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A Review of Fertilizer Policy Issues in Nigeria

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THE NIGERIA STRATEGY SUPPORT PROGRAM (NSSP)
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Abstract

Low fertilizer use is professed to be among the many reasons for low agricultural productivity in Nigeria. Fertilizer application, estimated at 13 kg/ha in 2009 by the Federal Ministry of Agriculture and Rural Development, is far lower than the 200 kg/ha recommended by the United Nations Food and Agriculture Organization (FAO). This report reviews the status of the fertilizer sector in Nigeria on the basis of a thorough overview of existing literature on Nigeria, reports on recent survey results, and analytic work conducted by IFPRI in Nigeria under the Global Food Security Response (GFSR) initiative of the USAID. It synthesizes the findings on key fertilizer issues in Nigeria, focusing on the demand and supply environment, the role played by subsidies, the regulatory environment, and the use of the vouchers system to aid fertilizer distribution. A key finding is that the heavy emphasis on price subsidization to the detriment of other approaches, such as complementary actions to improve farmers' fertilizer-use techniques, has hampered market development. Three policy recommendations arise from this report. First, the initial step the government should take should be to eliminate the existence of dual fertilizer markets by establishing the primal role of the private sector in fertilizer production, procurement and distribution. Second, the government should seek policy stability by reducing the frequency of government intervention in preference to building capacity in the private sector to handle all levels of the fertilizer value chain activities. Finally, it should provide a clear assignment of monitoring and regulatory roles, which are needed at every stage of fertilizer production (including blending) and distribution with a broader reach of regulatory activities at peri-urban and rural markets.

Introduction

Increased fertilizer usage played a significant role in the success of the green revolution in Latin America and Asia. It helped raise agricultural productivity and farm incomes, thus laying the foundation for broader economic growth. As much as 50 percent of yield growth in these regions could be attributed to increased fertilizer use (Toenniessenn, Adesina and DeVries 2008).[1] Similarly, a review of nine West African cotton-producing countries showed that fertilizer use (combined with related intensification practices) tripled yields from about 310 to 970 kilograms per hectare (ha) from 1960 to 1985 (Pieri 1989). Despite the growing evidence that fertilizers can substantially increase yields in Sub-Saharan Africa (SSA) as well as slow down soil degradation[2], farmers in SSA still lag far behind other developing countries in fertilizer use. According to Crawford et al. (2005) during 2000/01–2002/03, the average fertilizer use in SSA (excluding South Africa), estimated at 9 kilograms per hectare, was much lower than elsewhere in the world (for example, 86 kg/ha in Latin America, 104 kg/ha in South Asia, and 142 kg/ha in Southeast Asia).

In the case of Nigeria, fertilizer use is estimated at 13kg/ha (FMARD 2010), just above the average for SSA. Furthermore, it is estimated that Nigeria is experiencing deteriorating annual nutrient depletion[3] (Stoorvogel and Smaling 1990; Sheldrick and Lingard 2004), risking its ability to sustain the modest gains achieved from recent agricultural growth. The gap in fertilizer use in SSA (and Nigeria) relative to the rest of the world is given as one reason for the failure of the region to achieve its green revolution objectives. This failure raises the question of what types of policies and programs are needed for the region to realize the potential benefits from fertilizer usage (Kelly, 2006).

Fertilizer Policy in Nigeria

Although the low usage of fertilizer in Nigeria (and in SSA) could be traced to demand and supply factors such as low farmer incomes and high market prices resulting from limited fertilizer availability, public policy responses to fertilizer-related issues have also contributed to the continuing gap in usage. Several policy approaches have been used to promote increased use of fertilizer among smallholder farming systems (Crawford et al. 2005). Over the years, in Nigeria, these have included the promotion of state monopoly for fertilizer import and distribution, institution of price controls and subsidies at the fertilizer retail markets, provision of credit to farmers for the purchase of fertilizer, institution of import tariffs, decentralization of procurement and distribution, and deregulation of markets. The conclusions drawn from this review suggest that frequent changes in fertilizer policies and promotion of a dual fertilizer market (subsidized and free-market) have prevented the required response from the private sector in taking over the role played by the public sector. Problems with fertilizer quality, arbitrage, and timeliness of fertilizer distribution have persisted throughout most of the period.

Despite the repeated changes in policy scenarios for fertilizer at both the federal and state levels over the years, one factor has remained largely constant: the support for fertilizer price

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[1] Complemented by a combination of high rates of investment in crop research, infrastructure such as irrigation, market development, and appropriate policy support (Hopper 1993 cited in Kelly 2006; Pingali and Heisey 2001 cited in Pingali and Raney 2005).

[2] In nutrient-poor soils, fertilizer increases yields and biomass; the biomass can be plowed back to augment organic matter to improve moisture retention, nutrient efficiency and productivity (Larson and Frisvold 1996; Heisey and Mwangi 1996; Sheldrick and Lingard 2004).

[3] In 1998, nutrient depletion in Nigeria (N þ P þ K) was estimated at 2.89 million tonnes, accounting for 35 percent of total depletion in Africa.

subsidy. Fertilizer subsidy has been central to the policy direction of Nigeria and may be justified on many grounds such as market failures and equity considerations. In a competitive market, the introduction of subsidies will cause distortions leading to economic inefficiency and net welfare losses. However, the absence of a competitive environment in Nigeria and many developing countries provides a rationale for public intervention (Boadway 1979; Gramlich 1990 cited in Crawford et al. 2005). In addition, subsidies could be justified on equity grounds as a mechanism for dealing with skewed income distribution. Controversies still surround the continued use of the subsidy policy for equity purposes and its role in reducing farm gate prices while increasing smallholder farmers' effective demand for fertilizer. Arguably, there are serious and longstanding fertilizer supply problems in Nigeria largely due to low local production and the use of subsidies undoubtedly assisted in the adoption and expansion of maize seed-fertilizer technology in the 1990s (Smith et al. 1994). Malawi, for example, transformed from a food aid dependent economy to an exporter after facilitating access to subsidized seeds and fertilizer by smallholder producers through the use of a voucher system. On the other hand, the heavy emphasis on price subsidization to the detriment of other approaches, such as complementary actions to improve farmers' fertilizer-use techniques (e.g., extension programs), seeking lower transactions costs (e.g., better regulatory environment), or reduced risk (e.g., fertilizer quality control) has hampered market development in Nigeria (Yanggen et al. 1998).

In 2006, the leadership of Africa, in the context of the Comprehensive Africa Agriculture Development Program (CAADP) through the Abuja Declaration (Box 1) resolved to improve the usage of fertilizer as a means to achieving the region's green revolution objectives. As a follow-up, the Federal Government of Nigeria (FGN) decided to disengage from direct procurement of fertilizer in favor of promoting private sector participation. Corresponding to this commitment, the FGN piloted a fertilizer voucher system in selected Nigerian states as an alternative way of administering the fertilizer subsidy. The voucher scheme is reviewed in detail later in this study, but despite its potential in making sure the subsidy reaches the intended beneficiaries, the debate continues on the relevance of subsidy in the context of Nigeria. The opportunity cost of investments foregone in infrastructure, crop science technology which determines the agronomic response, extension, management practices, output and financial market development and so on are cited as alternatives which might have higher payoff for smallholder farmers than fertilizer subsidies. Nonetheless, key issues that could support the debate include how best to target smallholder farmers with a subsidy, what investments are needed to improve farmers' capacity to benefit from the subsidy program, and how well can the existing private sector network assist government to effectively pass on the subsidy to farmers.

Box 1: The Abuja Declaration

- Increase fertilizer use
- Harmonize policies and regulations to ensure duty- and tax-free movement across regions, and the development of capacity for quality control (eliminate taxes and tariffs on fertilizer and raw materials)
- Develop and scale up input dealers' and community-based networks across rural areas
- Develop and strengthen the capacity of youth, farmers' association, civil society and the private sector
- Grant targeted subsidies to poor farmers
- Accelerate investment in infrastructure to improve output market conditions
- Establish national financing facilities for input suppliers to accelerate access to credit at the local and national level
- Establish regional fertilizer procurement and distribution facilities
- Promote national/regional fertilizer production and inter-regional fertilizer trade to take advantage of economies of scale and capture bigger market share
- Improve access to complementary inputs
- Establish African Fertilizer Financing Mechanism
- Set up mechanism to monitor and evaluate the implementation of this resolution

Source: Abuja Fertilizer Summit, 2006 (Annex I)

Issues Confronting the Sector

A number of factors account for the sector's poor functioning and farmers' low use of fertilizer. These include factors that : (1) influence the agronomic potential for fertilizer use; (2) convert the potential into farmers' effective demand for fertilizer; (3) determine the growth of aggregate fertilizer supply; and (4) develop the fertilizer distribution system (Heisey and Mwangi 1996). First, quality assurance is a prime concern of policymakers as it affects one of the fundamental demand side factors (agronomic response) which determine the profitability and intensity of fertilizer use. The national fertilizer policy explicitly states the need to control the quality of fertilizer imported and produced locally, but the existing institutional framework operating within public service has not been able to deal with quality problems. Fake, adulterated, and misbranded fertilizers, as well as underweight fertilizer bags, are prevalent in the Nigerian market (Liverpool-Tasie, Auchan, and Banful 2010).

