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Abstract

Failures in agricultural input markets are common in developing countries and are a major constraint to productivity growth. Farmers in sub-Saharan African face particularly acute constraints, with poor output price incentives, high fertilizer prices, lack of liquidity/credit and lack of knowledge. In low input/low output agricultural systems, fertilizer subsidies can play a role in raising fertilizer use and agricultural productivity. They can help demonstrate the benefits of fertilizers and/or kick-start market development by raising input demand at a large scale. However subsidies do not represent a suitable policy option on the long run, as they do not address the root causes of low fertilizer use on input or outputs markets and they involve unsustainable fiscal costs for the economy.

This paper provides an analysis of the economic rationale for subsidizing agricultural inputs with public money and a literature review of recent experience with subsidies in Sub-Saharan Africa. The paper reviews 14 national policies implemented since the late 1990s. Those programmes evolved over time from small-scale demonstration packages to large-scale, multi-year programmes that heavily subsidize fertilizer price to producers. They are targeted at smaller scale farmers, as in East Africa (Kenya, Malawi, Rwanda, United Republic of Tanzania, Zambia), or universal, as in West Africa (Burkina Faso, Senegal, Mali, Nigeria, Ghana). The new generation of input subsidies ('*smart*' subsidies) brings innovations in design (e.g. targeting; vouchers) to support both the most constrained farmers and encourage the development of input markets. Available evidence, albeit very limited, suggests that such programmes have been effective in raising fertilizer use, average yields and agricultural production but that their success is highly dependent on implementation. Economic efficiency and equity considerations have been less studied and results look less conclusive.

The paper concludes with a set of recommendations on the potential contribution of fertilizer subsidies to national food security objectives and some of the entry points for improving their design and efficiency. Policy-makers should adopt clear and non-contradictory objectives that are aligned with their national food security objectives. They should develop targeted packages for a variety of agro-ecologic contexts and farming systems and combine those with complementary services to raise farmers demand (e.g. extension and research). Procurement and distribution of subsidized fertilizers should enhance and not inhibit input market development (market-friendliness). Finally complementary or alternative public expenditures should be mobilized to achieve national food security goals, e.g. cash transfer programmes to increase farm income and input use; market liberalization and infrastructure development to establish strong, private sector-led input supply markets.

Key words: (Inorganic) Fertilizer; Agricultural subsidies; Agricultural productivity; Sub-Saharan Africa

JEL classification: H22, O13, Q18

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EXECUTIVE SUMMARY

1. There is wide agreement that greater use of inorganic fertilizer is necessary to ensure that African farmers are able to farm profitably, maintain soil fertility and boost production to meet the food needs of the continent.

2. While universal price subsidies on fertilizers were common prior to the 1980s, their lack of results sustainability led to their demise under structural adjustment programmes led in the 1990s. Catalysed by high food prices, population growth and low soil fertility concerns, recent years have seen, however, a resurgence of interest in fertilizer promotion programmes but delivered as '(market)-smart subsidies'.

3. But many challenges have remained. The complexity of the multiple and contradictory objectives assigned to subsidies raise tremendous challenges for proper implementation. Programmes impact on input and output markets and interact with trade policies; yielding positive results is not a given. They are subject to continued politicization and they should be carefully monitored and evaluated to track implementation performance, efficiency and sustainability.

SECTION A: What is the issue?

4. In a world of perfectly competitive markets, conventional economic analysis demonstrates that subsidies are not desirable as they systematically result in economic inefficiencies and welfare losses and large fiscal costs. However, there might be a case for subsidies when markets do not work well, as is the case in Africa. African farmers may not be in a position to use fertilizer, or to use optimally, because they do not perceive the benefits, and/or they cannot afford to buy the fertilizer and/or fertilizer may not be physically available. In such cases, fertilizer subsidies would be economically justified to address the market failures and poor incentives faced by some farmers.

5. It is recognized that SSA displays a combination of high soil nutrient deficits and very low fertilizer use (3% of global fertilizer consumption; 7 kg/ha versus > 150 kg/ha in Asia) that comes from a set of failures on input and output markets. On the demand side, poor price incentives, highly seasonal and variable production due to increasing rainfall variability, lack of liquidity, credit or insurance and lack of knowledge about fertilizers undermine farmers' capacity to adopt the technology or to reap the benefits of its use. With low and dispersed demand, the industry remains largely underdeveloped; suppliers also cannot make the economies of scale that would reduce the high costs of transporting, stocking and distributing fertilizers. As a result, fertilizer sold in sub-Saharan Africa is the most expensive in the world.

6. By making fertilizer cheaper, input subsidies may raise fertilizer use. However, this augmented level of fertilizer use will only be optimal from an economic perspective if households benefiting from the subsidy are facing market failures. Two main market failures are mentioned when analysing fertilizer use in SSA; farmer lack of knowledge and lack of fertilizer market development. This implies targeting and while maximizing

distributional impacts it also raises greater implementation issues and creates more opportunities for political interference in distributing and allocating benefits.

7. One should be mindful that, even in the presence of subsidies, profitability might not be achieved in all and any contexts. Raising the technical efficiency of input use through improved agricultural practices (e.g. following best practices from integrated soil fertility management and conservation agriculture approaches) is critical in promoting sustainable benefits. This raises the importance of devoting public resources also to a set of complementary measures that will strengthen the demand for fertilizer.

SECTION B: What is the evidence?

8. Among the fifteen subsidy programmes implemented in sub-Saharan Africa since the early 2000s that are reviewed in this paper, ten of them have implemented large-scale subsidies. Those can be classified into two categories: universal subsidies (untargeted, pan-national price support for specific crops) implemented in West African countries (Burkina Faso, Senegal, Mali, Nigeria, Ghana); and targeted subsidies, which are found in East and Southern Africa (Kenya, Malawi, Rwanda, the United Republic of Tanzania, Zambia). These ten programmes are large in magnitude (millions of beneficiaries) and they have been implemented over a long time (3–5 years, sometimes even a decade). They are usually quite costly (US$ 100–160 million/year) and largely funded by national governments (50 to 100%).

9. Those programmes have the common and primary objective of raising national agricultural production for food security purposes. They have also been associated at times with other policy objectives, such as reducing poverty of smallholder households and/or supporting the development of dynamic input supply markets.

10. Available evidence, albeit very limited, suggests that subsidies have been effective in raising fertilizer use, average yields and agricultural production but that they could be improved in design and implementation. Economic efficiency and equity considerations have been less studied and results look less conclusive.

11. Cross-cutting issues linked to implementation represent a particularly important challenge. Those are: difficulties with administrative targeting; late delivery of fertilizer; leakages and fraud which both lead to displacement of commercial fertilizer purchases.

12. Vouchers represent a specific distribution system for subsidies: they offer a flexible and transparent system of subsidy distribution, which facilitates targeting and can help contribute to strengthening the private sector. On the downside, the success of input voucher schemes as an entitlement system is largely contingent on implementation (fraud and leakage resulting from reselling of vouchers). They can also be quite costly to implement (administration and monitoring costs).

SECTION C: Which role for fertilizer subsidies in food security strategies?

13. The contribution of fertilizer subsidies to national food security strategies remains highly controversial. What has been established, however, is that such programmes have become unavoidable in the agricultural policy portfolio. They have become a widely used policy instrument, to which governments devote very large shares of their national budgets, and this makes them de facto central to supporting national agricultural and food security strategies. It is also unanimously recognized that, in view of their mixed record, subsidies where they exist must be improved in order to raise their effectiveness.

14. In spite of a number of clear successes in increasing input use and sometimes in raising productivity, the new subsidies have not yet provided a convincing solution as they carry over many of the problems of the past. They have helped target smallholder recipients and they have generally increased the size of input markets. But they have also had negative impacts on the development of the private sector and on competition, when distribution schemes and procurement procedures did not encourage them. They have become highly politicized. They are too costly and, as such ,unsustainable in the long term.

15. Subsidies are likely to remain, nonetheless, highly politically attractive to national governments because a) the problems they are intended to address remain compelling at both the national and international levels and b) they provide immediate and visible benefits that can win quick political gains. The current debate on the role of subsidies to intensify agricultural production and improve food security is a step forward in that (a) it focuses on ways to improve targeting to reach farmers effectively (and vouchers will be useful for that purpose), and (b) fertilizer promotion programs are increasingly considered explicitly in relation to a range of alternative and complementary investments and policy tools.

16. Fertilizer subsidies can be an instrument to increase productivity in SSA and thus help solve the food availability dimension of food security. However their design needs to be improved to raise their efficiency and allow tacking other dimensions of food insecurity. FAO has a role to play in supporting governments in this task.

