no mention of licensing of manufacturers or importers (the ECOWAS regulation refers to licensing for importers, manufacturers, agrodealers, and distributors, as well as requirements on the installation of plants); there is no reference to a fertilizer quality control manual (the ECOWAS regulation calls for the establishment of a fertilizer quality control manual); there is no mention of the inspection and analysis of fertilizers (these provisions are contained in the ECOWAS regulation); and there is no inclusion of the principles of access to information and participation in decision-making, which are of key importance for ensuring that all fertilizer sector stakeholders can participate in both decision-making processes and management of activities related to fertilizer (this principle is enshrined in the ECOWAS regulation). The situation in Burkina Faso is representative of the majority of countries in the ECOWAS region (Garane & Barry, 2017). Notably, however, the ECOWAS regulation does not require product registration and instead follows a truth-in-labeling approach (NML & AFAP, 2017).

2.2.4. Empirical Evidence of the Impact of Regulations on Private Sector Participation and Investment in Fertilizer Markets in SSA

As is made evident by the preceding section, while the literature contains information about the status of fertilizer regulations in some SSA countries, not much is known about their impact on fertilizer businesses in SSA. That is, while there is no doubt that the strict fertilizer registration requirements and weak quality control regimes in SSA contribute to limited access to the national input markets for international suppliers and limit the supply of fertilizer to farmers and effectively raise the prices they must pay, almost no studies have been done to measure the impact. However, considerable work has been done on this topic for seed, and there are key lessons to be learned and

best practices identified from the seed sector in this regard. The literature on impact of regulations on the fertilizer industry in SSA is scant and can be placed in four categories.

First, there is literature that describes the current status of fertilizer regulations in different countries around the globe and infers or predicts the impact on the private sector and even provides some anecdotal evidence to support its predictions. The prime example is the global index “Enabling the Business of Agriculture” (EBA), which was developed by the World Bank and has been implemented in 100 countries since 2012-13 (World Bank, 2017). The EBA benchmarks elements of laws and regulations that impact the enabling environment for agribusiness markets and aims to inform and encourage policy decisions that support inclusive participation in agricultural value chains. It has developed three fertilizer indicators to measure laws and regulations related to the registration, import, and quality control of fertilizer products: a) fertilizer registration; b) importation and distribution of fertilizers; and c) fertilizer quality control. For each indicator, EBA is focused on good regulatory practices for fertilizers. For fertilizer registration, EBA maintains that: a) fertilizer registration should not be expensive, should not be subject to periodic fees, and should not expire; b) an official fertilizer catalogue should be made available online; and c) registration of a fertilizer product should not be required if it is registered in another country that is part of a regional agreement or if it is approved in the regional catalogue. For the importation and distribution of fertilizers, good practices highlighted by the EBA include: a) all entities (private, public, non-governmental organizations, and producer groups) should be allowed to import and distribute fertilizers; b) all entities should be allowed to register as importers, and this registration should not be expensive and should not expire; and c) import permits should not be required or they should be imposed only at the trader level with no volumes, shipments or time limits, and they should not be expensive and should be easy to obtain. For fertilizer quality control, the EBA indicators call for the following: a) fertilizers must be packaged in sealed bags and labelled in at least one of the country’s official languages including details such as brand name, content, origin, manufacturing and expiry dates, and safety instructions; and b) regulations should exist that prohibit the sale of mislabeled and open fertilizer bags and impose penalties on those who fail to comply with set standards (World Bank, 2017).

The EBA (2017) study found that the majority of countries with the worst performance on the fertilizer indicators were located in SSA and include Liberia, Benin, Senegal, Ethiopia, Sudan, and Burkina Faso (World Bank, 2017). The study further found that these countries have very basic regulatory frameworks for registering fertilizer. Many of the countries that performed poorly with respect to regulations for importing and distributing fertilizer were also primarily located in SSA, where the renewal period for importer registrations are shorter and import permits are more expensive and valid for a shorter period of time. Ethiopia received the lowest score of all 62 countries in the 2017 study on importing and distributing fertilizer because the private sector is prohibited from engaging in fertilizer importation and distribution. The lowest scores in the quality control indicator were again found predominantly in SSA due to the absence of laws prohibiting mislabeled and open bag fertilizer, the lack of appropriate penalties, and the absence of labelling requirements in at least one of the official languages of the country. The study surmises that these regulatory shortcomings negatively impact the availability of appropriate fertilizer products in a timely manner on the market in SSA by creating a discouraging environment for the private sector, however it does not do any analysis or provide any rigorous evidence to support these inferences.

EBA provides a set of tools for assessing the enabling environment for increased fertilizer use and regularly updates its data set to ascertain how countries performed on these indicators over a period of time. It also makes some inferences regarding the impact of the findings on private sector engagement in the fertilizer market. However, as noted, it lacks analytical support or rigorous evidence for these inferences, and, specifically, it does not measure the impact of the enabling environment that is created on private sector entry and investment in the fertilizer sector. Due to the nature of the benchmarking tool, it necessarily leaves out certain good regulatory practices that could be important to a well-functioning enabling environment, including other aspects of registration noted above. In addition, some indicators (such as the set of indicators on fertilizer registration) focus more on the elements of regulation and do not necessarily provide a regulatory incentive to move from a system of fertilizer registration to more of an enforcement-focused, truth-in-labeling approach.

The second category of literature is studies from other regions of the world showing the impact of deregulation on technology transfer and private sector participation for products other than fertilizers. Gisselquist and Grether (1998) present two case studies that show that deregulation leads to a significant increase in technological transfer. In Bangladesh, the lifting of restrictions on imported diesel engines in the late 1980s led to a fall in price and an increase in their use by farmers as consumers shifted to cheaper and smaller engines. In Turkey, deregulation of seed imports (1982-84) caused a large increase in the number of varieties allowed for sale and a rapid expansion of private company participation.

The third category is literature that is focused on SSA and analyses the impact of fertilizer regulations on private sector participation in the fertilizer industry. However, this is not rigorous empirical evidence, and highlights only correlations, not causal relationships. An interesting example is provided by Ethiopia, where, over the years, the Government has frequently intervened and sometimes completely dominated the fertilizer industry. Some progress was made in the 1990s when the government seemingly liberalized fertilizer importation and distribution and adopted free market principles. A government parastatal, the Agricultural Input Supply Corporation,³ lost its monopoly on fertilizer trade and all subsidies were removed. The private sector responded rapidly to these reforms. By 1996 several private firms were reported to be importing fertilizer, and 67 private wholesalers and 2300 retailers had entered the market and assumed a significant share of the domestic fertilizer market. However, shortly after liberalization, studies revealed that because of trading policies that were heavily biased in favor of government-affiliated companies and parastatals, private fertilizer firms could no longer compete and quickly exited the market. Available data suggest that market share of private firms engaged in fertilizer import declined rapidly, from 33 percent in 1995 to zero in 2009. Similarly, the public sector's share of distribution soared to over 70 percent, while that of private dealers was drastically reduced to only 7 percent of sales nationwide during the same period (AGRA, 2014). Today the AISE is in complete control of the fertilizer market and the sole importer and distributor of fertilizer in Ethiopia, and there are hidden subsidies in the procurement and distribution of fertilizers in the form of lower interest rates on finance provided to AISE to import fertilizers and operational and infrastructure costs related to fertilizer importation and distribution. AISE in collaboration with the cooperative unions and regional governments has a monopoly on importing fertilizer and is supported by a government-guaranteed credit scheme and loans from commercial banks. The main regulatory

³ Today it is the Agricultural Input Supply Enterprise or AISE.

hurdle that hinders private sector participation in the fertilizer industry in Ethiopia is the requirement that private firms obtain an import license from the Government of Ethiopia (GoE). Import licenses are usually allocated through a tender process and require that fertilizers be imported in lots of 25,000 tons – which costs between US\$5-10 million. Given that the GoE would require private importers to deposit 100 percent of the value of fertilizer to be imported when the line of credit is opened and for an import license to be issued, it is no surprise there is no local private importer of fertilizer in Ethiopia (Gisselquist et al., 2013; Spielman et al., 2011).

The fourth category is literature for SSA that is a little more rigorous, in that it analyses the impact of regulations on technology transfer and innovation as well as on private sector entry into fertilizer and other agro-input markets in Africa. Nevertheless, it is still mainly anecdotal and not published in peer-reviewed journals. During 2009-2011, teams of scientists and economists from the International Food Policy Research Institute (IFPRI), McGill University, and Rutgers University conducted a study in five countries, four of which are in Africa (Bangladesh, Kenya, Senegal, Tanzania, and Zambia) to assess private sector technology transfer and analyze the interactions between agriculture technology transfer and introduction, and private sector investment in research. Across all the countries the findings were that: private companies introduce most new agricultural technologies although the most common type of firms reporting innovations were seed firms that imported or bred new plant varieties; and that private technology transfer led to and supported private research. However, the study found that government regulatory controls on the introduction of several categories of agricultural inputs, including fertilizers, discouraged private technology introduction.

Pray et al. (2011) built on this study adding country surveys from South Africa. The paper documents the amount of private R&D and technology transfer being undertaken in SSA, identifies its impact, and suggests government policies and investments that might encourage the private sector to become more fully engaged in the agricultural sector in Africa. The key findings were: the most common types of firms reporting innovations were seed firms that imported or bred new plant varieties followed by firms in the pesticide or processing industries. The major source of innovations for the seed and pesticide industry was imported technology whereas local sources of innovation were more important for the fertilizer, food processing and machinery industries. Out of the five African countries only Kenya had some companies that invested in R&D for fertilizers; the two industries that have attracted the most R&D investment in Africa are the seed and processing industries.