Second, the demand for fertilizer, like other agricultural inputs, depends on the prospects of returns (Dembele and Savadago 1996), which are largely influenced by the nature of markets and how prices are determined. Agricultural prices act as signals for the allocation of resources by farmers. However, some inherent fertilizer characteristics help explain both the difficulty of devising optimal policies and the reason such policies are likely to vary in time and space. Fertilizer, like improved seed, is divisible and thus in theory likely to diffuse rapidly—even among smallholder farmers—when agronomic responses and price ratios are favorable. In practice, however, fertilizer costs are a considerably larger part of production-related cash outlays and thus likely to subject the farmer to greater financial risk than the costs of improved seed. Even after fertilizer is adopted, the information requirements for determining optimal fertilizer types and application rates pose considerable challenges to agricultural research systems. In SSA, input/output price ratios tend to be higher (more kilogram output is required to purchase one kilogram of fertilizer) and more variable than elsewhere in the developing world (Byerlee 1994; Yanggen et al. 1998), making it difficult for farmers to use prices when making decisions about fertilizer use. Transmission of price signals is not easy when communications and transportation infrastructure are weak and institutions to support markets are poorly developed. This increases marketing risks and costs, often resulting in low usage of fertilizer.

Third, there are supply factors which generate their own concerns. Over-dependence on external supply was brought about by the substantial availability of budgetary resources to support imports and overvaluation of the local currency in the past. During the late 1980s and mid-1990s, domestic fertilizer production of the total supply varied between 46 and 60 percent (Ogunfowora 1993 cited in Phillip et al. 2009). The situation deteriorated, as in the early 2000s (between 2002 and 2005) all the nitrogen phosphorous potassium (NPK) fertilizer used in Nigeria was imported in the absence of any domestic production as the result of the closure of the only producing unit, the National Fertilizer Company of Nigeria (NAFCON) for repairs (see Table 1). In the mean time, the Federal Market Stabilization Program (FMSP) remained an integral part of fertilizer policy in Nigeria and accounted for 43 percent of total capital spending in agriculture from 2001 through 2005 (Mogues et al. 2008), thereby supplying the budgetary resources needed for fertilizer imports. In addition, overvalued currency for most of the post-1980 period made it unprofitable to generate domestic production. Furthermore, domestic sources of organic manure were limited by a livestock industry that is largely mobile and separated from crop agriculture, making biomass sources uncompetitive with imported inorganic fertilizer, while agro-forestry technologies were not widespread.

Table 1: Fertilizer production, import, and consumption in Nigeria (in metric tons)

Fertilizer Type		2002	2003	2004	2005
Nitrogen	Production	0	0	0	0
	Import	94,400	137,603	101,001	115,041
	Consumption	94,400	137,603	101,001	115,041
Phosphate	Production	0	0	0	0
	Import	41,400	49,432	14,028	58,875
	Consumption	41,400	49,432	14,028	58,875
Potash	Production	0	0	0	0
	Import	30,400	42,712	37,141	41,255
	Consumption	30,400	42,712	37,141	41,255

Source: FAOSTAT <http://faostat.fao.org/site/575/DesktopDefault.aspx?PageID=575> adapted from Phillip et al. 2009.

Finally, seasonal demands and product bulkiness lead to relatively slow stock turnover and considerable storage requirements, which, in turn, result in high financing charges. Distributors are faced with substantial short-term credit requirements as well as the need to offer credit to end users or to work closely with credit agencies (Shepherd 1989). The quest to improve fertilizer use by facilitating timely access to it and ensuring that fertilizer subsidies get to intended beneficiaries has been one of the motivations behind the voucher system. The voucher system is an alternative to the government-administered system of the fertilizer subsidy program and depends on a viable private agro-input dealer network, an element of consensus under the Abuja Declaration.

The remainder of this report is as follows: The next section focuses on issues concerning the demand and supply environment, first by reviewing the literature on factors related to fertilizer demand and supply as well as assessing the demand/supply environment in Nigeria within that context. The fertilizer subsidy issue is also discussed. The following section presents the findings of surveys conducted to assess perceptions of operators in the fertilizer market on the regulatory environment for fertilizer quality control and distribution mechanism. A subsequent section is dedicated to the fertilizer voucher system as a mechanism for improving distribution and access by intended beneficiaries. The final section provides a summary of the main conclusions from this overview and highlights selected policy conclusions.

Fertilizer Demand and Supply Environment in Nigeria

Demand and supply factors are hard to separate when evaluating farmers' decisions to adopt fertilizer and their subsequent decisions about application rates. For example, many key influences discussed in the adoption literature, such as availability, prices, and the quality of fertilizer, may be related at least as much to supply side constraints as to farmer demand factors (Heisey and Mwangi 1996). In general, the factors that influence demand and supply may also be classified into price and non-price elements.

Overview of Demand Side Factors

When considering the demand side constraints, the basic price factor that influences the decision to adopt fertilizer is determined by the interaction between agronomic response and the nutrient-grain price ratio. Agronomic response, in turn, is determined by soil characteristics and climatic factors. If the marginal agronomic response at a level of 0 kg/ha of applied nutrient is greater than the nutrient-grain price ratio, in theory the farmer should adopt fertilizer. In practice, other factors like the cost of operating capital for the cropping season, information and learning costs, and, perhaps, the effects of risk aversion, often prove important. Many observers contend that marginal agronomic response must be at least twice the nutrient-grain price ratio (i.e., the marginal rate of return on working capital invested in fertilizer must be at least 100 percent) for significant adoption to occur (Heisey and Mwangi 1996).

Risk aversion also plays an important role in technology adoption decisions. Some analysts claimed that after adoption, risk aversion can reduce fertilizer applications by no more than 20 percent of the "optimal" rates (Binswanger and Sillers 1983; Shalit and Binswanger 1985; Roumasset et al. 1989). Furthermore, Ahmed et al. (1989) argue that the studies cited above usually focus only on production risk, not price risk in a general equilibrium context. Output price instability constitutes a risk for fertilizer users in western Africa (Vlek 1990; Byerlee et al. 1994). In eastern and southern Africa, maize prices are probably more stable than prices for certain other cereals (e.g., sorghum, millet), but less stable than maize prices in other developing regions of the world. These details suggest the need for more careful risk assessment in Africa compared to those in other regions.

Among the non-price factors, constraints on cash or credit availability often lead to farmer behavior that looks like risk aversion (Masson 1972; Binswanger and Sillers 1983). For many African smallholders, fertilizer expenditures can represent a considerable proportion of the total cash expense for crop production. Many analysts of fertilizer use and policy also argue that basic problems of availability (i.e., getting the right fertilizer to the right place at the right time) are at least as important as price-response interactions in determining fertilizer use (Fontaine 1991; Pinstrup-Andersen 1993; Blackie 1995).

Although the features of the African fertilizer economy that lead to high prices are often intertwined with those that constrain availability, policymakers have often focused solely on high prices rather than on availability and ignored the underlying causes completely.

Overview of Supply Side Factors

With regards to the supply side, the huge fertilizer procurement and distribution costs explain why the prices of fertilizer are inherently high. Most Sub-Saharan African (SSA) countries make importing fertilizer generally more economical than producing it locally (Vlek 1990).

Nonetheless, the differences between world freight on board (f.o.b.) prices and landed cost tend to be twice as high in many SSA countries compared to Asian countries (Shepherd and Coster

1987). Bumb (1988) states that this large difference is the result of the small fertilizer volumes that most African countries import. Small volumes increase unit transportation costs and weaken the importers' position in negotiating lower prices. Furthermore, in 1990, almost one-third of all SSA countries' fertilizer imports were financed by aid. In that year, for the 21 countries with small markets, all fertilizer was financed through donor programs. Donors impose conditions, such as limitations on origin, transporters, and fertilizer type, which lead to excessive marketing costs and margins, ultimately translating into higher fertilizer prices (Gerner and Harris 1993).

High distribution costs constitute a non-price factor contributing to low fertilizer use in SSA. First, landlocked countries face high transport costs from the closest seaport to point of entry. Second, internal distribution costs tend to be considerably higher than in other developing countries (Bumb 1988), due to high transportation costs and other factors, such as the small volume to be distributed. High transportation costs are the result of poor physical infrastructure. Sub-Saharan Africa lags far behind countries such as India and China in kilometer of roads per 100 km^2 (Vlek 1990; Spencer 1994). Other important infrastructural issues include failure in SSA to maintain roads and establish a balance between rural/feeder and trunk roads (Mwangi 1995).