17. The debate on the role of subsidies to intensify agricultural production and improve food security should focus on clearly identifying objectives and improving targeting to reach farmers who can raise fertilizer use more effectively. Those programmes should also be considered explicitly in relation to a range of alternative and complementary investments and policy tools, including social cash transfers, that will contribute overall to the national food security objectives.

18. Some of the critical steps and recommendations for assessing the value of subsidizing inputs and for improving the efficiency of subsidy schemes.

a) ***Fertilizer use must be seen as a tool for integrated soil health and fertility management rather than as a goal in itself***. In particular, subsidy programmes must be concurrently run with programmes promoting agronomic best practices. Farmers need to be taught about the use of mineral fertilizers in the context of their specific farming systems. In particular, knowledge on current soil properties, balanced fertilization, site specific nutrient management, combination of inorganic and organic fertilization are options to be considered. If local organic materials do not exist, the cropping system has to be diversified so as to include soil-improving crops.

b) ***Subsidies should be assessed within the framework of the national strategy for food security.*** The choice of opting for a subsidy must be weighed against national strategic objectives for reducing food insecurity and the range of available policy options to support those objectives.

c) ***Input subsidies' objectives should be clear, explicit and non-contradictory.*** If the national food security strategy prominently focuses on increasing national agricultural growth, then subsidies can be instrumental at reaching this objective, provided they are implemented temporarily and sensibly. Complementary objectives may be added but they should be carefully enounced.

d) ***Design should be aligned programmes objectives and truly "smart":***

- Promote targeting of those farmers, regions and crops which face the market failure related constraints and that will maximize impact. **This requires thorough research/analysis of farmers' constraints and incentives** related to fertilizer use under specific local conditions (national and sub-national levels).
- Promote market-friendliness by including private-sector actors in the scheme (importers, wholesalers and retailers/dealers) and by promoting competition. **This requires an improved understanding of the complementarities and trade-offs between public and private provision** as well as the contribution of different supply systems (independent agro-dealers versus vertically integrated distributors networks).
- Devise a clear timeline for the programme with a workable exit strategy
- Much more so than today, strategic objectives and subsidy design may need be differentiated geographically depending on the specifics of local conditions – soils and farming systems, input and output markets

e) Implementation must be supported to raise efficiency.

- Innovate on administrative targeting.
- Innovate in allocation of benefits, also provide venues for improving farmers' access to inputs

- Use secured entitlement systems (vouchers, smart cards, mobile phone)
- Strengthen monitoring and evaluation systems
- Enhance administrative and managerial capacity of the subsidy programme
- Train and empower key actors (suppliers, farmers)

e) Finally, subsidies should be included in a holistic approach for the promotion of fertilizer use. Expenditures should be balanced against complementary public policies to ***raise the technical efficiency of input use*** (agro-research, extension, irrigation, etc.), ***increase farm income*** (cash transfers) and to ***establish strong, private-sector-led input supply markets*** (market liberalization, infrastructure development, etc.).

Introduction

Given the poor natural endowments of African soils aggravated by poor management and sometimes damaging soil practices, there is broad consensus that substantial increases in inorganic fertilizer use are necessary to restore and maintain the fertility of African soils and enhance their productivity (Minot and Benson, 2009). However, the use of inorganic fertilizers has to be embedded either in an integrated soil fertility management approach (Vanlaue *et al*., 2010) or in a holistic cropping system management approach, such as Conservation Agriculture (FAO, 2008). The aim should be to increase crop production sustainably following the "Save and Grow" approach (FAO, 2011a).

1. *Historical overview*

Universal price subsidies on fertilizers were common from the 1960s to the 1980s in sub-Saharan Africa (SSA) and in Asia. In Asia, subsidies are considered to have played an important role in promoting increased use of fertilizer and to have partly contributed to the significant increases in yields (Morris *et al*., 2007), although their contribution to agricultural growth and poverty reduction after the initial phases is considered to have been very low (Fan *et al*., 2007). In Africa, most countries sold fertilizer at subsidized prices through a centrally controlled input importing and distribution system. Variations on this system were used in SSA in Kenya, Malawi, United Republic of Tanzania, Zambia, and Zimbabwe and in some West African countries up to the mid-1990s in some cases (Crawford *et al.*, 2006).

Experience with universal subsidies in SSA was largely negative: it resulted in inefficiencies, such as adverse selection of programme beneficiaries (capture by influential/well-off farmers) and displacement of commercial sales, and had disproportionate fiscal costs against their benefits (Morris *et al*., 2007). This failure, together with a shift of development paradigms towards structural adjustment, eventually led to the dismantling of fertilizer subsidies, the liberalization of most fertilizer markets and a switch of fertilizer policy towards supporting the development of private-sector-led markets (Minot, 2009). However, even during that period voices claiming a role for limited subsidies remained (Reardon *et al*., 1996). Many observers note that the removal of subsidies coincided with a reduction in food production and in fertilizer use (Banful, 2011). As Banful and Olayide (2010) note for Nigeria, "*the pattern of total fertilizer consumption has followed the ebb and flow of federal and state government subsidies*" (page 1). Interestingly, the country abandoned universal subsidies as late as 1997 to resume with reformed subsidy programmes as early as 1999.

From the early 2000s onwards, the conjunction of agricultural production stagnation, rising food insecurity, low soil fertility and environmental degradation has sparked fresh interest, from policy makers and development partners alike, in promoting input subsidies as a tool for addressing food insecurity. African governments and development partners have embraced the increase of fertilizer use as an enabling technology to boost food production.

A milestone in the surge of fertilizer subsidies, the African Fertilizer Summit held in 2006 in Abuja stated in its final declaration (African Union, 2006) that African policy-makers should grant "targeted subsidies in favour of the fertilizer sector, by granting, with the support of Africa's Development Partners, targeted subsidies in favour or the fertilizer sector" (page 3) . Since then the African Union, through NPCA, is monitoring the progress towards the goals set in the Abuja Declaration and is coordinating the establishment of an African Fertilizer Development Financing Mechanism (AFFM). AGRA also advocates for making available improved seeds and fertilizers that are subsidized by governments and delivered through the private sector to poor farmers. Last, the Millennium Villages programme also called for governments to boost fertilizer use, with subsidies if necessary (Minot, 2009). The fertilizer industry seems to be more cautious, reducing the scope for fertilizer subsidies to certain cases; acknowledging that subsidies alone will not be effective without a broader enabling environment supportive of agricultural development; and highlighting the need for more fertilizer supporting policies such as reduced taxation, regulatory harmonization and better infrastructure (IFA, 2010). Last, but not least, fertilizer subsidies are being put forward for inclusion into the Food Aid Convention as support to post-emergency recovery efforts to rehabilitate adversely affected agriculture sectors (Konandreas, 2010).

The Malawian government pioneered the return to fertilizer subsidies in 1998 when it started distributing free fertilizer after having discontinued similar programmes in the early 1990s. It was followed by Nigeria (1999); Zambia (2000); the United Republic of Tanzania (2002), Kenya (2006) and Ghana (2008). After the 2008 food and fertilizer prices crisis, subsidies have become all the more popular as governments have felt the urge to quickly improve domestic food production and have been able to use direct budget support from donors who were previously reluctant (Kelly *et al*., 2011). Importantly, they also remain an attractive policy option for national governments because they are visible and popular with voters.

2. *Understanding recent experience with subsidy programmes*

The revival of fertilizer subsidies came along with innovations in design seeking to avoid the downsides of past programmes (high costs, poor targeting and displacement of the private sector). The new "smart" subsidies, are directed at specific farmers; they also aim at supporting private-sector distribution and market-friendly solutions, generally with an associated poverty reduction and welfare enhancement objective. They frequently use vouchers (or coupons) to entitle beneficiaries and deliver against those objectives.

Notwithstanding the new design and objectives of smart subsidies, many challenges have remained. The complexity and the multiple, often incompatible, objectives assigned to the new schemes raise tremendous challenges for proper implementation. Subsidies will impact input and output markets and interact with trade policies, and yielding positive outcomes is not given. Although revived they are subject to continued politicization and they should be carefully monitored and evaluated to track implementation performance, efficiency and sustainability.

The purpose of this paper is to provide a comprehensive review and analysis of experiences of implementing fertilizer subsidies in SSA since the early 2000s, trying to identify how these programmes fit into the wider food security tool box. From this, we try to formulate recommendations on how to provide policy advice to countries which are considering implementing fertilizer subsidies as part of their national agricultural strategic policy.