The paper then assesses the impact of private innovation and R&D on yields and incomes but the majority of the studies cited relate to the impact of hybrid and genetically modified seed and no studies are cited for fertilizer. The identified government policies that encouraged research on private agricultural technology and its introduction include: the liberalization of agricultural input and output markets by reducing trade barriers; elimination of government monopolies; allowing local and foreign private firms to enter the agricultural sector; public investment in R&D since government research institutes and universities are the main sources of scientists to private R&D institutes; an enabling regulatory environment that does not restrict the introduction of new technologies on the basis of government tests of technology performance but instead allows unrestricted entry of new technologies (apart from regulations required to protect consumer health or the environment) and allows companies and farmers to decide which technologies perform well in their fields; and strong intellectual property rights that will allow private companies to capture

some of the benefits of new technology. However, none of the policies and regulations mentioned related specifically to the fertilizer industry. Further, the paper does not do any analysis of the impact of the policies and regulations on technology transfer and introduction, and although fertilizer is mentioned, the main focus of the study is the seed industry. Clearly this type of work has not been carried out for the fertilizer sector.

Gisselquist, Nash, and Pray (2002) describe regulatory reforms to remove barriers to private technology transfer and their impact on input industries in Bangladesh, India, Turkey and Zimbabwe. Using data from the four countries, they tested the following hypothesis: regulatory reforms reducing obstacles to the introduction of new agricultural technology stimulate technology transfer. Between 1980 and 1993, the regulatory reforms in these countries were as follows: Bangladesh, Turkey, and Zimbabwe ended fertilizer price controls and relaxed import controls, reducing barriers to company and product entry. Turkey and Zimbabwe maintained controls on fertilizer composition and Bangladesh introduced them. All three countries produced much of their own fertilizer: Turkey's industry included public and private companies; Bangladesh had several public plants and one private plant; and Zimbabwe's fertilizer production was all public. Fertilizer reforms left production patterns intact but removed barriers to private trade starting in 1990 in Bangladesh, 1986 in Turkey, and 1995 in Zimbabwe.

The study found that these reforms, particularly those allowing private imports, brought market entry, new products, and lower margins. In Bangladesh, expansion of private trade produced a shift from triple super phosphate to single super phosphate (the latter includes sulfur). The sulfur content of fertilizer sales grew from 14,000 tons (1.5 percent of all nutrients) in 1989/90 the last year before the reforms to 89,000 tons (7 percent of all nutrients) in 1995/96. This shift makes sense in light of the widespread sulfur deficiency in Bangladesh and suggests that pre-reform products – with production and imports controlled by the government – did not address soil deficiencies. Aggregate fertilizer sales continued to grow after reform at least as fast as they did before reform. Omnia, a major South African company, entered Zimbabwe with new compositions in 1995. Existing companies responded with their own new compositions. Omnia offers soil tests and made-to-order bulk blending for large customers.

Linked to the above, there is anecdotal evidence that regulatory regimes in SSA are stifling private sector investment in new products. The fertilizers used in the majority of countries in SSA have not changed over the past 20-30 years despite the fact that the crop mix and nutrient needs of the soils have changed. For example, the standard NPK formulation in Ghana is 15-15-15, established over 25 years ago, but this one-size-fits-all formulation is ill-adapted to soil differences across production zones and to different crops (AGRA, 2014). A key reason is the absence of regulations that require soil mapping and updating of fertilizer recommendations. Hence, even if the private sector wants to develop or import more suitable fertilizer products it does not know what is required unless they do their own tests. Further, the incentive to do so in many countries is low due to the stiff regulations and requirements around introduction of new products/technologies as described in the previous section.

There is also evidence of a high prevalence of poor quality fertilizers in SSA (weight, moisture content, nutrient content) but there is only anecdotal evidence that it is due to the weak regulatory regimes for fertilizer in SSA. The deregulation of the fertilizer industry in Nigeria and the government's complete exit from the industry, which increased the number of private actors in the

market, also stimulated the emergence of a number of rent-seeking entrepreneurs who have flooded the market with fake and adulterated products. Stakeholders contend that fake fertilizers are at an all-time high and a key reason is that Nigeria lacks a fertilizer act, a regulatory framework, and an independent agency to effectively govern and monitor the sale and distribution of fertilizer in the country (AGRA, 2014).

Similarly, there is a high prevalence of adulterated fertilizers in Uganda, which stakeholders attribute to the fact that until recently (late 2017) there was neither a Fertilizer Act nor Fertilizer Regulations in Uganda. A study of fertilizer quality in Uganda by Bold et al. (2017) found that 30 percent of N was missing from the urea fertilizer sampled. Similarly, Mbowe et al. (2015) found that analytical results from fertilizer samples in Uganda revealed low quality fertilizers with moisture content above acceptable limits of 0.5-1.5 percent, and untruthfulness in both weight and nutrient content. Results for urea fertilizer, the most common type on the market, revealed that it typically had 33 percent less nitrogen content compared to what was stated on the label.

The study also found that repackaging fertilizer into smaller quantities, while justifiable to meet the requirements of smallholder farmers, leads to loss of nutrients (especially nitrogen) and also aggravates the high moisture content problem. Overall, the study found that Ugandan farmers are pessimistic about fertilizer quality and that they expect nitrogen content of fertilizers to be lower than stated on the label.

IFDC has also undertaken regional studies of fertilizer quality in SSA. The methodological and analytical approach was quite rigorous, involving extensive market research and product testing. The findings indicated the prevalence of quality issues, namely: very low evidence of adulteration but severe nutrient deficiencies in bulk blends due mainly to inappropriate blending technology, frequent bag weight shortages, low quality of fertilizer imports, and degradation of physical attributes due to manual handling and inadequate storage. However, no assessment was done at the same time of the presence or lack thereof of a Fertilizer Act and accompanying regulations or whether there was any relationship between the status of the act and regulations and the prevalence of quality issues (Sanabria et al., 2013). That is, none of the studies on fertilizer quality sought to establish a linkage between the high prevalence of quality issues in the fertilizer industry in SSA and the status of the regulatory framework.

With regard to the impact of overregulation, while there are examples of overregulation in the fertilizer industry in SSA blocking the introduction of new technologies, the magnitude of the losses has not been investigated. To cite just one example: many countries in East Africa such as Tanzania and Kenya have adopted a maximum cadmium (Cd) specification of 7 parts per million (ppm), meaning they do not accept fertilizer with Cd levels above 7 ppm; this is the lowest Cd specification in the world. The majority of global fertilizer suppliers have a maximum specification of 30 ppm Cd so such a low maximum Cd specification excludes many suppliers from this market. In comparison, Tripp and Gisselquist (1996) provide the example of the Government of Turkey, which allowed the introduction of private maize hybrids in the mid-1990s, leading national maize yields to double within several years. The response to regulatory reform in this case suggests that annual foregone gains due to government controls on seed trade had exceeded \$100 million in the years before the reform (Tripp & Gisselquist, 1996).

2.3. Recommendations

To promote an enabling environment conducive for market growth, it is imperative that regulation of fertilizer promote competitive markets and shift towards a more ex post regulatory approach focused on truth-in-labelling. First, governments should allow companies to take the initiative to introduce new nutrients, grades, compositions, or mixtures without requiring additional registration. This will accelerate the introduction of useful products for all crops and soil conditions, and also allow companies to shop around for the best price per unit of nutrients. Second, if included in regulations, registration should be optional or automatic and be primarily designed to enable the government to carry out its oversight function. Registrations should have no time limit (or should last for at least 10 years), and registered fertilizer products should be listed in official catalogues that are accessible online. If companies are making other claims such as slow release claims, then the government may require registration based on a review of company or official efficacy tests. Third, registration procedures should be time- and cost-efficient to ensure that new products can reach the market in a timely manner. If registration becomes lengthy and expensive, it distorts competition by limiting the number of players and products in the market (World Bank, 2017). Therefore, if required, registration should take the least amount of time possible and involve the minimum number of procedures possible while still achieving its objectives. Countries may require companies to register fertilizer products in three ways: once in a lifetime, periodic reapplication for registration, or automatic renewal of registration after a certain period of time. A single registration of fertilizers is the most preferable, as it reduces transaction costs for private companies.

In general, regulations should not be burdensome to businesses. Overregulation or underregulation can lead to a restricted menu of products available in the market or allow inappropriate products to enter the market, with negative implications for productivity and the environment. Notably, an independent fertilizer regulatory authority with an appropriate mandate, staff, and laboratories could advance a stable and predictable regulatory environment as well as support development of and alignment with regional and international frameworks. (NML & AFAP, 2017). In addition, a shift to ex post measures is a good regulatory practice but requires sufficient capacity to implement such systems, and governments may consider establishing a reform process that strategically sequences short- and long-term regulatory interventions, as well as incorporates training, awareness, and capacity building (Kuhlmann, 2017). There are considerable costs to establishing the wrong regulatory regime, and many current regulatory systems in SSA are having difficulty adjusting to rapid technical change in agriculture and the growth of private input trade. It is important, therefore, to identify appropriate priorities for regulatory activity in SSA (Tripp & Gisselquist, 1996).

Registration of businesses can serve a legitimate purpose, but it can also increase the administrative burden and may lead to limiting market entry deliberately or inadvertently, thereby encouraging and protecting oligopolies or monopolies at various levels of the fertilizer supply chain. At the retail level, the requirement that agrodealers get approval from the ministry of agriculture to sell fertilizer may discourage legal trade of fertilizers altogether, since the volume of their fertilizer trade is small and seasonal. Therefore, the ideal situation is as follows: governments should either allow market entry without business registration or design the registration process to be simple, inexpensive, and non-restrictive based on low-cost objective criteria, not on discretionary

judgement. Agrodealers should be allowed to sell without registration up to some annual turnover or sell under the authority of registration held by wholesalers/distributors.

2.4. Knowledge gaps

This section has assessed the available evidence on the impact of the enabling environment for fertilizers on the private sector in SSA. There is substantial anecdotal evidence that the current policy, legal, and regulatory environment for fertilizer markets in SSA is not conducive to private sector entry and investment and, therefore, is posing a substantial obstacle to market growth and increased efficiency. However, there is little rigorous empirical evidence to this effect. There is a need for additional research on this issue, and the following five knowledge gaps are proposed/have been identified as starting points.