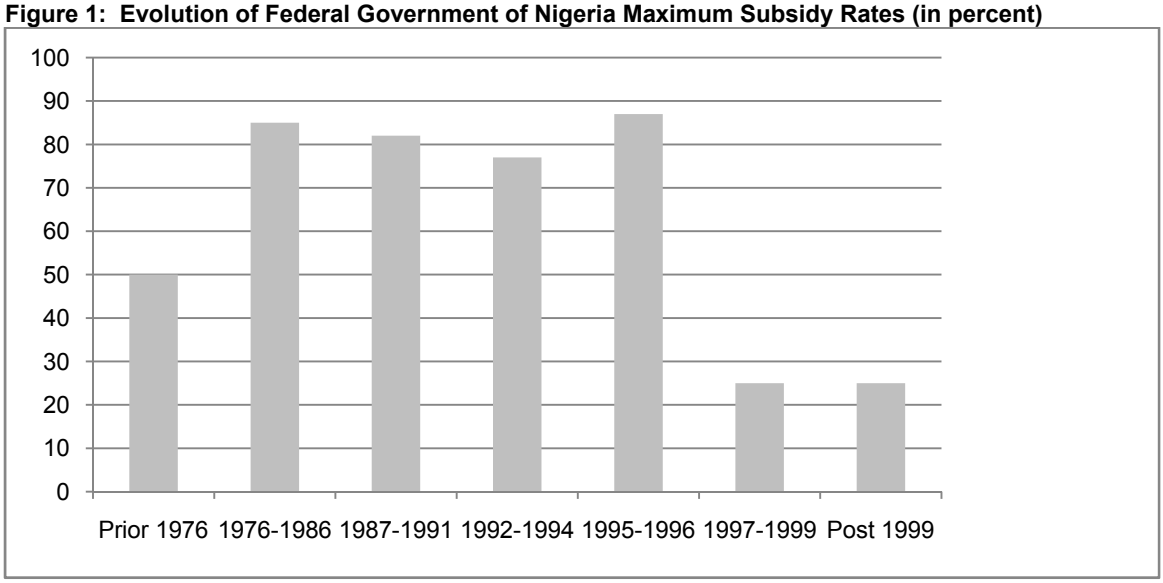
Similarly, substantial credit requirements throughout the fertilizer marketing channel commonly cause late delivery, thus raising the shadow price to farmers. Finally, the lack of competition in fertilizer distribution systems, often as a result of public-sector operation, can contribute to inefficiencies and higher marketing margins (Pinstrup-Andersen 1993).

Fertilizer Procurement and Distribution in Nigeria

As noted earlier, fertilizer subsidy occupies a significant position in the policy toolkits of the government and this explains why the federal, state, and local governments have all been involved in the procurement, distribution, and price determination of fertilizer at various times. The involvement of the federal government in the fertilizer distribution system dates back to 1976 when it adopted a national fertilizer policy put in place to (1) ensure self-sufficiency in national fertilizer requirement through local fertilizer production, (2) supplement local fertilizer production through fertilizer importation to ensure adequate and timely fertilizer supply to all Nigerian farmers, (3) offer subsidy on the market price of fertilizer to make fertilizer affordable to millions of small scale farmers, and (4) ensure that the right quality fertilizer is accessible to small-scale farmers at the right time in the right place (Ayoola et al. 2002). Consequently, conscious and deliberate efforts have been directed towards the realization of these objectives by stimulating local production based on available natural resources and securing the difference between national requirements and local production through imports (FGN 2006).

The fertilizer distribution system in Nigeria prior to 1997, when the fertilizer sub-sector was liberalized, operated virtually as a government monopoly. During this period, the federal government of Nigeria solely controlled fertilizer supply in the country. It procured all locally-produced and imported fertilizers and dispatched them to federation states and the federal capital territory. Sources of domestic fertilizer supply at that time were the fertilizer blending plants in existence and the outputs from these plants were supplemented by imports (FGN 2006). The policy evolution may be categorized into seven eras: prior to 1976 through post-1999 (Figure 1).

Figure 1: Evolution of Federal Government of Nigeria Maximum Subsidy Rates (in percent)



Sources: Eboh et al. 2006; Banful et al. 2010

Before 1976, state governments procured fertilizer independently and distributed the fertilizer through sales agents and the extension system. The subsidy level during this period ranged between 25 and 50 percent of the landed cost of fertilizer (Eboh et al. 2006). Extension agents played a significant role by educating farmers on the benefits of fertilizer use but the primary problems that characterized this era included interstate arbitrage, congested ports and demurrage charges, no control over fertilizer type or package quality, and poor subsidy administration and control (Nagy and Edun 2002).

Between 1976 and 1986, procurement and distribution of fertilizer was centralized by the federal government through the Fertilizer Procurement Distribution Division (FPDD). The Federal Superphosphate Fertilizer Company Ltd. (FSFC) located in Kaduna was established in 1976 with the capacity to produce 100,000 tonnes of SSP. This was in line with the federal government's fertilizer production policy of making fertilizer available locally with a long-term view to saving or earning foreign exchange from them (Ayoola et al. 2002). The FPDD procured imported fertilizer at the port from the private sector and FSFC and paid for transportation and distribution costs to depots in the states. The subsidy levels during this era ranged from 75 to 85 percent, depending on states (Eboh et al. 2006) and each state distributed fertilizer through agro-service centers and farm service centers. The significant problems that characterized this era included excessive storage and transit losses and late and sometimes non-delivery of fertilizer due to transportation problems.

Between 1987 and 1991, the federal government decentralized fertilizer procurement and distribution by allowing the physical transport of fertilizer from port and FSFC to be the sole responsibility of the states but the federal government reimbursed transport costs. States that could not afford transport costs left their allocations at the port causing the federal government to incur demurrage and warehousing costs. Subsidy levels during this era ranged from 70 to 82 percent. Storage and transit losses continued as in the previous era. The National Fertilizer Company of Nigeria (NAFCON) was established in 1988 with capacity to produce 1,000 tons per day (tpd) for ammonia, 1,500 tpd for urea, and 1,000 tpd for NPK, with a blending capacity

of 586,000 metric tons (MT). Also, six fertilizer depots were created in 1991 by FPDD which are located in Minna, Gombe, Lagos, Port Harcourt, Funtua and Makurdi to enhance the efficiency of the distribution system. All these proved costly and inefficient due to huge handling, storage, and transit losses (Nagy and Edun 2002).

Between 1992 and 1994, the depot system was abandoned and FPDD was given responsibility to distribute only imported fertilizer while NAFCON distributed locally-produced fertilizer. State agricultural ministries and Agricultural Development Projects (ADPs) distributed the fertilizer. Although this initiative reduced the system cost, non-delivery of fertilizer, as well as handling, storage, and transit losses still persisted. This was in spite of external consultants monitoring the fertilizer system for these problems. Accountability remained weak as offenders were identified but not charged (Nagy and Edun 2002). Subsidy levels during this era were 77, 65, and 65 percent respectively for the three years. The federal government in 1994 also experimented with distributing 80 percent of the fertilizer through local governments and 20 percent by the state governments. This experiment was implemented for one year and was abandoned, but the subsidy continued to be the responsibility of the federal, state, and local governments.

Between 1995 and 1996, the federal government stopped importing fertilizer, and transferred responsibility to the private sector. NAFCON and the blending plants were agencies for distributing locally produced fertilizer. The states collected their fertilizer allocation from the fertilizer plants, but were reimbursed for their transport costs by the federal government. Task forces were set up to monitor distribution, but they had little impact in improving performance. The problems of the past, particularly pertaining to the inability of some states to afford the transport costs, persisted. The subsidy levels during these years were 87 and 74 percents respectively.

Between 1997 and early 1999, the federal government discontinued the fertilizer subsidy and distribution programs and adopted a complete privatization and liberalization of the fertilizer sub-sector. Subsidies were abolished and the import tariff reduced from 10 to 5 percent. The initiative was largely ineffective because the ground work had not been properly laid out for the private sector to take over. Fertilizer use declined sharply and the federal government reintroduced a fertilizer subsidy of 25 percent in May 1999 and procured 101,000 tonnes to be distributed by the states, but targeted at poor farmers at the local governments. The subsidy program was discontinued again in August 2000 and the fertilizer import tariff was abolished. The federal government again procured and subsidized some portion of Nigeria's fertilizer in 2001 (164,000 tonnes), and in 2002, 163,700 tonnes was approved to be procured and subsidized at 25 percent. In 2002, the import tariff was reintroduced at 5 percent.

Frequent changes in fertilizer policies and the promotion of a dual fertilizer market prevented the required response from the private sector in the post-1997 period in taking over the public sector's role. Problems with fertilizer quality, arbitrage, and timeliness of distribution persisted. Government tenders for the targeted subsidized fertilizer were usually late, so were the federal government's payments to fertilizer distributors and the states' remittances to the federal government. Over-invoicing by fertilizer importers was prevalent and profiting from the arbitrage situation that existed between the official and parallel exchange rate markets was widespread. NAFCON discontinued production in 1999 to allow for the ammonia and urea plants to be refurbished, but the NPK plant was beyond repair. The FSFC sulfuric acid plant stopped functioning in 1989 and closed down in 2002 for a refurbishing, thus requiring the purchase of sulfuric acid by the federal government from within Nigeria and from imports.