Section A provides the general framework against which fertilizer subsidies may be justified and analysed. Section B reviews various subsidy programmes that have been implemented in SSA and the available evidence on their impacts. Lastly, Section C builds on the review to provide some recommendations on the contribution that fertilizer subsidy can make to food security strategic objectives and on how they can be designed and implemented to reach those objectives.

A. What is the issue?

1. *Conventional analysis associates price subsidies with inefficiencies and high costs*

In a world of perfectly competitive markets, conventional economic analysis demonstrates that subsidies are not desirable as they inevitably result in economic inefficiencies and welfare losses (Crawford *et al*., 2006). Moreover, models for OECD countries indicate that subsidies are the least efficient way of transferring income to agricultural households (Filipski and Taylor, 2011). Experts indicate that in addition to the deadweight loss associated with any subsidy, fertilizer subsidies are largely unsustainable fiscally beyond the very short-term due to high financial and administrative costs. Moreover, experience shows inefficient distribution is more common than not and typically leads to delayed deliveries and/or inadequate deliveries in both quantities and quality.

Universal fertilizer subsidies are socially regressive because they create rents for better-off producers who would have used fertilizers anyway; the result is known as "displacement" which refers to the non-subsidized sales that are displaced as a result of the subsidy, and in worse case scenarios generate no increment in total fertilizer use. Lastly, centrally managed and distributed subsidies will discourage the emergence of a viable private sector for fertilizer distribution as it undermines the private sector's incentives to invest to reduce prices. The experience with pan-territorial, centrally managed, price subsidies from the 1960s and 1980s in SSA fits all of the above description.

An additional drawback relates to the political economy of subsidies, which can undermine their impact even where they would be well designed and economically efficient. Fertilizer subsidy programmes create opportunities for entrenched rent-seeking behaviour from distributors/retailers and for political interference for either personal and/or political gains. They represent an opportunity to establish and maintain political and electoral support through clientelistic networks (Banful, 2011). Such behaviours have the effects of (1) directing subsidies to recipients with more political voice (independently of their relative poverty levels), and (2) undermining competition and efficiency in input delivery systems. Additionally, fraudulent behaviours may constrain beneficiaries' access to inputs, when those controlling inputs request payments/tips or when "leakages" happen in the form of diversion across products or diversion away from the intended beneficiaries or even countries (Dorward and Chirwa 2011).

However, when input and/or output markets do not work, there might nonetheless be a case for subsidies, and this might well be the situation in SSA. African farmers may not be in a position to use fertilizer, or use it at the technical optimal levels, because they do not perceive the benefits and/or cannot afford to buy the fertilizer and/or they have no physical access to fertilizer. In such cases, fertilizer subsidies would be economically justified to address the market failures and poor incentives faced by some farmers.

2. *Fertilizer is a critical but scarcely used input in sub-Saharan African agriculture*

Given the poor natural endowments of African soils aggravated by poor management and sometimes damaging soil practices, there is broad consensus that substantial increases in inorganic fertilizer use are necessary to restore and maintain the fertility of African soils and enhance their productivity (Minot and Benson, 2009). Therefore in SSA, the imperative of facilitating farmers' access to fertilizers has been and remains on top of the priorities in national agricultural agendas. However, as detailed below, such increased use needs to be done in conjunction with supporting agronomic measures aimed at sustainable crop production intensification. Moreover, additional agronomic knowledge on yield responses for specific crops and/or agro-ecological zones is still needed. Kelly (2006) in her review of factors affecting fertilizer demand points out that "*the first step in evaluating incentives is to establish the yield response curve*" (page 13). Such yield response curves exist for some crops (e.g. maize) for larger regions (Vanlawue *et al*., 2011), but do not exist for most other staple crops, (e.g., cassava (Fermont *et al.,* 2010), plantain (Hauser, 2000), yams (Carsky *et al*., 2001)).

Historically, a significant share of the increases in yields that occurred during the Asian Green Revolution has been attributed to greater fertilizer use. While differences in labour supply and soil fertility may partially account for the lack of success in Africa, perhaps the two main reasons why the successes in Asia have not been replicated in Africa are the lack of irrigation and the diversity of agro-ecological systems and array of crops typically grown there. The Asian Green Revolution was based on two main food crops, wheat and rice, grown under irrigation, while in Africa an array of food crops are grown in predominantly rain-fed agriculture (Dadi *et al*., 2004).

i. Overview of fertilizer use intensity in SSA

SSA displays a combination of high soil nutrient deficits and very low fertilizer use. The region accounts for only 3% of global fertilizer consumption, a figure which has stagnated over the past two decades. As per Table 1, average fertilizer use intensity is, at 7 kg/ha, significantly lower than in other developing regions of the world. Large discrepancies exist, however, in the use of mineral fertilizers by farmers, as detailed further down.

Table 1: Fertilizer use in sub-Saharan Africa compared to other regions

(kg of fertilizer nutrients* per ha of arable and permanent cropland)

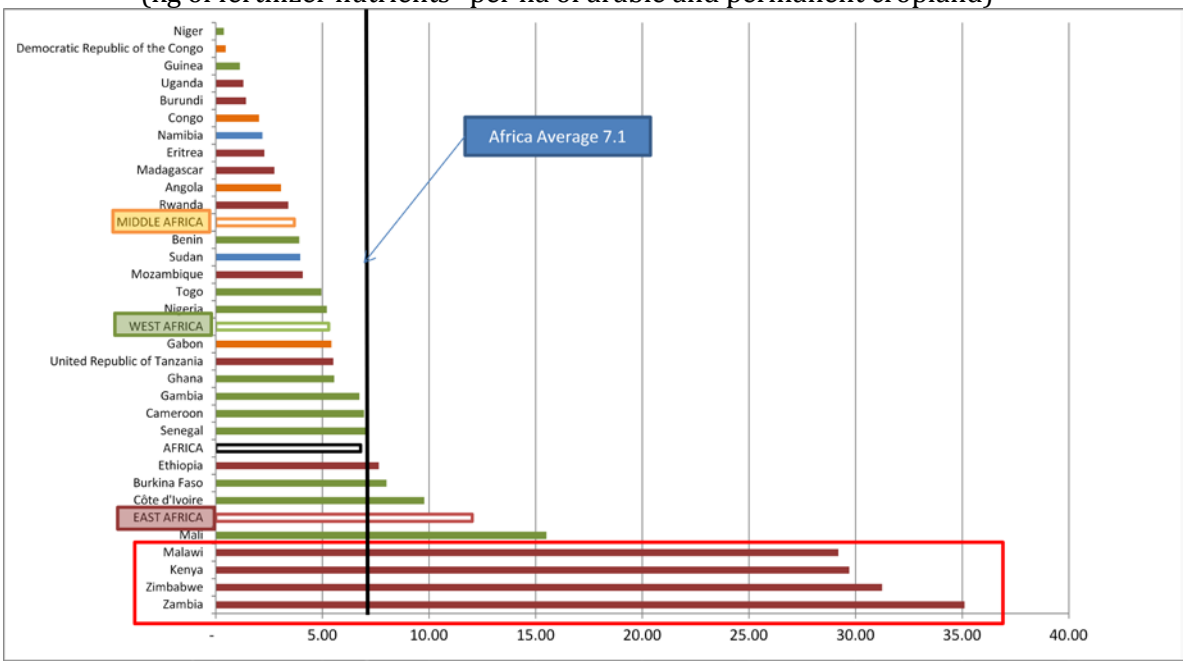
Region	2003-2005	2006-2008	% Change
Sub-Saharan Africa	7.0	7.1	1.9%
South Asia	109.4	129.4	18.2%
East & South East Asia**	107.6	109.6	1.9%
Latin America	99.7	104.8	5.1%

* Nitrogen (N), Phosphates (P_20_5), Potash (K_20); ** Excluding China and Japan

Source: FAOSTAT (2010)

At country level, we observe that notwithstanding the significant differences that exist (even in Zambia, where intensity of use is the highest in Africa), fertilizer application remains less than half that of other developing regions (**Figure 1**). From Figure 1, we see that East Africa is more fertilizer-intensive than West Africa, with the four most intensive fertilizer users in the continent. Moreover, if we take away a single data point (Mali, which displays a striking 38 kg per ha fertilizer use in 2005), there is no single country in West Africa that reaches the average fertilizer use of East Africa.

Figure 1: Average fertilizer use by country in SSA for 2002-2009
(kg of fertilizer nutrients* per ha of arable and permanent cropland)



* Nitrogen (N), Phosphates (P_2O_5), Potash (K_2O)
Source: FAOSTAT (2010)

ii. Main constraints to fertilizer use

It is recognized that low fertilizer use in SSA stems from a set of failures in input markets, complicated by broader rural development constraints.

