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MARKETING AND FINANCE
OCCASIONAL PAPER

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Policies and actions to stimulate private sector fertilizer marketing in sub-Saharan Africa

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Policies and actions to stimulate private sector fertilizer marketing in sub-Saharan Africa

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Contents

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Preface

This paper has been prepared jointly by the Agricultural Management, Marketing and Finance Service (AGSF) of FAO and the Department of Agricultural Economics, Michigan State University (MSU) in order to contribute to the ongoing debate about fertilizer use in sub-Saharan Africa. The paper consolidates and further substantiates some of the main findings of an earlier unpublished paper prepared for AGSF entitled 'Increasing fertilizer use and farmer access in sub-Saharan Africa' by Michael Westlake. It also draws heavily on contributions of the authors to the Africa Fertilizer Strategy Assessment carried out by the World Bank.

This paper synthesizes literature reviewed in order to characterize lessons learned from reform over the past two decades, identifies areas of consensus for improving fertilizer markets and increasing fertilizer use, evaluates the pros and cons of ongoing debates, and proposes potential actions for resolving debates and moving forward. It is hoped that the paper will provide valuable information for policymakers in Africa, as well as donors and fertilizer marketing companies.

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Abbreviations and Acronyms

CFA	African Financial Community
c.i.f.	Carriage, Insurance and Freight
FAO	Food and Agriculture Organization of the United Nations
f.o.b.	Free On Board
IFDC	International Fertilizer Development Center
LC	Landed Cost
NPK	Nitrogen, Phosphorus and Potassium
RSA	Republic of South Africa
SADC	Southern Africa Development Community
SG 2000	Sasakawa Global 2000
SSA	Sub-Saharan Africa
SWC	Soil and water conservation
VCR	Value-cost ratio

Summary

The growing contrast between the productive role played by fertilizer in other regions of the world and the very limited use of fertilizer in Sub-Saharan Africa (SSA) has stimulated a great deal of debate about the role fertilizer should play in Africa and the policies and programmes most likely to help SSA farmers realize the benefits of fertilizers. Many factors contribute to the low use of fertilizer in Africa. These include its high cost and low profitability, the risks of fertilizer use, low use efficiency and the non-availability of fertilizer. Addressing these factors will meet considerable obstacles, but none is insurmountable.

The objective of this Occasional Paper is to synthesize lessons from fertilizer market reform experiences in SSA over the past two decades. The intended readership includes policymakers, donors, and the fertilizer industry. The paper (a) provides a review of the reform process that began in the 1980s, (b) identifies areas of consensus about policies and actions capable of improving fertilizer markets and increasing fertilizer use, (c) evaluates the pros and cons of ongoing debates, and (d) proposes actions for resolving the debates and moving forward.

Privatization, liberalization, and subsidy removal have been viewed as the primary mechanisms for moving from inefficient, centrally controlled input supply, output marketing, and processing to more efficient and competitive markets. However, cost savings from privatization and liberalization have not been sufficient to offset price rises resulting from parallel devaluations and subsidy removals. Studies of fertilizer cost structures suggest that high prices are due more to policy uncertainty and structural problems that keep transportation, handling, and port clearance costs unnecessarily high, than to excessive margins.

For many African farmers the cost of fertilizer per cropping season can be many times larger than their net farm income for that season. Poorly functioning financial markets for input credit constrain farm-level demand for fertilizer across the continent. Farmers in cash crop schemes that lend themselves to linked credit-output markets (e.g., export crops such as cotton, coffee, tea, and horticultural products) have thus had better access to fertilizers than others; but there has been some decline in access when liberalization of an export crop sector has weakened credit recovery mechanisms.

There is reasonable agreement regarding measures needed to establish enabling conditions that stimulate both demand for and supply of fertilizer. Measures include building institutions to promote competition while improving supply chain efficiency, investing in transportation and market infrastructure, investing in research and extension, managing price and production risk, facilitating rural finance, and strengthening legal and regulatory institutions. Improvements in each of these areas will contribute to improved profitability of fertilizer use by reducing input costs, raising or stabilizing producer prices, and improving fertilizer use efficiency.

Fertilizer sector policies and strategies that continue to be debated in the literature include reform sequencing, the continuing role of state enterprises, criteria for developing fertilizer recommendations, the role of imports versus domestic production, the role of national versus regional markets, and the role of fertilizer subsidies.

Liberalizing output markets before input markets has been seen as the most appropriate sequence of agricultural market reform. In reality, there appears to be no single best approach to the issue of sequencing that can be applied to all SSA countries and all agricultural sub-sectors. Each national government needs to make its own decision on the best approach, based on country-specific analysis.

Liberalization has, in general, not eliminated state fertilizer trading. Experience shows that it is difficult for governments to separate the commercial from the political when maintaining state enterprises because (a) government market interventions are often related more to election pressures than to market needs, (b) the capacity of state enterprises to follow through on announced plans (e.g., fertilizer imports) is weak, often because governments fail to allocate necessary finance, and this increases market uncertainty, and (c) state enterprises benefit from a range of subsidies (e.g., inherited warehousing space and vehicles) that create unfair competition.

Fertilizer recommendations can be standardized at the national level, for specific sites, or by using the "best-bet" approach, which incorporates farmers' preferences when determining input package contents and quantities. Given the costs of developing and updating detailed site-specific recommendations and given the greater ease and therefore lower cost of supplying standardized packages, there would seem to be a case for erring on the side of standardization. However, this is an issue that needs to be resolved within each country, taking account of the extent of local soil variation and differences among individual farmers. In the long-run, farmers in all countries need to acquire the skills to evaluate their own situation and make informed judgments about the most appropriate doses and combinations of inputs; this implies significant improvements in basic education as well as in extension.

Currently, over 90 percent of all the fertilizer used in Africa is sourced through imports. This leads many to ask why SSA does not produce more of its own fertilizer. Experts recommend developing indigenous fertilizer resources only when demand for a single product exceeds 300,000 tons a year; this amount is far above prevailing levels of national demand throughout SSA. Local blending, on the other hand, can provide (a) significant cost savings through bulk purchases of single-nutrient components; (b) compound fertilizers formulated to meet location-specific plant nutritional requirements; (c) fertilizer pack sizes adapted to local needs; and (d) information on packaging in local languages. Blending tends to be cost-effective if demand for a single product exceeds 100,000 tons a year. Given the apparent success of SSA's initial investments in bulk blending in several countries, additional investment in such operations are likely to become profitable as demand grows or regional markets are developed.

The development of regional fertilizer markets was a key topic of discussion at the African Fertilizer Summit in June 2006. At present importers rarely pool their orders, and rarely do they arrange for joint handling, storage, and distribution. Some analysis of the potential for cost reductions and the types of incentives that would be necessary to stimulate joint procurement seems appropriate. Incentives that governments might

provide to stimulate regional markets include regional harmonization of fertilizer formulae and regulatory frameworks. To date, however, efforts to harmonize regional regulations concerning inputs have met with little success.

Subsidies may be warranted when there is a clear prospect of significant productivity gains, when they are a less costly form of income transfer than alternatives such as food aid, and/or when they can be designed in a way that avoids negative impacts on private markets. A growing body of evidence suggests that to promote efficient and sustainable use of fertilizer, alternatives and/or supplements to direct fertilizer price subsidies should be carefully evaluated and implemented when benefits are shown to exceed costs. Options to examine include:

- improving enabling conditions by promoting policies and institutions that contribute to efficient markets for inputs, financial services, and outputs;
- reducing the high costs of transportation, e.g., costs of handling and port clearance and poor road quality;
- reducing taxation on agriculture; and
- investing in agricultural research, extension, and rural education to improve fertilizer use efficiency.

Four specific interventions have been used in the recent past in SSA to avoid disruption of commercial markets by using *market-smart* subsidies. These were input vouchers redeemable by commercial suppliers or credit institutions; demonstration packs (if very small in size and designed to stimulate demand); matching grants (farmers or farmer groups invest an equal amount to the grant in some activity that is related to fertilizer use); and credit guarantees (used to encourage input importers to offer credit to distributors further down the supply chain).

The literature suggests the following "Critical Success Factors" for the promotion of efficient fertilizer use:

Farmers are more likely to demand fertilizer if they have access to credit, if they are relatively close to good roads and markets, if they can produce a fertilizer-responsive crop in a relatively low-risk environment (e.g., under irrigation, in higher rainfall zones, or using soil and water conservation practices), if the fertilizer-responsive crop has a relatively stable output demand, and if fertilizer is available in appropriate-sized packages at the desired time. Farmers are more likely to use fertilizer in a cost-effective manner if they have access to demonstration packs for testing inputs on their own fields as well as access to demonstration plots (those conducted jointly by extension services, input suppliers, and/or NGOs tend to stimulate greater demand). Cost-effectiveness is also increased if farmers are trained to use practices that increase fertilizer use efficiency, if they are provided with training in analyzing the financial returns to fertilizer use, and if market information (input/output prices and quantities) is available to them.

The private sector is more likely to import and develop retail distribution networks if government or donor distribution programmes to stimulate fertilizer use are designed collaboratively with the private sector and in a manner that does not crowd out existing commercial demand. It also appears desirable that the risks of providing credit to retailers are shared (e.g., credit guarantees) and that the costs of dealing with carry-over stocks at

remote locations are shared (e.g., farmers organize for bulk orders). Finally, it is essential that rural roads are maintained.

Local retailers are more likely to stimulate demand if they are well trained in business management and have good technical knowledge about the inputs they carry, if they have access to credit to maintain adequate stocks, if they sponsor demonstration plots or field days to promote products and if they are able to satisfy local demand (correct timing of delivery, appropriate package sizes).

Finally, ***banks*** are more likely to finance the agricultural sector if donors or governments share the risk during the early years (by providing credit guarantees), if loan officers are provided with training in agricultural risk management and if donor funding is available for the development of new loan instruments.

1 Introduction

1.1 The contribution of fertilizer to agricultural productivity growth

The structural transformation paradigm has been the foundation of rural development thinking for four decades since the pioneering work of Johnston and Mellor (1961). The paradigm argues that agriculture serves as the 'engine of growth' during the early stages of a country's economic development because the sector typically accounts for a high share of economic activity in developing countries and because agricultural activities tend to have strong growth linkages with the rest of economy.

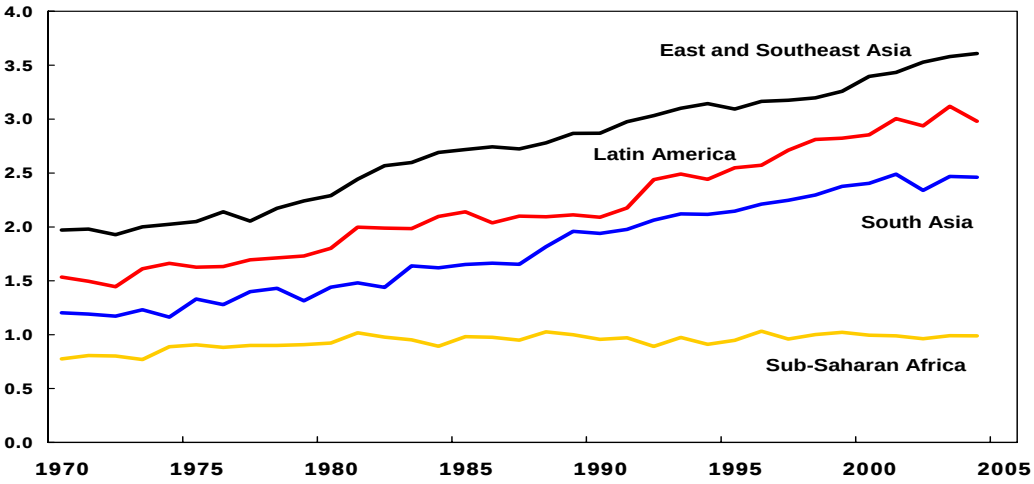
There are many other important features of the structural transformation process, but the key point is the catalytic role of agricultural productivity growth in starting these processes. To achieve the multiplier effects and economic growth, however, increased productivity must be achieved by a large proportion of farmers and on a large share of cultivated land.

Although there has been some agricultural productivity growth in sub-Saharan African (SSA) during the past several decades, current growth lags far behind that in other regions of the world and is well below that required to meet food security and poverty reduction goals. Statistics on cereal yields by region from 1970-2004 illustrate the point (Figure 1.1); SSA yield growth is barely perceptible. Rapid population growth, combined with slow growth in cereal yields, has resulted in declining per capita food production for SSA that contrasts sharply with trends in other regions of the world (Figure 1.2). In short, SSA has not yet experienced its "Green Revolution".

There is ample evidence from experience outside Africa that increased use of mineral fertilizers has been responsible for an important share of worldwide agricultural productivity growth. Some argue that fertilizer was as important as seed in countries where a Green Revolution has already taken place (Tomich 1995), contributing as much as 50 percent of the yield growth in Asia (Hopper 1993). Others have found that one-third of the cereal production worldwide is due to the use of fertilizer and related factors of production (Bumb 1995, citing FAO). The growing contrast between the productivity role played by fertilizer in other regions of the world and the very limited use of fertilizer in SSA - only 8 kg of nutrients per ha compared to 78 in Latin America, 101 in South Asia, and 96 in East and Southeast Asia (FAOSTAT 2002 values) - has stimulated a great deal of debate about what the role of fertilizer should be in SSA and what types of policies and programmes will be most likely to help SSA farmers realize the benefits of fertilizers.

Figure 1.1 Cereal yields, developing regions, 1970-2004

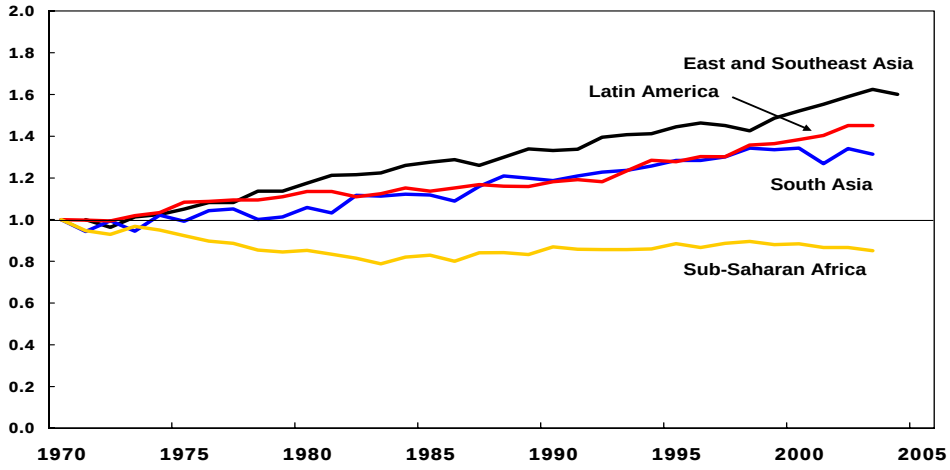
Tons/hectare



Source: FAOSTAT data.

Figure 1.2 Index of food production per capita: 1970-2003

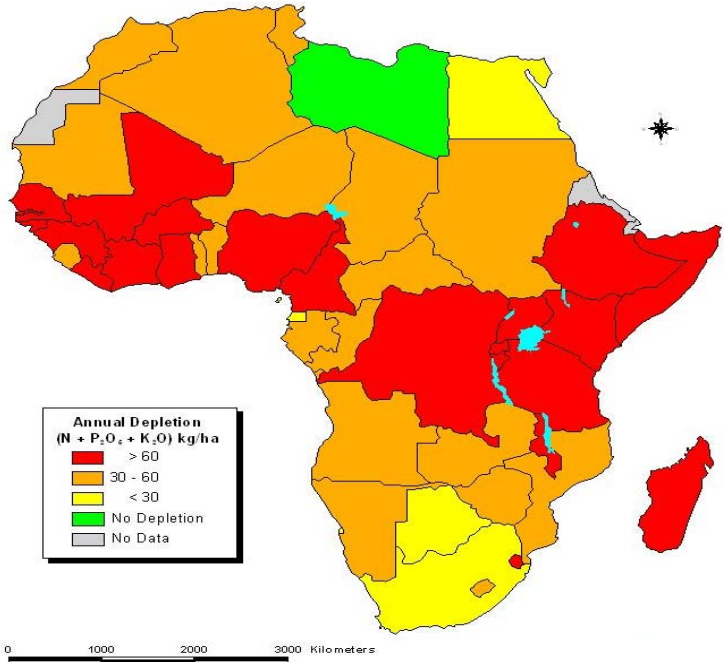
Index of food production: 1961=base year



Source: FAOSTAT data

Part of the problem is that African soils have inherent difficulties for agriculture, in terms of fertility, acidity, and drainage. Furthermore, land use practices during the past several decades have exacerbated the situation through nutrient mining by crops (Figure 1.3), leaching, and inadequate erosion control (FAO 2000; Scherr 1999; UNEP 1997, Stoorvogel and Smaling 1990, van der Pol 1992; Smaling *et al.* 1997; Buresh *et al.* 1997; Sanchez *et al.* 1997; Weight and Kelly 1999).[1]

Figure 1.3 Average Annual Rates of Nutrient (NPK) Depletion in Africa



Source: Henao and Baanante (1999) using data for 1993-1995.

The general case for increased mineral fertilizer use in SSA is based on the following arguments:

- Africa's soils are being mined of nutrients at an alarming rate because traditional soil fertility management practices are no longer adequate due to population growth and land pressure.
- Organic soil management methods contribute to soil fertility improvement but are inadequate for meeting the rapid and sustainable growth needed in SSA agricultural output.
- The only means of both maintaining soil fertility and of achieving the required rate of SSA agricultural growth is to significantly increase the quantities of mineral fertilizers used.

[1] Some researchers recognize that a problem does exist but draw more moderate conclusions about the rate of nutrient depletion, the likely impacts of soil degradation on future productivity trends, and the quantities of fertilizer (organic and inorganic) needed to develop sustainable agricultural systems (Barbier 1996, Dalton 1996, Snapp 1998, Mazzucato and Niemeijer 2000).

- Such fertilizers can be employed in combination with organic fertilizers to increase crop output (for food and commercial purposes) and the amount of biomass available for transfer to land on which crops are being grown.

Proponents of the low external input school of thought have long been vocal in their support of low-cost, predominantly organic approaches for Africa's smallholders (Pretty 1995 and 2002; Farrington 1995; Jiggins, *et al.* 1996). They see little hope for increasing productivity and reducing degradation through massive increases in the use of expensive fertilizers proposed by Green Revolution advocates of high external input approaches (Borlaug and Dowswell 1995; Quiñones *et al.* 1997). Both camps agree that farmers' failure to intensify agricultural production in a manner that maintains soil productivity is a key component of SSA's agricultural productivity problem (see Bationo *et al.* 1998; Breman 1998; Cleaver and Schreiber 1994; Gruhn *et al.* 2000; Kessler *et al.* 1995; Vierich and Stoop 1990; all cited in Mazzucato and Niemeijer 2001). The main area of contention is whether the solution requires substantial increases in mineral fertilizer or whether progress can be achieved in a more self-reliant manner, principally by changing farming methods.

This paper takes the position that increased fertilizer use is a desirable objective for the countries of SSA and that the optimal technical approach for a given situation is likely to be a function of a large number of location-specific, agro-climatic, demographic and economic variables.

1.2 Realizing the potential: the role of fertilizer markets

Linked to the assumption that increased mineral fertilizer use is an essential component of any strategy to promote agricultural productivity growth in SSA is the caveat that promotional policies and programmes must encourage *economically sound* and *technically efficient* fertilizer use if they are to produce sustainable increases in agricultural productivity. The aim of input market privatization was to establish private input supply systems that were more efficient and effective than state systems. It was assumed that market forces would result in an efficient set of trade-offs between the profit motives of the private sector and the needs of farmers to acquire the desired quantity of the right type of fertilizer at the right time from a nearby outlet at an affordable price. Coupled with the liberalization of product markets, it was assumed that the elimination of subsidies would lead to a more efficient use of fertilizer by farmers, based on economic signals reflected in market-determined prices for both inputs and agricultural end products. In practice, the development of efficient systems has faced major constraints in virtually all SSA countries.

A large part of the problem is that relatively little concrete progress has been made in SSA toward developing the type of enabling environment that is needed to (a) build farm-level fertilizer demand and (b) ensure a smooth and rapid transition from a state-run to a commercial input supply system. Vibrant fertilizer markets do not evolve in isolation; they grow in response to:

- a growing agricultural sector with opportunities for farmers to engage in profitable production that creates effective fertilizer demand;
- an enabling business environment that permits those investing in fertilizer supply to realize a reasonable return on their investment.

Theoretical frameworks identifying the determinants of fertilizer **demand** generally mention factors such as agricultural research to increase fertilizer-use efficiency and profitability, extension services to inform farmers of research results, and well functioning output markets (Kelly 2006; Crawford *et al.* 2003; Morris *et al.* 2007). These frameworks also suggest that the functioning of liberalized output markets improves when transportation infrastructure is adequate and market information is available to all actors. Agricultural growth also requires increasingly better educated farmers, capable of (a) understanding and evaluating a range of increasingly complex production technologies, from which they select a subset that is appropriate to their particular needs, and (b) evaluating input cost and output price information to make more and more complex commercial decisions.

Theoretical frameworks identifying the determinants of fertilizer **supply** usually mention some combination of the following "pillars" of market development: an enabling policy environment, human capital, access to finance, market information, and regulatory frameworks that facilitate transactions while protecting actors (Gregory and Bumb 2006; Crawford *et al.* 2003; Morris *et al.* 2007). Increased fertilizer supply requires policies and institutions that reduce investment risk and transaction costs. This would include macro-economic policies affecting foreign exchange (both rates and availability) and trade (particularly policies that affect regional collaboration in fertilizer trade). Clear rules and regulations concerning contracts, grades and standards can also reduce investment risk; but the rules must be accompanied by the political will and capacity to enforce them. Two other attributes of a favourable business environment that provide benefits to both farmers and the fertilizer sector are government investments in infrastructure (roads, irrigation) and policies and institutions that facilitate access to credit *for all* and high repayment rates *by all*.