Finally, since 1999 (except in 2000), the federal government under FMSP has procured fertilizer for sale to states at a subsidy of 25 percent. Several state governments also provide additional subsidy as well as procure fertilizer outside of the FMSP for sale to their farmers. In a study covering eight states, namely Bayelsa, Edo, Jigawa, Plateau, Sokoto, Taraba, Yobe and Zamfara, Banful et al. (2010) estimated that only 30 percent of subsidized fertilizer reached smallholder farmers at the subsidized price in 2008.

Table 2 shows the state fertilizer subsidy rates in 2008 and the amount of fertilizer that each state purchased through the FMSP. The average subsidy rates were highest in northern Nigeria where states procured the highest amounts of fertilizer both in terms of total amount and amount per agricultural household. The amount of fertilizer procured through the FMSP in 2008 ranged from 600 MT in Lagos state to 44,200 MT in Bauchi state. The estimated amount per agricultural household ranged from 5Kg in Ondo state to 208 Kg in the Federal Capital Territory (FCT). The average amount of fertilizer procured under the FSMP per agricultural household was 55 Kg or just over one standard bag of fertilizer (Banful et al, 2010). Unfortunately, in the absence of data on agriculture value added by state, the size of arable land under cultivation, it is not possible to assess the impact on the fertilizer use per state.

Table 2: Fertilizer procurement structure under the Federal Market Stabilization Program (FMSP) and state government's fertilizer subsidy rates in 2008

Regions/States	Metric tons procured under FMSP	Kilograms per agricultural household	State subsidy (%)
North – East			
Adamawa*	26,700	87	18.41
Bauchi	44,200	162	24.08
Borno*	9,330	20	19.29
Gombe*	29,100	142	22.85
Taraba*	28,200	117	24.40
Yobe*	5,070	56	18.71
North – west			
Jigawa*	13,560	32	48.51
Kaduna	9,870	27	17.66
Kano*	32,207	97	40.04
Katsina*	6,300	15	42.08
Kebbi*	35,036	122	12.36
Sokoto*	16,590	53	50.00
Zamfara*	32,800	115	11.35
North – Central			
Benue*	23,130	39	50.00
Federal Capital Territory	8,000	208	0.00
Kogi	40,560	118	17.36
Kwara*	3,930	26	22.50
Nassarawa	24,000	100	14.58
Niger*	27,990	76	16.63
Plateau*	27,000	87	17.36

Table 2. Continuation.

South – East			
Abia	6,000	13	17.23
Anambra	2,270	6	11.80
Ebonyi*	2,589	9	1.96
Enugu	8,359	30	2.77
Imo*	6,963	12	10.86
South – West			
Ekiti	7,600	47	18.50
Lagos	600	14	0.00
Ogun*	3,600	11	10.05
Ondo*	2,550	5	12.25
Osun*	8,998	38	10.55
Oyo	8,200	23	0.00
South – South			
Akwa Ibom*	9,650	30	18.43
Bayelsa	4,800	54	0.00
Cross River	9,330	19	5.86
Delta*	2,760	7	0.00
Edo	8,400	20	14.05
Rivers*	7,800	13	0.00

Source: Banful et al. 2010
*Indicate states that procure fertilizer from other sources in addition to those procured from federal government.

Fertilizer Prices in Nigeria

The FGN fertilizer policy document (FGN 2006) notes the reason for fertilizer subsidies as farmers' inability to afford the high free market price. But despite government's huge budgetary expenditure on fertilizer procurement and subsidy (Mogues et al. 2008), fertilizer prices remain high and continue to rise in Nigeria. The nominal prices of fertilizer (type unspecified) for a 50 kg bag rose from N50 in 1990 to N875 in 1996, N1200 in 1997, N1500 in 1999 and N1800 in 2000, with considerable price variation within states (Eboh et al. 2006). Fertilizer price reached N2000 per 50 kg bag in 2001, much above the official subsidy retail price of N900 per bag 50 kg bag, suggesting that federal and state government's subsidies are not fully transmitted to farmers. Recent price information by the Nigeria Agricultural Market Information Services (NAMIS 2009) suggests some price moderation for 2008/09.[4] Nagy and Edun (2002) also noted that only 30 percent of subsidized fertilizer reaches smallholder farmers at the subsidized price. The parallel sales of "subsidized" and "market" fertilizer tend to create an avenue for lower-priced subsidized fertilizer to be diverted for sale at higher market prices (Banful et al. 2010). The recent survey and analysis of the market prices of fertilizer in some selected states (Banful et al. 2010) provided further evidence to support the hypothesis that arbitrage opportunities created by the presence of fertilizer from subsidized sources are exploited. The findings generally reveal that "unsubsidized" fertilizer is cheaper in states with high subsidy rates, despite other state factors that are expected to increase fertilizer costs.

The variation in fertilizer prices across states could be attributed to differences in transportation costs. Thus, market prices for fertilizer in the northern states in Nigeria are expected to be

[4] Price changes for urea are estimated at 2.2 percent for Abia, 1.6 percent for Rivers and 16.7 percent for Kaduna during September 2008 and 2009. For the same period, the price changes for NPK (15:15:15) were 1.0 percent, 8.3 percent and 6.3 percent for Abia, Rivers and Kaduna respectively (NAMIS).

higher because transportation costs from the port in Lagos are higher [5], but they are generally lower than prices in the south. Scale economies, from the higher amount of fertilizer used in the northern states, may partially explain the lower prices in the northern states surveyed compared with the southern states. However, there are significant price differences among northern states and within the region. Zamfara is the only sampled state that had a functional blending plant in 2009, which should have given it an advantage in terms of increased supply of fertilizer, thereby putting downward pressure on unsubsidized fertilizer. Yet market prices in Zamfara tended to be higher than in the nearby states with higher subsidy rates. Banful et al. (2010) found a strong negative correlation between the state subsidies on state-procured fertilizer and the market prices for fertilizer: the correlation coefficients between the market price and subsidy rate for NPK 20:10:10 was -0.7 and urea was -0.6. The fact that higher state subsidies on fertilizer mitigate other factors that should increase the market price of fertilizer suggests that fertilizer is leaking from subsidized sources into the "unsubsidized" fertilizer market.

Constraints to Fertilizer Use in Nigeria. Low fertilizer use has been identified as a major challenge that must be overcome in order to increase Nigeria's agricultural productivity. However, there are several factors that contribute to low fertilizer use that are not addressed by direct price subsidies. First, the extension service system generally plays a critical role in driving demand for fertilizer through its transmission of information about soil improvement technology to farmers. In Nigeria, the extension service is also instrumental in providing farmers access to fertilizer. By drawing valuable insights from extension agents' perspectives on fertilizer in Nigeria, Banful et al. (2010) found that the primary constraint to fertilizer use in Nigeria is absence of the product at the time that it is needed, rather than affordability problems or farmers' lack of knowledge about its importance. Second, the most often-cited primary challenge for both male and female farmers is limited access to credit, cited by more than 55 percent of extension agents (Table 3). The other often-cited challenges are high prices of inputs other than fertilizer and an inadequate fertilizer supply. However, it is notable that high fertilizer prices are cited as the primary challenge to farming by only 3 to 5 percent of extension agents as shown in Table 3.

Table 3: Extension agents' perceptions of challenges to farming

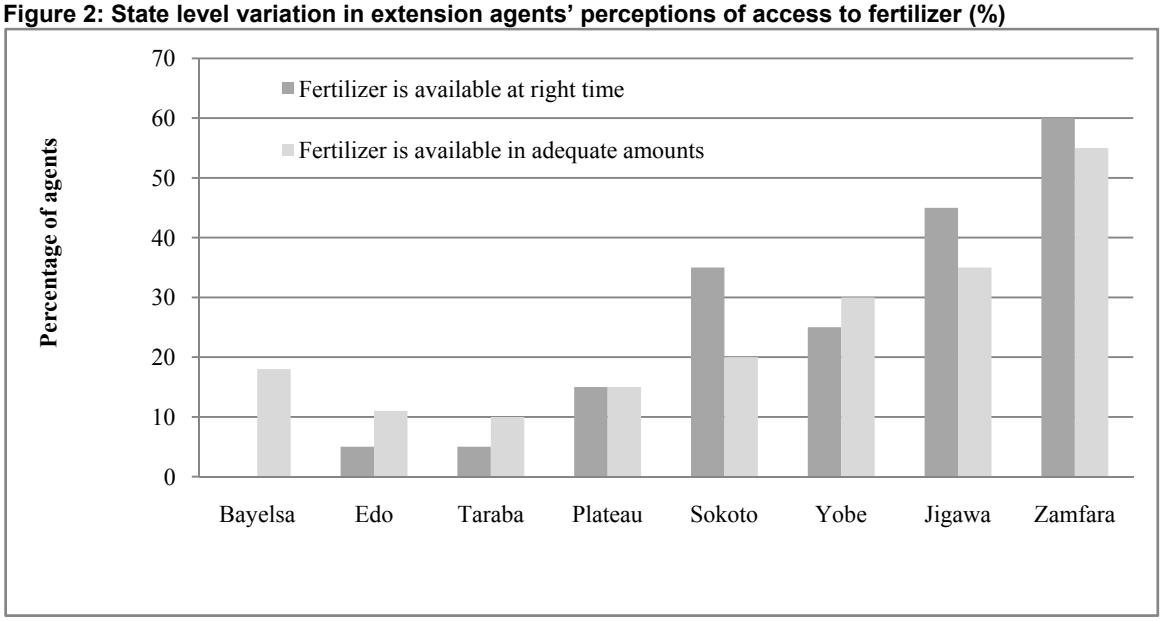
Challenge to farming	Female farmers (%)	Male farmers (%)
Limited access to credit	55	59
High prices of inputs other than fertilizer and seeds	11	10
Inadequate supply of fertilizer	8	8
Lack of access to seeds and other planting material	3	5
High fertilizer prices	5	5

Source: Banful et al. 2010

[5] Farm-gate fertilizer prices in several African countries revealed that in-country transportation costs contribute about 20 percent of the total price (Chemonics and IFDC 2007).