On the demand side, poor price incentives (low and volatile prices of outputs), highly seasonal and variable production, lack of liquidity or credit and lack of knowledge about fertilizers undermine farmers' capacity to adopt the technology or their ability to reap the benefits of its use. With low and dispersed demand, the industry remains largely underdeveloped and suppliers also cannot make the economies of scale that would reduce the high costs of transporting, stocking and distributing fertilizers and eventually reduce the price to farmers. At local level, transport and storage facilities may be simply inexistent. Overall, it is estimated that transport and distribution costs (and various taxes)

represent up to 50% of the final retail price in SSA versus 20% only in Asian countries (Bumb, 2009)[1].

Box 1: Constraints to fertilizer use

Profitability (low marginal returns)	***Affordability (high fertilizer prices)***
➢ *Low marginal returns, in quantity:* • Lack of knowledge of farmers regarding fertilizer use • Fertilizer availability at wrong time • Poor soil quality • Lack of adequacy of fertilizer to soil, crop or climate • Limited irrigated area • Impact of climate (e.g. drought) • Lack of crop insurance ➢ *Low marginal returns, in value:* • No or limited market access • Low output prices • Volatility of output prices	➢ Lack of physical access (i.e. no supply available) ➢ High transport costs ➢ Small market size ➢ Market power with retailers ➢ Lack of credit

Source: authors.

Box 1 summarizes the different factors that might explain low fertilizer use in SSA. Optimal fertilizer use, as for any other production factor, is set at the level where marginal return of fertilizer equals marginal costs. Thus, if observed fertilizer use is low, this can be either a case of low marginal returns (profitability issue) or high marginal costs (affordability issue). It should be noted in addition that the need for additional investments to make fertilizer use profitable (i.e. seeds) might increase the cost of technically efficient fertilizer use thus increasing the role of risk factors (skill- or climate-related) and credit constraint (for risk-taking farmers) in the lack of adoption. Land tenure constraints could also matter, as a farmer who does not own his/her land can act rationally and efficiently by using up the natural capital of his/her soil (the soil rent) by depleting its nutrients without fertilizing and then moving on to a new, more fertile plot.

[1] This situation makes fertilizer more expensive in SSA than in the rest of the world. As an example, a tonne of urea is at least four times more expensive in Africa than it is in Europe and cost increases proportionately with distance and transport costs: it is 4.4 times more expensive in Mombasa, Kenya (a port), 5.5 times more expensive in Western Kenya (inland) and 8.5 times more expensive in Malawi (a landlocked country) (Mokwunye, 2011).

iii. Who uses fertilizer in sub-Saharan Africa?

Aggregated statistical data do not capture the large discrepancies in the use of mineral fertilizers among African farmers. Important regional and local variations can be observed. For example, fertilizer use in the Western Highlands of Kenya reaches up to 160 kg of N-P-K per hectare (Ariga *et al.,* 2008). Farmers operating in urban and peri-urban areas also use large amounts of fertilizers, quite often exceeding recommended rates and polluting surface waters (Gockowski, 1999, Gockowski *et al.,* 2000).

It is taken for granted that a large part of fertilizer is being used for commercial agriculture, in plantations of banana, palm oil, citrus, rubber, tea, coffee, etc. as well as in contract farming, such as cotton. This would reflect the higher returns associated with these crops and/or better functioning supply chains that assure availability and/or lower prices. When it comes to smallholder subsistence farming, maize receives the bulk of fertilizers (Crawford *et al*., 2006), leaving next to nothing for other staple crops, such as cassava, yams, plantains and grain legumes.

Identifying which farmers have higher probabilities of using fertilizer has been a common area of research. Local/regional differences may be explained in part by high heterogeneity of land quality, which limits the profitability of fertilizer use even within seemingly homogenous regions: Marenya and Barrett (2009a) find a threefold variation in marginal physical product per unit of fertilizer input). But land quality is not the only explanatory factor for fertilizer use variability, as farmers in high potential lands do not apply the same level of fertilizer.

In **Ethiopia**, farmers more able to implement farming techniques, with better access to markets and higher levels of wealth have a higher probability of using fertilizer. However, once a farmer uses fertilizer, the level of fertilizer use is mainly driven by the input/output price ratio (Zerfu and Larson, 2010). The importance of market incentives in driving fertilizer adoption in Ethiopia is also reported by Dadi *et al*. (2004) for the period up to 1996. However, Yamano and Arai (2011) show that following the shift towards state-led fertilizer market development in the late 2000s, market incentives no longer explain fertilizer adoption. In Western **Kenya**, younger, more educated farmers who have frequent contact with extension services are those most likely to use fertilizers; however, market-based incentives only seem to work once a minimum threshold of soil quality has been reached (Marenya and Barret, 2009b). Yamano and Arai (2011) also conclude that market incentives are the driving force for fertilizer adoption in Kenya. In **Uganda,** the lack of fertilizer market development implies that only farmers in areas close to the Kenyan border use fertilizer while in other regions only very wealthy farmers can afford the high fertilizer prices. Last, land tenure seems to be unrelated to fertilizer use, at least in **West Africa** (Fenske, 2011). From a gender perspective, FAO (2011b) reports lower fertilizer use by female farmers in particular in West Africa, probably as a result of lower access to other assets.

Some more consistent evidence could be obtained from analysis of agriculture modules of living standards measurement surveys (LSMS). The 2009 LSMS for the United Republic of Tanzania showed that market-oriented households almost double the probability of using chemical fertilizer, with a high concentration of users in the southern highlands, for maize growers and those having more land.

The above review demonstrates that there is no single policy instrument that can increase fertilizer use as there is myriad of reasons why farmers are (not) using fertilizers. Fertilizer subsidies only tackle the price constraint, in a temporary/punctual manner. This highlights the importance of understanding the incentives and constraints behind fertilizer use to evaluate the adequacy of fertilizer subsidies, improve the design to channel it where it is most needed and assess their relative performance compared to alternatives.

3. *The economic case for fertilizer subsidies*

Under current market and land tenure conditions (as reviewed above), low fertilizer use might well be the most efficient farm behaviour. But if fertilizer markets are not functioning, introducing a subsidy that fosters greater fertilizer use might well be necessary to maximize welfare. In other words, if both marginal returns and marginal costs are the result of perfectly functioning markets, the general assessment of inadequacy of subsidies sketched out above is valid. However, when this does not hold true, there might be a case for public intervention.

- **The justifications for fertilizer subsidies**

The different justifications put forward for subsidizing fertilizer can be grouped as follows (Crawford *et al.,* 2006; Morris *et al*., 2007):

- Subsidies are justified on *efficiency* grounds. They raise fertilizer to optimal levels for farmers who are meeting market failures (lack of knowledge and/or high perceived risk versus benefits and/or low affordability). If subsidies can raise fertilizer use to optimal levels – including the uptake of fertilizer by smallholders currently applying close to zero fertilizer – and if the social benefits of the interventions do not outweigh their cost, then they can be justified. Based on the efficiency argument, it is hoped that subsidies will kick-start innovation (at farm level) and stimulate rapid market development (at industry level) (Morris *et al*., 2007).
- Subsidies may also be justified on *equity* grounds. They served as an income transfer to poor smallholder households, when well targeted (Crawford *et al*., 2006).
- Subsidies may be adequate finally when they help counteract the *negative externalities* of decreased soil fertility (increased rural poverty and migration to cities).

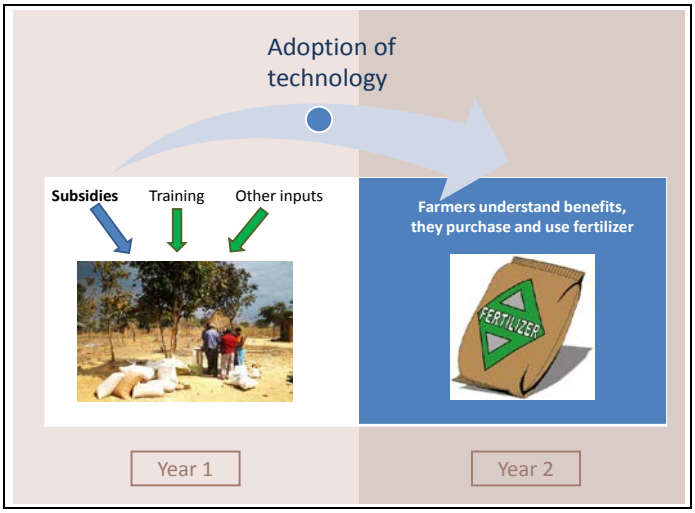
The rest of the discussion in this section focuses on the efficiency of fertilizer subsidies. However, when reviewing the evidence of fertilizer subsidy success in section B, we come back to equity issues.