First, what are the impacts of changes in the regulatory environment (with regards to fertilizer registration, importation and distribution, and quality control) on private sector participation and investment as well as on the introduction of new fertilizer products, fertilizer prices, and the level of competition in the fertilizer sub-sector? EBA has developed a set of benchmarks designed to reflect regulatory good practices for fertilizer and has identified countries in SSA that are performing poorly on the indicators and some that are performing well (World Bank, 2017). But a broader range of regulatory approaches and good practices should be studied, and what is not known is the impact of these regulatory actions on the fertilizer market, e.g., do the countries that are following regulatory good practices in SSA have more vibrant and sustainable fertilizer markets than those that are not following regulatory good practices?

Second, further work on the implementation of these regulatory practices should be conducted, since there is often a vast divide between regulations on paper and their application in practice (see Kuhlmann, 2015). This is an area in which the New Markets Lab and AFAP have begun conducting work that could provide a useful foundation. For example, the New Markets Lab and AFAP developed Legal Guides with support from AGRA and USAID to assess the regulatory system on paper and in practice in Ethiopia, Malawi, Mozambique, and Tanzania. These Legal Guides, which are based on a broader set of Legal Guides developed by the New Markets Lab, both assess the current legal and regulatory environment and evaluate its impact on market stakeholders, incorporating implementation of laws and regulations into the tool's design. For fertilizer, this work could be extended to other countries and regularly updated over time.

Third, what is the impact of deregulation on technology transfer and innovation – i.e., to what extent have regulatory reforms that have reduced obstacles to the introduction of new agricultural technology stimulated technology transfer and innovation?

Fourth, what is the impact of overregulation – i.e., what are the foregone gains due to overregulation of the fertilizer industry in SSA, which has blocked the introduction of new fertilizer technologies that are more suitable for soil and crop nutrient needs? As part of this, it would be valuable to assess the gains of moving to a truth-in-labelling approach (with a shift away from fertilizer product registration requirements).

And fifth and finally, what are the effects of poor quality fertilizer products on fertilizer demand, agricultural productivity, and farm incomes?

3. Fertilizer Subsidy Programs & the Creation of an Enabling Environment for Fertilizer Value Chains in SSA: Current Status, Evidence of Impact, and Knowledge Gaps

3.1. Overview of fertilizer subsidy programs in sub-Saharan Africa

Fertilizer subsidies have been a popular agricultural policy tool in SSA for decades (Morris et al., 2007). A fertilizer subsidy program (FSP) is one in which farmers can purchase fertilizer at less than the market price (or, in some cases, receive it for free). There are two broad types of fertilizer subsidies: universal and targeted. Universal subsidies are blanket, pan-territorial subsidies that (in theory) are available to all farmers. Targeted subsidies, on the other hand, are only available to farmers that meet certain eligibility criteria.

Under both types of subsidy programs, the fertilizer is provided to farmers for free or at a reduced price. Most FSPs in SSA were universal prior to structural adjustment in the 1980s and 1990s, when many FSPs were scaled back or eliminated altogether due to unsustainably high burdens on national treasuries (Morris et al., 2007). In contrast, many of the FSPs that have been put into place in the region since the early to mid-2000s have been targeted (Jayne & Rashid, 2013; Jayne et al., 2018). Another key difference is that subsidized fertilizer was almost exclusively distributed by government or parastatal entities prior to structural adjustment; since then, however, FSPs have been trending toward greater involvement of the private sector in the procurement (importation or manufacture) and/or distribution process (Morris et al., 2007). As of 2017/18, at least 14 countries in SSA had active FSPs, and recent estimates suggest that total government expenditures on the programs (including associated spending on subsidies for improved seeds) exceed US\$1 billion per year (Jayne et al., 2018).⁴

In the remainder of this section, we describe the major elements of the main FSPs in Malawi, Zambia, Tanzania, Nigeria, Kenya, and Ghana since the early 2000s. These six countries are chosen for two main reasons. First, there are some major differences in their approaches, and as such, they can be thought of as different FSP archetypes. And second, the vast majority of the empirical literature on the effectiveness of FSPs at meeting their objectives, including, *inter alia*, stimulating commercial fertilizer demand or supporting the development of private sector fertilizer value chains, comes from these six countries. Table 2 summarizes some of the key features of these programs.

Notably, the six countries highlighted below are all developing country Members of the World Trade Organization (WTO). As such, they are subject to WTO disciplines (and may qualify for related exemptions) concerning certain agricultural domestic support measures, which can include

⁴ These countries are Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Lesotho, Malawi, Mali, Nigeria, Rwanda, Senegal, Swaziland, Zambia, and Zimbabwe. Note, however, that although the Government of Ethiopia (GoE) subsidizes farmers' organizations, which then provide fertilizer to farmers at below-market prices, the GoE does not consider this to be an FSP per se. In Nigeria, the Growth Enhancement Support Scheme essentially ended in 2015 but some states continue to implement FSPs.

fertilizer subsidy programs like those discussed in this paper. Under the WTO Agreement on Agriculture, Members must reduce the amount of money spent on agricultural support measures that have a direct effect on production and trade each year. This calculation is known as the “Aggregate Measure of Support (AMS).” If a fertilizer subsidy program falls under this restriction, then the WTO Member must include it as part of its AMS calculation and any subsidy above the AMS is prohibited. However, developing countries receive special and differential treatment (S&DT) under the WTO. Under Article 6(2) of the Agreement on Agriculture, developing country Members may exempt the abovementioned measures from their AMS calculation if the measures (1) “encourage agricultural and rural development” as “an integral part of the development programs of developing countries” and (2) are “generally available to low-income or resource-poor producers.” (NML & AFAP, 2017).

Malawi

Malawi was one of the first countries to re-introduce an FSP after structural adjustment. Its first post-structural adjustment FSP was the Starter Pack (SP) program, which ran from 1998/99-1999/2000. Under the program, all Malawian smallholder farm households were to receive a package of free inputs consisting of 15 kg of inorganic fertilizer, 2 kg of hybrid maize seed, and 1 kg of legume seed. Given the vast scale and costliness of the program, it was heavily criticized by donors and the International Monetary Fund, and subsequently replaced by the Targeted Inputs Programme (TIP) in 2000/01 (Harrigan, 2008).

Continuing through 2004/05, the TIP also provided beneficiary farmers with a free pack of inputs (initially the same quantities as the SP but with open-pollinated variety (OPV) maize seed instead of hybrid; later 25 kg of inorganic fertilizer, 5 kg of OPV maize seed, and 1 kg of legume seed). However, unlike the SP that sought universal coverage of smallholder farm households, as its name suggests, the Targeted Inputs Programme was targeted and aimed to reach only a subset of smallholders in the country (Druilhe & Barreiro-Hurlé, 2012). Officially, TIP inputs were to be allocated to the poorest farmers using community-based targeting but there is little evidence that this was done in practice (Levy & Barahona, 2002).

TIP was replaced by the Farm Input Subsidy Programme (MFISP) in 2005/06 and the program continues to run to date. MFISP is a targeted program (like its predecessor) and as of 2016/17, beneficiary farmers were to each receive paper vouchers for the following inputs: one 50-kg bag of NPK and one 50-kg bag of urea (with coupons valued at MK15,000 per 50-kg bag of fertilizer); 5 kg of hybrid maize seed or 6 kg of OPV maize seed (with the coupon valued at MK5,000); and 2-3 kg of legume seed (with the coupon valued at MK2,500) (CDM, 2017). Farmers were to pay the difference between the market price and the coupon value to obtain the inputs. Targeting criteria and targeting mechanisms have varied over the years of MFISP implementation but two general criteria have been that recipients be full time smallholder farmers and not be able to afford 1-2 bags of fertilizer at the market price (SOAS et al. 2008); however, implementation and enforcement of the beneficiary selection criteria has been weak (Lunduka et al., 2013). An additional challenge has been the cost for the program, which accounted for around half of the Ministry of Agriculture’s 2011/12 budget and competes with other priorities like research and development (FAO, 2014).

With regard to fertilizer for the program, from 2005/06 through 2014/15 (with the exception of 2006/07 and 2007/08), the role of the private sector was limited to importation/procurement and transportation (Table 2). State-owned enterprises (the Agricultural Development Marketing Corporation (ADMARC) and the Smallholder Farmers Fertilizer Revolving Fund (SFFRFM)) also participated in importing/procuring and transporting the fertilizer, and farmers had to redeem all fertilizer vouchers at ADMARC or SFFRFM depots.

In contrast, private seed companies and agrodealers have been involved in the seed component of the MFISP and have always been allowed to accept MFISP seed vouchers since the early years of the program. The Malawian government allowed select larger-scale distributors and affiliated retailers (but not independent agro-dealers) to accept MFISP fertilizer vouchers in 2006/07 and 2007/08 but this policy was stopped abruptly in 2008. These private sector actors were again allowed to accept MFISP fertilizer vouchers beginning in 2015/16 in nine of the 28 districts in the country as a pilot (Kaiyatsa et al., 2018), then all 28 districts from 2016/17 to date (CDM, 2017) after the evaluation of the pilot. ADMARC and SFFRFM still continue to accept MFISP fertilizer vouchers as well.