While a holistic approach is needed that takes into account these diverse aspects of market development when analyzing the constraints to building vibrant fertilizer markets in Africa, there is also a need to identify a limited set of "critical success factors" capable of moving markets to a new level of maturity by simultaneously stimulating both fertilizer demand and supply.

1.3 Objective and organization of the paper

The objective of this paper is to present a synthesis of lessons learned from fertilizer market reform experiences in SSA over the past two decades, with a focus on the identification of a set of "critical success factors". The intended readership includes policymakers, donors, and the fertilizer industry. The paper (a) provides a review of the reform process that began in the 1980s, (b) identifies areas of consensus about policies and actions capable of improving fertilizer markets and increasing fertilizer use, (c) evaluates the pros and cons of ongoing debates, and (d) proposes potential actions for resolving the debates and moving forward.

Section 2 presents an overview of recent fertilizer consumption and production trends in Africa and factors thought to be shaping these trends. Section 3 looks at past experience with policy and institutional reforms of relevance to the fertilizer sector. The response to the reforms on the part of farmers and the commercial sector is discussed, with particular attention to the manner in which different agro-ecological, economic and political environments appear to have resulted in different responses. Section 4 identifies the policy

areas where there appears to be general consensus on what must be done to build vibrant fertilizer markets and Section 5 identifies policy areas where there remains substantial debate on the way forward. Section 6 concludes with recommendations on how to resolve the debates and move forward.

2 Overview of the fertilizer situation in Africa

A review of trends in African fertilizer production and consumption highlights the need for taking stock of the fertilizer policy reform process and identifying a way forward.

2.1 Recent production trends and future prospects

Aggregate fertilizer production for all of Africa grew by 4.8 percent annually from 1970 to 2002, when total production reached 5,791,436 tons for the entire continent—roughly four percent of world production (Table 2.1).[2] Growth was most rapid in the 1970s and 1980s, but it slowed during the 1990s. North Africa (primarily Egypt, Morocco, and Tunisia) is the major producing region, accounting for 92 percent of African production. The Republic of South Africa (RSA) is the fourth largest African producer (578,400 tons per annum).

Table 2.1 Fertilizer production in Africa by region, 2002/03

	N	P_2O_5	K_2O	Total
Sub-Region	('000 nutrient tons)			
North Africa	2,648	2,387	0	5,036
Sub-Saharan Africa	110	67	0	177
South Africa	298	280	0	578
Total Africa	**3,057**	**2,734**	**0**	**5,791**

Source: Gregory and Bumb, 2006.

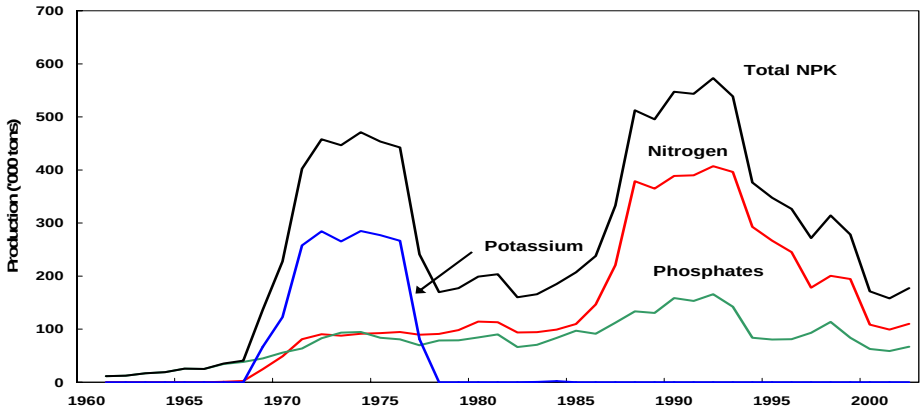
SSA (excluding RSA) has always been a negligible producer of fertilizer, with recent production levels at 177,350 metric tons annually (representing about 0.10 percent of world output). SSA production has been erratic since the 1960s (Figure 2.1). Beginning in 1994, structural adjustment and economic liberalization contributed to a sharp decline in production, as loss-making, state-owned and operated factories ceased production in Nigeria, Tanzania, Côte d'Ivoire, and Zambia. Other former producers, such as the Congo Democratic Republic, Mozambique, and Uganda stopped production in the late 1970s or the 1980s. The main SSA producers other than RSA are now Zimbabwe, Senegal, and Mauritius.

Raw material inputs into the fertilizer production process include natural gas (nitrogenous fertilizers), phosphate rock (phosphates), potassium salts (potassium fertilizers), and sulphur. Except for some deposits of phosphate rock and natural gas, few of these raw materials are found in SSA. Nigeria, Angola, and Mozambique are among the few countries where some economically viable production potential may exist (Gregory and Bumb 2006) and the economic feasibility of exploiting these resources may increase if natural gas and oil prices continue to rise.

[2] Unless otherwise noted, production statistics in this section reflect the situation in 2002 as reported in the online FAOSTAT database.

There has been some investment in the production of rock phosphate fertilizers from local phosphate reserves in countries such as Senegal, Mali, Burkina Faso, Madagascar, and Zimbabwe; but most of these markets face serious development problems (including the remote locations of phosphate reserves, high transport costs, and farmers' lack of enthusiasm for the product due to its powdery nature and slow response time). Where deposits exist, however, governments continue to seek funds to develop the industry.

Figure 2.1 Fertilizer production trends in SSA: 1960-2002



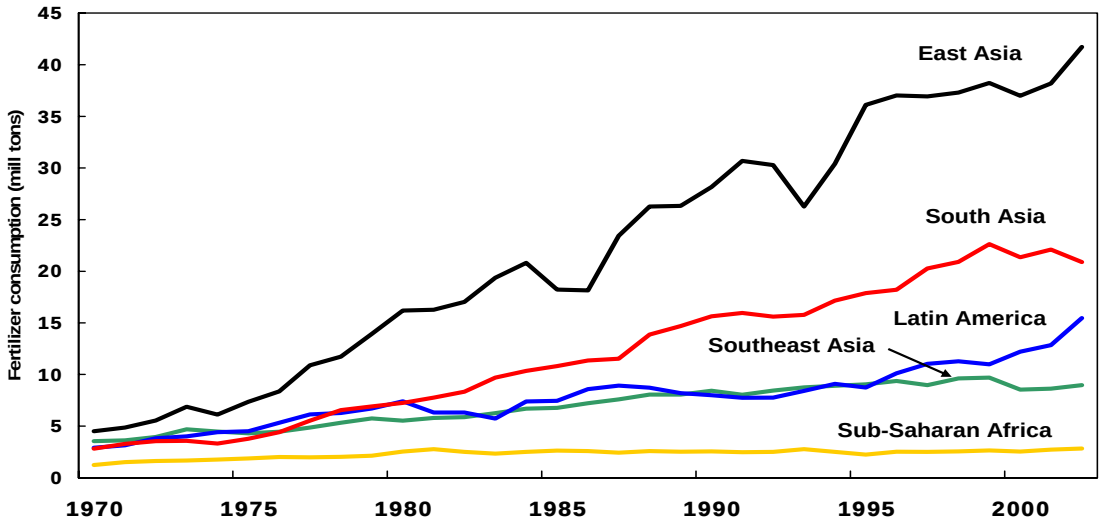
Source: FAOSTAT

Bulk blending, though not production *per se*, is a step beyond complete reliance on fertilizer imports. There have been investments in blending and bagging facilities in Malawi, Zambia, Nigeria, Zimbabwe, and Côte d'Ivoire.

2.2 African fertilizer consumption trends

Fertilizer use in Africa (4.3 million tons total in 2002, with 1.4 million tons for SSA) accounts for three percent of world consumption, with SSA accounting for less than one percent. Contrary to conventional wisdom, fertilizer use in Africa has grown during recent decades (1970-2002), but at a slow average annual rate (2.3 percent overall and 3 percent in SSA). A substantial part of this growth resulted from supply- and subsidy-driven use in Nigeria during the 1970s and 1980s. While overall growth has been positive, the slow rate of annual growth during the 1990s (only 0.22 percent) compared to earlier periods (5.43 percent in the 1970s) has been a cause for concern, even though much of the slowing in growth was driven by subsidy removal in Nigeria. Also, the extremely slow growth in SSA compared to other developing regions of the world is worrisome (Figure 2.2).

Figure 2.2 Fertilizer consumption trends by world region: 1970 – 2002



Source : FAOSTAT

Most SSA fertilizer is consumed in the sub-humid zone (where there are 180-269 plant growth days); fertilizer use is generally low in the humid zones and limited to irrigation schemes in the arid zones (with 90 plant growth days). Between 1970 and 2000, only cotton producers in West and Central Africa, and farmers in Kenya and Ethiopia had sustained increases in fertilizer use. Consumption in Nigeria, Zambia, Tanzania, Malawi, and Sudan grew to 1990 and then fell precipitously. Output price shocks significantly reduced Ethiopian fertilizer use following two consecutive bumper cereal harvests after 2000.

During the 1960s and 1970s, growth in fertilizer use intensity in Africa kept pace with growth in other developing regions, but beginning in the 1980s it slowed sharply (Table 2.2). By the 1990s, fertilizer use per hectare actually declined in about one-half of all SSA countries. Nevertheless, there were some successes. For example, in Kenya - where fertilizer use was already higher than in most other African countries - intensity increased by more than one-third during the 1990s (Ariga *et al.* 2006). It also rose in twelve other countries (including Uganda, Rwanda, Mozambique, Ethiopia, and Botswana), although most of these were starting from a much lower application rate than Kenya (Crawford *et al.* 2006). The average intensity of fertilizer use throughout SSA is estimated to have been 8 kg/ha in 2002, representing only 8-10 percent of the application rates in other parts of the world.

Table 2.2 Fertilizer use intensity and growth by developing country region: 1962, 1982 and 2002

	1962 Total NPK (kg/ha)	1982 Total NPK (kg/ha)	2002 Total NPK (kg/ha)	Average annual growth (%)	
				1962 to 1982	1982 to 2002
South Asia	3	38	101	13	5
East and Southeast Asia	12	53	96	8	3
Latin America	10	43	78	8	3
Sub-Saharan Africa	1	7	8	9	1

Source: Calculated from FAOSTAT data on fertilizer consumption and land use.

2.3 Recent patterns of fertilizer use by country and crop

Table 2.3 presents 2002 fertilizer consumption data for 18 of SSA's largest fertilizer consumers. Five traditional maize and export crop producers in Eastern and Southern Africa (Ethiopia, Zimbabwe, Kenya, Malawi, and Zambia) accounted for 48 percent of total SSA fertilizer use at this time. About 29 percent was consumed in nine cotton producing countries of West and Central Africa (Benin, Cameroon, Chad, Côte d'Ivoire, Ghana, Mali, Senegal, Sudan, and Togo). In Mauritius, fertilizer use (two percent of the SSA total) was mainly for sugar cane. Twenty-nine of the 47 SSA countries with fertilizer consumption data accounted for just six percent of SSA fertilizer use. Low consumption in many of these countries is related to: (a) civil war, political unrest or extremely weak government institutions; (b) low population density and dominance of shifting cultivation; (c) absence of cash crop systems or modern farm settlements; (d) existence of humid zones and tropical forests (with more than 269 plant growth days); and/or (e) predominance of arid zones with insufficient rainfall (with less than 90 plant growth days).

Intensity of fertilizer use varies among the top 18 users with a low of 4 kg/ha (Sudan, a cotton producer) and a high of 236 kg/ha (Mauritius, a sugar producer); 11 of the 18 top users exceeded the 8 kg/ha SSA average dose.

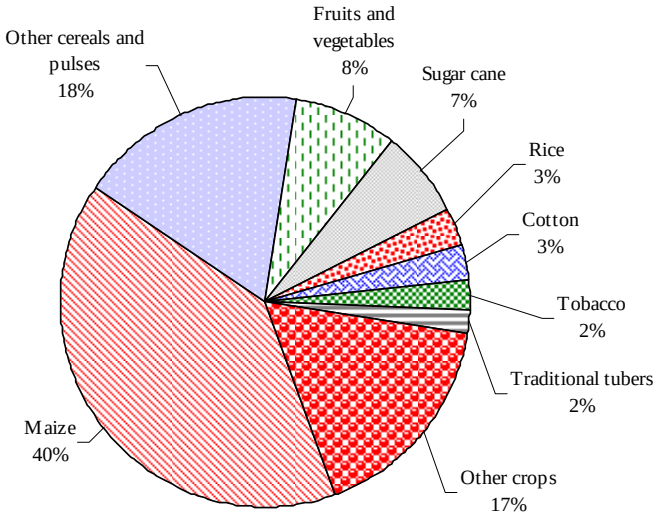
It is difficult to find representative SSA statistics on fertilizer use by crop. FAO does not report this in its database because much of the fertilizer consumption data is based on trade statistics rather than the tracking of fertilizer use within a country. The only multi-country analyses found on fertilizer use by crop were (a) a 1989 report of six countries covered in a World Bank study (Lele, Christiansen, and Kadiresen 1989), (b) a study of 14 SSA countries believed to represent about 43 percent of SSA's fertilizer consumption during the early 1990s (cited by Gerner and Harris 1993), and (c) a 2002 study that included 12 Africa countries jointly representing 70-75 percent of SSA fertilizer consumption during the late 1990s (FAO 2002). Figure 2.3 summarizes the results from the most recent study (FAO 2002).

Table 2.3 African fertilizer use by country: 2002

	Fertilizer consumption at national level		
	Tons of consumption	Share of SSA consumption	Fertilizer intensity kg/ha
Malawi	193,008	14%	79
Nigeria	166,200	12%	5
Ethiopia	150,032	11%	14
Kenya	142,758	10%	28
Zimbabwe	110,000	8%	33
Côte d'Ivoire	109,000	8%	16
Sudan	69,496	5%	4
Zambia	65,168	5%	12
Benin	47,841	3%	17
Mali	42,000	3%	9
Cameroon	34,899	3%	5
Senegal	33,491	2%	13
Ghana	31,030	2%	5
Mauritius	25,000	2%	236
Mozambique	24,900	2%	6
Chad	17,500	1%	5
Togo	17,055	1%	6
Rwanda	15,299	1%	11
Other 29 SSA countries	88,921	6%	2
TOTAL SSA	1,383,598		8
Rest of Africa	2,894,803		
TOTAL AFRICA	4,278,401		
TOTAL WORLD	141,571,130		

Source: Compiled by authors using FAOSTAT data.

Figure 2.3 Fertilizer use by crop, sub-Saharan Africa, late 1990s



Source: Compiled by Kelly 2006 using data on 12 countries in FAO (2002).

Figure 2.3 shows that maize was the principal crop fertilized (accounting for 40 percent of consumption in countries covered), followed by other cereals and pulses (primarily teff, barley, and wheat in Ethiopia, but also some sorghum and millet elsewhere)[3]. These data do not support the conventional wisdom that more SSA fertilizer goes to high value or export crops than to staple food crops. The extent to which agricultural policies (e.g., input and output price subsidies) influenced these results cannot be discerned from the data, but several countries had fertilizer subsidies in place during the period covered (e.g., Ethiopia in 1995 and Nigeria in 1996). The large share of fertilizer used on maize probably reflects some combination of (a) the relatively high fertilizer response of maize, (b) the strong market demand for maize, which converts it from a traditional "food" crop to a "cash" crop, and (c) in some cases, subsidized prices. Fruits, vegetables, and sugar cane combined represent another 15 percent of use reported in Figure 2.3. Rice, cotton, tobacco, and traditional tubers (such as cassava and yams) represent 2-3 percent each.

As a result of the fact that the countries included in the three studies differed, it is difficult to draw conclusions about trends in the use of fertilizer by crop. In all studies, however, maize was the dominant crop fertilized. Fruits and vegetables appear to be increasing in importance, as well as the diverse group of "other crops."

No quantitative fertilizer demand projections for SSA countries were found in reviewing the literature for this report. Increased attention to the role of fertilizer in SSA agricultural productivity growth and poverty reduction (as reflected in the UN Millennium Development Report and the African Fertilizer Summit in Abuja, Nigeria in 2006, for example) suggests that growth in SSA fertilizer consumption will increase. Future trends in world fertilizer prices will affect the extent to which SSA is able to increase consumption. Prices could be pushed higher by rising oil costs or lower by the expansion of fertilizer production capacity that is expected in China, the Caribbean, and elsewhere (personal communication, IFDC). Achieving more rapid growth in consumption will also require substantial improvements in the policy and institutional environment, to address the multiple factors responsible for low consumption.

2.4 Factors responsible for low fertilizer use in Africa

Many factors contribute to the low use of fertilizer in Africa. The most important of these include:

- **High cost of fertilizer.** Fertilizer prices in Africa are generally higher than in other developing regions[4] because of (a) low volumes, (b) long distances from ports to production zones, (c) poor road and storage infrastructure, (d) low population densities, (e) inadequate and costly financial services; (f) high risks due to policy uncertainty, and (g) graft and corruption.

[3] Fertilizer intensity measured as average kg/ha does not follow exactly the same pattern across crops. Intensity tends to be higher on tobacco, sugar and cotton and lower on cereals, including maize (Gerner and Harris 1993).
[4] For example, comparisons dating back to the early 1990s showed SSA urea and phosphate prices per ton ranged from $232 - $487 while those for Asia were $68 - $201 (Kelly *et al.* 1998).

- **Low fertilizer profitability.** Low output prices further exacerbate the problem of high fertilizer prices, with the combination often making fertilizer use unprofitable at unsubsidized prices, particularly in cropping systems with low fertilizer response. A comparison of fertilizer/output price ratios (a rudimentary indicator of potential profitability) for SSA, Asia, and Latin America revealed that SSA ratios tended to be less favourable for most of the principal crops (Yanggen *et al.* 1998).
- **Risks of fertilizer use.** Both production and price risk, influenced by climate and poorly functioning markets, are important factors.
- **Low fertilizer use efficiency**. Standardizing for agro-ecological conditions, there is little evidence to suggest that crop response to fertilizer is lower in Africa than in other developing regions. However, many farmers in Africa lack the land husbandry and crop management skills needed to use fertilizer efficiently.
- **Non-availability of fertilizer.** Fertilizer is often unavailable when, where, and in the formulation needed. Factors limiting supply include an unfavourable business environment, poor transport and communications infrastructure, and inadequate investment in developing human capital.

These factors pose considerable obstacles to increasing fertilizer use in Africa, but none is insurmountable. Prospects for increasing fertilizer use are brightest in areas with good agricultural potential that feature medium or high levels of population density, well-developed infrastructure, and well-developed output markets. These are the types of farming environments where the Asian Green Revolution began. It seems logical for SSA to follow the same approach of first building demand and supply where the conditions for profitable fertilizer use are most favourable and then working in the more challenging production environments where profitability may be questionable at present but could improve as markets become more developed and fertilizer costs decline.

3 Lessons from past experiences

To learn from past experience with reform, the evolution of the policy environment from the pre- to the post-reform period is described, initially focusing on the key reforms of relevance to the fertilizer sector and their anticipated benefits and then moving to a discussion of the observed effects of reforms on fertilizer supply, fertilizer demand, and agricultural productivity. The section concludes with a review of the present situation, characterized by a growing sense of urgency about the slow pace of agricultural productivity growth and the lack of positive results in poverty reduction, and discusses some of the key views on how to best address these problems.

3.1 Agricultural policy environment prior to reforms

The majority of SSA countries gained independence in the 1960s. Between independence and the early 1980s (and, in some notable cases, for a further 10-15 years[5]) national governments sought to closely control and participate in many aspects of economic activity. This was particularly true of the agricultural sector - generally the largest economic sector of the newly independent countries. The motivations for government involvement were multiple, including:

- the popularity of development paradigms building on concepts of African socialism;
- the conventional wisdom that there was no active private sector to assume responsibility for agricultural marketing and investment on a large enough scale to "modernize" the sector;
- incentives presented through cold-war politics made donor funding available for state-organized activities;
- a concern for ensuring national food security;
- suspicion of traders, particularly non-indigenous traders, coupled with optimism about the capacity of state agencies to perform marketing functions; and
- belief that state-owned enterprises could facilitate access to and repayment of agricultural credit.

Despite variations across countries, most national fertilizer policies during the pre-reform period in the 1970s and early 1980s were characterized by some combination of the following types of interventions (Kherallah *et al.* 2002):

- Government-controlled imports and distribution, usually through state enterprises. State monopolies existed in 30 of 39 countries surveyed by FAO in the mid-1980s (FAO 1986).

[5] In countries such as Kenya and Ethiopia the role of the state in fertilizer importing and marketing stayed largely unchanged until the end of the 1980s. In Nigeria, SSA's largest consumer of fertilizer, the fertilizer market remained under Government control until 1996.

- Imposition of price controls and subsidies on the retail price of fertilizer; explicit subsidies ranged from 10-80 percent of full cost.
- Provision of subsidized credit to farmers for fertilizer purchase, with repayment through state marketing agencies. Studies show that most credit was received by estates, large farmers, or commercial cash crop growers, and not by small farmers.
- Fertilizer provided as aid-in-kind by donors, often making up all or a substantial part of fertilizer imports.
- Incentives for fertilizer use stemming from overvalued exchange rates and other trade policies.