- **Two entry points for raising efficiency**

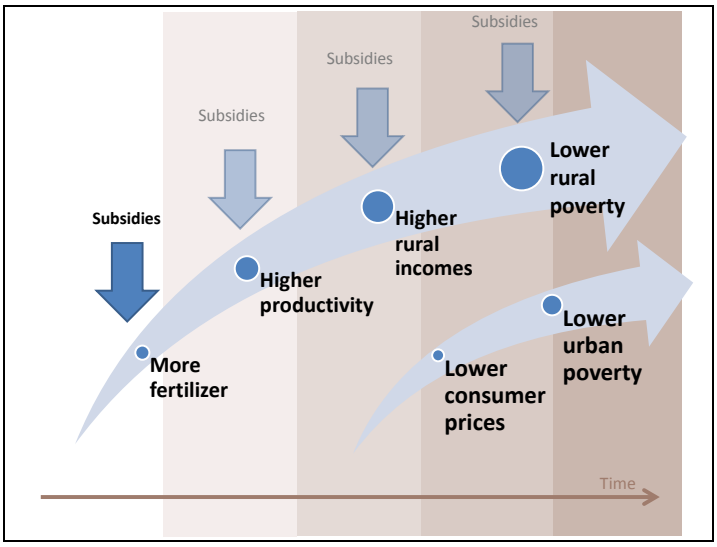
There are two main entry points to raise the level of efficient fertilizer use: a) increasing the marginal benefit of fertilizer use by promoting technology adoption and farmer learning by encouraging farmers to test inputs; b) increasing the affordability of fertilizer by reducing input prices, until a market reaches a size sufficient to capture economies of scale.

In the first approach, the subsidy reduces ***farmers' perceived risks and/or lack of knowledge of fertilizers benefits and use*** by making fertilizer available at an affordable price and in small quantities, for testing on a temporary basis. Generally this is implemented with complementary interventions addressing demand-side constraints and distributed with other productivity-enhancing inputs (seeds, pesticides, etc.) (**Box 2**). This approach believes that temporary price reductions of subsidized inputs for poor/constrained farmers increase their profitability and reduce the risk perceived by farmers in adopting them even in the absence of a price incentive.

Box 2: Punctual demonstration programmes
for technology adoption by smallholders



Box 3: Multi-year subsidies
for large input and output price reductions



The second approach addresses primarily the ***high cost of inputs (affordability)***, by using subsidies on a recurrent and large scale. This approach believes that the increases in production resulting from the subsidy can "thicken the supply chain" and "kick-start markets" inducing reductions in both input and output prices: "*subsidies are expected to relieve both affordability and profitability constraints to increased staple crop productivity from increased input use, and in doing so it would raise land and labour productivity and improves food security for large numbers of poor households through some combination of increased real wages and reduced food prices*" (Dorward, 2009) (page 23) (**Box 3**). Those additional benefits will be achieved when increases in production are sufficiently large to allow output prices to diminish, i.e. when the subsidies are on a very large scale (in terms of price reductions, target population and duration). Additionally, such benefits will be realized only if they are accompanied by complementary measures on both input and output markets to assure fertilizer market development and output markets for the additional production (*ibid.*).

Findings from Duflo *et al* (2009) highlight that the low affordability of inputs could also be tackled using ***time-specific interventions***, rather than by large magnitude programmes, because time constraints in accessing cash or credit can explain why farmers cannot afford to buy the needed fertilizer in time for the season (**Box 4**). Their approach minimizes the importance of market failures and highlight that low affordability of fertilizer can be solved with very punctual interventions rather than multi-year subsidies.

Box 4: Time-specific subsidies

Duflo *et al.* analyse that, since farmers use harvest income in a sequential manner, when time comes to purchase fertilizer, harvest proceeds are already spent and they can no longer afford it. As a result fertilizer use remains low.

The authors find that the issue can be addressed using small and time-limited reductions in the cost of fertilizer at the time of harvest, which has the potential to induce substantial increases in fertilizer use as much as considerably larger price cuts later in the season. Such small time-limited discounts could help present-biased farmers commit to fertilizer use without substantially distorting decisions of other (non-procrastinating) farmers and incurring other costs of heavy subsidies.

Source: Duflo et al. (2009)

- **Conditions for raising efficiency**

In order to maximize economic efficiency, subsidies should be ***targeted to farm households who are meeting market failures***, as identified above. In the first case, the subsidy is targeting a few highly constrained farmers, while in the second the subsidy is targeted to larger portions of the farmers' population. This is because in the first instance, the subsidy aims at raising farm household's profit function, while in the second it aims at lowering the input-output price ratio both in the short run (i.e. during the existence of the subsidy) and over the long run (i.e. by increasing the fertilizer market size). In both cases, subsidies introduced should also be removed once farmers have acquired sufficient experience or once the market has reached a critical size to reduce prices (Morris *et al.,* 2007).

Efficiency and the distribution of benefits will depend, not only on market failures, but also on the ***elasticities of supply and demand***. As explained by Dorward (2009), they will be greater when subsidies are geared towards staples, as consumers' benefits are maximized when there is *inelastic commodity demand* while supplier benefits are maximized when there is inelastic supply. Additionally, a simulation-based impact evaluation of alternative rural household transfers found that, under the assumption of *elastic input supply* and *inelastic input demand*, input subsidies dominate cash transfers in terms of both efficiency and effects on agricultural production. If *input supply* becomes *inelastic,* however, input subsidies are an inferior transfer compared to both social cash transfers and output price support (Filipski and Taylor, 2011).

4. *Can subsidies be the answer?*

- **The profitability of fertilizer use**

Fertilizer subsidies relieve the affordability constraint of fertilizer temporarily (if there is no rent-seeking behaviour by fertilizer dealers) but price might not be the only bottleneck preventing widespread input use. Farmers can face a number of constraints, as explained above. Understanding them and identifying the market failure that causes them is key to evaluating the adequacy of fertilizer subsidies, improving the design and assessing their relative performance compared to alternatives.

In particular, profitability of fertilizer use is not guaranteed. Using fertilizer will not be profitable under any ***market condition,*** for instance in some remote areas where output prices are too low (Minot and Benson, 2010). Additionally, ***the technical efficiency of input use*** is critical in reaping subsidies' benefits and depends upon the quality and appropriateness of inputs, the timing of their delivery to farmers, the availability of complementary resources (for example, seed and fertilizer together), extension services, agro-ecological conditions, and farmers' technical skill or competence in using the inputs (Dorward and Chirwa 2011).
Therefore, *stricto sensu*, subsidies would be justified only under certain agro-ecological and rural livelihood conditions (in high densities areas with market access, favourable agro-economic conditions, crops response to fertilizers with good soil-crop management practices (soil, water, pest and climate) (Dorward, 2009).[2] Elsewhere they may be adopted but they would have to be accompanied by a comprehensive set of *complementary measures* (i.e. improved market access, soil quality improvement), which tackle the other constraints to profitability.

Finally, since fertilizer subsidies can only raise the affordability of fertilizer on a punctual basis, they are unsustainable as a longer-term poverty reduction instrument or unable to strengthen dynamic commercial input markets (Morris *et al*., 2007). As such, they cannot constitute, in and by themselves, a comprehensive response to multiple rural development issues. The questions are: how subsidies should be best designed to promote sustainable fertilizer use, even after they are phased out? And what are the existing trade-offs and complementarities between subsidies and other interventions (transfers, interventions on input or output markets) in order to reach a defined set of objectives? Against this background, one needs to understand how input subsidy programmes fit into the different food security strategies of SSA countries and how they can be successfully operationalized to reach national objectives.

[2] The Alliance for an African Green Revolution (AGRA) refers to such places as "Africa's bread-basket areas", i.e. those with greatest potential to replicate green revolution type of outcomes.

iv. The role of inorganic fertilizers' role in raising soil productivity

The attractiveness of rapid impact from subsidies may constitute a disincentive for farmers, policy makers, politicians and development partners to address long term soil and land health problems (such as lack of soil organic matter, soil compaction, poor biological processes, high water run-off and soil erosion, etc.) (Poulton *et al.,* 2006). Fertilizer subsidies have to be considered in the broader context of sustainable intensification soil health practices which might include more comprehensive approaches to land management combining different activities (**see Box 5** for details).