Table 2. Key features of recent FSPs in Ghana, Kenya, Malawi, Nigeria, Tanzania, & Zambia

Country	Program (Years)	Point(s) in the value chain at which the subsidy occurs	Targeted or universal subsidy?	Vouchers used? (type)	Importation/ procurement of FSP fertilizer	Transportation of FSP fertilizer to point where collected by beneficiaries	Retailing or distribution of FSP fertilizer to beneficiaries
Ghana	GFSP (2010-present excluding 2014)	Farmer	Nearly universal (see note)	No (waybill system)	Private sector	Private sector	Accredited sales agents associated with selected fertilizer companies
Kenya	NAAIAP Kilimo Plus (2007-present)	Farmer	Targeted	Yes (paper then (mobile phone-based e-voucher)	Private Sector	Private Sector	Private sector (selected registered agro-dealers)
	NCPB fertilizer subsidy program, (2001-present)	Farmer	Universal (for registered and verified farmers)	No	Government (NCPB)	Government (NCPB)	Government (NCPB)
Malawi	TIP (2000/01-2004/05)	Farmer (free)	Targeted	Yes (paper)	Government (SFFRFM, ADMARC) and private sector via government tender	Private sector via government tender	Government (SFFRFM, ADMARC)
	MFISP (2005/06, 2008/09-2014/15)	Farmer	Targeted	Yes (paper)	Government (SFFRFM, ADMARC) and private sector via government tender	Private sector via government tender	Government (SFFRFM, ADMARC)
	MFISP (2006/07 and 2007/08)	Farmer	Targeted	Yes (paper)	Government (SFFRFM, ADMARC) and private sector via government tender	Private sector via government tender	Government (SFFRFM, ADMARC) and private sector (select large-scale distributors)
	MFISP (2015/16-present)	Farmer	Targeted	Yes (paper)	Government (SFFRFM, ADMARC) and private sector via government tender	Private sector via government tender	Government (SFFRFM, ADMARC) and private sector (select larger-scale distributors in pilot districts (2015/16) then all districts (2016/17-present))
Nigeria	FMSP (1999-2011)	Farmer and state-level	Universal	No	Private sector via government tender	Private sector via government tender	Government (mainly Agricultural Development Project outlets)

Country	Program (Years)	Point(s) in the value chain at which the subsidy occurs	Targeted or universal subsidy?	Vouchers used? (type)	Importation/ procurement of FSP fertilizer	Transportation of FSP fertilizer to point where collected by beneficiaries	Retailing or distribution of FSP fertilizer to beneficiaries
	KSVP (2009-2011)	Farmer and state-level	Targeted	Yes (paper)	Private sector via government tender	Private sector via government tender	Private sector (selected agrodealers)
	GES (2012-2015+)	Farmer	Targeted	Yes (mobile phone-based e-voucher)	Private sector	Private sector	Private sector (selected agrodealers)
Tanzania	NAIVS (2008/09-2013/14, 2015/16)	Farmer	Targeted	Yes (paper)	Private sector	Private sector	Private sector input suppliers and agrodealers
	NAIVS (2016/17)	Farmer	Targeted	Yes (paper)	Quasi-government (TFC)	Quasi-government (TFC)	Quasi-government (TFC)
Zambia	Traditional ZFISP, 2002/03-2016/17	Farmer	Targeted	No	Government (NCZ) and private sector via government tender	Private sector via government tender	Selected registered cooperatives (distribution)
	ZFISP e-voucher, 2015/16-present	Farmer	Targeted	Yes (prepaid Visa cards)	Private sector	Private sector	Private sector (selected input suppliers and agrodealers)

Notes: Ghana – “nearly universal”: all food crop farmers regardless of any size were eligible from 2010-2013; from 2015 onward, the program was geared toward “smallholders” cultivating various food crops, with potential consideration of farmers involved in out-grower schemes (Resnick & Mather 2016; Ministry of Food and Agriculture 2017).

Zambia

Zambia's major FSP in the post-structural adjustment era has been the Fertilizer Support Program (ZFSP), which was introduced in 2002/03 and renamed the Farmer Input Support Programme (ZFISP) in 2008/09.⁵ ZFISP continues to run to date but, as discussed below, the program transitioned from a traditional, government-led FSP to a more private sector-oriented program that utilizes electronic (e-) vouchers beginning in 2015/16. We refer to the former as the "traditional ZFISP" and the latter as the "ZFISP e-voucher". All three programs (ZFSP, traditional ZFISP, and ZFISP e-voucher) are targeted FSPs.

Although not strictly enforced (see World Bank 2010 and Mason et al., 2013), the official eligibility criteria for the ZFSP were that beneficiaries: (i) "be a member of a registered cooperative or other farmer organization"; (ii) "be a small scale farmer [i.e., cultivate less than 5 ha of land] and actively involved in farming within the cooperative coverage area"; (iii) have "the capacity to grow 1-5 hectares of maize"; (iv) "should be able to meet 50 percent of the cost of inputs" (lowered to 40 percent in 2007/08, then 25 percent in 2008/09); (v) "should not concurrently benefit from the Food Security Pack" (a small, grant-based FSP targeted at the poorest of the poor farmers); and (vi) "should not be a defaulter from the Food Reserve Agency and/or any other agricultural credit program" (e.g., the FCP) (MACO, 2002, p. 5).

In addition, only farmers that were members of a cooperative or other farmer organization that was selected to participate in ZFSP were allowed to be ZFSP beneficiaries, as the program was administered through these cooperatives/farmer organizations. Farmer beneficiaries were to receive 200 kg of basal dressing fertilizer, 200 kg of top dressing fertilizer, and 20 kg of hybrid maize seed.

ZFSP had a number of objectives. Those of most relevance to the current study are: (i) "to increase private sector participation in the supply of agricultural inputs to smallholder farmers thereby reducing government involvement"; (ii) "to ensure timely, effective, and adequate supply of agricultural inputs in the country"; (iii) "to improve access of smallholder farmers to agricultural inputs"; and (iv) "to expand markets for private sector input suppliers and increase their involvement in the distribution of agricultural inputs in rural areas, thereby reducing [the] direct role of government" (Ibid., p. 2). ZFSP was initially supposed to end after three years; instead, the scale of the program grew over time from 120,000 intended beneficiaries in 2002/03 to 1.6 million in 2016/17.

Despite the heavy emphasis on private sector participation in the program's objectives, ZFSP was heavily government-run. The role of the private sector was limited to importing/procuring top dressing (urea) for the program, transporting it to district centers, and then to farmer cooperatives, all on behalf of government (Table 2). No vouchers were used, and beneficiaries collected the subsidized inputs from their cooperative/farmer group. The parastatal Nitrogen Chemicals of Zambia (NCZ) provided the basal dressing (compound D) in most years of the program. As

⁵ The Zambian government implemented a fertilizer credit program (FCP) through the Food Reserve Agency from 1997/98 through 2001/02. Although the program was not officially an FSP and farmers were to be paying the market price for fertilizer they acquired through the program on credit, repayment rates were extremely low. Thus, *de facto*, the program was like an FSP. See Mason et al. (2013) for details.

discussed further below, although tenders for importation/procurement (and transport) were to be awarded based on a competitive bidding process, two companies repeatedly won the tenders for importing urea (Omnia and Nyiombo Investments Limited).

ZFSP was renamed ZFISP in 2009/10, and the major programmatic change was that the input pack size was cut in half to 100 kg of basal dressing, 100 kg of top dressing, and 10 kg of hybrid maize seed. The farmer eligibility criteria largely stayed the same as ZFSP except that the hectares of maize farmers had to have the capacity to grow was reduced from 1.0 to 0.5 in 2009/10; this criterion was then dropped in 2013/14 (MACO, various years; MAL, various years). Farmers also had to be registered with the Ministry of Agriculture to participate in ZFISP starting in 2013/14.

After years of pressure from donors and in the face of severe budget constraints (Resnick & Mason, 2016), Zambia began piloting an e-voucher approach to ZFISP in 2015/16. The ZFISP e-voucher program was implemented in 13 districts in 2015/16, 39 in 2016/17, and then nationwide (106 districts) in 2017/18.⁶ During the pilot period, the traditional ZFISP continued to operate in the non-pilot districts. Beneficiary farmers received prepaid Visa cards that they could redeem at participating input suppliers' and agrodealers' shops upon activation. E-voucher cards were to be activated once farmers paid the required farmer contribution through their cooperative or other farmer organization. The farmer contribution was K400 in 2015/16 and 2016/17, and government contributed an additional K1700. The program utilized an existing Visa card platform that had been established by the Zambia National Farmers Union for some of its programs.

In addition to the major change of introducing e-vouchers that could be redeemed at private sector retailers' shops (as compared to the government-centric approach of the traditional ZFISP), the other major design change with the ZFISP e-voucher is that it was no longer limited to fertilizer and maize seed.⁷ Instead, beneficiaries could redeem the vouchers for a range of crop, livestock, poultry, and fish farming inputs and equipment (subject to availability at the input suppliers' shops). The eligibility criteria for the e-voucher were also slightly different, with a hectares-cultivated requirement of 0.5-2 ha (instead of a maximum of 5 ha), or that the farmer raise a certain number of livestock (2-10 cattle, 5-30 pigs or goats, 20-100 chickens, or 1-2 fish ponds).

Tanzania

After structural adjustment, the Government of Tanzania (GoT) re-introduced fertilizer subsidies in 2003, and from 2003-2007, the subsidy was in the form of a subsidy on internal transport costs for private sector distributors and agrodealers.⁸ However, there was no mechanism in place to ensure that distributors and agrodealers passed on the savings to farmers. Thus, as of 2007/08, the GoT instead began implementing a targeted, voucher-based FSP that was somewhat modeled on the Malawi FISP but with modifications to make it more private-sector friendly.

The program was called the National Agricultural Input Voucher Scheme (NAIVS) beginning in 2008/09, and it was implemented with financial and technical support from the World Bank. In

⁶ The information in this section is drawn from the MoA (2015, 2016).

⁷ Beginning in 2010/11, the traditional ZFISP included very small quantities of seed for other crops but the program continued to be heavily dominated by the maize seed and fertilizer components until the introduction of the e-voucher.

⁸ The information in this section is drawn from Mather (2016) and Mather et al. (2016).

2009/2010, the program targeted 1.5 to 2 million beneficiaries covering 57 districts (AFAP, 2015). However, NAIVS constitutes a significant investment for the government and its development partners. The cost during one three-year period from 2009/2010 to 2011/2012 is estimated to be USD 100 million, with a near even split between the government (47 percent) and the World Bank (53 percent) (Benson et al. 2015). The subsidy accounted for more than 40 percent of the entire Ministry of Agriculture budget in 2012 (AFAP 2015). Its sustainability is also impacted by concerns related to poor transparency and administration. (NML & AFAP 2017). NAIVS was implemented through 2013/14 but temporarily suspended in 2014/15 due to long delays in GoT repayment of importers. The program resumed in 2015/16 and the private sector participated, but repayment delays continued, and private sector importers refused to participate in 2016/17. The government continued to implement NAIVS in 2016/17 but all fertilizer for the program was imported/procured and distributed by the Tanzania Fertilizer Company (TFC), a majority state-owned company.