Although the policy picture was similar across the continent, there were some country-level particularities. The government was the sole importer and distributor of fertilizer in Tanzania, Ethiopia and some West African nations. In Malawi, the government monopolised the importation and distribution of fertilizer to small-scale farmers but permitted private importation for large-scale cash crop production. In Kenya, commercial importation was in the hands of private traders and cooperative unions, which sold to all categories of farmers. However, the government regulated national import quantities, allocated import quotas to private traders and cooperatives, and set maximum retail prices based on notional import and distribution costs.

The undeniable growth in fertilizer use and agricultural productivity that took place during this period proved to be short-lived. Misallocation of agricultural resources occurred as state marketing agencies set pan-seasonal and pan-territorial prices. State credit schemes for financing input purchases experienced low repayment rates. There were major losses of public funds due to the accumulation in good rainfall years of large domestic cereal stocks for which there was inadequate storage. In some countries, governments sought to offset these losses and meet other budgetary needs by taxing export crop producers. This further distorted the allocation of agricultural resources. Eventually the fiscal burden of these policies exceeded the capacity of governments to continue the price and input support programmes (Jayne and Jones 1997; Jayne *et al.* 2004).

3.2 Theoretical basis and expected benefits of reforms

Reforms of relevance to the fertilizer sector include a variety of macro-economic policies designed to reduce inflation and stabilize exchange rates, and a broad range of agricultural market reforms designed to increase the efficiency and reduce the costs of input supply and output marketing activities.

Macro-economic reforms

Stabilization policies, currency devaluations, and trade liberalization are the three principal instruments of macro-economic reform relevant to the fertilizer sector.

Macro-economic stabilization

A key medium-term aim of macro-economic policy is the stabilization of domestic inflation at a low rate, thereby allowing low interest rates and obviating the need for currency rate management through devaluation.

High and erratic rates of domestic price inflation and interest rates, and unpredictable devaluations of the national currency, increase the risks faced by both farmers and fertilizer traders. Given the structure of fertilizer markets, importers are heavily dependent on large amounts of foreign exchange obtained through credit that is carried over a period of 6-12 months. When the macro-economic situation is unstable, the real cost of procuring the foreign exchange and credit can change dramatically before the repayment period begins. The greater the perceived risks on the part of the importer, the higher the margins that will be sought and consequently the higher the selling price. High fertilizer selling prices, in turn, discourage demand.

Currency devaluation

Devaluation influences fertilizer profitability and demand in different ways depending on the nature of the crop being produced. In the absence of other influences, one would expect devaluation to increase export crop prices by more than domestic food crop prices and consequently to stimulate a proportionately greater increase in fertilizer use on export than on food crops.

Should devaluation cause both farm-gate fertilizer and crop prices to increase by the same percentage (a likely outcome for traded crops), the profitability of production would increase because the prices of some factors of production - most notably land and labour - are non-tradable and not influenced by the first-round effects of devaluation. Thus, devaluation can be expected to have a positive net impact on the returns to fertilizer used on traded crops.

Since the producer prices of non-traded crops are not immediately affected by devaluation, the anticipated impact is generally an increase in the price of fertilizer that exceeds any increase in output price; this leads to less profitable fertilizer use on non-tradable crops and reduces demand. In addition to highly perishable crops and crops with very high weight-to-value ratios, crops that fall into the non-traded category include staple food crops for which the national market normally clears at domestic prices that are between export and import parity and for which currency devaluation is insufficiently large to cause the export parity price to rise above the domestic market clearing price.

Although the domestic price of non-tradable staples rises following devaluation, due to shifts in demand associated with import substitution or declining production, the price usually does not rise to import parity due to the low purchasing power of the mostly very poor population who are the primary consumers of these staples. Consequently, the domestic market may clear at a level of purchases and consumption that leaves a large proportion of the population malnourished. In this circumstance, devaluation, particularly if accompanied by the removal of fertilizer subsidies, could be expected to reduce food output and worsen food insecurity.

Trade liberalization

Trade liberalization involves the removal of non-tariff barriers and tariff reform. Because these barriers and tariffs are usually implemented as alternatives to devaluation when exchange rates are overvalued, trade liberalization usually follows, or is accompanied by, exchange rate realignment. Evaluating the response to trade liberalization is often difficult due to the overlapping nature of different policy instruments. For example, a tariff may be

reduced but if import licenses or foreign exchange rationing is still in effect, the tariff reduction may not make much of a difference.

Trade liberalization in the fertilizer sector involved opening up import markets to the private sector (e.g., breaking the monopoly on imports held by ministries of agriculture in Ghana and Nigeria or by state-owned enterprises such as NAMBOARD in Zambia) and the elimination of price controls that protected consumers and local fertilizer producers from international price volatility (e.g., Zimbabwe, Zambia). The advantage of the pre-reform import monopolies was that they were in a position to realize economies of size and scale but they also led to rent seeking by officials.

Theoretical basis for market reforms

Privatization, liberalization, and subsidy removal were viewed as the primary mechanisms for moving from inefficient, centrally controlled and monopolistic decision making in input supply, output marketing, and processing to more efficient and competitive markets that would respond better to farmers' and consumers' needs, and encourage agricultural productivity growth.

Privatization and liberalization

Privatization refers to the sale of government-owned enterprises and productive assets or, at a minimum, the transfer of the management of these assets to the private sector. However, privatization alone does not lead to increased competition unless (a) the assets of a large state-owned monopoly are broken up and sold to multiple actors or (b) liberalization occurs simultaneously.

Liberalization refers to changes in policies, laws, and institutions that increase competition through a reduction in government control of an industry. Liberalization encourages the lifting of barriers to entry to accommodate many players in the market and hence transform a market into a free and open one. It is possible to liberalize markets without privatization. For example, many African countries attempted to increase competition in input markets without privatization of a state-owned enterprise, through the deregulation of entry requirements that permitted new actors to enter the industry and compete with the state-owned enterprise. Liberalization can also include the removal of government price controls and subsidies that distort incentives for private investment. Fertilizer subsidy removal was a particularly important component of reform in SSA.

Fertilizer subsidies

Fertilizer subsidies have few theoretical justifications that are broadly applicable. Justifications depend on crop type (e.g., how fertilizer-responsive it is), agro-ecological characteristics, farm size, and the effect of fertilizer on risk, among other factors. At the beginning of the subsidy reform period, Shalit and Binswanger stated (1984: p. 37):

> "The only theoretical case for a permanent fertilizer subsidy is the existence of a non-optimal tax on output for public revenue purposes. . . . The only other valid theoretical reason for fertilizer subsidies is to speed up the adoption process. However, this is a case for a temporary subsidy in a particular crop region where fertilizers are freshly introduced or where much higher doses should be applied when varieties change."

Analysts offer a range of reasons for exercising caution with fertilizer subsidies. In addition to the problem of fiscal costs, these arguments include:[6]

- Targeting difficulties; the benefits have generally gone to relatively well-off farmers, either directly or through leakages. Thus, input subsidies are regressive and a very inefficient way to transfer income to the poor.
- Increased need for price control and rationing, which encourages rent-seeking behavior and thus increases the leakage problem.
- Negative impacts on the emergence or effective operation of a private sector input marketing system.
- Difficulties in eliminating subsidies because, far from being temporary, they have tended to create a hard-to-end dependency.
- Failure to address the underlying causes of low fertilizer use, such as supply and credit constraints or underinvestment in public goods, to mention just a few.
- High opportunity cost, through a reduction in funds available for public goods investments such as extension services, agricultural research, and roads.

3.3 Implementation of reforms

The agricultural market reforms promoted by the World Bank and the International Monetary Fund were expected to reduce the bias against agriculture that was evident in many African economies and open the sector to market forces. In countries where agricultural exports were taxed and domestic food crop prices were kept artificially low to protect urban consumers, it was believed that the combined effects of (a) input market reforms (the removal of regulatory restrictions such as licensing requirements and pan-territorial prices that discouraged private investment, the end of expensive subsidies, and the elimination of state-owned fertilizer enterprises or their transformation into viable commercial actors), (b) output market liberalization, leading to more efficient and better integrated markets, and (c) subsidy removal, could result in lower consumer prices and higher, more stable farm gate prices. This fortuitous set of events was expected to reduce price risks associated with fertilizer use, increase fertilizer profitability, increase fertilizer demand for use on high value and/or fertilizer responsive crops, and decrease demand for use on non-responsive, low-value crops.

Output markets

Beginning in the 1980s, donors and international lending agencies began promoting food marketing and food price policy reform in Africa in an effort to stem the rising costs of price stabilization policies. At this time, many countries had price controls for a variety of agricultural commodities and most governments managed sizeable food security stocks to be drawn on in times of crisis. Most governments had neither the financial resources to intervene in the markets to support the prices nor the human and physical resources to manage stocks efficiently. Neither governments nor consumers were benefiting from the policies.

[6] This section draws on Crawford *et al.* 2006 who cite Donovan (1996 and 2004), Pender *et al.* (2004), Ellis (1992), Kherallah *et al.* (2002), and IFDC (2003).

The reform recommendations included reducing barriers to entry, removing regulatory controls (particularly those on prices), and reducing direct government purchasing and selling. There was also some discussion of investing in public goods to lower transactions costs borne by private intermediaries (e.g., marketing infrastructure, market information), reforming commercial codes to make them more business friendly, and relying on trade rather than management of government stocks to address temporary supply imbalances; but it is only recently that these types of investments and institutional issues have begun to get the attention of governments and donors.

Input markets

Early input market reforms focused on the removal of subsidies and price controls. Implementation of these programmes was varied. For example, USAID funded a three-year declining fertilizer subsidy programme in Senegal in the mid-1980s and the World Bank developed a programme with Malawi to phase out their subsidies between 1983 and 1989. The Senegalese subsidies actually ended as scheduled (largely because of their dependence on USAID funding to cover the costs); but the government introduced free distribution of local rock phosphates in the 1990s as part of a programme to restore soil fertility. Malawi, faced by a rash of external shocks (drought, restricted access to foreign ports, and devaluation) that rapidly raised fertilizer costs and lowered food availability, reinstated the subsidy in 1988 after having reduced it by 30 percent between 1983 and 1987.

Efforts to open the sector to private enterprise accompanied or followed subsidy removal in most cases. Local distribution was frequently liberalized first, with state-owned distribution services often continuing to function in the same geographical areas. Importation tended to be liberalized next. For example, Senegal permitted commercial imports of urea in the late 1980s but not of other fertilizers that might compete with the local phosphate industry. In some countries the government retained control of who was able to import through issuance of licenses and foreign exchange rationing (e.g., Kenya).

During the first 10-15 years of the reform period there was a tendency to focus exclusively on price and market-structure issues related to competition. Table 3.1, for example, presents the World Bank's assessment of how well African countries were implementing fertilizer sector reforms by 1992. Of the countries listed, 63 percent had completely removed fertilizer market and price controls. Only two of the 27 countries were still listed as continuing with both market and price controls and the other eight countries were in an intermediate position. Given this relatively high rate of compliance as early as 1992, major improvements in fertilizer supply and demand could have been expected over time. However, this has not generally been the case. In some instances, there has been backtracking after the initial reform efforts, and some argue that there was significant variability in how the reforms were implemented in the first place (Jayne and Jones 1997; Kherallah *et al.* 2002; Jayne *et al.* 2002).

It has also become clear that price controls, subsidies, and lack of competition were not the only causes of high input prices and inefficiency in the state-owned enterprises. By the late 1990s, African fertilizer market analysts started talking about the need for an "enabling environment" to stimulate the private sector and the notion of investments in public goods (roads, communications) and institutions (legal and regulatory codes, contract enforcement, finance) were gradually added to the list of "must dos" if the private sector

was to fulfill its fertilizer supply role (for example, Bumb and Baanante 1996; Jayne *et al.* 1997; Poulton *et al.* 1998; Dorward *et al.* 1998; Townsend 1999). As with the output market reforms, donor and government support for investments in public goods and institutional reform have tended to be verbal rather than financial.

Table 3.1 Progress in price reforms and fertilizer subsidies

Country	Pre-Reform	Late 1992
Benin	*	+
Burkina Faso	*	@
Burundi	*	@
Cameroon	*	#
Central African Republic	*	+
Chad	*	@
Côte d'Ivoire	+	@
The Gambia	*	@
Ghana	*	@
Guinea	*	@
Guinea-Bissau	@	@
Kenya	*	@
Madagascar	*	@
Malawi	*	*
Mali	*	@
Mauritania	*	@
Mozambique	-	@
Niger	*	@
Nigeria	*	*
Rwanda	#	#
Senegal	*	@
Sierra Leone	*	#
Tanzania	*	#
Togo	*	@
Uganda	*	#
Zambia	*	@
Zimbabwe	#	#
Marketing controlled and prices subsidized		*
Marketing controlled, but at world prices		+
Marketing liberalized, but some fertilizers sold at below-market prices or prices controlled		#
No controls on prices or marketing		@
Data Not available		-

Source: Adapted from World Bank 1994, p. 88.

3.4 Responses to, and effects of, reforms

It is difficult to generalize about the response to the reforms affecting the fertilizer sector in SSA because of (a) the variety of initial conditions (in terms of the policy environment, agro-climatic potential, and human capacity available to implement reforms), (b) the timing of the key reforms (e.g., Senegal and Cameroon initiated reforms in the mid-1980s while Nigeria did not begin until the late 1990s), (c) the pace of the reforms (e.g., Senegal rapidly phased in subsidy removal while Malawi and Nigeria are still working on it), and (d) the level of government commitment to full implementation of reforms (e.g., the Kenyan government has followed a largely hands-off approach while the Zambian government remains heavily involved in fertilizer imports, credit, and distribution).

Another problem is that the response to reforms can change over time. Many of the studies that document these responses were conducted during the 1990s; those done at the beginning of the 1990s often draw different conclusions to those conducted at the end of the 1990s. Also, most studies available have focused on the major fertilizer consuming countries of SSA, so there is relatively little understanding of how reforms have influenced countries with low initial levels of fertilizer use.

Despite these problems, a review of the available literature does provide a number of insights on the supply and demand response to the reform process and the effect that this has had on agricultural production and productivity.

Supply response to reforms

In most SSA countries, the private sector is now involved in some international fertilizer procurement. Side by side with the increased level of commercial procurement, however, are varying levels of government procurement. Examples exist of government procurement directly by ministries (Malawi), through agricultural inputs procurement and distribution agencies (Ethiopia), and by marketing boards (Kenya in 2005 after many years of non-intervention). These procurement procedures are often complex, time consuming and, more significantly, market distorting. They tend to introduce uncertainty in the market, and this diminishes private sector imports (Gregory and Bumb, 2006).

If reforms elicited the desired supply response, it should be possible to document growth in the number of actors at various levels of the supply chain (importing, wholesaling, retailing); less direct intervention in markets by donors and governments; and lower real costs of acquisition and supply that translate into lower farm gate prices; and increased reliability of supply (available when, where, and in the quantity needed). These indicators are examined below.

Number of actors

Growth in the number of commercial actors in the fertilizer sector has been important, since most countries started with a single state-owned enterprise. Kenya, one of SSA's largest fertilizer consumers (about 351,000 tons in 2004), has probably made the most progress, with seven to eight major importers (including cooperatives and estates), 300 wholesalers and 3000 retailers (IFDC, 2005).[7] Cameroon, a medium-sized consumer

[7] Kenya did not have a "state-owned" enterprise prior to reforms. Fertilizer imports and distribution were managed by a cooperative established by farmers in the commercial sector. The cooperative's monopoly position was supported by government policy and government tended to influence decisions about quantities imported. These numbers are cited as they are the most recently published, but earlier estimates suggested higher numbers. For example, Mose 1998 cited in Kherallah *et al.* 2000 reported 12 importers, 500 wholesalers and as many as 5000 stockists; Jayne *et al.* 2003 estimated that retailers had grown to over 7000 by 2000.

(35,000 tons in 2002) also had a good record during the early liberalization period, with more than 12 firms bidding for import contracts and three to four generally winning them each year. Distributors increased from four to more than 20 within five years and there were signs of competition (efforts to cut costs through local bagging, larger lots, etc.) (Kherallah *et al.* 2002). At the other end of the spectrum in terms of market size is Rwanda (varying between 5,000 and 10,000 tons annually since 2002).[8] Despite the small quantities, there were seven firms importing within one year of market liberalization, which followed on a post-war situation (1995-1998) where fertilizer imports were managed exclusively by donors (primarily the EU) and the tea and coffee parastatals (see Box 3.1).

Box 3.1
Rwandan Liberalization: Responding to Commercial Concerns

In 1998 and 1999, after it became clear that the post-war EU programme of fertilizer imports and subsidies was being discontinued, the Government of Rwanda held multiple meetings with representatives of Rwanda's commercial sector in an effort to get them involved in fertilizer importation and distribution. Three issues were raised:

- The need to eliminate free and/or subsidized distribution except in special cases of extreme need that would be approved in advance by the Ministry of Agriculture. Given the post-war situation, there were many NGOs who had been distributing fertilizer liberally to farmers; the commercial sector was unwilling to invest in the sector if such programmes continued.
- Reduction of taxes on imports, which added 20 percent to import costs, to compensate for the removal of subsidies.
- Provision of a subsidized line of credit for importers (9 percent interest rather than 16 percent).

The Government, with assistance from the World Bank, responded positively to all three requests. In 1999 (the first year after the end of the EU programme), imports of fertilizer were less than 3000 tons and the principal actors were one private firm (which subsequently went out of business) and the tea parastatal. In 2000, after the Government responded to the commercial sector's three requests, seven firms imported a total of 6,500 tons. Most of these firms entered the market using their own financial resources and lines of credit as the subsidized credit programme proved very demanding in terms of paperwork. In 2002, imports totaled almost 21,000 tons although it appears that the level of imports fell after 2002.

Source: Kelly *et al.* 2001 and personal communication Josephat Mugabo, ISAR 2006.

In some cases (e.g., Ethiopia and Benin), continued government involvement in markets (through control of foreign exchange, licences, or input credit programmes) and political influence have resulted in a partial liberalization that has not permitted true competition (Box 3.2). In these cases, decision-making authority to determine quantities and prices has not been transferred to the private sector. In a few cases (e.g., Guinea) analysts have suggested that liberalization has led to too many actors in the market. Although this seems counter-intuitive, the argument is that it is so easy to be licensed to market fertilizer in some countries that there are many opportunistic traders who enter the market for brief periods of time to take advantage of policy-induced price or supply changes in one country (e.g., a Nigerian subsidy change) that make it very profitable for a

[8] Personal communication, Josaphat Mugabo; estimates do not include informal cross-border trade from neighboring countries.

short time to buy up supplies and sell them in a neighbouring country (e.g., Niger). This type of opportunistic trading does little to build reliable private sector networks. In other cases (e.g., Mali), the number of licensed actors is large, but the number of effective actors is small because so many are unable to access the financial capital needed to import fertilizer.

Box 3.2
Partial Liberalization in Benin and Ethiopia

In Benin, the cotton company SONAPRA began to reduce its role in input supply in the early 1990s by contracting private firms to import and distribute fertilizer supplies. Within five years, nine commercial firms were active in the sector, yet analysts found that the position of SONAPRA as the dominant buyer prevented true liberalization: there was little sign of price competition, distributors found themselves without any security, and the overall system remained relatively unresponsive to farmer demand (Kherallah *et al.* 2002).

From 1984 to 1993 Ethiopian fertilizer import and distribution was under the control of a state-owned enterprise. In 1993, a new National Fertilizer Policy was developed in collaboration with the World Bank; it provided substantial funding to soften the impact of subsidy elimination and open up the market to private entrepreneurs. In 1993, two large firms with import experience in other commodities entered the market in competition with the state-owned enterprise. In 1995 a number of new "firms" also entered the market, some importing and others working only on internal distribution. These new firms were holding-companies created by influential politicians and their political parties. They had very strong ties to regional governments and soon became the chief importers and distributors for the government's new extension programme, which has financed 75 percent or more of the fertilizer used by farmers since the programme began during the 1994/95 cropping season. The major commercial firms that originally entered the market found it impossible to compete with the holding companies and have dropped out. In short, liberalization led to an increased number of actors, but there is a lack of competition at both the import and the distribution levels. In 2001 all imports were handled by three firms: the state-owned enterprise and two of the politically influential holding-companies (Stepanek 1999; Jayne *et al.* 2003)

There is also recognition that in the early stages of input market development the benefits of many actors competing against each other need to be balanced against the potential for fewer actors to realize economies of size and scale through larger imports and better vertical coordination of the sector (leading to reductions in contracting, handling, storage and transport costs).

Although significant progress has been made on increasing the number of actors in the fertilizer sector, the response has been slower than expected, particularly in geographically remote areas and zones with lower agricultural potential. Macro-economic instability leading to devaluation and high interest rates, lack of marketing skills and finance, and inadequate regulatory systems and market transparency are among the most frequently mentioned constraints.

Reduced role of donors and governments

Although the amount of fertilizer aid-in-kind is declining, it remains a factor in many countries. In Kenya, for example, it declined from about 50 percent of imports in the late 1980s to only 5 percent in 1996. In the recent past, Kennedy Round 2 (KRII) fertilizers have created problems for the private sector in Uganda, Tanzania, Mozambique, and Madagascar (Gregory and Bumb 2006). Although KRII fertilizer must be sold at a minimum of 50 percent of the free on board price, this is significantly lower than the price

charged for commercial imports. If traders are able to get KRII fertilizers below market costs, this introduces an element of unfair competition into the market.