The Strategic Investment Programme for Sustainable Land Management in SSA Africa promotes an integrated and synergistic resource management approach that calls for community-based participatory planning of technology developments, in which fertilizer use becomes part of broader plant nutrition management. The challenge is to raise input use efficiency while maintaining ecosystems stability and the preservation of natural resources.[3] In line with these objectives, Integrated Soil Fertility Management (ISFM) approaches advocate for a more limited but more efficient application of inorganic fertilizer, to complement the use of organic fertilizer, which has the best chance to sustain production on fragile soils (Vanlauwe *et al.,* 2001), and other good agricultural practices such as crop diversification or rotation. This approach belongs to the broader integrated sustainable intensification approach, which aims at raising productivity in a sustainable way, using good agricultural practices to trigger agronomic efficiency of fertilizer and recapitalize or maintain soil fertility (**see Box 5** for details).

Box 5: Sustainable agriculture and integrated soil fertility management

Intensive agriculture cannot be sustained unless nutrients are applied to the soil to replace those removed through erosion, land degradation and increased crop production. Sustainable agriculture promotes approaches that will maximize productivity of soils while at the same time maintaining and enhancing environmental and natural resources sustainably. The role of inorganic fertilizer in this context can be framed as follows:

- **Sustainable agriculture**. As defined by the United States Department of Agriculture in the 1990 Farm Bill sustainable agriculture must: "[…] over the long term, satisfy human needs, enhance environmental quality and natural resource base, make the most efficient use of non-renewable resources and integrate natural biological processes, sustain economic viability, and enhance quality of life." (US GOP, 1990). Sustainable agriculture does not refer to a prescribed set of practices and it differs from organic agriculture because, in sustainable agriculture, agrochemicals (synthetic fertilizers and pesticides) still play a role.
- **Sustainable crop production intensification (SCPI).** Promoted, among others, by FAO, sustainable intensification approaches aim to increase crop production per unit area, taking into consideration all relevant factors affecting productivity and sustainability, including potential and/or real social, political, economic and environmental impacts.

[3] Inorganic fertilizer can damage water sources, soil health, fauna. Additionally, the production of nitrogen fertilizers involves large production of energy and nitrogen-based fertilizer formulas are responsible for significant greenhouse gas emissions (Dorward andChirwa, 2011). At current levels of fertilizer use however, environmental concerns are not yet a predominant issue in SSA but should be factored in as greater use is promoted.

Recognizing that fertilizers are applied in ways and quantities that are far from efficient, it promotes an Integrated Soil Fertility Management (ISFM) approach (FAO, 2011).

- **Integrated soil fertility management ISFM** is one of the most used means to promote sustainable agriculture and concerns technologies that combine the use of soil amendments (organic matter, phosphate, lime) and inorganic fertilizers. This approach includes, among other measures, a shift from the use of mineral fertilizers to combinations of mineral and organic fertilizers (obtained on and off the farm), from exploitation of soil fertility to its maintenance and improvement, and from soil fertility management to more comprehensive soil productivity management (Vanlauwe *et al.,* 2010).
- **Organic and Inorganic fertilizer use.** Organic and inorganic fertilizers act as complements rather than substitutes. Organic fertilizer alone cannot solve the fertilization deficit of African soils. First because of its properties: soil nutrient losses occur when plant uptake and nutrient release from fertilizers are not synchronized, e.g., at crop establishment when crops are too young to take up large amounts of nutrients or through erosion and the application of organic fertilizers, animal or green manure, can replenish only some of them (Agwe *et al.,* 2007). Additionally, organic manure transport is labour-intensive and it is not sufficiently available to address Africa's soil nutrient losses to the required level (Morris *et al*., 2007). Combined with inorganic fertilizers however, manure plays a crucial role in improving fertilizer use efficiency and soil moisture conservation (Vanlauwe *et al.,* 2011).

- **The impact of the high food and fertilizer prices contexts**

It is unclear how the current context of high and volatile food prices will impact on the affordability and profitability of fertilizer for smallholders and what the implications are for assessing the value of opting for subsidies. High and volatile food prices make African smallholder agriculture potentially more profitable and smallholder farming more influential as a force for poverty reduction but it also makes farming more risky. At the same time, damaging land practices, the steady trends of land erosion, climate change and increasing frequency of extreme weather events change the agro-ecological production environment. It is yet unclear how these new economic and ecological conditions will affect the performance of agricultural production, farmers' welfare and the quality of the fields in SSA (World Bank, 2011).

It has been established that smallholders might not benefit as much as they could from high selling prices for their production due to low access to inputs, and to information and institutional failures. This makes a strong case for establishing price subsidies on inputs, especially for net food buyers for whom the affordability of input use is exacerbated by the currently high prices of food (Dorward, 2009). But since the context is also marked by very high fertilizer prices , impacts will vary depending on farmers' market situation as well as the relative situation of input versus output prices. If fertilizer prices rise even more than food prices, as was the case during the 2008 crisis, high input prices would reduce the profitability of input use as the short term returns of using fertilizer would be low. Without facilitating access to inputs at better prices however, one can argue that food production will fall, increasing further domestic prices and raising even more the

affordability issue (*ibid*.). This has been a strong justification for governments and donors alike to support subsidy programmes after the 2008 food crisis.

B. What is the evidence?

1. *Overview of country programmes*

We review in this section a total of fourteen interventions classified in **Table 2** according to their design. Three broad types of programme design can be distinguished: in the early 2000s, *demonstration packages*; thereafter *large-scale multi-year programmes* that were either *targeted* (in East & Southern Africa) or *universal* (in West Africa).

Table 2: Overview of 14 input subsidy programmes in sub-Saharan Africa

<table>
<tr><th colspan="2">Type of subsidy (design)</th><th>Date / Country / Programme</th></tr>
<tr><td>Early 2000s
Demonstration Programmes</td><td>Temporary
Small quantities, Free
Physical distribution</td><td>• (localized) Sasakawa Global 2000 (1998-1999, several countries)
• (national) Malawi StarterPack 1998 (untargeted) and TIP 2003-04, both moved to vouchers</td></tr>
<tr><td rowspan="2">Late 2000s
Multi-Year Subsidies</td><td><u>a) Targeted ('smart')</u>
Multi-year
≥ 50% price subsidy
Vouchers</td><td>• Kenya NAAIP 2007-on; Malawi AISP 2005-on; Rwanda CIP 2007-09; United Republic of Tanzania NAIVS 2008-13; Zambia FSP 2002-on (physical distribution)</td></tr>
<tr><td><u>b) Universal</u>
Multi-year
≤ 50% price subsidy
Physical Distribution</td><td>• Burkina Faso 2008-on; Ghana 2008-on; Mali RI 2008-on; Nigeria FMSP 1999-on (vouchers piloted); Senegal GOANA 2008-15</td></tr>
<tr><td colspan="2">Several countries: Sasakawa Global 2000, 1998-99
Burkina Faso: 2008-on
Ghana: 2008-on
Kenya: NAAIP (National Accelerated Agricultural Input Programme) 2007-on
Malawi: StarterPack 1998; TIP (Targeted Input Programme) 2003-04; AISP (Agricultural Input Subsidy Programme) 2005-on</td><td>Mali: RI (Rice Initiative) 2008-on
Nigeria: FMSP (Federal Market Stabilization Programme) 1999-on
Rwanda: CIP (Crop intensification programme) 2007-09
Senegal : GOANA (« Grande Offensive Agricole pour la Nourriture et l'Abondance ») 2008-on
United Republic of Tanzania: NAIVS (National Agricultural Input Voucher System) 2008-13
Zambia: FSP (Fertilizer Support Programme) 2002-on</td></tr>
</table>

i. Demonstration Programmes

At the beginning of the 2000s, subsidies were implemented as demonstration packs in several countries with the main objective of raising awareness on fertilizer use and demonstrating its utility to smallholder farmers. This follows the first theoretical model identified in section A and depicted in Box 3, by which punctual subsidies are designed in the form of demonstration packages to facilitate quick technology adoption through the demonstration of fertilizer's benefits.

Demonstration Packs			
Country	**Malawi**	**Malawi**	**Several countries**
Name & date	**Starter Pack** 1998	**TIP** 2003-04	**Sasakawa Global Initiative 2000** 1998-99
Targeted	No	Yes – Poor 25% of farm households	Geographically (village or region)
% subsidy	100% on 0.1 ha	100% on 0.08 ha	Credit at 0%
Distribution	Physical distribution, moved to vouchers	Physical distribution, moved to vouchers	Physical distribution
Other inputs	Seed subsidy Extension		Extension
Source: adapted from Dorward, 2009.			