In 2017/18, the GoT replaced NAIVS with a bulk procurement system under which one private sector importer was selected via a competitive bidding process to import fertilizer on behalf of all local distributors and importers who did not win the bid. Once fertilizer arrived, the lead importer was to distribute this to local distributors and importers in quantities agreed upon prior to the initiation of imports. The goal of the program was to bring down the per unit costs of fertilizer through bulk procurement.

Under NAIVS, beneficiaries were to each receive three vouchers for three years (then graduate from the program): one voucher for basal dressing (50 kg of DAP or 100 kg of Minjingu Rock Phosphate); one voucher for top dressing (50 kg of urea); and one voucher for 10 kg of maize seed or 25 kg of rice seed. To participate in the program, farmers were required to: (i) be resident farmers growing no more than one hectare of maize or rice; (ii) not have used fertilizer on maize or rice in the past five years; and (iii) be able to pay the farmer top-up, which was 50 percent of the market price of fertilizer per 50-kg bag. Seed was provided to farmers for free. Except in 2016/17, all importation/procurement, distribution, transportation, and retailing of fertilizer for NAIVS was handled by the private sector (Table 2). The program is generally considered to be the most private sector-friendly FSP implemented in SSA to date (Wanzala-Mlobela et al., 2013; Mather & Minde, 2016).

Nigeria

Nigeria has had two main federal government-led FSPs since structural adjustment: the Federal Market Stabilization Program (FMSP), in place from 1999-2011, and the Growth Enhancement Support Scheme, which ran from 2012 onward. We describe the key features of each of these programs, as well as those of a pilot FSP implemented in Kano State from 2009-2011. We include the latter because below we discuss some important empirical evidence related to the effects of the program on smallholder farmers' demand for fertilizer at the (unsubsidized) market price.

FMSP was a universal (untargeted) FSP in which the federal government of Nigeria had importers and blenders procure fertilizer on its behalf via a tender process, then the federal government sold the fertilizer to state governments at a 25 percent subsidy (Liverpool-Tasie & Takeshima, 2013; Wanzala-Mlobela et al., 2013; Takeshima & Liverpool-Tasie, 2015). Some farmers received the

fertilizer at an even greater subsidy, as states and local government areas were free to further subsidize the inputs (Ibid.) No vouchers were used and FMSP fertilizer was mainly distributed through state-owned Agricultural Development Project depots (Takeshima & Nkonya, 2014).

Nigerian federal and select state governments began experimenting with targeted voucher-based FSPs in 2009. Pilot programs were implemented in Kano and Taraba states from 2009-2011, and Bauchi and Kwara states from 2010-2011. Of particular relevance in this report is the Kano state program, which was implemented in partnership with IFDC. Under Kano state voucher program (KSVP), a portion of the FMSP fertilizer allocated to the state was distributed through agrodealers instead of state-owned outlets, and beneficiary farmer organizations were given paper vouchers to redeem for subsidized fertilizer for their members (Liverpool-Tasie, 2014). The vouchers were good for two 50-kg bags of NPK and one 50-kg bag of urea per member at subsidies of 60 percent and 65 percent, respectively (Ibid.) The KSVP targeted approximately 140,000 smallholder farmers per year.

With the experience of the KSVP and other voucher pilot programs under its belt, Nigeria discontinued the FMSP in 2012 and introduced the Growth Enhancement Support Scheme (GES). GES utilized vouchers as well but replaced the paper vouchers of the pilot programs with a mobile phone-based “e-wallet” (e-voucher) system. The vouchers were good for two 50-kg bags of fertilizer at 50 percent of the market price plus 20 kg of certified maize seed or 25 kg of certified rice seed for free. GES’ goal was to reach 5 million farmers per year for four years. The private sector was responsible for fertilizer importation/procurement, transportation, and retailing (S. Mohammed Idris, personal communication, January 29, 2018). Payment delays plagued the program and that, coupled with the transition from President Goodluck Jonathan to current President Muhammadu Buhari in 2015, stalled the program, though it has not been terminated officially (Ibid.; S. Liverpool-Tasie, personal communication, January 28, 2018).

Under President Buhari, the country’s major fertilizer-related program has been the Presidential Fertilizer Initiative (PFI), which was approved in December 2016 and continues to run to date. The PFI supports domestic production and blending of fertilizers in an effort to reduce imports and bring down fertilizer prices in the country (Ibid.).

Kenya

Kenya has two FSPs: a universal FSP implemented by the National Cereals and Produce Board (NCPB) and a targeted FSP known as the National Accelerated Agricultural Inputs Access Program (NAAIAP). The NCPB program was implemented on a small scale beginning in 2001/02 but it has been operating at a much larger scale in most years since 2008/09, initially as a response to the 2007-2008 food and fuel price crisis. Fertilizer for the program is sold at NCPB depots throughout Kenya at pan-territorial, subsidized prices (in the range of a 30 percent subsidy) (Jayne et al. 2013). In theory (although not necessarily in practice), only registered and verified farmers can access subsidized fertilizer through the NCPB, and the quantity of fertilizer each farmer can get is limited based on their farm size. The private sector is not involved in the implementation of this program. No vouchers are used.

The NAAIAP program, in particular its Kilimo Plus component, is a voucher-based FSP through which selected beneficiaries receive vouchers good for 50 kg of basal dressing, 50 kg of top dressing, and 10 kg of improved maize seed. The subsidy rate varied – e.g., 100 percent in 2007/08 and 75 percent in 2012/13 (KMOA, 2012). Farmers redeem these vouchers at accredited agrodealers' shops. Officially, NAAIAP targets farmers who cannot afford fertilizer and maize seed at unsubsidized prices, with preference given to female- and child-headed households (KMOA, 2007). The minimum and maximum land size requirements for beneficiary farmers have varied from year to year.

Ghana⁹

Ghana's main FSP in recent years has been the Ghana Fertilizer Subsidy Program (GFSP), an untargeted FSP introduced in 2009/10 and implemented through a waybill system.¹⁰ No vouchers are used; instead, the Ministry of Food and Agriculture selects, via a tender process, major fertilizer companies to import and transport specific quantities of different types of fertilizers to their main distributors and then to retailers. In 2017, for example, 11 fertilizer companies were selected to participate in the program (Ministry of Food and Agriculture, 2017). The retailers then sell the fertilizer to farmers at a pan-territorial subsidized price (e.g., approximately 50 percent of the retail market price in 2017). In order to recoup the remaining 50 percent from government, distributors and retailers have to complete and have approved a series of forms. (See Wanzala-Mlobela et al., (2013) for details.)

The program was suspended in 2014 due to long delays in payments by government to importers but implemented again in 2015 (Resnick and Mather, 2016); GFSP continues to run to date. In 2017, subsidized fertilizer for the program was to be available to any smallholder that grew maize, rice, sorghum, millet, soybean, cowpea, or vegetables; farmers involved in outgrower schemes were also considered. There was to be a quantity limit per farmer: a maximum of ten 50-kg bags of compound fertilizer and five 50-kg bags of urea (Ministry of Food and Agriculture, 2017). Women farmers were to “receive priority as much as possible” (Ibid., p. 3).

3.2. Evidence of impacts on commercial fertilizer demand and on private sector engagement and investment in fertilizer value chains

Impacts on commercial fertilizer demand

One of the main goals an FSP is to increase national fertilizer use, and, in the case of targeted ISPs, to increase fertilizer use among the targeted population. A key determinant of the extent to which an FSP increases fertilizer use is its effects on farmers' demand for fertilizer at the market price, which we refer to as “commercial fertilizer demand” for brevity (Xu et al., 2009; Ricker-Gilbert et al., 2011). More specifically, if an increase in the amount of subsidized fertilizer acquired by a farmer has a negative effect on his/her demand for commercial fertilizer, then the FSP is said to “crowd out” or “displace” commercial fertilizer demand. This might be the case if, for example,

⁹ The information in this section is drawn from Wanzala-Mlobela et al. (2013) unless otherwise stated.

¹⁰ Ghana had a voucher-based FSP for one year 2008/09 but it had many challenges and was replaced by the waybill system in 2009/10.

the subsidized fertilizer is received by a farmer who would have purchased fertilizer at the market price had s/he not received the subsidy. In such a case, some or all of the subsidized fertilizer would replace what would otherwise have been purchased by the farmer at the market price. If subsidized fertilizer displaces some commercial demand, then total fertilizer demand will increase by *less* than the amount of subsidized fertilizer distributed.

On the other hand, if an increase in the amount of subsidized fertilizer acquired by a farmer has a positive effect on his/her demand for commercial fertilizer, then the FSP is said to “crowd in” commercial fertilizer demand. This might be the case if, for example, the FSP utilizes vouchers redeemable at private agrodealers’ shops and the subsidy offsets some of the fixed costs associated with acquiring fertilizer from an agrodealer (e.g., the costs of traveling to the agro-dealer) but the FSP quantity is less than the quantity of fertilizer required by the farmer. The farmer might then purchase the remainder of the fertilizer s/he requires at or nearby the same agrodealer where s/he redeemed the FSP voucher. If an FSP crowds in commercial demand, then the increase in total fertilizer demand would be more than the amount of subsidized fertilizer distributed.

Numerous empirical studies have quantified the crowding in/out effects of FSP fertilizer on commercial fertilizer demand. The results of these studies are summarized in Table 3.¹¹ All of the studies summarized in the table utilize survey data from smallholder farm households and rigorous statistical techniques to obtain the reported estimates. Several key insights emerge from Table 3. First, in eight of the 10 studies that consider the current year effects of subsidized fertilizer on commercial fertilizer demand, the results suggest that subsidized fertilizer ***crowds out*** commercial fertilizer demand. This is the case for the FSPs in Kenya, Malawi, Nigeria (for the FMSP), and Zambia (prior to the ZFISP e-voucher). As a result, each additional kg of subsidized fertilizer distributed in these countries only raises fertilizer use by 0.41 to 0.93 kg (instead of by a full 1 kg) (column E). Each of these studies attributes the crowding out to the targeting of subsidized fertilizer to some households that would have purchased commercial fertilizer in the absence of the FSP. The extent of crowding out may be the highest in Kenya because fertilizer use in the country was already very widespread (used by 85 to 95 percent of households in medium and high potential areas) prior to the introduction of NAAIAP in the late 2000s (Mather & Jayne, 2015).