In another study of stakeholders' perspectives on constraints to farming and fertilizer use, Nagy and Edun (2002) found that fertilizer quality and availability are the main constraints.[6] While farmers will use more fertilizer if prices are lowered, they would use much more fertilizer at prevailing market prices if the quality was good and if it was available when needed. Another impediment to fertilizer use is the non-availability and high cost of credit. All sampled stakeholders indicated that acquiring credit for fertilizer purchases was a significant problem but put quality and timeliness constraints ahead of that (Nagy and Edun 2002).

Figure 2: State level variation in extension agents' perceptions of access to fertilizer (%)



Source: Banful et al. 2010

Furthermore, despite subsidy rates reaching as high as 87 percent (Figure 1), fertilizer consumption rates in Nigeria have remained low. Findings from a recent survey of selected stakeholders' perspectives in the Nigerian fertilizer sector (i.e., key individuals employed at state ministries of agriculture and the agricultural development programs (ADPs), agricultural input dealers, members of smallholder farmers' associations and farmers not aligned with any farmers association) on different aspects of the federal and state government fertilizer subsidy programs reveal that fertilizer is highly demanded by farmers, many of whom will be willing to pay market price as long as the product is available. Specifically, all 44 stakeholders interviewed indicated that there is a high demand for fertilizer which far outstrips the supply each year. However, there is a persistent shortage of fertilizer supply from both public and private sources. The subsidy programs have been plagued by the pervasive problem of late delivery. Rent-seeking activities and political manipulation have also resulted in diversion of subsidized fertilizer from the proclaimed beneficiaries (Banful and Olayide 2010).

[6] The stakeholders included FGN officials, state government officials of Oyo and Kano, donors, fertilizer importers, fertilizer producers, blenders, and those who distribute fertilizers (wholesale and retail agricultural enterprises) and both commercial and subsistence farmer representatives.

The Regulatory Environment for Fertilizer Quality Control

Overview of Institutions for Fertilizer Quality Regulation in Nigeria

Despite a multifaceted fertilizer quality regulatory process with numerous and diverse participants, fertilizer quality remains a challenge in Nigeria as noted earlier. Fake, adulterated, and misbranded fertilizers, as well as underweight fertilizer bags, are prevalent in the Nigerian market (FGN 2006; Chude 2006; Ayoola 2002). Fertilizer quality issues have been identified as another major constraint to fertilizer use in Nigeria and farmers have indicated interest in higher fertilizer use, despite the cost, if they were assured of improved quality (Nagy and Edun 2002; Chude 2006).

Numerous fertilizer regulatory activities concurrently exist in Nigeria. The Standards Organization of Nigeria (SON), National Agency for Food and Drug Administration and Control (NAFDAC), Federal Fertilizer Department (FFD) of the Federal Ministry of Agriculture and Rural Development (FMARD), States Ministries of Agriculture (SMAs) and Agricultural Research Institutes under the National University System are key agencies mandated to participate in fertilizer regulation.

SON, created in 1971, is a statutory body with a core mandate to produce and periodically review standards relating to products, measurements, and material processes in Nigeria. It promotes standards developed at national and regional levels and is meant to certify industrial products. SON also monitors product quality. Currently it has two programs: Standards Organization of Nigeria Conformity Assessment Program (SONCAP) and Mandatory Conformity Assessment Program (MANCAP). SONCAP requires importers to secure product certification at point of export and SONCAP Certification on a shipment by shipment basis. In December 2005, SONCAP Certification became a mandatory customs clearance document issued by local SON Country Offices (SONCO) located in countries from which fertilizer is imported. MANCAP focuses on quality assurance verification and compliance, and operates once fertilizer gets into the country, or for locally-produced fertilizer, the local SON offices issue MANCAP National Industrial Standards NIS Logo Certification to those in compliance.

NAFDAC was established in 1993 with the mandate to regulate and control quality standards of foods, drugs, and chemicals imported or manufactured locally and distributed in Nigeria. It was meant to regulate and control quality standards made by SON, serving as a quality regulator and control agency for the importation, local production, and marketing of fertilizers. NAFDAC issues permits for the importation of chemical products (e.g., agrochemicals). They collect fertilizer samples from the ports and send them to a laboratory for analysis. Fertilizer is only released to an importer when tested samples confirm that the fertilizer being imported confirms with the claims of the manufacturer. NAFDAC is mandated to also inspect warehouses where fertilizers are stored.

In addition to NAFDAC and SON, the Federal Fertilizer Department (FFD), now called the Agricultural Input Services Department (AISD)[7], is also charged with ensuring that both locally-produced and imported fertilizers meet required quality standards. It is meant to liaise with SON and agricultural research institutes on fertilizer quality and specification issues**.** AISD collects

[7] This is one of the 14 Departments under Federal Ministry of Agriculture and Water Resources responsible for fertilizer quality issues

and tests fertilizer samples at the ports, as well as manufacturing and bulk blending plants. It collects and analyses samples of fertilizer under FMSP to ensure quality standards are met before the fertilizer is delivered to the states. In addition to laboratory testing for quality adherence, AISD conducts field trials on new fertilizer technologies and products for quality verification and efficacy prior to its introduction into the market.

Other key players in fertilizer regulation in Nigeria are the state ministries of agriculture (SMAs). These ministries play active roles in the distribution of fertilizer that comes through the Federal Market Stabilization Program (FMSP), where the federal government buys fertilizer and sells to states at a 25 percent discount. The SMAs distribute fertilizer to farmers either directly through various distribution committees at local government and ward levels, farm groups or farm service centers or indirectly through state agricultural input supply companies and farmer service centers. Although monitoring fertilizer quality (particularly those procured directly by states) is considered under its domain, there is no clear designation of its responsibilities in this regard. Agricultural research institutes and universities play an important technical role in fertilizer quality regulation by providing sample testing services to numerous ministries and local fertilizer producers.

Despite these numerous participants charged with fertilizer quality regulation, fertilizer quality issues remain a challenge in Nigeria. The quality challenges occur along the full spectrum of the fertilizer supply chain. Adulteration, which usually involves fertilizer being mixed with products like sand and crop or weed seeds, is a major problem. Other issues like nutrient deficiency of fertilizer samples subjected to laboratory tests and underweight bags have also been confirmed across the country (Ayoola 2002; IFDC 2005). In addition to the use of substandard raw materials, nutrient deficiency is largely attributed to poor process control in production plants or poor product mixing in the case of blending plants (Ayoola 2002). Underweight bags, used to increase profit margins, typically occur during multiple levels of re-bagging, often in the absence of proper scales. Other fertilizer quality issues prevalent in Nigeria include poor quality bags and storage facilities, inadequate warehouse ventilation, poor product handling and misbranding, misleading or absent labels and false nutrient specifications (Ayoola 2002; Chude 2006).

Effectiveness of the Fertilizer Quality Regulatory Mechanism

In order to understand and assess the effectiveness of the fertilizer quality regulatory system in Nigeria, Liverpool-Tasie et al. (2010) administered questionnaires to desk officers in the ministries of agriculture or ADPs, where appropriate, in all states They also administered questionnaires to the internal quality control officers of all 12 operational blending plants and to the two manufacturing plants in the country. Respondents were asked about the organizations and agencies responsible for fertilizer regulation in their states, the nature of fertilizer quality problems in their state, and the regulatory process for fertilizer quality.