Another issue often raised by fertilizer suppliers is that of unfair competition from NGOs or government agencies who provide inputs to farmers for free or below full market cost. In many situations, the NGOs recover the full commercial costs of the inputs but provide indirect subsidies by using project funding to cover transport and/or storage. Again, this discourages the private sector from developing markets in areas served by NGOs. Rwanda (Box 3.1) had to outlaw free and subsidized distribution before the private sector would invest in the fertilizer sector (Kelly *et al.* 2001) and Tanzania had to extend the subsidy available to the state-owned Tanzania Fertilizer Company to potential private sector actors before they would invest in fertilizer imports (Kherallah *et al.* 2002). There has been increased effort to use input vouchers as a means of increasing access to fertilizer while also helping to develop input supply. Designing these voucher programmes in a manner that does not "crowd out" existing demand or favour some distribution channels (government supported ones) over others (commercial ones) is difficult (Gregory 2006). IFDC's vouchers-for-work programmes in Malawi have proven relatively successful in targeting the most needy and food-insecure households (Gregory and Roy 2005; Gregory 2006), but a Malawi government voucher programme that allowed only government distributors to redeem vouchers resulted in many commercial distributors going out of business.

Fertilizer aid can also introduce uncertainty into the fertilizer supply processes. This was illustrated in Malawi in 2004 and 2005 when - before working out the details of donor funding, amounts to be distributed, and anticipated beneficiaries - the government announced that it would distribute large amounts of subsidized fertilizer to smallholder farmers in an effort to help them overcome food shortages induced by recurrent droughts. By the time the details were announced each year, many farmers and suppliers had made less than optimal fertilizer procurement decisions. The end result for the commercial sector was supply shortages in the first year and overstocking in the second year.

In sum, direct donor and government involvement in the fertilizer sector declined but is now on the rise again. This rise has gained momentum from the Millennium Development Report, which argues that increased access to fertilizer can reduce poverty. This review finds, however, that solid empirical evidence is weak on the link between large-scale national programmes that promote rapid expansion of fertilizer use and growth in agricultural productivity leading to increased incomes and food security for the poor. (see Section 5.6 below).

Costs and prices

Most evidence suggests that reforms have not reduced farm gate prices of fertilizer. The reasons for this are multiple (Kherallah *et al.* 2002). By 1992, 17 of 27 countries surveyed had removed fertilizer subsidies and three others were in the process of doing so. Twenty-one SSA countries studied experienced currency devaluations during the 1980s; in five of these countries (Nigeria, Ghana, Zambia, Tanzania, and Madagascar) the devaluation was greater than 100 percent. In 1994, all of the countries in the CFA (African Financial Community) franc zone experienced a 50 percent devaluation.

When devaluations were implemented simultaneously with subsidy removal, farmers received a double shock, losing the implicit subsidy from an overvalued exchange rate as

well as the explicit subsidy offered by government. In Ghana, for example, the exchange rate went from 3 cedis to 350 cedis per US dollar and the fertilizer subsidy declined from 50 percent to zero, increasing fertilizer prices twelve-fold. These price changes were accompanied by a decline in annual use from 30,000 to 11, 000 tons. Some analysts attribute the decline to the poor sequencing of subsidy removal and devaluation (Bumb and Baanante 1996) while others argue that the decline was more a result of inefficiency on the part of the government, which continued to be the dominant player in the sector until commercial actors entered the market in 1991 (Donovan 1996).[9] Nigeria is another country where there is some debate about whether supply dropped off as a result of diminishing demand during reforms or because of government's inability to maintain supply as subsidies were being phased out; subsidies represented 32 percent of agricultural spending in 1985 and 70 percent in 1989 (World Bank 1994).

Studies of fertilizer cost structures suggest that high prices are due more to policy uncertainty and structural problems that keep transportation, handling, and port clearance costs unnecessarily high than to excessive margins. Supplier margins in Kenya, Zambia, and Uganda were estimated to represent less than 10 percent of total farm gate fertilizer costs (Jayne *et al.* 2003). Higher margins of 28 percent were found in Malawi; these were attributed to suppliers trying to cover potential costs of uncertainty associated with exchange rate fluctuations and inflation (Westlake 1999). Estimates of importer margins in Mali are in the 8-15 percent range (LeTurioner, personal communication). These margins are higher than those found in more developed markets (usually less than 5 percent) but appear justified given levels of risk.

Despite the lack of evidence for declining overall costs, there is evidence of some reduction in margins. For example, the margins on shipments from Mombassa to Nakuru in Kenya fell from $275 to $149 per ton between 1996 and 2000 and margins on shipments from the US Gulf to wholesalers in Lusaka dropped from $382 in 1996 to $231 in 2000 (Jayne *et al.* 2003).[10] In Ethiopia, there is evidence that costs were reduced by between four and thirteen percent through competitive bidding for the rights to distribute National Extension Programme fertilizers; but transparent bidding procedures were often not used (Stepanek 1999).

In sum, the sense of the literature on fertilizer cost reductions following reforms is that the cost savings from privatization and liberalization have not been sufficient to prevent net price rises induced by devaluations and subsidy removal (Kherallah *et al.* 2002). A recently documented exception to this trend is Kenya, where reductions in fertilizer marketing margins have kept maize/fertilizer price ratios fluctuating within a fairly narrow band from the early 1990s to the present, maintaining incentives for farmers to use fertilizer on this important food crop (Ariga *et al.* 2006).

Availability

Availability can be assessed in terms of total quantities supplied, timeliness of supply, where supplied, and how well the products supplied match the effective demand. The record is mixed.

[9] Budgetary costs of Ghana's fertilizer subsidy rose from 3.4 percent of the agricultural budget in 1980 to 10.6 percent in 1988. In 1988 it represented 33 percent of Ghana's development budget.

[10] In Kenya, mean domestic marketing costs fell by 24% between the period 1990-1995 ($262 per ton) and the period 1996-2000 ($206 per ton) (Jayne *et al.* 2003).

Availability tends to be best for cash crop schemes with interlinked input credit and output markets, such as for cotton in West Africa, or sugar and tea in Kenya (Jayne *et al.* 2003; Tefft *et al.* 1998; Tefft 2003; Poulton *et al.* 2004; Ariga *et al.* 2006). In such cases, state-owned enterprises often continue to play an important role in determining quantities to order and in setting prices. They have tended to outsource the procurement and distribution activities to the commercial sector through tenders and delivery is generally timely.

In cash and export crop situations, where privatization and liberalization have weakened the links between input credit and output markets, supply has been problematic - often because demand is uncertain without a reliable credit system (see Box 3.3 for examples from Ghana, Uganda, and Tanzania).

Box 3.3
Challenges in reforming interlinked input-output-credit markets
Case studies from Uganda, Ghana, and Tanzania

Resistance to privatization and liberalization of key export crop markets that are characterized by interlinked input-output-credit markets is high in SSA due, in part, to concern that input credit repayment and production will fall. Experiences in liberalizing cotton (Uganda and Ghana) and coffee (Tanzania) suggest that it will be difficult to avoid some reduction in input use.

In Uganda ginners formed an association with mandatory membership. Members used a government-guaranteed loan to provide farmers with inputs. Prices offered to farmers for seed cotton were net of a standard deduction per kg to cover input costs, and ginners reimbursed the credit fund in direct proportion to the quantity of cotton they ginned (Gordon 2000; Gordon and Goodland 2000). The programme was abandoned after two years of major defaults because harvest estimates were poor, resulting in deductions that were not adequate to cover the loan. Cotton is a crop grown almost exclusively by poor farmers in Uganda; hence a successful input credit system in this sector could have high poverty-alleviation benefits. Uganda has now come to the realization that smallholder cotton production must be accompanied by institutional development at the farmer level and is planning to pursue this avenue in 2003 through training and the promotion of farmer associations.

In Ghana, cotton companies tried to reduce side-selling after liberalization by offering a common price, while competing through quality of service and other non-price incentives. A culture of strategic default and switch evolved whereby farmers defaulted on payments with one firm and got credit from another the following season. Also, lack of price competition has resulted in lower cotton prices relative to other crops, leading farmers to neglect cotton production in favour of the more profitable alternatives (Poulton *et al.* 1998).

The 1994 liberalization of the Tanzanian coffee sector resulted in heavy losses for cooperative unions and the Tanzanian Coffee Marketing Board (almost US$7 million) because producers sold their coffee to emerging private sector coffee buyers offering higher prices. Consequently, only 15 percent of farmers had access to input credit from 1995 through 1997, in sharp contrast to the pre-liberalization situation where all farmers had access. However, a cost-benefit calculation of the net impact of reduced access to finance and increased output prices suggests that only 15 percent of farmers were worse off post-liberalization (Winter-Nelson and Temu 2002).

Source: Kelly *et al.* 2003.

Availability through commercial channels has also been relatively good in high potential, low-risk production zones such as the Western Highlands of Kenya and the irrigated rice zones in Mali's *Office du Niger,* but the supply is not problem-free. In Mali, for

example, there were serious fertilizer shortages in the *Office du Niger* in 2004 and 2005 because many of the suppliers were unable to obtain credit. Among the problems identified were the discontinuance of upstream manufacturer credit due to poor repayment by Malian importers, lack of interest in the fertilizer sector on the part of Malian banks (who are unwilling to use fertilizer stocks as loan collateral), and a lack of strong commercial skills and professionalism among actors in the sector.

The other major constraint on availability in high potential zones stems from policy uncertainty associated with government activity in the market. Suppliers are unwilling to risk investing in imports when there is a chance that government or donor programmes will also import and sell at subsidized prices. This has resulted in years with inadequate and/or late supplies (e.g., Malawi and Zambia).

Remote zones or those with low agricultural potential and high production risks that had been relatively well served by state-owned enterprises and pan-territorial pricing patterns tend to be the orphans of the post-reform period. The private sector's tendency to ignore these zones is often referred to as a market failure in the literature but some argue that it may reflect a market success in that fertilizer use at commercial prices may well be unprofitable in these zones and thus there is no effective demand; if costs of supply exceed willingness to pay, a commercial firm should not be expected to supply fertilizer (Jayne *et al.* 2003). Nevertheless, social and political concerns suggest that alternative solutions should be sought to improve profitability or reduce the costs of supply for these zones so long as livelihoods are predominantly agriculture based. Concern over the increasing poverty in rural Africa has led some to suggest that targeted fertilizer subsidies be used in these marginal and remote zones to stimulate fertilizer demand and supply (e.g., Millennium Development Report).

An alternative approach to increasing input availability for poor farmers has been to develop products and packaging that better suit their needs and budgets. There have been a variety of success stories in this area since market reforms were introduced, mostly associated with selling fertilizers in very small packages, often in combination with small packages of improved, fertilizer-responsive seed (Box 3.4). For these "small-pack" programmes to be successful, governments and manufacturers often need to change legislation or company rules that prohibit breaking down larger packages. Authorized rebagging also raises the need for quality inspections at the retail level - something that is not yet well developed. Nevertheless, Kenya repealed a law in the early 1990s that prohibited sales of fertilizer in less than 50 kg bags; by 1996 46 percent of fertilizer sales to smallholders were in 10 kg bags (Agriconsult undated; Arwings-Kodhek 1996 cited in Kelly *et al.* 2003). The popularity of small packs led two Kenyan firms to develop new fertilizer formulae and market them in 1 kg bags to encourage farm-level experimentation. Those promoting small packs report that clients increase their purchases from 1 kg to 5 kg and then to 10 kg bags over a few years. Despite the evidence of effective demand for small packs, many feel the approach is too slow in promoting widespread productivity growth, given increasing levels of rural poverty.

Box 3.4

Successful introduction of small packs to increase input use by poor farmers in Kenya

In 1990, the Sustainable Community-Oriented Development Programme (SCODP) undertook a programme to increase input use among poor farmers by promoting fertilizer and improved seed. The targeted zone was characterized by extremely low crop yields and incomes, representing a pocket of poverty in the otherwise agriculturally prosperous region of Western Kenya. The approach included raising farmers' awareness of modern inputs, participatory input testing, blending and packaging of fertilizers into affordable mini-packs, and a SCODP distribution network (rural stockists selling on a cash basis from SCODP shops or through promotion programmes at markets, churches and schools). An unanticipated outcome of the programme was that local traders learned by observing SCODP shops that there was effective demand for inputs and began stocking them, particularly fertilizers. By 2002, SCODP was selling over 500 tons of fertilizer annually and an estimated 50,000 farmers had begun to use fertilizer as a result of its programme (Fritschel 2002).

This innovative approach has been successful in developing demand among some of Kenya's poorest farmers and improving their physical and financial access to purchased inputs. SCODP focused on food crops generally grown for home consumption (e.g., maize, beans, collard greens) in an effort to improve food security. The awareness-raising campaigns, carried out at markets and churches where farmers congregate, were a key component of the success. They were complemented with extension assistance to farmers willing to test the inputs. These input promotion techniques contrasted sharply with government extension methods using direct contacts with a relatively small group of well-to-do model farmers (Sindi, personal communication, 2003).

Although the strength of the programme when compared to others appears to be its ability to inform both farmers and traders about inputs, the programme did address multiple constraints: farmer knowledge through awareness campaigns, farmer skills through participatory input testing, affordability through the use of mini-packs, and availability by establishing SCODP shops and stimulating general merchandise traders to stock fertilizers. Had the programme not addressed the affordability and availability constraints, inputs would not have been available to farmers touched by the awareness campaigns and traders would not have learned that there was demand for these inputs (Wanzala 2003).

Source: Kelly *et al.* 2003.

Demand response to reforms

Demand response to reforms can be measured to some extent through a review of fertilizer use trends, but it is often difficult to pinpoint exactly the factors shaping these trends. The literature suggests that two key determinants of fertilizer demand during the reform period were changes in the profitability of fertilizer use and access to credit. The discussion of fertilizer use trends is followed by a discussion of how changes in fertilizer profitability and access to input credit have affected fertilizer demand.

Use trends

Comparing the early 1980s and the mid-1990s, Kherallah *et al.* (2002) report a decline in fertilizer use in seven of the main fertilizer using countries but an increase in 14 others. For example, Nigeria, Malawi, Zambia, Zimbabwe, Sudan, and Tanzania have experienced important reductions and/or inter-annual fluctuations in fertilizer demand, often a result of uneven implementation of market liberalization and macro-economic reforms. A different analysis of 16 West African countries showed that, in 2000, 38 percent of the countries

were at consumption levels lower than those before the reforms began (Cameroon, Gambia, Ghana, Mauritania, Nigeria, and Senegal), while three countries (Guinea, Niger, and Sierra Leone) with low initial consumption were experiencing rapid rates of growth (22-45 percent annually) (Kelly 2000). There are also numerous examples of fertilizer use shifting from lower to higher value crops, and from less to more fertilizer-responsive crops after reforms (e.g., from peanuts to irrigated rice and horticulture in Senegal; from maize to tobacco in Malawi). These shifts were not only responses to changes in fertilizer and crop profitability following input and output market liberalization but also a response to non-market reforms. For example, smallholder fertilizer demand in Malawi increased when policies restricting tobacco (a highly fertilizer-responsive crop) to estate farms were discontinued and smallholders became tobacco producers. Overall, the cotton producing countries of West Africa (particularly Benin, Burkina Faso, Côte d'Ivoire, and Mali), Kenya, and Ethiopia are the countries that demonstrated relatively consistent growth in fertilizer demand from 1970 through 2000. It is noteworthy that, among those with consistent demand growth during this period, only Kenya could be characterized as having a fertilizer sector that was relatively free of government intervention.

A recent comparison of World Bank fertilizer policy scores[11] and fertilizer consumption growth rates from 1986-2002 reveals a lack of correlation between consumption trends and policy implementation (Meertens 2005). For example, policy scores that ranked countries on how extensive their implementation of reforms had been (drawn from Townsend's 1999 update of scores reported in Table 3.1) showed extensive reform for Malawi, Zimbabwe and Tanzania where growth in fertilizer consumption was negative. Policy scores showed less reform for Senegal, Togo, and Benin where growth was much more rapid. Although the lack of correspondence may be due in part to recent backtracking on reforms that was not captured by the 1999 policy rankings by Townsend, this analysis and the comparisons noted in the previous paragraph suggest that factors other than policy reform *per se* are probably driving fertilizer use trends. Although it is difficult to establish a clear link between how well reforms were implemented and fertilizer consumption trends, some argue that incomplete implementation has been common (Kheralla *et al.* 2002; Jayne *et al.* 2002). Others argue that the lack of progress is due more to weak institutions, particularly for input credit, that were either ignored in the design of the reform process or actually weakened by reforms (Dorward *et al.* 1998; Poulton *et al.* 1998; Kydd 2002). In low-potential zones where fertilizer use became unprofitable after subsidy removal and/or devaluation, discontinuation of some of the pre-reform fertilizer credit programmes can be justified on economic grounds. In cropping systems where fertilizer use is profitable under post-reform price conditions, there has been inadequate attention to building institutions to support input credit.

Fertilizer profitability

Fertilizer profitability is a function of fertilizer response (kilograms of additional output per kilogram of fertilizer used), fertilizer prices, and output prices. Evaluating fertilizer profitability is not difficult, but it is a parameter that changes from year to year as well as within a single marketing season, due to variability in output prices. It is also a parameter that changes from farmer to farmer, with farmers who have better farming skills or those living in higher potential zones using fertilizer more efficiently and therefore obtaining

[11] Countries were ranked on factors such as the extent to which the private sector had replaced government parastatals in the input supply system and the extent to which fertilizer prices were determined by markets rather than by government price policies.

higher response. In the long run, farmers should have the skills needed to assess fertilizer profitability for their individual situations - an area of skill-building seldom addressed by extension services. Compounding the problem is the fact that African research and extension services seldom invest their resources in location-specific fertilizer recommendations based on profitability analyses. Annual updates of fertilizer recommendations that take prices changes into account are even rarer. This has been problematic in the post-reform period as governments have frequently wanted to continue promoting pre-reform fertilizer recommendations, even though there is reason to believe that they are no longer profitable.

The combined effect of subsidy removal and devaluation was generally a substantial increase in fertilizer prices during the post-reform period. Given evidence presented above concerning the limited nature of reductions in fertilizer distribution costs, which could have served to counter-balance the subsidy and devaluation impacts, the only remaining option for increasing fertilizer profitability and effective demand would have been through significant improvements in output prices or fertilizer use efficiency. Because of the general lack of location-specific fertilizer response and annual updating of profitability analyses, there is a tendency for analysts to use a number of rough indicators to assess trends in fertilizer profitability; these rough indicators are used in the discussion that follows.[12]

The fertilizer-crop price ratio is a rough indicator of changes in fertilizer profitability over time; it shows how many kilograms of output it "costs" a farmer to obtain one kilogram of fertilizer. Kherallah *et al.* (2002) compared ratios during 1981-85 with those prevailing in 1994-96 for 11 countries; they report that the ratio more than doubled in Benin, Ghana, Nigeria, and Tanzania and increased by 50 percent in Malawi, Senegal, and Zambia. It fell (making fertilizer more affordable) in Ethiopia, Kenya, and Zimbabwe.

Case studies such as those conducted on Sasakawa Global 2000 (SG 2000) seed/fertilizer promotion programmes in Ethiopia provide supporting evidence that fertilizer use was highly profitable on maize in the mid-1990s (Howard *et al.* 2003). However, Ethiopia's bumper cereal harvests in 2001 and 2002 completely reversed the tables, illustrating how rapidly fertilizer profitability can change. Output prices declined by 80 percent and input/output price ratios increased from 1.7 to 9 (Gabre-Madhin 2003). Fertilizer became unaffordable for farmers, who could not market their surplus at a price permitting them to repay their fertilizer credit. In other situations, donor food aid programmes and governments wanting to win favour with politically influential urban constituencies have encouraged policies that keep food prices low. Although such policies are less common now than before reforms, where they continue to exist they do reduce producer prices and fertilizer profitability. For non-food crops, there is evidence (Kherallah *et al.* 2002) that farmers are receiving a larger share of the f.o.b. export price where output markets have been more fully liberalized (e.g., Cameroon, Malawi, Tanzania and Uganda) than where liberalization has been timid (e.g., Benin, Côte d'Ivoire, Ghana and Senegal). In general, higher shares of f.o.b. export prices for farmers will be associated with improved fertilizer profitability.

[12] Yanggen *et al.* 1998 provide detailed discussions of the strengths and weakness of these rough indicators. Kelly and Murekezi (2000) and Benson (1999) provide examples from Rwanda and Malawi of research/extension efforts to promote area specific fertilizer recommendations based on different types of profitability analyses.