Demonstration packs were programmes implemented punctually (one to a few years) which distributed to a significant number of farmers (all or a high percentage of all in a given country or area) small quantities of free or heavily subsidized fertilizer, generally as part of a package involving complementary inputs and training/extension. Examples include two demonstration packages implemented in Malawi, the Starter Pack (universal, rationed subsidy) and Targeted Input Programme (targeted version of the Starter Pack), or the
Sasakawa Global Initiative programmes implemented from the mid-1990s to the early 2000s in several African countries (**Box 6**).

Box 6: Demonstration programs, Sasakawa Global 2000 in Ethiopia

During the 1990s, the Sasakawa Global Initiative (www.saa-safe.org) implemented a series of pilot programmes to promote crop productivity in Africa. This took the form of introducing packages of improved technologies (comprising mainly fertilizer and improved varieties plus crop management information) to more than 3 million farmers through extension demonstration plots. Sasakawa Global 2000 was active in 14 countries throughout Africa.

Ethiopia is acknowledged as one of the most successful pilot countries of the Sasakawa Global Initiative. This initiative, in collaboration with national extension services, sought to promote rapid adoption of new seed/fertilizer technologies by providing free credit for inputs, which would be bought from the private sector, together with extension efforts on closely supervised, half-hectare demonstration maize plots cultivated by individual small-scale farmers in high-potential agro-ecological zones on their own land. Farmers initially targeted were, on average, less poor and more educated. After one or two years the support is withdrawn and farmers are expected to continue using the new technologies due to their superior performance. In this sense, the Sasakawa Global experience considers the low fertilizer use trap as an awareness problem.

Results showed consistent yield increases both during the programme and afterwards, which could pay for the additional costs of fertilizers under a broad range of input and output prices. The success of the pilot programme led the Government of Ethiopia to continue the approach,

broadening its target population under the New Extension Program (NEP) moving from 32 000 beneficiaries in 1995 to 600 000 in 1997 and an expected 3 000 000 in 1998. However, this up-scaling brought along new implementation problems with less-targeted extension and more emphasis on relaxing credit constraints and fertilizer availability. Thus the NEP shifted emphasis from awareness towards affordability.

Sources: Howard et al. *(1999); Stepanek* et al. *(1999) and Gebre (2001).*

ii. Multi-Year subsidies

The second approach involves subsidies to boost national production and productivity by making inputs more affordable on a very large scale and over a longer time period. Those objectives are possibly combined with a clear poverty reduction objective. Wanzala-Mlobela *et al.,* (2011) report that for the four schemes they review these were stated objectives, combined with up to a maximum of three others.[4] This follows the theoretical model identified in section A 3. (and represented in Box 3) where multi-year subsidies are designed to kick start markets and bring about large reductions in both fertilizer and output prices. We distinguish two groups of subsidies depending on whether these are targeted to a specific farmer category, crop and region or more or less universal.

- Targeted subsidies

We consider targeted subsidies the five recent programmes implemented in East and Southern Africa – in Kenya, Malawi, Rwanda, the United Republic of Tanzania and Zambia. These subsidies correspond to what is understood as a new model of pro-poor, targeted, and market-friendly "smart" subsidies. The example of Malawi is telling of the evolution of African programmes from demonstration packs at the beginning of the decade to those larger but more targeted subsidy programmes in the late 2000s. The objectives of the Malawian schemes evolved from social protection for vulnerable households with the first programme (Starter Pack), to kick-starting agricultural production with the second (Targeted Input Programme), to national food production and self-sufficiency objectives in the third and so far final phase (AISP). This translated into a much greater scale for the AISP (130 000 tonnes of input in 2005/6 versus 50 000 tonnes two years earlier with the TIP). The scale of the new programmes involves very large organizational, logistical and time management challenges: in 2008/9 there were 1.5 million beneficiaries (or about 65% of farm households), about 6 million vouchers distributed and about 3 million bags of subsidized fertilizers purchased.

[4] Improve private-sector input distribution, reduce urban food prices and compensate factors making fertilizers expensive where the additional objectives.

Targeted subsidies					
Country	**KENYA**	**MALAWI**	**RWANDA**	**UNITED REPUBLIC OF TANZANIA**	**ZAMBIA**
Name & date	**NAAIP** 2007-on	**AISP** 2005-on	**CIP** 2007-10	**NAIVS** 2008-on	**FISP** (ex-FSP) 2002-on
Number of beneficiaries	2.5 million	1.5 million or 65% of farm HH	0.7 million	2.5 million	0.5 million
Targeted crops	Staples	Maize + tobacco	Maize, wheat, potato	Maize, rice	Maize
Targeted farmers	Poor	Poor	Poor Land > 0.5 ha	Poor Land < 1 ha in high potential areas	Less poor Land 1-5 ha
Allocation criteria		Farm size and need[5]		Female-headed HH in priority	
% subsidy and ration	100% on 1 acre or for 2 bags	64-91% on 1 acre or for 2 bags	75%, 50%, 25% Up to 3 bags	50% on 1 acre or for 2 bags	50-60% on 2 acres (1 ha bef. 2009) or for 4 bags
Distribution system	Vouchers	Vouchers	Vouchers (2010 & on)	Vouchers	Physical distribution (cooperatives & FOs)
Other inputs	Seed subsidy	Seed subsidy Extension	Seed subsidy Extension Land consolidation	Seed subsidy	Seed subsidy
Participation of agro-dealers	Encouraged	Very limited (dealers affiliated importers)	Encouraged	Encouraged	Limited
Source: authors					

[5] Full time smallholder farmers who cannot afford to purchase one or two bags of fertilizer at prevailing commercial prices as determined by local leaders in their areas (SOAS *et al*., 2008).

Targeted programmes have in common their large scale in terms of number of beneficiaries (e.g. 2.5 million in Kenya), time-frame (multi-year, e.g. 10 years in Zambia), coverage (nation-wide), and implementation arrangements (targeted and/or using vouchers). As a result, subsidized sales cover a significant share of total fertilizer market (e.g. up to 42% in Malawi) and they also absorb a significant part of total public expenditure in agriculture (e.g. 60% in Malawi, up to 50% in the United Republic of Tanzania and 40% in Zambia). Those programmes are ongoing and have run for already many years (3 years or more), generally without a clear time frame and exit strategy (with the exception of Rwanda and the United Republic of Tanzania). There is strong national ownership of those initiatives, for which funding comes primarily from national budgets (e.g. Zambia 100%; the United Republic of Tanzania 50%), with some co-funding by development partners.

- Universal subsidies

West Africa (**Burkina Faso, Ghana, Mali, Nigeria and Senegal**) are implementing fertilizer subsidies which seem to revert to universal (untargeted) price subsidies, targeted at specific crops only (rather than farmers). In four cases out of five, this has been implemented following the food and fertilizer crisis of the late 2000s.

Universal Subsidies					
Country	**Burkina Faso**	**Ghana**	**Mali**	**Nigeria**	**Senegal**
Name & date	2008-on	2008-on	**Rice Initiative** 2008-on	**FMSP** 1999-on	**GOANA** 2008-on
Number of beneficiaries	0.5 Mill	0.9 Mill	*unknown*	*unknown*	*Unknown*
Targeted crops	Rice, maize, cowpea + cotton (credit)	Staples + cash crops	Rice, maize, wheat + cotton (credit)	Staples	Staples
% subsidy	≤ 50% (15-30% actual)	50% (30-50% actual)	25%	25% (federal) +0-60% (state)	50%
Distribution system	Physical	Physical (Vouchers piloted and dropped)	Physical (Vouchers may be piloted)	Physical (Vouchers piloted in several states)	Physical Local committees
Participation of agro-dealers	None (Public offices)	Very Limited (dealers affiliated importers)	Very Limited (dealers affiliated importers)	None (Public outlets)	*unknown*
Other inputs	(None)	(None?)	Seed subsidy	(None)	Seed subsidy
Source: authors					

As an example, in 2008, in response to the food and fertilizer price crisis, Mali launched a fertilizer subsidy targeted at rice (which was extended thereafter to other crops). Under this scheme, all farmers growing the targeted crops are eligible and receive fertilizers in proportion of the size of their planted area. Implementation is quite complex and involves a paper form ("*caution technique*") indicating the number of bags each farmer is eligible and which is used both at the time of fertilizer allocation and reimbursement of

suppliers/dealers[6]. More details on this are provided in **Box 7**. Funding, as in other recent schemes, is largely national (Burkina Faso 100% in 2008 and 2010; Mali 70%; etc.)