¹¹ See Jayne et al. (2018) for a review of the literature on other household- and aggregate-level effects of FSPs (e.g., crop production patterns and productivity, incomes, poverty, food security, and political economy).

Table 3. Empirical evidence of the crowding in/out effects of FSPs on commercial fertilizer demand

(A)	(B)	(C)	(D)	(E)	(F)	(G)
Country	Study	FSP evaluated (program years)	Effect of a 1-kg increase in FSP fertilizer on kg of commercial fertilizer demanded	Effect of a 1-kg increase in FSP fertilizer on total kg of fertilizer demanded	(E) adjusted for diversion of FSP fertilizer (percent diverted)	Heterogeneous effects: Crowding out is less among ...
Ghana	None					
Kenya	Mather & Jayne (2015)	NAAIAP (2009)	-0.59	+0.41	N/A	<ul style="list-style-type: none"> - HHs with less land or fewer farm assets - HHs in low potential zones (NCPB only) - Female-headed HHs
		NCPB (2009)	-0.50	+0.50	N/A	
	Jayne et al. (2015)	NCPB & NAAIAP pooled (2009)	-0.43	+0.57	+0.38 (33 percent ^a)	N/A
Malawi	Ricker-Gilbert et al. (2011)	TIP (2002/03-2003/04), MFISP (2006/07)	-0.22	+0.78	N/A	- HHs with fewer farm assets
	Jayne et al. (2015)	TIP (2002/03-2003/04), MFISP (2006/07, 2008/09)	-0.18	+0.82	+0.55 (33 percent)	N/A
	Ricker-Gilbert & Jayne (2017)	TIP (2002/03-2004/05), MFISP (2005/06-2010/11)	-0.29 in the current year, +0.13 over 4 years (current year + 3 years after that)	+0.71 in the current year, +1.13 over 4 years	N/A	N/A
Nigeria	Takeshima & Nkonya (2014)	FMSP (separate data for 2003 & 2007 vs. 2010)	0.1-2.1 p.p. reduction in probability of purchasing commercial fertilizer	N/A	N/A	N/A
	Liverpool-Tasie (2014)	KSVP (2009)	+0.26	+1.26	N/A	N/A
Tanzania	Mather & Minde (2016)	NAIVS (2010/11, 2012/13)	+0.11	+1.10	+0.83 (26 percent)	N/A
Zambia	Xu et al. (2009)	FCP (1999/2000), ZFSP (2002/03)	-0.07 to -0.08 nationwide	+0.92 to +0.93	N/A	<ul style="list-style-type: none"> - HHs with fewer farm assets - HHs in low PSA areas prior to subsidies (to the point of crowding in of +0.06 kg/kg)
	Mason & Jayne (2013); Jayne et al. (2015)	FCP (1999/2000), ZFSP (2002/03, 2006/07)	-0.13	+0.87	+0.58 (33 percent)	<ul style="list-style-type: none"> - HHs with smaller farm sizes - Female-headed HHs - HHs in low PSA areas prior to subsidies

Notes: N/A = results not available. NAAIAP = National Accelerated Agricultural Inputs Access Program. NCPB = National Cereals & Produce Board. TIP = Targeted Inputs Programme. MFISP = Malawi Farm Input Subsidy Programme. FMSP = Federal Market Stabilization Program. KSVP = Kano State Voucher Program. NAIVS = National Agricultural Input Voucher Scheme. FCP = Zambia FRA Fertilizer Credit Program. ZFSP = Zambia Fertilizer Support Program. PSA = private sector fertilizer retailing activity. p.p. = percentage point. ^a This is an assumption made in the paper and is not based on empirical evidence that there is this degree of diversion in Kenya. Diversion estimates for the other studies are evidence-based.

Second, there is some empirical evidence that crowding out would be mitigated (and the contributions of FSPs to total fertilizer use would be greater) if more subsidized fertilizer were allocated to households with relatively smaller farm sizes or fewer farm assets, or to households that are female-headed or that are located in areas where there was less private sector fertilizer retailing activity prior to the establishment of the subsidy programs (Table 3, column G). We refer to the latter as “low PSA” areas.

Third, there is some evidence that subsidized fertilizer *crowds in* commercial fertilizer demand in the year it is received in Tanzania under NAIVS (Mather and Minde. 2016) and in Nigeria under the KSVP (Liverpool-Tasie. 2014). Notably, both of these FSPs utilized vouchers redeemable at private agrodealers’ shops. In addition, once potential lagged effects of FSPs on commercial fertilizer demand are taken into account, there is some evidence of crowding in in Malawi as well (Ricker-Gilbert & Jayne. 2017).

What might explain these crowding in effects? In the case of the Nigeria KSVP, Liverpool-Tasie (2014) puts forth several explanations:

- (i) Private input suppliers that participated in the program were required to be physically present in all local government areas (LGAs) where the program was implemented. The KSVP also subsidized the private input suppliers’ costs of distribution. Both of these factors could have reduced the transactions costs and transportation costs incurred by farmers in the LGA when purchasing fertilizer (on commercial cash terms or with an FSP voucher).
- (ii) A key difference between the KSVP and the traditional FSPs in Malawi and Zambia is that under the KSVP, beneficiaries (or a representative from their farmer group) redeemed their vouchers at private agrodealers’ shops to obtain the subsidized fertilizer. In contrast, in Malawi and Zambia, subsidized fertilizer was not distributed through agrodealers but rather through government depots (Malawi) or farmer cooperatives (Zambia).
- (iii) Under the KSVP, beneficiaries were entitled to three 50-kg bags of fertilizer at a 60-65 percent subsidy. Liverpool-Tasie (2014) argues that this quantity of subsidized fertilizer may have been large enough to make it worth farmers’ effort to redeem the vouchers but insufficient to fully cover their fertilizer needs, leaving scope for them to make additional purchases at the market price at the same time they redeemed their vouchers. In contrast, under the Zambia Fertilizer Support Program (which is the program for which crowding out was found), beneficiary farmers received a much larger quantity of subsidized fertilizer (eight 50-kg bags), which may have largely satisfied their needs.
- (iv) Unlike the other studies highlighted in Table 3, which are for nationwide programs, the KSVP was a pilot program in a single state in Nigeria and it was closely monitored by the IFDC. Given the increased difficulty of monitoring larger programs, it is not clear if there would still be crowding in if the program (and analysis) had been nationwide.

In the case of Tanzania, Mather and Minde (2016) contend that their finding of crowding in of commercial fertilizer demand by NAIVS subsidized fertilizer can be attributed to the fact that a

large majority (75 percent) of NAIVS voucher recipients had not used fertilizer on any crop prior to participating in NAIVS (see also Mather et al., 2016). Recall that an explicit targeting criterion of NAIVS was not having used fertilizer on maize or rice within the past five years; this criterion appears to have been fairly well enforced.

In contrast, there was no such criterion for the Zambia program, and although the Malawi FSP and Kenya's NAAIAP officially required that beneficiaries should not be able to afford fertilizer at the market price, this criterion was not well enforced in either case (Ricker-Gilbert et al., 2011; Sheahan et al., 2014). Another potential contributing factor to the crowding in of commercial fertilizer demand by NAIVS is the fact that the majority of NAIVS recipients also met the criterion that they grow less than one hectare of maize (or rice) (Mather & Minde, 2016). Based on evidence from other countries, crowding out tends to be less (and there may be more scope for crowding in) when households with relatively less land are targeted.

In addition, Xu et al. (2009) finds very modest crowding in of commercial fertilizer demand by subsidized fertilizer in low PSA areas in Zambia (Table 3, column G). These authors argue that by stimulating effective demand for fertilizer in these areas, the subsidy program may have provided incentives for the private sector investment there. An important caveat, however, is that if PSA was low prior to the subsidy program due to low profitability of fertilizer use at the market price, then it may not make sense to target the subsidies to these areas (Ibid.).¹²

Returning to the main insights from Table 3, the fourth and final key point is that the contribution of FSPs to total fertilizer use is further undermined by the diversion and resale on commercial markets of fertilizer intended for FSPs (see column F). In the years analyzed in the studies summarized in Table 3, it is estimated that 33 percent of the fertilizer intended for the FSPs in Malawi and Zambia was diverted and sold before it ever reached beneficiaries as FSP fertilizer; this figure stands at approximately 26 percent for Tanzania.¹³ Once diversion is taken into consideration, one kg of subsidized fertilizer raises total fertilizer demand by just 0.55 kg in Malawi, 0.58 kg in Zambia, and 0.83 kg in Tanzania.

Note that in the latter case in particular, accounting for diversion drives this figure from above one to below one (compare columns E and F). FSPs are particularly vulnerable to diversion when the subsidized fertilizer is handled by government or parastatal actors (as was the case in Malawi and Zambia until recently) (Jayne et al., 2015).

Overall, the findings in this section suggest that FSPs are least likely to crowd out (and may even crowd in) smallholder farmers' demand for commercial fertilizer if the FSP targets households that were not previously using fertilizer and that can afford the farmer contribution but that have relatively less land or fewer non-land assets and are female-headed. FSPs that operate through vouchers redeemable at private sector input suppliers' or agrodealers' shops may also be less likely

¹² Ricker-Gilbert & Jayne (2017) provide little explanation for their finding of modest crowding in in Malawi once lagged effects are taken into consideration. However, their main rationale for testing for these effects was assertions by others that "subsidizing fertiliser for farmers over time can kick start growth processes that sustainably raise incomes and food security" – a hypothesis that had not yet been rigorously tested (Ibid., p. 71).

¹³ See Mason and Jayne (2013) and Jayne et al. (2015) for extensive discussions of the diversion issue and how figures like those in column F of Table 3 are obtained.

to crowd out commercial fertilizer demand. Finally, findings way to reduce diversion of subsidized fertilizer can substantially raise the contributions of FSPs to total fertilizer use.