Results from the study on the fertilizer quality regulatory mechanism in Nigeria (Liverpool-Tasie, Auchan, and Banful 2010) indicate that though there are bodies rendering some monitoring services on fertilizer quality, it is not well-developed. There are organizations and agencies with the mandate to monitor fertilizer quality, but their execution is inadequate, particularly in more rural areas. Though requirements are laid out, execution and enforcement are limited. Activities and responsibilities within the regulatory system are disparate, which limits effectiveness. Where fertilizer is one among many products under the mandate of a regulatory body, it tends to be overlooked. For example, fertilizer is not on SON's list of products being sent for physical and chemical tests to a lab in Lagos (Ayoola et al 2002). Although SON's SONCAP and MANCAP are well laid out programs to enforce quality standards of imported and locally-

produced merchandise, actual enforcement is hardly evident in the fertilizer sector. While MANCAP logos can be seen on the packaging of many products, they are not typically found on fertilizer bags. Stakeholders focus on the portions of the supply chain most relevant to their activity; local producers and the private sector address fertilizer quality issues in as far as it affects their operation at the importation and production stages, leaving fertilizer at lower levels of the chain open to violation. By statutory provision, NAFDAC should regulate all chemicals including fertilizer. Currently, NAFDAC activities are limited to the importation and production stage with limited activities at the distribution stage where most of the product dilution occurs (Ayoola et al. 2002). While NAFDAC engages in the registration of fertilizer producing and importing companies, it does not engage in market surveillance.

The report on fertilizer quality regulation in Nigeria (Liverpool-Tasie et al. 2010) also shows that the nature and sources of fertilizer quality challenges are well known, cutting across all fertilizer products in the market. Adulteration and fake products are largely associated with fertilizer in the open market. Underweight bags and poor bagging appear to be common with FMSP fertilizer, and wrongful chemical composition is largely associated with locally-produced (largely blended) fertilizers. The Liverpool-Tasie et al. (2010) report also notes that although proper procedures to guarantee substandard fertilizer are well known, effective execution and regulation are deficient. While numerous activities exist to guarantee the quality of imported fertilizer, this intensity of activities dwindles downward to the ADP office level and rural markets. The results show that fertilizer sample tests are frequently conducted at importation and production stage but this is less evident as one moves towards rural areas.

These findings raise serious concerns. Having about 50 to 70 percent of desk officers consider FMSP fraught with underweight bags and poor packaging indicates the inefficiency of the regulatory mechanism even at higher levels during importation and distribution to state ministries[8]. This calls for a reassessment of the seemingly rigorous requirements at levels of importation and production in Nigeria. The high association of adulteration and fake products with fertilizer in the open market reflects the ineffectiveness of the regulatory system at lower levels of the supply chain closer to the farmers. There is no agency clearly assigned to quality regulation at that level and the conduct of sample tests at that stage is limited. Though this is partially due to the limited availability of testing laboratories, it also appears that random market checks are more evident in larger cities with limited evidence of their occurrence by the time fertilizer gets to sub-state ADP offices and the rural market.

Legislation and policy require enforcement and implementation to be useful and promote societal development. However, fertilizer experts at the state ministries and local producers both consider legal authority to punish producers and distributors of substandard fertilizer to be lacking and a major reason for the ineffectiveness of the fertilizer quality regulatory mechanism. They also prescribe more frequent and extensive sample tests in well equipped and efficient laboratories for improved performance.

[8] Majority of respondents indicated these problems as being identified when fertilizer is distributed to their offices for further disbursement to ADPs or farmer groups.

Improving Fertilizer Distribution – An Example of Input Vouchers

Role of the Voucher System

Government distribution of subsidized fertilizer in Nigeria is often characterized by cumbersome and expensive administrative processes as well as diversion of the product from the proclaimed beneficiaries. Consequently, limited quantities of inputs often get to farmers long after they are needed (Minot and Benson 2009). Agricultural input vouchers are seen to be more flexible, enabling holders purchase specific quantities and/or types of inputs from authorized input dealers who agree to accept vouchers as payment. The dealers can then redeem the vouchers from the government or voucher program organizers, often with an agreed margin to cover their expenses and agreed level of profit (Gregory 2006).

Voucher programs are seen as an effective way to build private-sector distribution networks when farmers are required to take their vouchers to private input dealers to exchange for fertilizer. Providing guaranteed demand and margins to small input dealers, they accelerate market development (Gregory 2006). This can be strengthened by capacity building and linkages to initiatives in output marketing, financial services, and market information for dealers (Gregory 2006). Through well-built exit strategies such as reducing the value of a voucher over time or converting it to a crop production credit that is repaid at harvest, input vouchers can be sustainable programs. Further still, in emergency response situations, vouchers can replace food aid as medium-term support to those affected (Minot and Benson 2009).

By providing access to fertilizer and other inputs at lower cost, vouchers help reduce adoption disincentives due to farmer cash constraints and/or risk aversion and low expectations of returns from investments in inputs (Dorward and Poulton, 2007). They increase the probability that farmers will use the technology and benefit from its use by increased agricultural productivity and consequently increased incomes and food security.

In line with these thoughts, agricultural input vouchers are being increasingly employed to address problems associated with agricultural productivity and food security. Malawi has used input vouchers in its nationwide fertilizer and seed subsidy programs since 1999. Input vouchers have also been used in various countries such as Afghanistan in 2001, Mozambique in 2002, Zambia in 2003, Tanzania in 2008 and Ghana in 2008 and 2009 (Longley et al. 2003; Longley et al. 2007; Gregory 2006; Minot and Benson, 2009; IFDC 2010). In Nigeria, the use of vouchers to provide federal and state government subsidized fertilizer has been piloted in several states in 2004 and from 2008 to 2010. The promotion of voucher use in Nigeria stems from the years of wastage and diversion challenges inherent in government's agricultural inputs procurement and distribution. The standard national program purchases fertilizer from importers and then distributes it to state level blenders and agricultural development programs. This national program, however, undermined the development of private sector, commercial sales, and suffers from substantial leakages and non-payments from states to the federal government. The International Center for Soil Fertility and Development (IFDC) Developing Agricultural Inputs Markets in Nigeria (DAIMINA) pilot project was on the use of fertilizer vouchers in three states in 2004 (Kano, Bauchi and the Federal Capital Territory (FCT)). The objective of the project was to allow farmers to procure fertilizers with a 25% subsidy from private dealers, complementing the government distribution channel and increasing the density of the outlet network. The pilot was expected to demonstrate the potential for a more efficient private sector management system of the state and federal government fertilizer subsidy to targeted beneficiary farmers (Gregory 2006). A second pilot was done in 2008 (Kano and Bauchi) and another one in 2009 in Kano and Taraba states.

Kano and Taraba States Voucher System

The application of the pilot fertilizer voucher programs on fertilizer supplied under the Federal Market Stabilization Program (FMSP) in Nigeria was a response to the challenges of the traditional distribution of subsidized fertilizer in Nigeria. The 2009 voucher program in Kano and Taraba was a collaborative effort between the federal and state governments, the private sector suppliers and dealers, and IFDC. The program was designed to deliver subsidized fertilizer to 140,000 and 76,000 smallholder farmers in Kano and Taraba states respectively. The pilot program was an attempt to address fertilizer distribution challenges and did not involve or accompany any substantial policy change. Three fertilizer suppliers[9] and over 150 private sector agro-dealers participated in the program. Participating farmers were provided with vouchers, which were redeemable at certified agricultural input dealers within their local government of residence. The value of the voucher was a N2000 (about US$13 in 2009) discount per bag on two bags of nitrogen phosphorous potassium (NPK) and one bag of urea in Kano, and on two bags each of NPK and urea in Taraba. Farmers' vouchers were allocated to match the volume of product requested by states from the federal government through suppliers with specific dealers in the various local government areas (LGAs). This limited farmers' choices on their source of the product. In most cases, there were different certified agricultural input dealers for NPK and urea, which increased the transaction costs associated with redeeming the vouchers.

Due to state level peculiarities (Table 4), the program was administered slightly differently in the two states. In Kano, there is a long history of farmers organizing into small farmer groups but such groups are rare in Taraba. Both states required voucher recipients to be members of an organized group. In Kano, the recipient had to be a member of a small farmer group. In Taraba, however, the recipient could be a member of any organized group, not necessarily a farmer group. In Kano, a farmer group received a single voucher that entitled its members to a N2,000 discount on three bags of fertilizer per member. In Taraba, each individual member of the organized group received a voucher and could purchase four bags of fertilizer at the discounted rate.

Table 4: Summary of main state differences in the 2009 voucher program administration

Kano	Taraba
Participation required membership in a farmer group	Participation required membership of some organized group not necessarily a farmer group
Each voucher was given to an entire farmer group	Each voucher was given to the individual farmer
Voucher entitled recipients to two bags of NPK and one bag of urea at subsidized price	The voucher entitled recipients to two bags of NPK and two bags of urea at subsidized price
Farmers were required to deposit N6,000 per member in an account	No deposit was required

Source: Liverpool-Tasie et al. 2010.