A better indicator of trends in fertilizer profitability is the value-cost ratio (VCR), which is the ratio of the value of additional production attributable to fertilizer use divided by the cost of using the fertilizer (it takes into account changes in fertilizer response as well as prices). The higher the ratio the more profitable fertilizer use is. Estimates of VCRs for selected countries and crops reported in Table 3.2 show declining VCRs for most examples. Use of urea on maize in Kenya is an exception, as the ratio has shown modest improvement.[13]

Table 3.2 Changes in value-cost ratios for the main fertilized crops in the main fertilizer consuming countries of SSA from early 1980s to early 2000s

Country	Crop-Fertilizer combination	VCR during early 1980s[a]	VCR in 1986[b]	VCR during mid-1990s[a]	VCR during early 2000s[c]
Benin	Cotton-NPKSB	5.1	-	2.6	3.2
Côte d'Ivoire	Rice-Urea	-	4.1	-	2.3
	Cotton-NPKSN	-	-	-	2.7
Mali	Rice-Urea	6.7	-	5.7	3.3[d]
	Cotton-NPKSB	-	-	-	3.0
Burkina Faso	Cotton-NPKSB	-	2.8	-	2.2
Ghana	Maize-AS	6.8	-	1.5	2.2
Senegal	Groundnuts-Mixed Fertilizers	15.0	-	9.0	3.0
Ethiopia	Maize-Urea	2.7	-	9.0	2.5
Togo	Cotton-NPKSB	-	-	2.7[e]	3.0
Kenya	Maize-Urea	2.6	-	3.5	2.8[f]
Cameroon	Cotton-NPKSB	-	4.6	-	1.7
Zimbabwe	Maize-Urea	3.1	-	2.5[g]	2.6[h]
Malawi	Maize-Urea	7.4	-	3.3[i]	1.3[j]
Nigeria	Maize-Nitrogen	7.5	-	2.1	3.1[k]
Zambia	Maize-Nitrogen	5.2	-	3.1	1.1[l]
Tanzania	Maize-Nitrogen	6.5	-	1.1[m]	1.1[n]

[a] Based on fertilizer/crop price ratios mentioned in Kherallah *et al.* (2002) and typical fertilizer response rates of maize, rice, cotton and groundnuts in different parts of SSA from Kelly *et al.* (2005), unless otherwise stated.
[b] Based on crop and nutrient prices per kg in 1986 mentioned in FAO (1989**)** and a fertilizer response rate of 8 kg/kg nutrient for rainfed rice and 5 kg/kg nutrient for cotton in West-Africa.
[c] Based on crop and nutrient prices per kg for the early 2000s found in FAO (2004) or FAOSTAT (2005) anmd typical fertilizer response rates of maize, rice, cotton and groundnuts in different parts of SSA from Kelly *et al.* (2005), unless otherwise stated.
[d] Farmgate price of paddy rice and urea in the l 'Office du Niger from Ani *et al.* (2002).
[e] Source: FAOSTAT (2005).
[f] Based on average farmgate maize price of 11.2 KShs/kg and average farmgate fertilizer (CAN and DAP) price of 68.2 Kshs/kg nutrient mentioned in Salasya (2005).
[g] Based on 1995 maize producer price of 1.05 Z$/kg (FAOSTAT, 2005) and 1995 farmgate price of 120 Z$/bag of 50 kg AN or Compound D (8-14-7), which is equal to 7.3 Z$/kg nutrient (Chibudu *et al.* 2001).
[h] Based on 2000 farmgate maize price of 5.00 Z$/kg and an estimated farmgate price of 500 Z$/bag of 50 kg AN or Compound D mentioned in Twomlow and Ncube (2001).
[i] Source: FAOSTAT (2005).
[j] Farmgate maize price of 10 MK/kg (RATES, 2003a) and a price of 3000 MK/bag or urea (USAID, 2005).
[k] Retail 2004 maize price of 23 N/kg and retail 2004 urea price of 52 N/kg in Kano State (AFMIN, 2005).
[l] Retail 2002 maize price of 200 ZMK/kg and farmgate 2002 urea price of 1,400 ZMK/kg (FAO/WFP, 2002).
[m] Average 1995/96 farmgate maize price of 50 TShs/kg in Southern Highlands and 1995/96 farmgate price of 751 TShs/kg nutrient on the application basis of 2 bags Can and I bag TSP (MAC, 1997).
[n] Farmgate 2002 maize price of 55 TShs/kg (RATES, 2003b) and CAN price of 850 TShs/kg N (FAO, 2004).

Source: Meertens 2005, p. 10

[13] Both this VCR and the fertilizer-crop price ratio comparisons use subsidized prices for the pre-reform analysis if subsidies existed; this may exaggerate the negative effects of the reform period if subsidies were accompanied by supply shortages that created parallel markets forcing farmers to pay higher than official prices.

Distinct from the level of output prices is their volatility. When output prices fluctuate widely across seasons and years, farmers have difficulty assessing the potential benefits of fertilizer, which may result in sub-optimal use. Several studies have reported increased price volatility since the reform process began. The situation in Ethiopia during the early 2000s was probably the most dramatic (Gabre-Madhin 2003), but increased price volatility following reforms has also been noted by others (Barrett and Carter 1999; UNCTAD 2003, and Dembélé and Staatz 2002). Problems are greater for landlocked countries. In situations where both price and production risk is high - for example, domestic food crops produced in low-potential rainfed zones - average profitability can be improved through increased fertilizer use efficiency using micro-dosing and improved soil and water conservation and natural resource management practices (see section 4.3 below).

In sum, input and output price trends since reforms began have generally made fertilizer use less profitable and more risky than the situation prevailing before reforms; this decreased fertilizer demand, particularly in cropping systems where fertilizer use was only marginally profitable before reforms. The generally lower profitability in the post-reform period should not, however, be interpreted as a *lack* of profitability; there is ample evidence that fertilizer can be used profitably in many of SSA's cropping systems (Benson 1999; Kelly and Murekezi 2000, Howard *et al.* 2003; Snapp *et al.* 2003, Piha 1993, Yanggen *et al.* 1998).

Credit as a key determinant of demand

For many African farmers the cost of fertilizer per cropping season can be many times larger than their net farm income for that season. This implies an important role for credit if there is solid evidence that profitability over time is good (i.e., an average VCR greater than two). Poorly functioning financial markets for input credit constrain farm-level demand for fertilizer across the continent. The key challenge is developing a system that ensures a high rate of repayment. During the reform period there were clear declines in fertilizer use in Zimbabwe, Tanzania, Malawi, and Senegal following the tightening of credit programmes or their dissolution due to high default rates (see, for example, Eicher and Kupfuma 1997, on Zimbabwe; Kelly 1988, on Senegal). Ethiopia invested heavily in a government-run credit programme to promote fertilizer use on cereals, but had difficulty enforcing repayment following the 80 percent output price declines noted above. As export crop markets were liberalized in Ghana, Uganda, and Tanzania the interlocked credit/output markets were "unlocked", causing problems with credit that usually led to sharp declines in input use (Kelly *et al.* 2003; Poulton *et al.* 1998; Dorward *et al.* 1998).

Credit is probably the most vexing constraint to growth in African fertilizer demand and increasingly raises questions about how one can further liberalize West African cotton markets without breaking the input/output market links that have held the credit system together. Recent studies (Poulton *et al.* 2004, Tschirley *et al.* forthcoming) review different approaches to privatization, such as regional monopolies (e.g., Ghana, Mozambique), market-based systems with a dominant actor (e.g., Zambia, Zimbabwe), and competitive sectors with many small actors (e.g., Uganda and Tanzania). The sectors with dominant actors or regional monopolies have generally done better in terms of input credit than those with many small actors. Most analysts note, however, that it is not market structure *per se* that matters but rather the government's ability to assume an appropriate supporting role given a specific market structure (e.g., monitoring prices and sanctioning non-

competitive practices for systems with dominant actors, stimulating efficient and effective coordination and provision of public goods for multi-actor sectors).

Some have suggested investigating the re-introduction of the abandoned systems of monopsonistic interlocking support to input finance for food production, but with a new governance structure that is more responsive to farmers' interests and conducive to operational efficiency and fiscal discipline (Kydd *et al.* 2002). The case for such an approach is based on past experience with such systems having fostered the beginnings of a maize Green Revolution in Africa (Byerlee and Eicher, 1997) and growing evidence that pure competition in an environment of weak market institutions leads to poor market coordination (Dorward *et al.* 1998; Kydd *et al.* 2001; Dorward *et al.* 2002). When competitive markets are thin, growth requires investments by many different players, but the returns to investment are dependent on simultaneous investments by other players. Consequently, non-market coordinating mechanisms are needed for individual investments to yield the desired return. Although state interventions in markets theoretically have the potential to address these problems by reducing risks and transactions costs for traders and farmers, there is little empirical evidence that governments can implement such interventions effectively and keep rent-seeking in check.

Production and income response to reforms

It is difficult to find conclusive evidence of productivity impacts from market reforms because productivity is more sensitive to weather, macro-economic reforms, exchange rate policies, and technology change than to privatization and liberalization efforts. Some studies cite national statistics or results from post-reform farm survey data showing declining agricultural productivity (both aggregate and per capita) as evidence that the reforms have had a negative impact (Reardon *et al.* 1996; Reardon *et al.* 1999). These results are balanced, however, by various reports showing that fertilizer use and aggregate production has increased in some sectors (e.g., cotton in Mali and Benin; irrigated rice in Mali, cashews in Mozambique and Tanzania; horticulture in Kenya; coffee in Uganda) following the introduction of reforms (Tefft *et al.* 1998; Ariga *et al.* 2006; Bonneval *et al.* 2002). The most negative production impacts tend to be found where both input credit and subsidies were eliminated at the same time (e.g., the oil peanut sector in Senegal described by Freud *et al.* 1997) or where pre-reform fertilizer use on maize was made artificially profitable by pan-territorial fertilizer pricing and output market price supports (e.g., Malawi, Zambia, Kenya).

Interestingly, Central Africa[14] seems to have done better with maintaining or increasing production of basic staples than the West, East and Southern Africa regions. FAO cereal production per capita and cereal yield data for Central Africa show statistically significant and positive trends (0.61 percent and 1.43 percent growth respectively) for the 1990 to 2005 period. West Africa had significant and negative trends in per capita cereal production (-0.79 percent) with significant and positive yield trends (0.44 percent). Analyses for East and Southern Africa did not result in statistically significant trends.

In sum, there is little conclusive evidence in the literature on the productivity impacts of reforms affecting the fertilizer sector or the indirect effects this might have had on rural incomes and welfare. The one safe statement is that the productivity effects varied by

[14] Represented by Angola, Cameroon, Central African Republic, Democratic Republic of Congo, Congo, Chad, Gabon, San Tao and Principe in the FAOSTAT data base.

country and cropping system. Kherallah *et al.* (2002) conclude that subsidy removal and changes in the fertilizer/crop price ratios probably had a negligible effect on welfare (1-2 percent drop in rural income at the most) because only a small portion of farmers were using fertilizer prior to reforms (15-35 percent, depending on the country) and most of these farmers were generally better off, in terms of income and access to land, and were thus able to withstand the negative effects.

3.5 A renewed sense of urgency

It is generally agreed that, for a variety of reasons, liberalization and privatization of the fertilizer sector has not met expectations. Consequently, efforts to promote fertilizer use have become increasingly eclectic and diverse.

A range of new approaches that go well beyond the scope of policy reform became popular in the mid-1990s:[15]

- **Technology generation** efforts gave more attention to location-specific and best-bet recommendations of relevance to Africa's small-scale farmers (see, for example, Snapp *et al.* 2003 or Pound *et al.* 2003)
- **Technology transfer** efforts made greater use of demonstration plots and other fertilizer promotion programmes, many funded through public-private partnerships (SG 2000 programmes in Ethiopia and Mozambique, for example, described in Howard *et al.* 2003).
- **Improved input distribution networks** have been supported by donor-funded programmes providing training and credit guarantees for rural agro-input dealers (described in Kelly *et al.* 2003).
- **Promotion of input/output market linkages** has been used to alleviate credit repayment problems (see Kelly *et al.* 2003; Poulton *et al.*, 1998; Poulton *et al.* 2004; and Coulter and Onumah 2002).
- **Institutional reform** has been promoted to improve the enabling environment through better contract law, grades and standards, etc. (Gisselquist and van der Meer 2001).

Although selected examples of these new approaches have been cited in the literature as "success stories", most of them have been tested using relatively small-scale pilot projects that have not generated the types of large-scale change in input use and poverty reduction that governments seek. In response, governments are returning to direct market interventions such as fertilizer subsidies, seed/fertilizer distribution programmes, fertilizer imported by state-owned enterprises, and food aid distribution, all of which influence production and marketing decisions made by commercial input suppliers and farmers. The illustrations are numerous:[16]

- In 1999, Nigeria announced a 25 percent subsidy and obliged the private sector to deliver fertilizer to government depots for subsequent distribution by the public sector.

[15] Information in the following bullets is adapted from Morris *et al.* 2007.
[16] These examples are drawn from Gregory and Bumb 2006.

- Since the late 1990s Malawi, with donor support, has been distributing free fertilizer and seeds through a variety of programmes, some targeted to poor farmers and others available to all smallholder farmers; in 2005 the government introduced a 33 percent fertilizer subsidy.
- In 2003 Zambia imported and distributed 48,000 tons of fertilizer (40 percent of total imports) and sold the fertilizer at half price to targeted farmers.
- In 2003, Tanzania provided subsidized fertilizer to selected maize production areas of the country where fertilizer use had declined.
- In 2004, the Government of Madagascar announced that it would import fertilizer, but failed to get funding.
- In 2005, concern about the high prices of commercial fertilizers led the Government of Kenya to authorize its grain marketing board to import fertilizers for distribution to smallholder farmers.

In each of the above cases, government re-entry into the fertilizer market was problematic. In Nigeria, the private sector was not paid in a timely manner and was therefore unable to import fertilizer for the following season. In Kenya, the cost of fertilizer imported ended up more, rather than less, expensive per unit of nutrient than the stocks that were being held by the private sector. In Zambia, the bulk of the subsidized fertilizer went to wealthier rather than poorer farmers (Jayne *et al.* 2006). The Malawi Starter Pack programme (consisting of a "best-bet" package of fertilizer and maize/legume seed adequate to cultivate 0.1 hectare of land) had relatively good reviews in the first couple of years (Levy *et al.* 2000), but then a series of programme changes and unreliable funding led to policy uncertainty that has seriously hampered commercial fertilizer supply operations and reduced the benefits for poor farmers (Blackie *et al.* 2006).

Although evidence to date suggests that the reintroduction of pre-reform policy instruments has been no more successful than the reforms themselves in building sustainable levels of productivity-increasing fertilizer consumption, there is renewed interest in using fertilizer subsidies, despite the problems outlined above.

Fertilizer subsidy renaissance

Sanchez *et al.* (1997) argue that growing evidence of social, political, and economic externalities since the elimination of fertilizer subsidies in Africa can justify their reintroduction. The argument is that soil fertility depletion lowers the returns to agricultural investment and, through linkage effects, lowers non-farm incomes and employment. This increases the problems of rural poverty and negative environmental externalities (Crawford *et al.* 2006).

The controversy over fertilizer subsidies was given added impetus in 2005 following the publication of the UN Millennium Hunger Task Force Report, which advocates the use of *carefully managed* fertilizer subsidies targeted at highly food insecure farmers (UN Millennium Project 2005, italics added). In reality, the Millennium Village approach being tested in Kenya, Malawi, and elsewhere began with a programme of free fertilizer distribution for all farmers in the programme area, regardless of poverty or food security status. Influenced by the UN Millennium Report recommendations and Millennium Village test cases, many governments in Africa are now discussing the possibility of re-introducing fertilizer subsidies as a way of increasing fertilizer use, boosting crop productivity, and

improving food security. These discussions have raised important questions about the best use of public funds to promote growth and reduce poverty, hunger, and vulnerability.

Thus far, neither policy reforms nor the reintroduction of subsidies and government distribution programmes have resulted in the levels of input use, agricultural productivity, and income growth that both donors and African governments are seeking. The search for appropriate interventions continues, with an emerging consensus on some of the longer-term institutional reforms and public investments needed to support input/output market growth, continuing debate about how fully reforms were implemented, and growing disagreement about the contribution that fertilizer subsidy programmes might make to poverty reduction strategies in the short to medium term.

4 Policy areas of consensus

In general, there is much more consensus on recommendations for establishing desirable enabling conditions to promote a more efficient fertilizer sector than on the nature of specific interventions to scale up fertilizer demand and supply rapidly. This section reviews the policy areas where there seems to be general consensus, before moving on, in Section 5, to the areas of continuing debate.

The literature shows reasonable agreement regarding strategic measures to establish appropriate enabling conditions to stimulate both demand and supply. Fortunately, many of these measures contribute to both the demand and the supply side of the picture, thereby yielding multiple benefits. The following paragraphs describe the nature of the consensus view for improving the enabling environment. Six key policy areas are covered:

- Building institutions to promote competition while improving supply chain efficiency
- Investing in transportation and market infrastructure
- Investing in research and extension
- Managing price and production risk
- Facilitating rural finance
- Strengthening legal and regulatory institutions

Improvements in each of these areas will contribute to improved profitability of fertilizer use - the underlying driving force for expanding fertilizer adoption - by reducing input costs, raising or stabilizing producer prices, or improving fertilizer use efficiency.

4.1 Promoting competition and supply chain efficiency

In industries such as fertilizer, which are characterized by significant economies of size or scale, government regulation is often required to ensure the emergence of supply chains that are not only strong and vibrant, but also competitive. Fertilizer importation in most African countries is characterized by limited competition because aggregate national demand tends to be low (in 2000, only six SSA countries imported over 50,000 tons of fertilizer). Although this type of limited competition can lead to a concentration of market power and excess profits, an alternative characterized by multiple, small importers is not cost-efficient due to the importers' weak bargaining power and high costs per unit of ocean shipment.

These same trade-offs between competition and economies of size and scale are observed as fertilizer moves down the marketing chain, but a wider range of potential savings from improved supply chain management also come into play. Most African distribution systems are characterized by relatively long and costly supply chains with multiple actors involved and fertilizer stocks changing hands numerous times before

reaching the end user. In many cases it is thought that the benefits of the increased number of actors do not outweigh the additional costs of multiple transactions. When a supply chain is functioning well, costs that firms would normally consider external are internalized and the product changes hands fewer times. The benefits that can be realized include product sourcing at lower cost; more efficient inventory management; better preservation of product integrity; improved trade financing; savings on transport, handling, storage and bagging operations; physical loss prevention; and increased investment in market development activities. The drawback is that if a few highly concentrated supply chains dominate the market, it can contribute to reduced competition, which may limit how much of the cost savings are passed on to consumers.

The combination of the lack of import competition and the efficiency benefits from greater supply chain coordination of wholesale and retail marketing argues for a strong government role in monitoring for collusive practices, such as the fixing of prices and the segmentation of markets. Market excesses may result from weak and ineffective institutions (Gisselquist and van der Meer 2001). Rules to ensure competitive practices must be developed, implemented, and enforced through the application of stiff penalties. Anti-competitive conduct needs to be clearly defined, so that there is no ambiguity about what is legal and what is not (Morris *et al.* 2007).

An alternative to regulation is direct government intervention in fertilizer markets through price controls or state-owned distribution systems but, as already noted, this approach has met with little success. Some governments continue to seek a direct market role as a means of "keeping the private sector honest" (e.g., Ethiopia, Kenya, Zambia, Malawi). In general, these bodies are not operating efficiently and their unpredictable market behavior tends to increase uncertainty and costs for the private sector. Increased government attention to regulatory issues might be a more cost-effective approach. A complementary option would be to invest in building strong producer organizations; in some cases they can become part of the supply chain, negotiating with suppliers for better prices and providing individual farmers with the opportunity to capture some economies of size through joint procurement.

4.2 Investing in transportation and market infrastructure

Investments in transportation and market infrastructure have the potential to reduce input costs and to increase producer prices, thereby improving fertilizer profitability. Because fertilizer marketing costs within SSA are extremely high, this discussion focuses on issues related to reducing these costs. The high costs are due primarily to long delivery distances and poor transport, handling and storage infrastructure, as well as a variety of other factors.

Distance itself is a major cause of high marketing costs for countries such as Zambia, where some farms are 2000 km from the nearest port. However, in many cases, the problem of distance is compounded by less than optimal management of imports. In a number of countries, war and internal strife have damaged railways and trunk roads and, for some landlocked countries, have resulted in the closure of the most direct route from a seaport (e.g., the case of Mali following disturbances in Côte d'Ivoire).

There are a number of other problems that inflate costs. The first is poor security that leads to high losses from the theft of fertilizer in transit and storage. In Southern Africa, it

is not unknown for whole trains to be hijacked and their entire load of fertilizer to be stolen. Second, poor-quality warehouses and long storage periods in humid climates lead to substantial losses from fertilizer caking. Third, limited port capacity adds further to costs since large shipments face delays and high demurrage charges. The use of the nearest port may also lead to high inward shipping charges if it is normally not possible to arrange a return load for vessels that deliver fertilizer. Fourth, national regulations that require distribution by domestic transporters sometimes necessitate an additional round of off-loading and loading, which adds to costs and increases security problems. Fifth, importation of low analysis fertilizers increases the transport cost per kilogram of fertilizing nutrient and results in farmers often unwittingly paying more for less.

Landlocked countries may also face levies imposed by countries through which the fertilizer travels. For example, in 1999 Mozambique imposed various charges on transiting fertilizer that amounted to US$13 per ton. For Malawi, this added 14 percent to the f.o.b. (ex-NW Europe) cost of urea and accounted for 3.4 percent of the final retail price to farmers. Priority use of national rolling stock for domestic purposes may also hamper the movement of fertilizer in international transit and add further to the total marketing costs and delays faced by farmers in landlocked countries.

The end result of these deficiencies is that often more than half the price that SSA farmers pay for fertilizer comprises costs incurred between the port and the point of retail sale. Table 4.1 presents the cost build-ups for fertilizer delivered to the U.S. mid-west compared to delivered costs to Nigeria, Malawi, Zambia and Angola for 2003. The table shows that the ratio of the retail price to the c.i.f. price ranges from 1.42 in the U.S. to 2.56 for Angola (Gregory and Bumb 2006). As already noted, c.i.f. prices can also be inflated in SSA due to small shipment sizes.

The reductions that could be made to the cost of transporting, handling and storing fertilizer through *fertilizer-specific* measures, such as investment in dedicated port handling facilities, storage and railway rolling stock, vary by situation. Published estimates suggest that cost reductions of 10-20 percent from transportation improvements of this type are possible in several cases (Jayne *et al.* 2003; IFDC 2005; Wanzala 2003). Additional cost savings could also be realized by improvements in governance and general operational efficiency that stem from broad economic development and better controls on corruption.

4.3 Research and extension

Most analysts agree that investments in fertilizer research are still needed, and there is growing consensus that the research should focus on increasing fertilizer use efficiency (in particular, on more responsive varieties, and on complementary soil and water management practices) than in the past.

Research that generates information to improve fertilizer use efficiency needs to be transferred to farmers and applied by them. This transfer is complicated by the variety of fertilizer management strategies, especially those that take into account the great diversity of production situations and the need to use fertilizer in combination with a variety of complementary practices.