Impacts on private sector engagement and investment in fertilizer value chains

In contrast to the fairly large peer-reviewed literature on the *demand-side* crowding in/out effects of FSPs, to our knowledge, to date there have been no peer-reviewed journal articles on the *supply-side* crowding in/out effects of the programs, nor on their broader impacts on private sector engagement and investment in fertilizer value chains. There have, however, been a handful of reports, working papers, and policy briefs on this topic. These studies are largely descriptive in nature and while they highlight some potential effects of FSPs on the private sector, the methods used do not allow them to identify the *causal* effects of the subsidy programs; rather, most of the studies highlight *correlations* between the FSPs and various indicators of private sector engagement and performance.

The main exception is a recent study by Kaiyatsa et al. (2018) that estimates the effects of the Malawi FISP 2015/16 pilot program to allow select larger-scale distributors to participate in the retailing of subsidized fertilizer on private sector fertilizer sales (commercial and total).¹⁴ Under this program, two large-scale distributors were awarded tenders to sell subsidized fertilizer to smallholder farmers in nine of the 28 districts in the country. Private retailers associated with these distributors were allowed to accept MFISP fertilizer vouchers from smallholders in the nine districts, while vouchers could only be redeemed at the government parastatal ADMARC and SFFRFM depots in the other 19 districts. Independent agrodealers continued to be excluded from the retailing of subsidized fertilizer nationwide. Kaiyatsa et al. (2018) use a unique nationally-representative dataset that followed participating and non-participating large-scale distributors and associated retailers as well as independent agrodealers in three consecutive years: 2013/14, 2014/15, and 2015/16. Interviewing the same fertilizer distributors and agrodealers over time and having data on their fertilizer sales before and during the 2015/16 pilot program enables the authors to rigorously evaluate the effects of the pilot program on private sector fertilizer sales.

The main findings from Kaiyatsa et al. (2018) are that the 2015/16 pilot program in Malawi:

1. Had no effect on commercial fertilizer sales by retailers linked to larger-scale distributors that participated in the program, nor did the program affect fertilizer sales by retailers linked to larger-scale distributors that were *not* selected to participate in the program but were located in the pilot districts;
2. Increased *total* fertilizer sales (commercial plus subsidized fertilizer) by retailers linked to participating larger-scale distributors by an average of 299 MT per retailer; and
3. Reduced total fertilizer sales by independent agrodealers in pilot districts by an average of 28 MT per agrodealer.

¹⁴ A study by Fitzpatrick (2012) had similar objectives focusing on the supply-side effects of the short-lived policy of allowing select larger-scale distributors to participate in MFISP fertilizer retailing in Malawi in 2006/07 and 2007/08. However, as acknowledged by the author, the study was plagued by data problems, so the results are not discussed here.

Due to the negative effects on fertilizer sales by independent agrodealers in the pilot districts, the 2015/16 pilot program is estimated to have crowded out commercial fertilizer sales by 14 percent. In other words, a 1-MT increase in subsidized fertilizer distributed through the subsidy program in the pilot districts is estimated to have only increased total fertilizer sales by 0.86 MT.¹⁵ Based on key informant interviews that were conducted to complement the retailer survey data, Kaiyatsa et al. (2018) further find that private sector retailers participating in the 2015/16 pilot program had inputs in stock and available for MFISP beneficiaries much earlier than the SFFRFM and ADMARC depots in the non-pilot districts. This likely improved the ability of beneficiary farmers to obtain and apply the fertilizer in a timely fashion, and likely increased the maize yield-boosting effects of the subsidized fertilizer.

Based on these findings, Kaiyatsa et al. (2018) recommend that the Malawian government: (i) continue to increase the participation of private sector retailers in MFISP; and (ii) invest in building the capacity of independent agrodealers so that they can continue to serve remote areas that are undeserved by large-scale distributors and so that they can eventually participate in the retailing of MFISP fertilizer. On this last point, a potential model that Malawi could look to is Tanzania, which included as part of the larger umbrella project that encompassed NAIVS a training program for agrodealers called Cultivating New Frontiers in Agriculture (CNFA). The CNFA training covered agribusiness management skills as well as best practices for the use of inorganic fertilizer and improved seed in maize and rice production (Mather et al., 2016).

Several additional insights and lessons learned emerge from the more descriptive literature on the effects of FSPs on private sector fertilizer markets.¹⁶ First, *FSPs that have the private sector (and not state-owned enterprises) handle importation/procurement, distribution, and retailing of fertilizer for the subsidy program have the potential to crowd in private sector investment in fertilizer value chains* (Wanzala-Mlobela et al., 2013). A key example of this is the Tanzania NAIVS, where the available evidence suggests that the sustained, predictable increase in effective demand for fertilizer brought about by the program contributed to: (i) importers and distributors building several new, large, modern storage/distribution warehouses; (ii) many agrodealers shifting from renting space for their shops to purchasing shops; and (iii) increases in the total number of agrodealers in operation as well as the number of agrodealers setting up seasonal shops in or delivering inputs directly to villages (Mather et al., 2016).

Preliminary findings from Zambia similarly suggest that the shift from the country's shift from the traditional FISP to the FISP e-voucher has resulted in the establishment of hundreds of new agrodealerships, increased employment at existing agrodealerships, and greater incidence of agrodealers transporting agro-inputs to the village level (Kuteya et al., 2016; Machina et al., 2017). Moreover, offering a 'remoteness premium', as was done in Malawi in 2007/08 when select private sector retailers were allowed to participate in the MFISP, is one potential way to encourage

¹⁵ Using less rigorous methods, SOAS et al. (2008) find a supply-side crowding out effect of 0.42, meaning that each MT of subsidized fertilizer reduced private sector commercial fertilizer sales by 0.42 MT and thus only increased total fertilizer sales by 0.58 MT.

¹⁶ We identified one or more reports related to the effects of FSPs on the private sector in five of our six focus countries (Ghana, Nigeria, Malawi, Tanzania, and Zambia). However, to our knowledge, there have been no such studies for Kenya. The studies cited in this section rely on various types of data, including from surveys of fertilizer retailers and farmers, key informant interviews or focus group discussions with fertilizer sector stakeholders, secondary data, and previous reports (e.g., from the Logistics Unit in the case of Malawi).

retailers to service more remote areas (Kelly et al., 2010).¹⁷ Sustained private sector involvement in the retailing of FSP fertilizer may even result in increased provision of inputs on credit to private retailers and agrodealers by larger-scale distributors as the repeated interaction over multiple seasons can increase trust between the parties; there is some evidence of this occurring in Tanzania under the NAIVS (Mather et al., 2016).

In contrast, ***FSPs are unlikely to crowd in private sector investment if the private sector is excluded from the retailing of subsidized fertilizer and government tenders for the importation and transport of fertilizer are awarded to only a small number of private sector firms.*** An example of such an approach is Zambia's ZFSP. Per the World Bank (2010, p. 53), "far from increasing private sector participation in the supply of agricultural inputs to smallholder farmers [in Zambia], many people met during this study raised concerns that the [Fertilizer Support] program is having the exact opposite effect. To date, Omnia and Nyiombo are the only private companies ever contracted to supply urea and all basal fertilizer has been single-sourced from the state-owned firm, Nitrogen Chemicals of Zambia (NCZ) except in the first two years when Omnia and Nyiombo shared the contracts for compound D with NCZ". The Nigeria FMSP is another relevant example.

Another reason to involve the private sector in the handling of fertilizer for FSPs is that doing so can reduce the costs of the program (SOAS et al., 2008; Chirwa & Dorward, 2013; Kuteya et al., 2016; Kuteya & Chapoto, 2017). The profit motive of private sector firms often leads to greater efficiency, less waste, and reduced bureaucracy relative to more government-centric programs.

A fourth major insight emerging from the descriptive literature is that ***trust between the government and private sector actors is paramount for sustained involvement of the private sector in FSPs, and to the development of private sector input markets more broadly; trust is easily undermined and difficult to re-establish once it is lost.*** Key examples come from Malawi, Tanzania, and Ghana. In the case of Malawi, the government signaled an increasing openness to private sector participation in the MFISP when it allowed select large-scale distributors to participate in the retailing of MFISP fertilizer in 2006/07 and 2007/08. Recall that only ADMARC and SFFRFM had been allowed to do so in 2005/06, the first year of the program. In response to this opportunity, Kelly et al. (2010) argue that large-scale distributors expanded their distribution networks and also began developing partnerships with independent agrodealers. However, when the Government of Malawi abruptly changed course in November 2008 and disallowed all private sector involvement in MFISP retailing, the government's credibility with the private sector was severely damaged. Kelly et al. (2010, p. 41) describe the repercussions as follows:

"Not only did the decision undermine hard-won confidence in transparent dialog between the public and private sectors, but the timing of the decision could not have been worse in terms of the financial harm imposed on the private sector. Contracts had already been awarded, fertilizer imported and paid for, etc. ... Ironically, the private sector companies who were most negatively affected by the Government's decisions were the ones who had done most to respond to the government's desire for expanded access in rural areas – fertilizer importers with distribution networks. Those private sector importers specializing

¹⁷ Under this program, retailers received a MK 100-200 premium per voucher for operating in relatively remote areas (Kelly et al., 2010).

solely in suppling government were unaffected. The immediate result of the Government's decision, besides loss of credibility with the private sector, was the dismantling of private rural fertilizer and related outlets to pre-2007/8 levels... The longer-term consequence is lack of credibility in the government in regard to its commitment to develop a commercially viable fertilizer input sector rather than one where the private sector is limited to contracts to supply government and farmers are dependent for access to subsidized inputs on a state monopoly."

Relatedly, SOAS et al. (2008) and Chirwa and Dorward (2013) suggest that the Malawian government's policy inconsistency and late announcements on whether and to what extent the private sector would be allowed to participate in MFISP fertilizer retailing increased the risk and uncertainty associated with private sector investments in fertilizer value chains. There are, however, signs of improvement. As of 2016/17, select private companies are allowed to accept MFISP vouchers throughout the country.