In Taraba, farmers from selected organized groups gathered at a voucher distribution center on a prearranged day. Each was required to bring three passport photographs. The leader of the group would vouch for the identity of each of the groups' members as a farmer. Two passport photographs were put on the voucher and the third was affixed to a roster to be given to the specific agricultural input dealer at which the farmer could use the voucher. In addition farmers

[9] The three suppliers are the three companies that produced or imported the fertilizer used in the program. They were Notore Chemicals Industry, Golden Fertilizer and TAK Fertilizer.

thumb-printed each voucher. Upon filling necessary documents, farmers were given the vouchers. A farmer and his or her assigned agricultural input dealer then arranged a day on which the farmer could purchase and pick up the four bags of fertilizer.

In Kano, farmer groups were required to bring their registration certificate to verify their group's authenticity. Due to the long history of farmers with farm groups in Kano, a single voucher was issued to the entire farmer group and the subsidized fertilizer had to be purchased as a group. Rather than having individual photos of farmers on the voucher as was the case in Taraba, photos of the farm group representatives (i.e., Secretary, Chairman, and Treasurer) were placed on the voucher. Individual members of the group also had to provide one single passport photo to the farm group executive to be presented at voucher distribution day but the members of the group were not required to be present for the groups' voucher to be provided to the group leadership. In Kano each farmer, listed on the membership roster of a participating farmer group, was required to contribute N6,000 each as a sign of the group's commitment to fully utilize the voucher. This requirement may have been a measure to limit the demand for participating in the voucher program in Kano as there was initially much higher demand than could be serviced by the total amount of fertilizer available under the program. Farmers had to tie up their money early in the implementation of the voucher program and bear the risk of not receiving fertilizer they had committed funds to purchase in order to be eligible to participate in the program. Each voucher in Kano entitled a farmer group member to receive 3 fertilizer bags– the number of farm group members was indicated by the total deposit supplied by the farmer group divided by N6,000.

In both states, the redeemed vouchers were taken by agricultural input dealers to the fertilizer wholesalers/importers who gather the vouchers and submitted them to the Project Implementation Team (PIT) which consisted of fertilizer wholesaler/importers, IFDC, the state ADP, and the state representative. The team would then check and verify vouchers against the appropriate lists. Once the PIT confirmed the value of the reconciled vouchers for each fertilizer wholesaler/importer, that value would be credited to their various accounts (IFDC 2010). In the program, fertilizer wholesalers/importers were to ensure fertilizer availability through designated agricultural input dealers. Specifically, they were to ensure fertilizer supplied to agro-dealers met proposed redemption allocations and timeframes (no more than 30 days from a specified date in each state) and to pay their contracted distributors a 5% gross margin for agro-input dealers. In Kano, the state government was also responsible for ensuring the quality of fertilizers at supplier, agro-dealer, and farmer levels. The government reserved the right to reject any substandard product discovered at any level.

The 2009 Voucher Program Participants

The data used in the study by Liverpool-Tasie et al. (2010) came from 640 households in Kano and 360 households in Taraba. The interviewed households in Kano and Taraba were selected from 10 randomly selected Local Government Areas (LGAs), administrative units under each state constituting the third tier of the administrative structure in Nigeria (Liverpool-Tasie et al. 2010). The selected LGAs in each state represented potential LGA variation in proximity to state capitals which affects road availability and quality.

The study found that participants in the voucher program in Kano were (1) mainly farmers who had used subsidized fertilizer in the past, (2) formally educated, (3) in a farmer group that purchased fertilizer together in 2009, and (4) belonged to households with larger livestock holdings. For Taraba, participants were also more formally educated and more likely to have received subsidized fertilizer in the past. The results indicate that the likelihood of respondents

participating in the voucher program depended on the local government they resided in. In Kano, the results indicate that the poorest and less educated farmers might have been excluded either because of cumbersome program requirements or limited resources. While wealth did not distinguish participants from non-participants in Taraba, the less educated were somewhat excluded from the program.

Survey respondents in Kano who did not attempt to participate in the voucher program attributed this to the complicated and burdensome nature of the participation process. This includes the group membership requirements, passport photographs, meetings, commitment of upfront funds (N6,000) prior to participation, as well as the transaction costs associated with participation such as arranging with a dealer when to pick up fertilizer, and numerous trips necessary before the product is actually received. The main reason given by non participants in Taraba was limited awareness about the program, while lack of confidence in the program and a complicated participation process were the next two most important reasons.

Evaluation of the Voucher System

The voucher program was intended to improve on the traditional fertilizer distribution system characterized by numerous leakages and the late delivery of poor-quality fertilizers to farmers at often close to the market price (Nagy and Edun 2002; IFDC 2010). Thus, we would expect an improved system to reduce fertilizer leakages and increase the *quantity* of subsidized fertilizer that farmers had access to. We would also expect to see *better quality* fertilizer being distributed to farmers who participated in the program *on time* and at a *price* significantly lower than the market price. Consequently, the study by Liverpool-Tasie et al. (2010) empirically tested if the voucher program improved these four outcomes for participants: quantity, quality, timeliness, and reduced price of fertilizer.

Quantity

Besides the private market, the voucher program is one of several sources of subsidized fertilizer for farmers. Particularly in Kano, but also in Taraba, several subsidy programs existed concurrently, with other programs typically utilizing the traditional fertilizer distribution mechanism. It was expected that after controlling for other factors that might affect farmers' access to and demand for subsidized fertilizer, the number of bags as well as the probability that program participants use subsidized fertilizer would be greater than that of their counterparts who did not participate in the program. Results showed that participating in the program did significantly increase the likelihood of receiving subsidized fertilizer, even after controlling for previous access to subsidized fertilizer (Table 5). Furthermore, program participation increased the quantity of subsidized fertilizer received compared to non-participants. In Kano, association to the farm group president was an important factor affecting the number of bags participants received. This indicates that while groups are a possible mechanism to distribute fertilizer, inequities within groups is an important issue to guarantee equal access to products by less influential farmers.

Price

Under the inefficient traditional delivery system, farmers typically are forced to pay higher than the announced subsidized prices, often almost identical to the market price (Nagy and Edun 2002; IFDC 2010). It was expected that a more efficient distribution system would minimize leakages so that the price paid by program participants would be significantly lower than market price. Program participants paid higher prices for subsidized fertilizer received through the program compared to their counterparts who received subsidized fertilizer from other sources

outside the program. However, they paid significantly lower prices compared to those who purchased directly from the market.

Table 5: Summary of key findings on the expected effects of participating in the voucher program

Outcome variables	Voucher Program Participation	
	Kano	Taraba
Probability of receiving subsidized fertilizer	0.764***	7.170***
Number of bags of fertilizer	2.568***	3.556***
Price of NPK paid relative to other subsidized fertilizer	201.2***	
Price of urea paid relative to other subsidized fertilizer	129.0	-241.7**
Price of NPK paid relative to market price	-453.2***	-854.2***
Price of urea paid relative to market price	-353.7**	-1016***
Timeliness of receiving fertilizer	0.452**	0.387
Quality (underweight bags) of fertilizer received	0.017	0.870***
Quality (with foreign substances) of subsidized fertilizer	0.281	1.214***
Quality (with foreign substances) of fertilizer from the private market	0.070	0.209

Source: Extracted from Liverpool-Tasie et al (2010)

Timeliness of Fertilizer Receipt

The delivery of subsidized fertilizer is persistently late (Banful and Olayide 2010). Consequently, the Liverpool et al. (2010) study explored whether the farmers who participated in the voucher program tended to receive fertilizer closer to the ideal time it was needed. Their results indicated that on average, participating in the voucher program did not improve the timeliness of fertilizer receipt; rather where significant, it increased the likelihood that the product was received late. Timeliness of fertilizer availability appears to be beyond farmer control. What determines the timeliness of fertilizer availability are state and local government policies and infrastructure. This implies that the efficiency of programs like the voucher program may be improved by interventions to ensure that the product is timely purchased (largely imported) and distributed to states and local governments.

Quality of Fertilizer

Another commonly cited issue with subsidized fertilizer is that it is adulterated or underweight (Chude 2006). A voucher program, particularly the 2009 program which only worked with three suppliers (such that substandard products could be more easily traced back to the supplier) could improve the fertilizer delivery along these dimensions. We thus expect fewer complaints from program participants about fertilizer received being short weighted or filled with foreign substances. We find that participating in the voucher program did not provide farmers with better quality fertilizer; again where significant, program participants were more likely to complain about fertilizer quality problems than non-participants.

Conclusions

Findings

Although most of the empirical findings in this overview are based on limited samples and may not claim to have nationwide applicability, they point to conclusions that may assist Nigeria to review its fertilizer policy. This review has found that

- Despite the repeated changes in the fertilizer policy scenario in Nigeria (at both the federal and state levels) over the years, one factor has remained largely constant and it is the support for fertilizer price subsidy. Fertilizer subsidy has been central to the policy direction of Nigeria and may be justified on many grounds, such as market failures and equity considerations. However, it has largely failed to achieve the desired outcomes. The heavy emphasis on price subsidization to the detriment of other approaches, such as complementary actions to improve farmers' fertilizer-use techniques (e.g., extension programs), seeking lower transactions costs (e.g., better regulatory environment), or reduced risk (e.g., fertilizer quality control) has hampered market development.