Table 4.1 Comparison of Fertilizer Procurement and Distribution and Marketing Costs, 2003 (US$/ton)

Country	USA			Nigeria			Malawi			Zambia			Angola[a]		
Cost Items and Margins		Cumm.	Margin		Cumm.	Margin		Cumm.	Margin		Cumm.	Margin		Cumm.	Margin
f.o.b. cost	135.00		%	135.00		%	145.00		%	145.00		%	226.00		%
Ocean freight	25.00	160.00		30.00	165.00		25.00	170.00		25.00	170.00		95.00	321.00	
Insurance	0.08	160.08		0.10	165.10		0.10	170.10		0.10	170.10		2.00	323.00	
c.i.f. cost and % of Retail Price		**160.08**	**70.64%**		**165.10**	**49.12%**		**170.10**	**52.94%**		**170.10**	**51.03%**		**323.00**	**39.00%**
LC cost	0.80	160.88		1.65	166.75		1.70	171.80		1.70	171.80		3.23	326.23	
Port costs and transfer inland	4.00	164.88		21.70	188.45		7.82	179.62		17.50	189.30		98.00	424.23	
Duties	0.00	164.88		12.04	200.49		1.63	181.25		1.63	190.93		48.00	472.23	
Losses	1.65	166.53		3.77	204.26		1.80	183.05		1.89	192.83		0.00	472.23	
Bags and Bagging	0.00	166.53		15.69	219.95		0.00	183.05		0.00	192.83		0.00	472.23	
Free on Barge/Truck		**166.53**	**2.85%**		**219.95**	**16.32%**		**183.05**	**4.03%**		**192.83**	**6.82%**		**472.23**	**18.02%**
Barge/truck transport	10.00	176.53	4.41%	50.00	269.95	14.87%	60.00	243.05	18.67%	72.00	264.83	21.60%	5.00	477.23	0.60%
Barge/truck unloading	4.00	180.53		0.50	270.45		0.50	243.55		0.50	265.33		0.50	477.73	
Storage and truck loading	10.00	190.53		1.00	271.45		7.29	250.84		1.50	266.83		3.00	480.73	
Interest	2.22	192.75		16.97	288.41		12.54	263.38		13.00	279.83		30.05	510.78	
Wholesale cost		192.75			288.41			263.38			279.83			510.78	
Importer margin	3.86	196.61	2.00%	31.73	320.14	11.00%	39.51	302.89	15.00%	28.84	308.67	10.31%	97.50	608.28	19.09%
Wholesale price		**196.61**	**86.76%**		**320.14**	**95.24%**		**302.89**	**94.26%**		**308.67**	**92.59%**		**608.28**	**73.44%**
Dealer costs and margin	30.00	226.61	15.26%	16.01	336.15	5.00%	18.44	321.33	6.09%	24.69	333.36	8.00%	220.00	828.28	36.17%
Farmer price	**226.61**			**336.15**			**321.33**			**333.36**			**828.28**		
Ratio of wholesale price to c.i.f.		**1.20**			**1.75**			**1.55**			**1.65**			**1.58**	
Ratio of retail price to c.i.f.		**1.42**			**2.04**			**1.89**			**1.96**			**2.56**	

a. These data are for NPK 12-24-12 and therefore are not comparable with data for urea for other countries in the table.

Notes: 1. USA Data estimated from industry sources by IFDC. Bulk Urea imported, transferred to barge and delivered Mid West location.

2. Nigeria data from IFDC DAIMINA Project Reports. Bulk urea imported to Lagos, bagged at port and delivered to retail outlets in Federal Capital Territory (Abuja).

3. Malawi data estimated from IFDC AIMS Project Reports, Bagged urea imported through Beira Port, Mozambique and trucked to Lilongwe, Malawi.

4. Zambia data estimated by IFDC Action Plan Team, 2004.Bagged urea from Mid East port imported through Beira Port, Mozambique and railed to Lusaka.

5. Angola data estimated by IFDC Assessment Team, 2004. Bagged 12-24-12 from Portugal by 20 ft. container to Luanda amd delivered to Huambo by truck.

6. All urea fob prices standardized for comparative purposes with a $10/mt difference in bulk and bagged prices.

7. The c.i.f. Cost used for land-locked countries (Malawi and Zambia) is based at the first port of entry. The actual c.i.f. is approximately equal to the wholesale cost.

Source: Gregory and Bumb 2005, Table 13.

Equipping African farmers with the knowledge and decision making skills needed to manage fertilizer requires a shift from traditional top-down extension approaches that were designed for delivering standardized recommendations to approaches that can strengthen the management capacity of individual farmers and equip them with farm-level decision making skills. Farmers must have sufficient knowledge and skills to assess the nutrient requirements of the crop, match those requirements with available sources of nutrients, calculate the expected profitability of alternative soil fertility improvement strategies, and implement the strategy effectively.

Consequently, extension agents, both public and private, need training in farm management and marketing analysis and in more participatory extension methods than have been used in the past. Four areas of growing consensus concerning the content of fertilizer extension messages include:

- the need to inform farmers about the cost implications of low analysis fertilizers
- the need for regular updating of fertilizer recommendations
- the potential for public-private partnerships through demonstration plots
- the need to promote soil and water conservation practices to increase fertilizer use efficiency.

Low analysis fertilizers. In the absence of effective extension advice, farmers seek to purchase low-analysis fertilizer that has the lowest cost per kilogram rather than the lowest cost per unit of nutrient. Traders, in turn, import and distribute the fertilizer that farmers demand. Since a large proportion of total marketing costs is a function of the weight of the fertilizer supplied, the end result is that the prices of fertilizers used embody unnecessarily high marketing costs per unit of nutrient. Turuka and Kilasaru (2002) note that this is happening in Tanzania, where most fertilizer is now low analysis and the proportion of total fertilizer usage provided by low-analysis fertilizer is reportedly still rising.

Updating recommendations. Fertilizer recommendations must reflect changes in profitability that result from price changes. In most SSA countries, recommendations were not adjusted after the dramatic changes in profitability that followed subsidy removal and devaluation. In a liberalized market environment, extension staff face the same dilemma as farmers: appropriate recommendations really depend on the market prices that farmers will obtain for their crop. Nevertheless, extension staff must be (a) trained to estimate optimal application rates (given fertilizer prices at local points of supply and farmers' objectives) and (b) given the discretion to assist farmers in selecting an appropriate application for their particular circumstance.

Demonstrations. One approach that has proved to be particularly effective in building farmers' confidence in their ability to use fertilizer properly involves the use of demonstration plots. Demonstrations have been scaled up and used effectively in Malawi and Kenya, largely in conjunction with NGO programmes (Farm Inputs Promotions-Africa and The Citizens Network for Foreign Affairs) to build agro-dealer supply networks (Phiri 2004; Blackie and Albright 2005). The advantage of demonstration plots is that they can be used for multiple purposes, including research (fine-tuning recommendations to local agro-climatic conditions and farmer circumstances), extension (transferring knowledge about fertilizer management practices to farmers), and product promotion (generating demand for fertilizer among potential purchasers). Different types of

organizations have an interest in supporting demonstration plots, including research organizations, extension services, and private input distributors. The confluence of interests creates opportunities to launch public-private partnerships to promote fertilizer use. For example, private fertilizer distributors can finance demonstration plots using technical advice provided by public researchers and conveyed to farmers with the assistance of local public extension agents.

Farmer field schools are also proving to be an effective forum for farmer experimentation and direct learning within the local community (Friss-Hansen *et al.* 2004).

Soil and water conservation. Soil and water conservation (SWC) practices include the use of anti-erosion structures such as contour ridges or rock lines, vegetative bands, and living hedges that serve to slow down soil degradation and conserve soil moisture. Often they are used in conjunction with practices to improve soil fertility (planting holes or "zai", composting, and fertilizer). SWC practices significantly improve fertilizer use efficiency and contribute to productivity and income growth for farmers in rainfed production systems, as illustrated by the yield results from adoption of contour ridges in Mali (Table 4.2) and a study of adoption impacts in the Central Plateau of Burkina Faso (Reij and Thiambiano, 2003). To date, adoption of SWC technologies in most African countries has not gone very far beyond a small group of relatively well-off farmers, who have demonstrated the yield-increasing and risk-reducing potential (Kelly 2003). There is general agreement that wider adoption of such practices would contribute to increased uptake and efficiency of fertilizer use (IFDC 2002a; Barrett *et al.* 2002; Kelly *et al.* 2005). To expand adoption, public investments could be used to support the extension specialists required to train farmers, the equipment and technicians needed to mark contours, and the vehicles needed to transport materials such as rocks, soil, and plants. In the past, the latter element has tended to be supplied as a farmer or community contribution, but there is growing concern that such an approach is limiting the spread of adoption.

Table 4.2 Farmers' yields before and after adoption of Soil and Water Conservation (SWC) practices in Mali

	Before Ridge Tillage	After Ridge Tillage		
Crops	(1999)	(2000)	(2001)	(2002)
	(yields in kilograms per hectare)			
Sorghum	647	969	1,027	1,018
Millet	678	936	1,044	1,004
Maize	1,025	1,422	1,467	1,900
Cotton	810	1,171	1,191	998
Rainfall (mm in Segou)	955	624	673	505
Rainfall (mm in Sikasso)	1,123	973	1,022	779

Source: Berthé 2004, using results for 41 farmers in the Segou, Sikasso, and Koulikoro Regions.

4.4 Managing price and production risk

In many parts of Africa, the profitability of fertilizer use is strongly influenced by production and price risk. Both forms of risk are associated with sharp year-to-year production variability caused by unpredictable climatic factors, pests, and plant diseases. While there is evidence that price variability has increased in SSA since markets were liberalized (e.g., Barrett 1995 and 1996; Dembélé and Staatz 2002) there is less consensus on the causes, among which figure liberalization itself, greater climatic variability, or governments' tendency to continue to intervene in an unpredictable manner (the latter point being stressed by Jayne *et al.* 2002; Sanders and Ahmed 1998). Solutions most frequently mentioned in the literature include the use of risk-mitigating production practices (Brannan *et al.* 2005; Tappan and McGahuey 2004; IFDC 2002a), the provision of market information (Shepherd 1997; Weber *et al.* 2005; Dembélé *et al.* 2003), and farmer training in how to use market information and assess risks (Kelly 2006).

There is a key role for extension services in the training of farmers in SWC and other practices that reduce the risk of fertilizer use. For example, a 'response farming' technique that uses early rainfall events to decide on the amounts of fertilizer to apply in a given season is showing promise in Zimbabwe (Snapp *et al.* 2003; Piha 1993). The key to the system is flexibility in fertilizer application, with low initial doses applied when early rainfall is inadequate and higher doses applied when early rainfall is promising. Over a five-year period, response farming gave 25-42 percent more yield and 21-41 percent more profit than did existing fertilizer recommendations. In favourable rainfall years, participating farmers' profits were 105 percent higher than those of a control group of comparably good farmers in the area. There is also a need for farmer training in methods of assessing risk when making decisions. In most SSA countries, the delivery of these types of extension messages will require a major re-orientation of extension systems towards greater emphasis on the farm household as an economic unit, and recognition of the fact that, following the abolition of pre-announced crop buying prices by a marketing board, farm households must make critical choices in an environment that involves increased price uncertainty.

Private firms have few incentives to provide market information services, because if they invest in collecting, compiling, and distributing market information, they cannot easily prevent buyers of their services from re-selling the information to others. Therefore a strong case can be made for public investment in the collection and distribution of market information. In the long-run, public funding for market information services can be supplemented by private funding based on the sale of specialized analyses or services, as is now happening in Kenya and Mali (see Box 4.1 and Mukhebi 2004; Sansoni 2002; World Bank 2004). Many market information services in Africa are heavily dependent on donor funding and tend to focus mainly on farm output prices, neglecting input prices and quantities of both inputs and outputs available in the markets. Improvements in the collection and dissemination of market information, coupled with training of farmers in how to use the information, could reduce some of the price risk associated with fertilizer use.

Box 4.1 "Silicon Mali"

Mali's success in establishing a market information service earned it the title of "Silicon Mali" by Forbes Magazine in 2002. Mali's market information service (Observatoire des Marchés Agricoles) is based on enumerators visiting 58 markets around Mali and recording the high and low prices and product flows for grains, crops, and livestock. They enter these on laptop computers and e-mail the information by FM radio waves on solar-powered equipment to other regional offices where data are compiled and reports prepared for different types of producers and traders.

The system, built up over a decade, has made Malian grain farmers more efficient, knowing when and where to sell, and for what price. With better information, the government can now rely on the private sector to shift surpluses to areas with shortages without resorting to foreign aid. Mali's information system has become a model for the rest of West Africa, where such countries as Niger and Burkina Faso are setting up similar systems that will be linked together. Soon, farmers will be able to do more selling across national boundaries.

Another recent innovation is reduced reliance on donor funding. The operating costs of the system are now covered entirely by Malian Government funding and small amounts of income from sales of services for specialized data products and analyses; some capital costs continue to be covered by donors.

Source: Sansoni 2002 cited in World Bank. 2004.

The development of commercial risk mitigating instruments is in its infancy in Africa and not broadly supported as a feasible option in the short-run. Area-based rainfall insurance is a new instrument for reducing the risk of weather-induced production variability that is being tested in Ethiopia and Malawi. Reliance on non-discretionary and objectively verifiable indicators such as a rainfall index can substantially reduce opportunities for farmers to misrepresent crop losses and gain unjustified compensation; however, many regions lack reliable rainfall and yield data and even if data were available there must be strong correlations between typical on-farm yields and rainfall levels for this type of insurance to work (see Ibarra 2005 for a discussion of Malawi).

4.5 Facilitation of rural finance

There is broad agreement that rural finance is a major constraint on agricultural development in the post-liberalization period. The collapse of seasonal input credit systems has been witnessed in many SSA countries - for example, for coffee and cotton in Tanzania, peanuts in Senegal, and maize in a set of countries where it is the main staple, such as Kenya, Malawi and Zambia. The main problem for both export and staple crops is that the introduction of multiple buyers following market liberalization has broken the input-output market linkages that ensured credit repayment in the single–channel, government-owned enterprises of the past.

The key constraint in the development of credit markets is information asymmetry; there are no institutions to help lenders assess the creditworthiness of borrowers. This problem is exacerbated by small-scale farmers' lack of acceptable collateral, the culture of strategic default fostered by the prior state systems, and the near impossibility of lenders obtaining legal redress in the event of default. Additional factors include the relatively large

cash requirements for inputs compared to net farm incomes, high output price risks, and the high administrative costs of developing credit services for smallholder farmers.

Although there are no "magic bullets" for resolving input credit problems, the sense of the literature reviewed is that the way forward will include a combination of the following:

- an expansion of contract farming opportunities that link input and output markets
- support for the creation and capacity building of producer associations capable of obtaining and managing input credit
- capacity building and incentives to draw commercial banks into the agricultural sector.

Contract farming. Since liberalization, product processors and exporters, rather than input traders, have supplied fertilizers to many farmers who formerly relied on government systems. The contract farming systems that they have created provide loans in the form of fertilizer and other inputs, the cost of which is subsequently recovered from the payouts made when farmers deliver their products. Contract farming has the advantage of creating input-output linkages and encouraging an efficient use of fertilizer. It is in the interest of the contracting enterprise to ensure that the farmer is supplied with the optimal quantity of the most appropriate type of fertilizer at the right time. It is also in the interest of the contracting enterprise to train farmers to apply and otherwise use the fertilizer efficiently. The end result is that in contract farming, unlike other forms of small-scale farming in SSA, fertilizer is used widely and efficiently. Flowers and green beans in Kenya are among the most successful experiences with contract farming to date. Nevertheless, although promising, contract farming is not a foolproof solution, as illustrated by experience with chilli and paprika production in Zambia where side-selling of the product became a problem and loan repayments fell to untenable levels (Kelly *et al.* 2003).

The fact that effective replacement credit systems have focused on cash crops (Dorward *et al.* 1998), means that a reduction in access to credit has hit producers of maize and other food crops the hardest. The success of commercial interlocking credit supply and marketing systems for cash crops raises the issue of whether governments could create a suitable environment for their successful operation for crops whose production and processing characteristics do not, of themselves, create a natural captive market (Kydd 2002). To date, the consensus is that the establishment of effective new systems for seasonal credit in such situations is likely to be a difficult process.

Producer associations. Programmes to create and train producer associations are as popular as the results are variable. Lenders (whether they be output marketers, input suppliers, or commercial banks) cannot deal individually with the large number of small-scale farmers who need credit. The solution is for farmers to organize themselves to reduce the transactions costs, but unless the associations are (a) formed from the bottom up by freely associating individuals, (b) have clearly stated and realistic goals, and (c) are able to access high-quality business management training or services, the likelihood of establishing a successful input credit programme is small. There is a growing literature on what it takes for producer associations to succeed (Bingen *et al.* 2003; Coulter *et al.* 1999). Two important messages emerge from reviews on past experience: firstly, good training can be expensive, but is often worth the extra investment and, secondly, producer associations are often most

effective when they hire professionals to manage key functions (e.g., output marketing, input procurement, group storage of production) rather than try to do everything themselves. The second point suggests a need to be developing capacity in the private sector for the provision of such services to producer associations, as is currently being done by Mali's agricultural college, with a two year post-high school diploma programme in various types of technical and management support areas for the agricultural sector (Koné 2005).

Incentives for commercial banks. Much of the lending in Africa's agricultural sector is done through agricultural banks which tend to be government-run enterprises, as private commercial banks have been timid about agricultural loans. There is general agreement that staff of African commercial banks has inadequate knowledge about the agricultural sector and a poor understanding of the types of risk analysis commonly used for agricultural investments. Support to training programmes for bank agents could increase interest in agricultural credit, as could the development of various types of incentives to reduce bankers' risk as they move into the agricultural sector. Incentives being tested include various types of credit guarantees and donor funding to help banks develop loan products that respond to the needs of different actors (particularly input suppliers and processors). Examples include Rockefeller Foundation support to the Citizens Network for Foreign Affairs, which is providing credit guarantees for input stockists in Malawi and Kenya; a USAID-funded project dating back to the 1980s which provided guarantees to encourage banks to deal directly with farmer associations for input credit in one of Mali's cotton zones; and a programme by the Kenya Rural Enterprise Programme (K-REP) which is developing innovative credit products to stimulate rural income diversification (Rosengard *et al.* 2000).

4.6 Strengthening legal and regulatory institutions

A discussion of legal and regulatory institutions is a good follow-on topic to the issue of rural finance because. without improvements in the legal system, particularly with respect to enforcement of business contracts, there is little recourse for lending institutions to recover unpaid loans and little recourse for farmers who are supplied sub-quality inputs to be compensated. The key areas of consensus on this topic include:

- recognition that laws concerning business relations and contracts need to be clarified, simplified, and enforced through a legal and judiciary system that can make decisions quickly and is not subject to corruption; and
- improved capacity (either government or private sector) to verify the authenticity of fertilizer products (e.g., enforcement of labeling requirements and frequent verifications of the truthfulness of the labels) plus the application of consequent penalties in cases of infringement (Gisslequist and van der Meer 2001).

Capacity to verify truth in labeling is particularly important in fertilizer markets serving small farmers. As previously noted, stockists frequently re-bag fertilizer into smaller packages to satisfy consumer demand. Re-bagging increases the possibility for both intentional and unintentional adulteration at the retail level, yet most verification of fertilizer quality tends to be done much higher up the supply chain (typically at the point of importation).

5 Areas of continuing policy debate

Important fertilizer sector policies and strategies that continue to be debated in the fertilizer literature include:

- How to sequence reforms
- The role of state enterprises in a liberalized market
- The role of standardization versus localization in fertilizer recommendations
- Importation versus domestic production
- The merits of moving from national to regional fertilizer markets
- The role of fertilizer price subsidies

In most cases, these topics differ from the ones discussed in the previous section because they deal with programme or project design and implementation issues rather than actions that establish broad enabling conditions to facilitate economic growth and the development of private sector input distribution systems. One of the reasons for the continuing debates is that those discussing individual policies may hold different views of the underlying policy objective (e.g., market development versus poverty alleviation) or be focusing on different target populations or production systems, and this requires the use of different strategies and criteria for evaluating the outcomes. The various perspectives found in the literature for each of these six topics are discussed below.

5.1 Sequencing of reforms

A macro policy reform that has sharply affected fertilizer demand was currency liberalization, which in most countries resulted in devaluation. Devaluations are implemented to resolve a broad range of economic problems and the potential impact on the fertilizer sector is rarely a factor in the decision-making process. This means, however, that there are numerous examples of devaluations that have taken place at approximately the same time as fertilizer markets were being liberalized, subsidies dropped, and credit programmes cut back. The result was a magnified price shock and liquidity problem at the farm level. The combined impact on effective demand was usually sufficiently negative that the private sector was either unwilling to invest in fertilizer supply or unable to earn a level of profit that would sustain investment over time.

Ghana and Malawi are countries where the combined effects of liberalization and devaluation have been cited as causes of depressed demand for fertilizer and the lack of robust fertilizer supply networks (Bumb *et al.* 1994; Bumb and Baanante 1996; IFDC *et al.* 2000; IFDC 2002b). Most of the West African cotton producing countries in the CFA franc zone, however, have been able to sustain input use following devaluation because the input credit and distribution systems were still intact and the world market price for cotton was rising at the time of the devaluation.

Liberalizing output markets before input markets has been seen as the most appropriate sequence of agricultural market reform because the demand for inputs is a derived demand that depends on the marginal value product of input use. If the price of the outputs does not reflect opportunity costs, then the demand for inputs will also not reflect their opportunity cost.