In the case of Tanzania, unacceptably long delays in government repayment of private sector importers of fertilizer for NAIVS contributed to the suspension of the program in 2014/15; it also led, in 2016/17, to private sector importers refusing to participate in NAIVS until they were repaid in full (Mather, 2016).¹⁸ Per Mather et al. (2016, p. 2), "When the GoT was unable to repay fertilizer importers what they were owed in 2012/13 and 2013/14 even long after both of those seasons had concluded, this led to a rapid decline in the level of trust that private sector fertilizer supply chain actors had in continuing with NAIVS or other future public/private initiatives".

Payment delays have been common in Ghana since 2012 as well, and this, coupled with late announcements of whether or not there would even be a subsidy program in 2015/16, resulted in two of the largest private importers in the country deciding to pull out of the program (Mather 2016). Relatedly, as of 2007, the Zambian government was so far behind on repaying the two private importers that had been supplying urea fertilizer for the country's FSP since inception (Omnia and Nyiombo Investments Limited), that these importers temporarily halted their release of fertilizer for the program (Musonda, 2008).

Trust issues are not limited to private sector mistrust of government. Government mistrust of private sector actors is also an issue and was cited by government officials as a reason for Malawi's reluctance to involve the private sector in the retailing of MFISP fertilizer in the past (Kelly et al. 2010; Chirwa & Dorward 2013). However, there is little empirical evidence to support claims that private sector retailers accepted MFISP fertilizer vouchers for items other than fertilizer, and private sector retailing of MFISP seed has been allowed and seen as working well since the inception of MFISP (Ibid.). Ultimately, "the involvement of the private sector will require mutual trust among stakeholders, systems of transparency and accountability, and policy consistency and credibility. These conditions can create a conducive environment for private sector investments in input markets" (Chirwa and Dorward, 2013, p. 14).

Related to the transparency issue raised by Chirwa and Dorward (2013), a fifth insight from the descriptive literature is that ***government tendering processes for FSPs in several countries have***

¹⁸ Despite the withdrawal of private sector importers from participation in NAIVS in 2016/17, the government still implemented the program, instead working with the government parastatal Tanzania Fertilizer Company (Mather 2016).

been extremely opaque, and there have been allegations of corruption and politically-motivated awarding of tenders. Examples include Nigeria's FMSP (Wanzala-Mlobela et al. 2013) and Zambia's traditional FISP (Resnick and Mason, 2016). In fact, in 2013, the two private sector companies involved in importing fertilizer for Zambia's traditional ISP were found guilty of bid rigging and fined US\$20 million (Ibid). Such practices reduce competition in fertilizer markets, likely drive up fertilizer prices for farmers, and increase the costs of FSPs. To improve transparency in the tendering process, Mather (2016) recommends that all bids be made public.

Sixth, ***it is imperative that the awarding of tenders and import quotas for FSP fertilizer be announced early and that sufficient government resources be available to make payments in a timely manner.*** Late payments have already been alluded to as a source of eroding trust between the private sector and government. But late payments and decisions on tenders and import quotas by government can also result in importers having to pay higher per unit costs for fertilizer (Mather 2016) and increase the likelihood that farmers will not be able to access the inputs early enough for timely application to their crops (Ibid.; Chirwa & Dorward, 2013).

In Ghana, for example, there have been years when importation quotas have been announced just six weeks before planting time, hardly allowing sufficient time for the imports to be mobilized (Mather, 2016). Furthermore, the short time between the start of Ghana's fiscal year and the planting season has led to delays in fertilizer availability to farmers (Ibid.) Mather (2016) therefore recommends that the Ghanaian government approve the FSP's budget on a different schedule than the main government budget. And in Zambia, while early evidence suggests significant benefits from the shift to the flexible FISP e-voucher, the 2016/17 pilot program was not funded in a fluid manner, which resulted in major delays in the distribution and activation of e-voucher cards (Kuteya & Chapoto, 2017). The program also encountered technical challenges with the activation of the e-cards in some cases (Ibid.)

Seventh, ***it is important to involve representatives from all parts of the fertilizer value chain in discussions to set marketing margins for private sector actors involved in FSPs*** (Wanzala-Mlobela et al., 2013; Mather, 2016). Doing so is likely to increase private sector participation in the FSP because different actors' marketing margins are more likely to be covered. Problems arose in the early years of the Ghana waybill system because marketing margins for all actors were decided by the government in consultation with importers only. As a result, several distributors and retailers chose not to participate (Mather, 2016). In contrast, Tanzania's NAIVS involved representatives from all levels in the fertilizer value chain (Ibid.).

Eighth and finally, ***it is best if importers/distributors decide which retailers/agrodealers to work with for an FSP rather than this being decided by government officials*** (Mather, 2016). The Tanzania NAIVS initially used the latter approach but after consultations with importers and distributors, this responsibility was shifted to them. Allowing importers and distributors to choose with whom to engage in business transactions is important given the key role of trust in these relationships.

3.3. Knowledge gaps

The preceding literature review points to several knowledge gaps and areas in need of further study. These include:

1. What are the enduring (lagged) effects of FSPs on demand-side crowding out? For example, even if a program initially crowds out some commercial fertilizer demand, by raising farmers' yields and potentially incomes and hence effective demand for fertilizer at unsubsidized prices, does it crowd in commercial demand in subsequent years? (Only one study – Ricker-Gilbert and Jayne (2017) – has explored this issue.)
2. What are the effects of FSPs on smallholder access to fertilizers? (While a number of studies have been done on the effects of the programs on smallholder demand for fertilizer (see Table 3), less is known about the effects of FSPs on accessibility of fertilizers.)
3. What are the effects of FSPs on fertilizer supply (i.e., supply-side crowding in/out) and on private sector engagement and investment in fertilizer value chains, and how does this vary with different program designs and implementation strategies? (Again, only one rigorous study has been done on this topic – Kaiyatsa et al. (2018). Similar studies in other countries and a follow-up study in Malawi are needed.)
4. Does a shift from a government-led to a more private sector-led FSP improve the performance of the FSP on the demand and/or supply sides? A key example would be Zambia's transition from the traditional FISP to the FISP e-voucher. (Preliminary research on this topic is underway by researchers at the Indaba Agricultural Policy Research Institute in Lusaka in collaboration with Michigan State University.)
5. How has the shift from NAIVS to bulk procurement in Tanzania and from GES to the Presidential Fertilizer Initiative in Nigeria affected private sector investment in fertilizer value chains, farmgate prices for fertilizer, and smallholder access to and use of fertilizer?
6. What are the most effective ways to build trust between governments and private sector actors?
7. What are best practices for ensuring transparency and fair play in tendering processes?

To answer many of these questions in a rigorous manner and to establish the causal effects of fertilizer subsidy programs or program changes will require sustained data collection efforts. Ideally, data from importers, distributors, input suppliers, and agrodealers would be collected on a regular basis and (to the extent possible) in a consistent manner across countries to enable cross-country comparisons.

The World Bank's Living Standards Measurement Study Integrated Surveys on Agriculture (LSMS-ISA) is one model to look to but it has focused on household-level surveys. Surveys of other value chain actors are sorely needed. Moreover, waiting to do these surveys until *after* a policy or regulatory change has been made will be too late. Data will be needed before, during, and after such changes to credibly measure the impacts of the changes – hence the important of on-going and sustained data collection efforts. But such efforts are likely to pay off as at the moment, policymakers largely have only anecdotal or descriptive evidence on which to base their decisions.

4. Conclusions

Raising inorganic fertilizer use in SSA is widely recognized as critical for promoting agricultural transformation in the region. It is now generally accepted by African governments that in order to develop sustainable fertilizer markets and improve farmers' access to fertilizers, it is necessary to create an enabling environment for private sector investment. The "enabling environment" consists of the policies, laws, and regulations including the institutional infrastructure that guide the conduct of stakeholders (e.g., farmers and fertilizer retailers, importers, etc.) in pursuit of their goals. However, to date, there has been no systematic stock-taking of the types of policies, laws, and regulations that promote versus hinder fertilizer business in SSA. This report describes the current status of enabling environments in the region, reviews the available empirical evidence on the topic, and highlights knowledge gaps where additional research is needed.

The report highlights four key findings. First, with the exception of South Africa, there are no current examples in SSA of countries that have competitive, transparent, predictable, and sustainable enabling environments for increased investments in fertilizer value chains. While there are some examples of countries with fairly competitive fertilizer markets but uncertain policy environments (e.g., Kenya and Tanzania), most SSA countries' fertilizer sub-sectors are still predominantly state-run or heavily state-influenced. While most of these countries allow for private sector involvement in these markets, the incentives for private sector investment are low in many cases due to heavy state control and ad hoc policy environments.

Second, while there is a large and growing peer-reviewed literature on the targeting and demand-side effects of fertilizer subsidy programs, which are used by numerous SSA governments to improve smallholder farmers' access to fertilizers, there is little rigorous empirical evidence on the supply-side effects of the programs, including program effects on private sector investment.

Third, compared to the large overall literature on the effects of fertilizer subsidy programs, there has been virtually no rigorous analysis of how other policies, laws, and regulations affect fertilizer enabling environments or the performance of fertilizer sub-sectors in SSA.

Fourth, the existing empirical evidence on the impacts of regulations on private sector participation and investment in fertilizer markets in SSA can be grouped into three broad categories: (i) literature that describes the current status of fertilizer regulations in different countries around the globe and infers or predicts the impacts thereof on the private sector and, in some cases, provides anecdotal evidence to support its predictions (a key example being the World Bank's "Enabling the Business of Agriculture" reports); (ii) studies from outside of SSA on the impacts of deregulation on technology transfer and private sector participation (mostly for products other than fertilizers); and (iii) studies from SSA on the impacts of fertilizer regulations on private sector participation in the fertilizer industry that mainly highlight correlations and descriptive relationships but do not identify the causal effects of the regulations.

Given the scant empirical evidence on the effects of laws, regulations, and policies other than subsidies on private sector investment in fertilizer value chains in SSA, there is great need for more research on these topics. The main report highlights specific areas for future research.

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