- The parallel sales of "subsidized" and "free-market" fertilizer tend to create avenues for the lower priced subsidized fertilizer to be diverted for sale at higher market prices. The survey results reviewed discussed in this study support the hypothesis that arbitrage opportunities created by the presence of fertilizer from subsidized sources had been exploited. The findings by Banful et al. (2010b) suggest that "unsubsidized" fertilizer is cheaper in states with high subsidy rates, despite other state factors that are expected to increase fertilizer costs. In general though, states with higher state subsidies have lower market prices for fertilizer.

- The review findings further suggest that the primary constraints to fertilizer use in Nigeria is the absence of the product at the time when it is needed, rather than problems of affordability or farmers' lack of knowledge about its importance. In addition, while farmers will use more fertilizer if prices are lowered, farmers would use much more fertilizer at prevailing market prices if the quality was good and if it was available when needed.

- With respect to the regulatory environment in Nigeria, the high association of adulteration and fake products with fertilizer in the open market reflects the ineffectiveness of the regulatory system at lower levels of the supply chain; that is, closer to the farmers. There is no agency clearly assigned to quality regulation at that level and the conduct of sample tests at that stage is limited.

- Finally, it appears that the experimental voucher program had positive outcomes for participants in the 2009 program. Participating in the program significantly increased the likelihood of receiving fertilizer and increased the quantity of subsidized fertilizer received compared to non-participants. Program participants paid higher prices for subsidized fertilizer received through the program compared to their counterparts who received subsidized fertilizer from other sources outside the program. However, they paid significantly lower prices compared to those who purchased directly from the market. Where significant, program participation increased the likelihood that the product was received late. Similarly, participating in the voucher program did not provide farmers with better quality fertilizer; again where significant, program participants were more likely to complain about fertilizer quality problems than non-participants.

Recommendations

Three principal policy recommendations arise from this review with respect to policy formulation, how to deal with low level usage, and improving the regulatory environment.

- The most important first step of the government should be to eliminate the dual fertilizer markets (subsidized and free-market) by establishing the primary role of the private sector in fertilizer production, procurement, and distribution. This is because the existence of a dual fertilizer market has hampered the required response from the private sector in taking over the role played by the public sector as posited by the pronouncements of various past governments.

- Promoting policy stability by reducing the frequency of government intervention in preference to building capacity in the private sector to handle all levels of the fertilizer value chain would send the right signals to the private sector on government commitment to reforms.

- Finally, addressing fertilizer quality challenges in Nigeria requires a holistic approach to the regulation of fertilizer production and distribution in the country. A clear assignment of monitoring and regulatory roles is needed at every stage of fertilizer production and distribution with a broader reach to peri-urban and rural markets. Such role assignment needs to be backed by legislation and accompanied by punitive powers to ensure that violators of established regulations can be duly prosecuted and punished. Training of manpower for fertilizer testing across the nation is necessary. Opportunities for farmers and local agro-dealers to voluntarily bring their products for testing requires either improved access to laboratories or an extension of ADP offices equipped to offer this service. This further requires adequate trainings as well as access to resources to conduct such tests.

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Annex I: The Abuja 2006 Fertilizer Summit Declaration and Resolutions

The African Union Ministers of Agriculture convened in Abuja on June 12, 2006 for the Africa Fertilizer Summit:

Recognizing that Africa needs a Green Revolution which is long overdue and yet constitutes the way of getting African farmers out of the poverty trap by achieving food security and other relevant the Millennium Development Goals;

Recognizing that fertilizer is crucial for achieving an African Green Revolution in the face of rapidly rising population and declining soil fertility;

Realizing that most farmers in Africa are poor, have virtually no access to fertilizer and that the poorest of them urgently need special attention;

Recognizing the urgent need for a strategic investment program to increase the availability and use of fertilizer alongside with other inputs to usher in the Green Revolution on the African continent;

Declare fertilizer, from both inorganic and organic sources, a strategic commodity without borders; and

Resolve that the African Union Member States will accelerate the timely access of farmers to fertilizers:

1. Given the strategic importance of fertilizer in achieving the African Green Revolution to end hunger, the African Union Member States resolve to increase the level of use of fertilizer from the current average of 8 kilograms per hectare to an average of at least 50 kilograms per hectare by 2015.

2. By mid-2007, the African Union Member States and the Regional Economic Communities should take appropriate measures to reduce the cost of fertilizer procurement at national and regional levels especially through the harmonization of policies and regulations to ensure duty- and tax-free movement across regions, and the development of capacity for quality control. As an immediate measure, we recommend the elimination of taxes and tariffs on fertilizer and on fertilizer raw materials.

3. By mid-2007, the African Governments must take concrete measures to improve farmers' access to fertilizers, by developing and scaling up input dealers' and community-based networks across rural areas. The Private Sector and Development Partners are hereby requested to support such actions.

4. By 2007, the African Union Member States must take concrete measures to specially address the fertilizer needs of farmers, especially women, and to develop and strengthen the capacity of youth, farmers' associations, civil society organizations, and the private sector.

5. With immediate effect, the African Union Member States must improve farmers' access to fertilizer, by granting, with the support of Africa's Development Partners, targeted subsidies in favor of the fertilizer sector, with special attention to poor farmers.

6. The African Union Member States should take immediate steps to accelerate investment in infrastructure, particularly transport, fiscal incentives, strengthening farmers' organizations, and other measures to improve output market incentives.

7. The African Union Member States should establish national financing facilities for input suppliers to accelerate access to credit at the local and national level, with specific attention to women.

8. The African Union Member States, hereby request the establishment of Regional Fertilizer Procurement and Distribution Facilities with the support of the African Development Bank, the Economic Commission for Africa, the Regional Economic Communities and the Regional Development Banks, through strategic public-private partnerships by the end of 2007.

9. Given the extensive fertilizer raw material resources in Africa and the fact that they are underutilized in many parts of the continent, the African Union Member States undertake to promote national/regional fertilizer production and intra-regional fertilizer trade to capture a bigger market and take advantage of economies of scale through appropriate measures such as tax incentives and infrastructure development. This should be supported by the African Development Bank, the Economic Commission for Africa, the Regional Development Banks, the Regional Economic Communities, other Development Partners, and the Private Sector.

10. The African Union Member States should take specific action to improve farmer access to quality seeds, irrigation facilities, extension services, market information, and soil nutrient testing and mapping to facilitate effective and efficient use of inorganic and organic fertilizers, while paying attention to the environment.

11. The African Development Bank, with the support of the Economic Commission for Africa and the African Union Commission, is called to establish, by 2007, an Africa Fertilizer Development Financing Mechanism that will meet the financing requirements of the various actions agreed upon by the Summit. We, the African Union Member States, undertake to support the establishment of this facility and will pledge resources for its immediate operation.

12. The African Union Member States request the African Union Commission and the New Partnership for Africa's Development to set up a mechanism to monitor and evaluate the implementation of this resolution. This should be done in collaboration with the Economic Commission for Africa and the African Development Bank. The African Union Commission should give a progress report to the African Heads of State at every sixth-monthly African Union Summit, starting in January 2007.

Annex II: Fertilizer production, Import and Consumption in Nigeria 2002-2008

Fertilizer Type	Element	2002	2003	2004	2005	2006	2007	2008
Nitrogen Fertilizers (N total nutrients)	Production Quantity in nutrients (tonnes of nutrients)	0	0	3,800	4,868	20,821	12,505	12,500
Phosphate Fertilizers (P205 total nutrients)		0	0	2,200	2,779	12,540	6,553	6,500
Potash Fertilizers (K20 total nutrients)		0	0	2,450	3,066	14,314	6,803	6,800
Ammonium nitrate	Import Quantity (MT)	2,849	2,437	0	0	0	0	63,538
Ammonium sulphate		4,709	5,17	74,420	76,490	78,619	24,260	1,576
Diammonium phosphate (DAP)		5,009	466	0	0	0	19,532	24,438
Monoammonium phosphate (MAP)		219	20	30,000	25,000	22,000	0	19,571
NPK complex >10kg		97,605	25,770	0	0	0	0	439,312
Potassium chloride (Muriate of potash)		2,946	10,810	11,000	10,000	11,000	12,219	67,380
Superphosphate other		0	0	8,000	10,000	10,000	14,718	0
Urea		288,252	77,207	39,000	417,900	306,900	75,864	601,870
Nitrogen Fertilizers (N total nutrients)	Import Quantity in nutrients (MT of nutrients)	94,400	137,603	36,868	211,047	160,104	43,508	370,676
Phosphate Fertilizers (P205 total nutrients)		41,400	49,432	17,040	14,800	13,240	11,634	60,793
Potash Fertilizers (K20 total nutrients)		30,400	42,712	6,600	6,000	6,600	7,331	40,428
All	Fertilizer Consumption in Kg-hectare of Arable land	51.9375	71.79594	20.89636	69.30286	63.2275	24.2011	0

Source: FAOSTAT 2010.