In reality, it has been difficult to implement this sequencing. For a large number of smallholders, the acquisition of inputs has, in practice, been dependent on state-operated, interlocked, single-channel input and output markets for core food and cash crops. Liberalizing output markets generally calls for immediate changes in the existing system for marketing fertilizer and other inputs, because it introduces competition among new entrants in the output market. This competition makes it possible for a farmer to get input credit through one firm and evade repayment by marketing with another firm. As a result, traders who offer input credit in liberalized markets often face high rates of default. They soon stop offering credit, fertilizer demand falls off, and crop productivity declines. This has been well documented for cotton systems in Uganda (Gordon 2000; Gordon and Goodland 2000) and Ghana (Poulton *et al.* 1998), and for the coffee system in Tanzania (Winter-Nelson and Temu 2002), suggesting a need to simultaneously address the issue of input markets and credit when liberalizing major output markets.

There is a growing body of analysis on the liberalization of cotton sectors in Tanzania, Zambia, Zimbabwe, Uganda, Ghana, and Mozambique and the implications that this has had for farmers' access to inputs and credit (Poulton *et al.* 2004; Tschirley *et al.* forthcoming). These analyses suggest that the pre- and post-reform structure of the sector tends to be more important in shaping post-reform performance with respect to inputs than the sequencing of reforms. For example, sectors retaining higher levels of concentration following reforms (e.g., Zimbabwe and Zambia) tend to perform better with input supply and credit systems than those where the sector becomes fragmented.

There appears to be no single best approach to the issue of sequencing that can be applied to all SSA countries and all agricultural sub-sectors. Each national government needs to make its own decision on the best approach, based on country-specific analysis. Policy analysts working in the agriculture sector in general and the fertilizer sector in particular need to be sure their voices are heard in discussions about macro-economic and sectoral reforms and that those "voices" are founded on solid analyses of the potential impacts of different policy scenarios.

5.2 The role of state enterprises in a liberalized market

Liberalization typically has not eliminated state trading; this is particularly true of countries such as Kenya, Malawi, Zambia, and Ethiopia where state enterprises continue to intervene in both fertilizer supply and politically sensitive cereal markets. Governments argue that they would be irresponsible if they withdrew entirely from the marketing sector before the private sector showed that it was capable of performing critical marketing functions.

This approach of allowing state enterprises to compete with emerging private sector firms has not been criticized strongly on theoretical grounds. Experience shows, however, that it is difficult to separate the commercial from the political when maintaining state enterprises. Critics of state enterprises functioning in a liberalized market argue that (a) market interventions often respond more to election pressures than market demand and supply, (b) the capacity of state-enterprises to follow through on announced plans (e.g., fertilizer imports) is weak and increases market uncertainty, and (c) state enterprises benefit from a range of subsidies (e.g., inherited warehousing space and vehicles) that create an unfair playing field (Jayne *et al.* 2003; Jayne *et al.* 2002).

The alternative is a carefully prepared liberalization process in which state enterprises cease acting as traders at the time that the market is liberalized. The aim should be to ensure that warehouses and other facilities of these enterprises are used productively by private traders. This can be achieved either through the sale of these facilities to private enterprises or through the state trading enterprise being temporarily transformed into a service enterprise which rents its facilities to the private sector but does not trade on its own account. If well planned and executed, such a programme could prevent the problems that stem from the commercial sector needing to compete with an established state enterprise, while ensuring that state-owned facilities are not duplicated unnecessarily through private sector investment.

5.3 Fertilizer recommendations: Standardization, localization, or "best-bet"?

Most farmers in SSA do not follow official fertilizer recommendations. They use much lower doses, which are often a result of financial constraints rather than of estimates of potential profitability. In the post-reform period, farmers - and the research and extension services that provide them with support - need to increase the attention given to identifying the most profitable approaches to fertilizer use. Three approaches to developing fertilizer recommendations are standardization, localization, and "best-bet".

Standardization. Simple region-level technology packages have a number of advantages. They are easily demonstrated to farmers through large-scale demonstration plots, they simplify the training of extension staff, and they allow local traders to stock a small number of bulk-blended fertilizer types in predetermined proportions (e.g., an appropriate complex NPK fertilizer) or in high analysis fertilizers such as DAP (*Diammonium Phosphate*) and urea that are less expensive per kilogram of nutrient than ammonium sulphate and can be used in recommended ratios by farmers. Fewer fertilizer types may result in lower procurement costs.

The SG 2000 maize promotion programme in Ethiopia, which relied on farmer-run demonstration plots supported by simple, uniform, regional-level technology that made no attempt to fine tune usage to specific sites, is an illustration of a standardized approach (IFDC 2000). The programme is credited with rapidly increasing the uptake of improved maize varieties and fertilizer. Despite the standardized approach, Howard *et al.* (1999) noted that "graduates" of the SG 2000 programme adjusted fertilizer doses after

experimenting for several years and managed to get higher average returns than participants in the programme who were still using recommended doses. This suggests that once farmers are familiar with a technology package, they are able to adapt it to their circumstances without heavy reliance on extension services. Forster and Mwebesa (2002) report the success of a similar SG 2000 programme in Uganda, in which standard technology packages were used on demonstration plots; but they note that researchers were working to improve the specificity of recommendations. In contrast, Howard *et al.* (1998 and 2003) reported highly variable results for the standardized SG 2000 trials in Mozambique, suggesting that the approach may work well in some situations but not in others. There is also a pattern of fertilizer use falling off rapidly (e.g., Ghana) when SG 2000 programmes begin to withdraw their support services, which often include some indirect subsidies. This suggests problems with the sustainability of the approach.

Localization. There is growing support in the literature for programmes that employ localized fertilizer recommendations based on soil testing and results from local demonstration plots. In East Africa, Kenya has reportedly gone furthest in this regard, through comprehensive studies under a Fertilizer Use Recommendation Project that commenced in 1986. This aimed to develop fertilizer recommendations for major cropping systems specific to soils and agro-ecological zones. These were then employed from 1994 by extension staff, but have recently been criticized for a lack of updating in response to changes in fertilizer/crop price ratios.

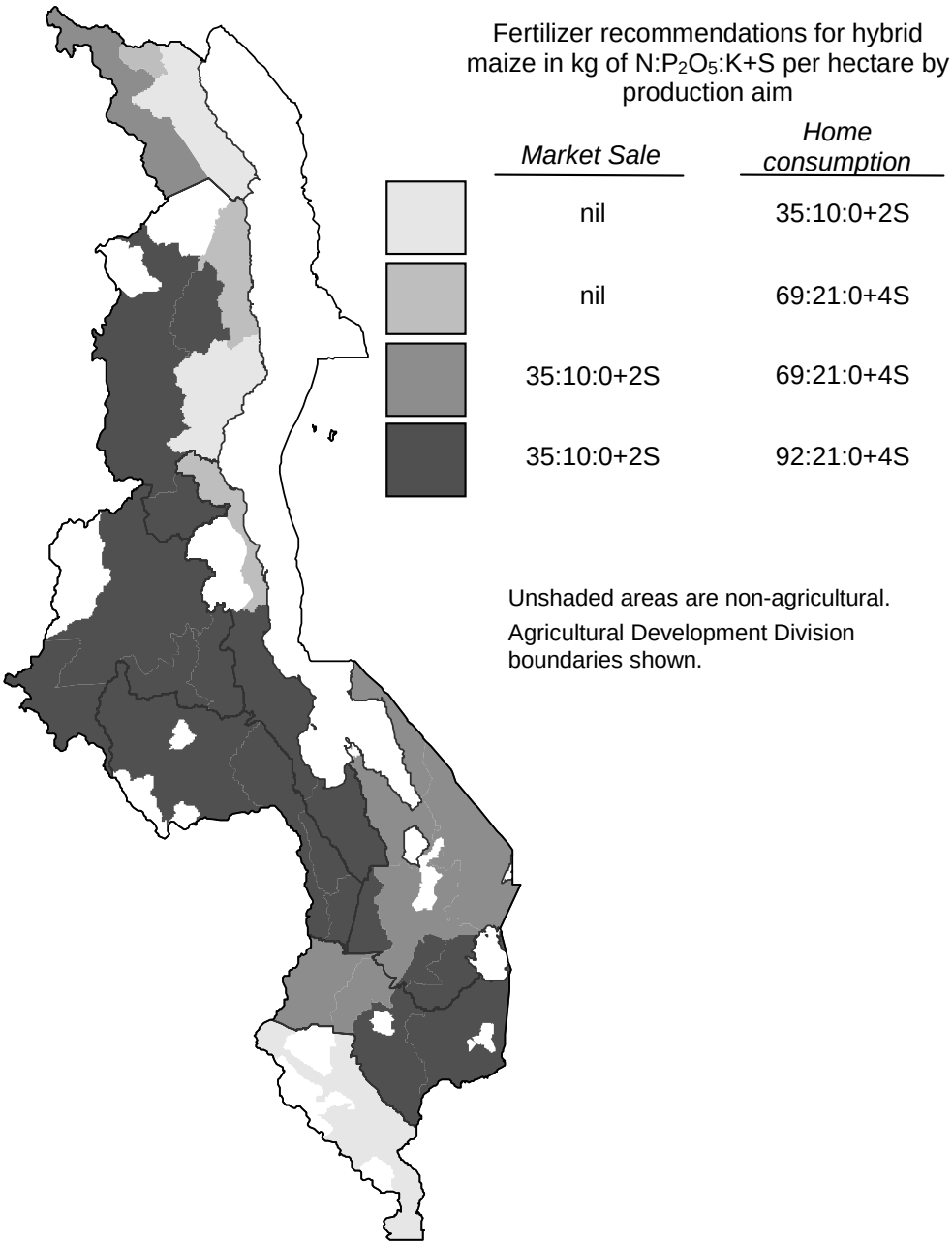
The Maize Productivity Task Force in Malawi took a step in the same direction when it developed area-specific maize recommendations that also took into account different ways of valuing the output based on whether farmers were producing for home consumption or for the market (Benson 1999). Because consumer prices of maize are higher than producer prices, the recommended fertilizer doses for home consumption are higher than those for marketed output (see Figure 5.1). In reality, the idea of offering farmers recommendations for ideal fertilizer applications for each of their crops does not appear to be a very cost-effective approach, yet country-level proposals have been put forth for site-specific testing of farmers' fields and to set up soil testing facilities for farmers and dealers (IFDC *et al.* 2000).[17] Farm Input Promotions Africa, Limited (FIPS-Africa) in Kenya has been promoting an alternative that involves training farmers to use proxy indicators of soil nutrient deficiencies (e.g., colour patterns on maize leaves or deformed cobs) and to choose fertilizers that supply the missing nutrients.

"Best-bets". "Best-bet" packages are based not on yield or profit-maximizing criteria but primarily on the assessment criteria used by farmers participating in research and demonstration trials (Kelly 2006; Mann 1998). In addition to land differences, farmers are not homogeneous in their access to complementary production resources (other purchased inputs, labour, equipment) and their crop production objectives (e.g., maximizing cash income versus food production). "Best-bet" recommendations take all these factors into account. Box 5.1 illustrates the different rankings obtained by using agronomic, economic, and farmer choice criteria. Although best-bet recommendations are often developed and used within fairly homogeneous agro-ecological zones, the approach can also be used to

[17] The Malawi Action Plan provides for this to be undertaken through a donor-funded extension project. It would clearly be a massive undertaking but it is not included explicitly in the costing of the resource requirements for implementing the Plan.

develop standardized packages for national programmes, as was done in the case of the initial starter pack programme in Malawi (Snapp *et al.* 2003; Blackie *et al.* 2006).

Figure 5.1 Profitability-based fertilizer recommendations for Malawi maize



Source: Benson 1999

Given the major cost of developing and updating detailed site-specific recommendations and given the greater ease and therefore lower cost of supplying standardized packages, there would seem a case for erring on the side of standardization, at least early in the process of developing commercialized input supply structures. However,

this is an issue that needs to be resolved within each country, taking account of the extent of local soil variation and differences among individual farmers. In the long-run, farmers need to acquire the skills necessary to evaluate their own situation and make informed judgments about the most appropriate doses and combinations of inputs; this implies significant improvements in basic education as well as in extension.

Box 5.1 Ranking methods used to refine the selection of "best bet" technologies, Malawi

Comparison of three technology ranking methods for Mother trials: 1997/98-1999/200

Option	Agronomic	Economic	Farmer
Unfertilized maize	5	6	5
Maize + standard fertilizer dose	2	4	7
Maize + pigeon pea	3	2	2
Maize+pigeon pea+standard fertilizer dose	1	3	6
Groundnut+pigeon pea	6	5	3
Maize+tephrosia	4	7	4
Mucuna-maize rotation	7	1	1

"Mother" trials are conducted by researchers and completely randomized with four replications. The fertilizer doses were area-specific recommendations based on research reported in Benson (1999). Agronomic rankings are based on yield, economic rankings on marginal rates of return, and farmer rankings on their expressed preferences. Rankings shown are based on a value of 1 indicating the first choice.

Comparison of three technologies ranking methods for Baby trials: 1997/98-1999/2000

Option	Agronomic	Economic	Farmer
Unfertilized maize	3	4	4
Maize + pigeon pea	2	1	1
Groundnut+pigeon pea	4	2	2
Maize+tephrosia	1	3	3

"Baby" trials are either researcher- or farmer- managed; they are not replicated but conducted at multiple sites around a Mother trial on a subset of the trials included in the Mother trial.

Observations: For Mother trials the ranking based on agronomic criteria is different from that based on economic criteria because of different resource requirements, and input and output prices of maize and legumes. The rankings based on economic criteria and farmers' preferences are the same for mucuna-maize rotation and maize-pigeon peas treatments but different for others because the marginal rate of return analysis does not consider resource constraints, access to input and output markets, risk and food security.

For Baby trials, there is a high correspondence between rankings based on economic criteria and farmers' preferences. This shows that Baby trials achieve a better targeting of technologies that best fit farmers' circumstances and which are likely to be selected first for adoption.

Source: Adapted from Twomlow, Ruskie, and Snapp 2001.

5.4 Importation versus domestic production

Currently, over 90 percent of all the fertilizer used in Africa is sourced through imports.[18] Capacity to produce fertilizer within Africa is currently limited and has declined over time. In 2002/03, out of 147.9 million tons of fertilizer produced worldwide, only about 177,000 tons were produced in SSA.

The odds against producing fertilizer cost-effectively in most countries of SSA are high. There are few places in Africa that have (a) ready access to abundant supplies of raw materials, and (b) reliable low-cost transportation links to world markets for exporting surplus production. Raw material inputs into the fertilizer production process include natural gas (nitrogenous fertilizers), phosphate rock (phosphates), potassium salts (potassium fertilizers), and sulphur. Except for some deposits of phosphate rock and natural gas, few of these raw materials are present in Africa.

Despite the unfavourable odds, recent increases in fertilizer prices, a result of rising demand and rising petroleum costs, have led to renewed discussions about Africa producing more of its own fertilizer (African Fertilizer Summit Secretariat 2005). Nigeria, Angola, and Mozambique are among the few countries where some production potential may exist. If the Southern Africa Development Community (SADC) countries can achieve progress in lowering intra-regional trade barriers, for example, it might be possible to establish a profitable ammonia / urea production unit in Mozambique (using local natural gas) to supply the entire SADC market. Surplus production could be exported to countries in Asia. It would be important to ensure that locally produced fertilizer would be able to compete successfully with imported fertilizer. For increased African production of fertilizer to become a profitable reality, greater regional coordination of fertilizer policies and procurement would probably be necessary (see section 5.5 below).

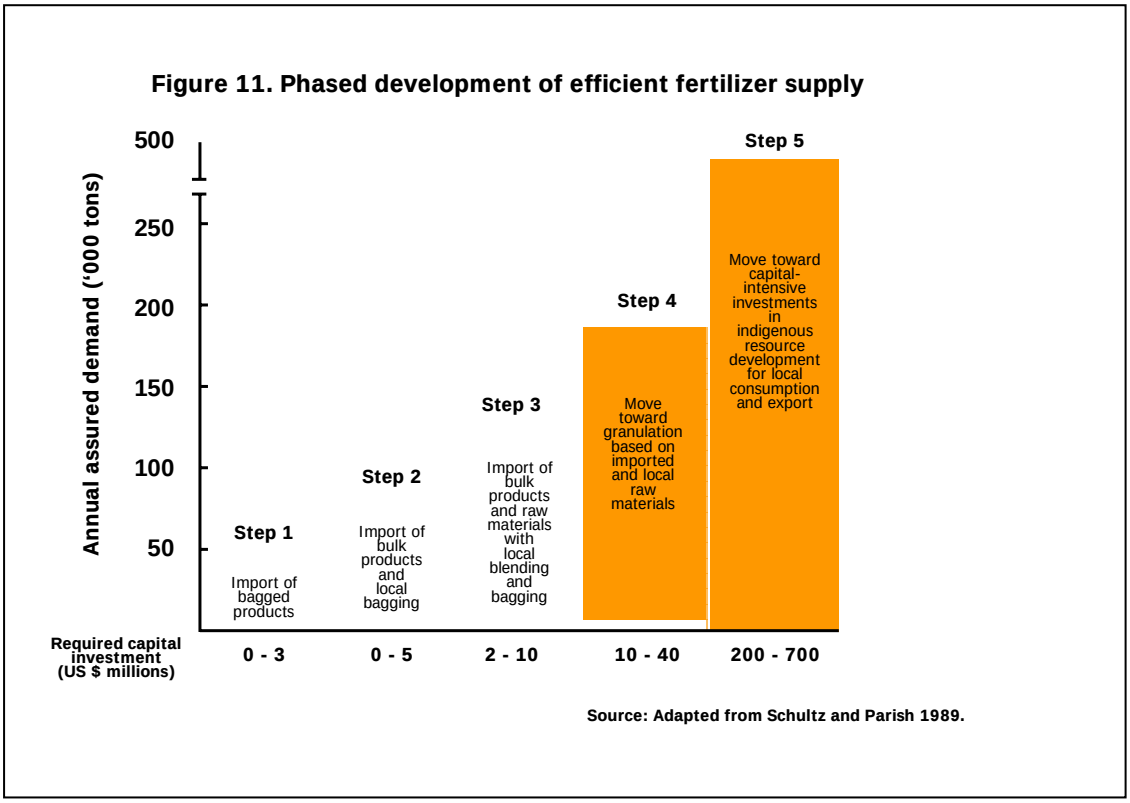
As markets grow in size, opportunities for improving the cost-effectiveness of fertilizer sourcing include a gradual transition to increased domestic processing of raw fertilizer materials. Figure 5.2 describes five different sourcing options based on market size and capital costs, including blending imported nutrients and manufacture from raw materials. Capital-intensive investments in developing indigenous resources are recommended only when demand for a single product exceeds 300,000 tons/year.

Blending, however, can be an effective approach when demand approximates 100,000 tons. Local blending offers four potential advantages over importing pre-blended fertilizer: (a) significant cost savings through bulk purchases of single-nutrient components; (b) compound fertilizers formulated to meet location-specific plant nutritional requirements; (c) fertilizer pack sizes adapted to local needs; (d) information on packaging in local languages. However, the shortcomings associated with blending include problems of the different minerals settling during transport and the final product no longer being homogenous at the time of application.

Given the apparent success of SSA's initial investments in bulk blending in Malawi, Zambia, Nigeria, Zimbabwe, and Côte d'Ivoire, additional investment in such operations may be a profitable option in other countries as demand increases and regional markets are developed.

[18] This entire section draws heavily on Gregory and Bumb (2006) and Morris *et al.* (2007).

Figure 5.2 Phased development of efficient fertilizer supply



Source: Gregory and Bumb 2006

5.5 Merits of moving from national to regional fertilizer markets

The growing interest in regional fertilizer markets is underscored by its choice as a key topic of discussion addressed at the African Fertilizer Summit in June 2006, and encouraged by the large number of regional agreements in SSA that have attempted to set regional policies. For example, the Common Market for Eastern and Southern Africa (COMESA), which embraces countries as diverse as Egypt and Swaziland, is attempting to develop a regional agricultural marketing policy as part of a common regional agricultural policy. Donors and NGOs are sponsoring regional workshops in order to reinforce this trend. A recent externally supported, fertilizer-specific workshop in East Africa sought, as one of its objectives, to develop a strategy to improve availability, accessibility and utilization of fertilizer in Eastern and Central Africa. The report of the workshop contained recommendations for a regional fertilizer sub-sector development project (Oluoch-Kosura 2002).

Those who are not sure that regionalization of markets is the solution focus on the great diversity of situations across SSA countries. They differ enormously in terms of land area, climatic conditions, soils, irrigation potential, population size and density, social structures, degree of urbanization, extent and nature of industrialization, quality of

domestic communications, access to sea transport, extent of external support, and GDP per capita. In the case of fertilizer, the review of literature points to major differences between countries in levels of fertilizer use, in the degree of market reform, and in the structure of marketing.[19] Is it possible for regionally based fertilizer policies and markets to adequately take into account differences in soil types and qualities, climatic conditions, the spatial location of production, the size and structure of farms, the seasonality of production, the availability of storage and transport infrastructure, and economies of scale in crop processing? These are legitimate questions given arguments presented earlier for more localized and "best-bet" fertilizer recommendations. Another concern is that regional markets would be likely to encourage a large role for a very few players, thereby reducing competition.

Those promoting regional markets point out that volumes of fertilizer imported into most SSA countries are small by world standards. More than half of the countries use less than 10,000 nutrient tons per year and over 80 percent use less than 50,000 nutrient tons. Additionally, these countries use several different products—urea, ammonium sulphate, CAN, TSP, DAP, MOP, NPKs, (15-15-15, 14-28-14, 20-20-0, 25-5-5, and others), Compound D (in Southern Africa), cotton formula (Western Africa), and a large number of other compounds. Because of economies of scale in production and procurement, countries using small quantities of these products end up paying higher prices for both the product and shipping. There is a need to examine whether economies can be realized by consolidating both national and regional fertilizer imports.

Rarely do importers - whether public agencies or private firms - pool their orders, either within the same country or among several different countries, and rarely do they arrange for joint handling, storage, and distribution. Uganda provides an example of what this type of pooling can do.

> "In 1999, importers in Uganda were importing in small parcels of 500-1,000 tons each of different product at high prices and farmers were paying over $600/ton for urea when urea sold for $100/ton in the global market…When Ugandan importers were advised to piggyback their import orders with large importers in Kenya, the retail price of urea dropped to $300/ton." (Gregory and Bumb 2006, p. 22).

This example illustrates the point made by others (e.g., Morris *et al.* 2007; Gregory and Bumb 2006) that there is potential for substantial savings in multi-country trading blocks, such as Malawi-Zambia-Mozambique or Tanzania-Mozambique-Malawi, where importers could take advantage of common ports, rail networks, and road systems to consolidate orders. Regional markets would appear to hold the most promise for traders in landlocked countries if they could be linked more cost-effectively to importers in countries through which their fertilizer must be transhipped.

At present, there seem to be few incentives for large importers to organize for joint procurement with smaller importers. Some analysis of the potential for cost reductions and the types of incentives that would be necessary to stimulate joint procurement seems appropriate. Incentives that the government might work on include regional harmonization

[19] For example, fertilizer use in Tanzania is little over half that in Malawi, despite the fact that it has a much larger area of arable land and almost three times the rural population. In Malawi, fertilizer marketing to farmers is dominated by the agents of importing enterprises (IFDC *et al.* 2000), whereas in Tanzania most rural fertilizer traders operate on their own account using their own funds (Turuka and Kilasaru 2002).

of fertilizer formulae[20] and regulatory frameworks (Gisselquist and van der Meer 2001), keeping in mind the need to balance the potential cost benefits of harmonization with the diversity of fertilizer needs among the participating countries. To date, efforts to harmonize regional regulations concerning inputs have not met with much success.

Although cost factors and lack of appropriate natural resources are likely to restrict the expansion of fertilizer production in SSA for the near future, the development of regional production and distribution facilities was a topic on the agenda for the African Fertilizer Summit in 2006. Two of the 12 Summit resolutions addressed this issue directly:

> 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.

It should be noted that the Summit resolutions are much more optimistic about the availability in SSA of the raw materials needed for fertilizer production than other assessments reviewed for this study.

5.6 Role of fertilizer price subsidies

The most contentious fertilizer policy issue in the recent past has been that of subsidies. During almost 20 years of input and output market reforms, donors and international banking institutions have discouraged the use of fertilizer subsidies and most SSA countries conformed to these recommendations despite a growing sense of frustration at stagnating agricultural production and growing rural poverty - often seen by African governments as a result of declining input use triggered by sector and macro-economic reforms.

Although there were voices raised during the 1980s and 1990s suggesting that the issue of input subsidies needed to be revisited if SSA was to meet agricultural productivity growth targets (e.g., Reardon *et al.* 1999), it was not until the Millennium Development Report seized on increased fertilizer use as a potential solution to rural poverty and a means of meeting the Millennium Development Goals that the fertilizer subsidy debate was catapulted to front and center stage (UN Millennium Project 2005). In many instances the debate is poorly grounded on underlying economic principles and clouded by poor articulation of the goals for which fertilizer subsidies are being proposed. Traditionally,

[20] Malawi, for example, uses an NPK compound fertilizer that is used nowhere else in the world and needs to be manufactured (at high cost) exclusively for Malawi (IFDC *et al.* 2000). The cotton formula used in Mali has also been singled out as unnecessarily costly because it includes some specialized ingredients (Diouf *et al.* 1998).

fertilizer subsidies have been aimed at increasing agricultural productivity by stimulating farmers to adopt economically profitable seed/fertilizer technologies. In this new era of MDGs, fertilizer subsidies are viewed by many as instruments to "jump start" a process of reducing rural poverty and improving food security - the extent to which this is possible will depend on the medium- to long-term prospects for poor farmers to profitably use the inputs when subsidies are removed. There is also growing evidence from countries like Ethiopia, where fertilizer use has increased substantially during the past decade, that the link between increased fertilizer use and agricultural productivity growth leading to increased incomes and food security is not automatic. Byerlee *et al.* (2006, p. 2) note that:

> "…despite more than a decade of policies that place high priority on cereal intensification, backed by one of the highest rates of public expenditures on agriculture in Africa (as a share of the budget), Ethiopia has yet to see the payoffs in terms of higher and more stable cereal yields, reduced dependency on food aid, improved food security, and lower consumer prices for staples."

The Government of Malawi has also supported a wide range of fertilizer promotion programmes, with evidence of positive short-term food security impacts from the universal starter pack programmes in the late 1990s (Levy 2005) but less positive impacts from subsequent programmes involving targeted input distribution and direct subsidies (Blackie *et al.* 2006). Both the Malawi and Ethiopian cases suggest that extension efforts to ensure appropriate, cost-effective use of fertilizer must accompany other types of fertilizer promotion activities.

Recent reviews of the fertilizer subsidy debate (Crawford *et al.* 2006) describe the arguments for subsidies as follows:

- *Financial*: increased agricultural output or incomes (for farmers and traders) are valued using prevailing (i.e., financial) prices, without necessarily making an explicit case that the efficiency losses from the subsidy are offset by any output/income gains.
- *Economic*: subsidies are expected to create real economic gains by (a) "kick-starting" a process of innovation, e.g., through credit to overcome liquidity constraints, so that agricultural productivity rises in the medium to long term or (b) correcting for missing or imperfect input and output markets.
- *Non-economic*: subsidies are expected to help restore soil fertility, improve food security, alleviate poverty, and provide social and environmental protection - all objectives whose economic impacts are difficult to quantify.

Arguments against fertilizer subsidies most often stress the following problems:

- *Misallocation of scarce resources*: fertilizer use is stimulated where it is not economically profitable, and/or scarce public resources are diverted from other productivity-enhancing investments that promise higher or longer-lasting payoffs.
- *Ineffective targeting*: the beneficiaries are supposed to be poor farmers but some fertilizer leaks out to others and elites may capture much of the benefit.
- *Market disruptions*: unpredictable changes in subsidy programmes; price control and rationing; political interference; and unfair competition between state-run and private

sector enterprises combine to discourage private sector investment and to promote rent seeking by officials. Such effects can undermine the development of commercial fertilizer marketing networks to serve small farmers.

Crawford *et al.* (2006) conclude that subsidies may be warranted when there is a clear prospect of significant productivity gains (addressing economic growth objectives), when subsidies are a less costly form of income transfer than alternatives such as food aid (addressing poverty alleviation objectives), and/or when they can be designed in a way that promotes sustainable private sector involvement, or at least that avoids negative impacts on private markets. The challenge remains to determine whether these conditions are likely to be met in a given situation.

Proponents of fertilizer subsidies often use soil fertility depletion arguments to justify subsidies (Sanchez *et al.* 1997) or cite the Asian example for which there is growing evidence that fertilizer promotion played an important role in stimulating agricultural productivity growth and reducing poverty (Fan *et al.* 1999; Fan *et al.* 2002). While soil fertility decline is a well-documented problem in SSA, the relevance of the Asia experience needs to be analyzed more carefully given the important differences in governance and institutional capacity, agro-ecology (e.g., availability of irrigation), population densities, education levels, and infrastructure development.

A growing body of evidence (much of it cited in Section 3 above) suggests that if the goal is to promote efficient and sustainable use of fertilizer, alternatives and/or supplements to direct fertilizer price subsidies should be carefully evaluated in terms of potential benefits and costs. Options to examine include:

- Improving enabling conditions by promoting policies and institutions that contribute to efficient markets for inputs, financial services, and outputs.
- Reducing the high costs of transportation, e.g., costs of handling and port clearance and poor road quality.
- Reducing taxation on agriculture.
- Investing in agricultural research, extension, and rural education to improve fertilizer use efficiency.

In effect, the policy question many are asking is: "Do we subsidize or not?" The question they should be asking is: "What is the most cost-effective use of available resources for meeting both agricultural productivity and poverty reduction objectives?"

There is a continuing need for empirical studies of innovative ways of using public resources to reduce the price and/or improve the availability of fertilizer at the farm level. Morris *et al.* (2007) describe four recent innovations: input vouchers (Gregory and Roy 2005; Gregory 2006), matching grants (McKean and Ostrom 1995; van der Meer and Noordam 2004), new financial instruments such as loan guarantees for input suppliers (Kelly *et al.* 2003) and weather insurance (Ibarra *et al.* 2005). Much of the evidence on these efforts remains preliminary and anecdotal; more solid work on monitoring and evaluating would improve the level of debate on the issue of fertilizer subsidies and other types of public support programmes to stimulate fertilizer use.

Finally, it is important to note that policy and programme choices should be based at least in part on local-level empirical analysis of likely impacts and their resulting costs and benefits. It is not enough to know the tradeoffs, i.e., types of benefits and costs, associated with alternatives. To decide among them also requires some estimate of the magnitudes of the costs and benefits. It is essential to move beyond anecdotes to more systematic evaluations of the private and social costs and benefits of different fertilizer promotion efforts. When undertaking these analyses, it is important to remember that increased fertilizer use should not be considered a goal in isolation. The broader goal is to ensure adequate soil fertility in order to support increased agricultural productivity, food security, and incomes. Mineral fertilizer is one of many inputs needed to accomplish these broader goals, hence the systematic evaluations of private and social costs mentioned above must also include analyses of technologies and practices that complement and/or substitute for mineral fertilizers (Crawford *et al.* 2006).

6 The way forward

6.1 Critical success factors

Information presented in this Occasional paper suggests that the following set of critical success factors would be capable of moving markets to a new level of maturity by simultaneously stimulating both fertilizer demand and supply. They are presented in terms of their contributions to different aspects of demand and supply.

Farmers are more likely to demand fertilizer if:

- they have access to credit
- they are relatively close to good roads and markets
- they can produce a fertilizer-responsive crop in a relatively low-risk environment (e.g., under irrigation, in higher rainfall zones, or using SWC practices)
- the fertilizer-responsive crop has a relatively stable output demand
- fertilizer is available in appropriately sized packages at the desired time.

Farmers are more likely to use fertilizer in a cost-effective manner if:

- they have access to demonstration packs for testing and demonstration plots conducted jointly by extension services, input suppliers and, possibly, NGOs
- they use practices that increase fertilizer use efficiency (SWC, natural resource management, and conservation farming, for example).
- they are provided with training in analyzing the financial returns to fertilizer use, and market information (input/output prices and quantities) is available.

The private sector is more likely to import and develop retail distribution networks if:

- government or donor distribution programmes to stimulate fertilizer use are designed collaboratively with the private sector and in a manner that does not crowd out existing commercial demand
- the risks of providing credit to retailers are shared (e.g., credit guarantees)
- rural roads are maintained
- costs of estimating retail demand and dealing with carry-over stocks at remote locations are shared (e.g., farmers organize for bulk orders).

Local retailers are more likely to stimulate demand if:

- they are well trained in business management and have good technical knowledge about inputs they carry
- they have access to credit to maintain adequate stocks
- they sponsor demonstration plots or field days to promote products
- they are able to satisfy local demand (correct timing of availability, package sizes).

Banks are more likely to finance the agricultural sector if:

- donors or government share the risk during the early years (credit guarantees)
- loan officers are provided with training in agricultural risk management
- donor funding is available for the development of new loan instruments.

This list of "critical" factors is long and suggests that some prioritization may be in order. The items in each category are listed by order of importance suggested in the literature reviewed. However, one of the recurring themes in this paper is that SSA is very diverse and what works in one situation may not necessarily work in another; this clearly makes it difficult to offer a definitive prioritization.

A caveat is also needed concerning the analytical and empirical underpinnings of the literature on input market reform. Much of the literature reviewed describes "success stories" based on analyses conducted after only two to three years of a pilot project; there is a need to invest more in the monitoring and evaluation of pilot projects, with particular attention to their sustainability and spread effects over a five to 10-year period. There is also a need to support more empirical analysis of the market reform process as it evolves over a substantial period of time. A recent in-depth study of input market development in Kenya (a country that increased fertilizer consumption from 180,000 tons/year during 1980s to 351,776 tons in 2004/05) permits appreciation of the wide range of actors involved and the contributions they made (Box 6.1). The process that has worked in Kenya may not be transferable in its totality to other countries with different cropping systems and resource endowments. However, the Kenya example does illustrate that commercial markets that are relatively unfettered by government policies and direct intervention can make a substantial contribution to increased fertilizer use when supported by a variety of relatively small-scale donor-funded programmes that reduce private sector risks and improve farmers' knowledge and skills.

6.2 Context-specific analysis

While country studies such as the Kenyan one provide useful insights for other countries seeking to improve their input markets, recent comparative studies of the liberalization of different pre-reform export crop systems in multiple countries (Poulton *et al.* 2004; Tschirley *et al.* forthcoming) go even further in building the empirical data base needed to resolve some of the debates discussed in Section 5. Similar long-term (5 to 10 years) analyses of input supply systems developed in conjunction with diversification crops with and without interlinked input/output markets would also be useful.

In most cases the debates discussed in Section 5 continue because (a) there is a lack of empirical data, leading to a reliance on theoretical arguments, (b) analyses of the empirical data have produced conflicting or inconclusive results, or (c) the best way forward should really be context-specific. In all three cases, more case studies and comparative analyses of the type described above could contribute to an improved level of debate and identification of appropriate, context-specific solutions.

In the case of the debate about standardization versus localization of fertilizer recommendations, a multi-disciplinary group (agronomists, fertilizer suppliers, extension agents, and farmers) could review available data on yield response and fertilizer procurement/delivery costs to develop a reasoned set of cost-effective recommendations, taking into account any non-price concerns of farmers and extension agents.

Box 6.1 Key components of Kenya's multi-faceted approach to fertilizer sector development

Contribution of government:

- Market reforms (elimination of retail price controls, import licensing quotas, foreign exchange controls, and the phase-out of external fertilizer donation programmes)
- Stable government policy environment during more than a decade (i.e., no direct or indirect government intervention in the market)
- Generally supportive environment for input/output market linkages fostering input access via credit for producers of major cash crops (sugar, tea, coffee, horticultural exports).

Contribution of private sector:

- Rapid growth in new entrants to the market at the import, wholesale, and retail levels that spurred competition and contributed to the following outcomes:
  - Reduced fertilizer marketing margins by about 60 percent
  - Kept fertilizer prices relatively stable in face of rising world prices
  - Expanded retail distribution system to reduce distances farmers travel for fertilizer purchases from 8.4 to 4.1 km on average between 1997 and 2004
  - Invested in demonstration plots, agricultural fairs, and other farmer education programmes.

Contribution of donors:

- Significantly reduced fertilizer aid imports and other programmes competing with private sector
- Supported innovative programmes to test alternative options for removing structural constraints:
  - Rockefeller agro-dealer, market information, and cereal bank programmes
  - USAID's Kenya Maize Development Project to strengthen farmer capacity to run associations, obtain credit, market output, order and use inputs in a cost-effective manner
  - Multi-donor support to Farmers' Inputs Promotions (FIPs) to improve public/private extension linkages and experimentation with new fertilizer/seed products.

Contribution of farmers:

- Responded enthusiastically to public/private programmes to improve knowledge and use of inputs
- Formed and strengthened associations to reduce input and output marketing costs
- Experimented with diversification crops for both domestic and export markets.

Despite the progress, there is a need to guard against potential threats that could raise costs and constrain supply:

- Declining quality of port, road, and rail infrastructure could lead to increased transport costs
- Increasing policy uncertainty due to signals that the government is planning to re-enter the market:
  - Cereal board imports and marketing of fertilizer in 2005
  - Plans for large-scale government-run input subsidy programme to begin in 2006
- Promotion of fertilizer in zones where it is not profitable rather than identifying non-fertilizer options to increase productivity and rural incomes (small-scale irrigation, livestock, rural job creation).

Source: synthesized from Ariga *et al.* 2006

6.3 Fertilizer subsidies

The most contentious issue mentioned in Section 5 is the one about fertilizer subsidies, a topic hotly debated at the recent African Fertilizer Summit. One of the 12 conference resolutions called for subsidies:

> 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 favour of the fertilizer sector, with special attention to poor farmers.

Here too, there is a need to ground decision-making in solid analyses of past experiences rather than hypothetical projections of likely impacts. Important points to keep in mind when thinking about fertilizer subsidies include:

- A supportive policy environment and increased investment by governments, donors, and the private sector are needed to increase African fertilizer use in a cost-effective manner (with or without subsidies).
- Policies and investments to promote sustainable increases in fertilizer use may contribute to poverty reduction, but empirical evidence on this link is weak (Byerlee *et al.* 2006), particularly where fertilizer use is highly risky and of questionable profitability at real prices (the case in many of sub-Saharan Africa's farming systems where the poor are concentrated).
- Heavy expenditures on fertilizer promotion programmes based on free or subsidized distribution can have very high opportunity costs if they compete with investments that would address structural barriers that presently reduce the profitability of fertilizer use (low investment in SWC practices and irrigation; high transportation costs due to poor road and rail networks; under-funded and poorly managed research and extension services; underdeveloped financial and risk markets).
- There is great diversity among African smallholders. Fertilizer promotion programmes as a means of reducing poverty have worked better for smallholder farmers who have the other necessary complements to fertilizer (adequate land, labour, and equipment). In some cases, relatively better off farmers have captured benefits intended for the poorest. The record (and maybe the prospect?) of fertilizer being helpful and sustainable is not very good for many of the poorest smallholders, especially those with few assets, little education and living in difficult climate settings, where the viability of sustainable fertilizer use is very difficult at best.

Given scare resources, lessons from past experience in Africa and elsewhere must contribute to more effective use of the limited resources available for African agricultural development. Growing interest in the reinstatement of fertilizer subsidies of various kinds must be balanced with increased analysis of past efforts. There is no strong evidence that fertilizer promotion programmes involving either direct or indirect subsidies have been able to "jump-start" productivity growth among poor farmers in Africa enough to sustain high levels of input use and improved food security when the programme support ends.

SG 2000 programmes are illustrative here, with fertilizer use falling off when direct support was reduced in Ghana and a number of other countries. Also, Nigeria experienced major reductions in use when long-supported subsidies were dropped and Malawi continues to experience major food security problems despite years of experimentation with different types of fertilizer promotion programmes. A recent analysis for Southern Africa (Zambia) revealed that households purchasing fertilizer from private dealers had similar characteristics to those acquiring fertilizer through the government distribution programme designed to help needy farmers (higher incomes and wealth; close to tarmac roads and district centers; and higher education or employment as civil servants). Furthermore, the yield response was so poor (1.6 kg of maize per kg of fertilizer compared to a potential of 3-12 kg.) that the returns on the "investment' were a negative 12 percent in the single year for which the analysis was conducted. These experiences need not be interpreted as proof that fertilizer subsidies cannot work at all, but the lessons from these experiences need to be incorporated into the design of future fertilizer support measures.

Although the economic justifications for fertilizer subsides are few, they have strong political appeal and SSA governments will no doubt continue to explore ways of using them to win favour with rural populations. In such cases, it will be important to design *market-smart* subsidies that help poor farmers but do not interfere with markets. Market-smart subsidies would be implemented only when the enabling environment for developing effective commercial demand and supply systems is favourable (or can be made favourable during the time period in which the subsidy is in place). Market-smart subsidies would be designed to address demand and supply constraints simultaneously. To address supply constraints, subsidies would be administered in a manner that provides incentives for the development of commercial supply (e.g., the use of input vouchers redeemable by private sector stockists) and rural financial markets (e.g., use of vouchers that provide credit through local institutions rather than free or subsidized fertilizer). On the demand side, market-smart subsidies would be used to link fertilizer use to complementary farming practices and technologies (e.g., improved seed and SWC practices that increase fertilizer use efficiency and reduce risk). Finally, market-smart subsidies must be established with an exit strategy in mind and managed in a transparent and cost-effective manner.

Four specific interventions that have been used in the recent past in SSA can be adapted to meet these guidelines for *market-smart* subsidies and provide assistance to the poor while not interfering with markets:

- input vouchers redeemable by commercial suppliers or credit institutions
- demonstration packs (if very small in size and designed to stimulate demand)
- matching grants (farmers or farmer groups invest an equal amount to the grant in some activity that is related to fertilizer use)
- credit guarantees (used to encourage input importers to offer credit to distributors further down the value chain).

6.4 Conclusion

In closing, it is fitting to cite the closing remarks that were offered by two eminent experts invited to attend the African Fertilizer Summit:

> "It is politically easier to mobilize funds for quick fixes, such as free fertilizer, than for other necessary but longer-term solutions, such as building roads and training agricultural scientists.… [but], unlimited fertilizer subsidies without substantial resources for the basics of infrastructure, technology and training will leave Africa just one season away from the next food crisis." (McPherson and Rabbinge 2006)

This quote is in line with the general conclusions of the majority of the literature reviewed in the preparation of this document. Limited use of well-designed fertilizer subsidies can contribute to the overall effort of building input demand and supply, but in most cases fertilizer subsidies alone will not represent a "critical success factor".

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This paper synthesizes available literature on fertilizer market reform and the economics of fertilizer use in sub-Saharan Africa, in order to characterize lessons learned from reform over the past two decades. It identifies areas of consensus for improving fertilizer markets and increasing fertilizer use, evaluates the ongoing debates, and proposes potential actions for resolving debates and moving forward to higher levels of consumption and more efficient fertilizer marketing. Particular attention is paid to the subject of fertilizer price subsidies, where it is noted that the literature does not strongly support the renewed enthusiasm in the region for subsidies.

It is hoped that the paper will provide valuable information for policymakers and their advisors in Africa, as well as for donors and fertilizer marketing companies.

Policies and actions to stimulate private sector fertilizer marketing in sub-Saharan Africa

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