Besides the focus on food crops in Burkina Faso, Mali and Ghana, plantation farmers have also received subsidies. Under such schemes, the company procures the fertilizer, distributes it and manages the credit. The system seems to function better than procurement and distribution through the state decentralized offices (Burkina Faso) or through distributors under contract with the state (Mali), but it benefits only farmers already affiliated to the companies. In the case of Burkina Faso and Mali, cotton companies/offices provide the fertilizer in the form of input credit to cotton farmers. In Burkina Faso, credit to cotton farmers is extended to cereals fertilizer, to avoid the typical diversion of cotton fertilizer to food crops (cereals).

Box 7: Mali, overview of the Rice Initiative fertilizer subsidy

Objectives of the subsidy. Starting in 2008/09, the Government of Mali (GoM) launched a large fertilizer subsidy programme for rice producers. Since the 2009/2010 planting season, the subsidy also covers other crops such as cotton, wheat and maize. The subsidy programme was part of the Government's response to the 2008 increases in cereal prices but it also constitutes a structural measure to increase production and make Mali a net cereal exporter within the next five years. In addition to the subsidy, the GoM Rice Initiative programme also supplies machinery, seeds of improved varieties and additional technical assistance for producers.

Programme costs, funding. In 2008/09, GoM spent an estimated CFA 11.5 billion (approximately €17.5 million) on fertilizer subsidies. For that year, government expenses for the fertilizer subsidies were more than 25 percent higher than planned. Funding for the 2008/9 and 2009/10 planting seasons came from GoM's own funds and from development partners including Canada, the Netherlands and the African Development Bank (37 %). However, lack of transparency and leakages issues led some donors to suspend their contribution in the 2010/11 season.

Design of the subsidy. The subsidies targeted urea and di-ammonium phosphate (DAP) to ensure a CFA 12 500 retail value for 50 kg fertilizer bags. For urea, this represents a 22 per cent subsidy and for DAP, it amounts to a 43 % subsidy. At present, producers are eligible for the subsidy based on their planned planted acreage of eligible crops. In controlled irrigation areas, the adequate quantities of fertilizer are 2 bags of DAP and 4 bags of urea per ha. In flood areas, the quantities are 2 bags of DAP and 3 bags of urea per ha. The number is rounded to integer number of bags.

Implementation. A producer needs to register the regional Ministry of Agriculture office (Direction Régionale de l'Agriculture, DRA). In some remote areas, producers were not aware of the subsidy and registration has been low. As a result, they buy unsubsidized fertilizer. An information campaign took place in 2010/11 to increase registration and take-up. Based on his/her planted area, the producer is eligible to buy up to a given number of subsidized fertilizer bags. The DRA issues the producer a *caution technique* (technical

[6] Interestingly, in Burkina Faso, since the subsidy is universal, the state felt compelled to provide specific support to the most disadvantaged farmers and is to launch another programme for smallholders (< 5 ha) including a price subsidy on fertilizers maintaining the percentage of subsidy over the whole period in contrast to other farmers who receive a decreasing percentage of subsidy over three years (from 75% down to 25%).

guarantee, on paper), which mentions the number of bags he/she is eligible to buy. The DNA (Direction Nationale de l'Agriculture) issues a nominative list, which enables GoM to plan the amount of fertilizer and subsidy and issue the "caution technique".

If producers receive credit through a producer organization, they obtain the fertilizer from their organization. If they do not receive credit, producers use their *caution technique* to buy fertilizer either through (1) a private dealer under contract with GoM, or (2) with local dealer. Dealers, DRAs and producers' organizations then submit the proofs of sales to the National Bank for Agricultural Development (Banque Nationale du Développement Agricole, BNDA), which reimburses them the value of the subsidy. This last step is a lengthy process and can take up to 8 months or more.

Source: authors; Government of Mali (2009a and 2009b)

2. *Smarter subsidies?*

Looking at new programme design implemented after the mid-2000s, the question to be asked is whether the new subsidy schemes are truly "smart" in design and in practice. There is no single commonly agreed definition of "**smart subsidies**" in the literature. There is agreement that smart subsidies are targeted to farmers and seek to enhance their welfare and are market-friendly, involving the private sector in fertilizer distribution. Minde and Ndlovu (2007b) describe "smart" subsidies as those involving: (S)pecific targeting to farmers who would not otherwise use purchased inputs (or to areas where added fertilizer can contribute most to yield improvement); (M)easurable impacts; (A)chievable goals; (R)esults orientation; (T)imely duration of implementation, i.e., being time-bound or having a feasible exit strategy.

i. Targeting to smallholders

The main objectives of recent "smart" schemes remain, by and large, focused on increasing agricultural production.[7] To do so, schemes are *targeted* to *smallholders*, thus assuming that these are the ones who will have a higher raise marginal fertilizer use. The following characteristics serve to demonstrate the change in paradigm:

- Five countries have large-scale targeted programmes that focus on poor/constrained smallholders for specific crops, nationally (as in Malawi or Kenya) or in specific areas (as in the United Republic of Tanzania, where NAIVS focuses on landholders with less than 1 ha in high potential areas). Other countries target less-poor households (as in Zambia, landholders with more than 1 ha but less than 5 ha, theoretically). Such innovations in targeting the subsidies make them a progressive type of transfer that covers at the same time a large fraction of agricultural households (e.g. in the United Republic of Tanzania 2.5 million planned and reached in 2011; in Zambia 500 000 in 2009).

[7] This is the only objective found for all eight programmes reviewed in Wanzala-Mlobela *et al.* (2011).

- In addition, programme design generally includes **rationing**, which sets a ceiling of subsidized volumes per beneficiary (e.g. 1 acre equivalent in Kenya or in the United Republic of Tanzania).
- Subsidies are **geared towards staple crops**, primarily maize (which is widely consumed and has a commercialized surplus, and with hybrid maize very responsive to fertilizers). Other targeted crops are rice, then sorghum, cowpea, etc. Nonetheless, a tendency to extend the subsidy to cash crops has also been observed, for example tobacco growers in Malawi or cotton or cocoa farmers in West Africa.
- New targeted programmes imply a **high rate of subsidy**: about 50% in Zambia and the United Republic of Tanzania; 64-91% in Malawi but also 100% in some exceptional years in Kenya. In Rwanda, the subsidy starts at a high rate which decreases over time (75%; 50%; 25% over three years) to devise an exit strategy. In Nigeria, the subsidy rate varies greatly as it includes variable top-ups by regional governments to a 25% subsidy provided by the federal state.
- Some recent subsidy programmes explicitly include poverty reduction in their objectives, such as Malawi (programme focus is on small farm household food security) or the United Republic of Tanzania (programme focus is on national but also household food security). Others explicitly support "smallholders for increased national food supply" (Zambia, Rwanda, or Nigeria and Ghana).

Finally, a minority of subsidies have an explicit focus on supporting the development of the fertilizer distribution/supply markets: Kenya, the United Republic of Tanzania and Rwanda (as well as Malawi and Zambia, but only in theory). In all cases, this remains a secondary and not a primary objective of the subsidy programmes.

ii. Use of vouchers

Smart subsidies also brought about change in implementation, principally with the introduction of **vouchers** in all targeted schemes, except in Zambia. Vouchers promote private-sector participation as they can be redeemed at any eligible agro-dealer shop. They act as coupons to transfer purchasing power to targeted smallholder farmers either by reducing the price of the input below market cost (the voucher has a fixed face value as in the United Republic of Tanzania) or by allowing farmers to acquire inputs at a fixed reduced price (the voucher has a flexible value as in Malawi). Farmers redeem the value of the vouchers for inputs at local, often small-scale, private input suppliers. The suppliers, in turn, take the voucher to a designated agency, which reimburses them for the value. For suppliers, the vouchers are a way to guarantee demand, potentially capture economies of scale in their business and reduce their risk.

Input vouchers are one possible way to make subsidies smart, in that they can simultaneously serve as a mechanism to target subsidies, develop demand in private markets (redemption of vouchers is done at private-sector suppliers) and associate the voucher scheme with financial institutions providing credit to farmers or retailers. They have the additional advantage of bringing greater flexibility in the implementation of the subsidy and greater transparency (tracking of delivery and use). On the negative side, they involve higher financial and administrative costs (linked to the production and to the distribution and allocation of vouchers and finally to the reimbursement of suppliers) and are prone to fraud (counterfeit vouchers) or to the creation of secondary markets. While there is a clear consensus about input vouchers being a preferable delivery mechanism to direct distribution, proper implementation is necessary in order to reap their potential benefits.

iii. Theory and practice of smart subsidies

While theoretically aligned with the smart schemes approach, actual design and implementation of large targeted subsidies is not necessarily "smart". The case of Zambia FISP, the objectives of which are very "smart" but did not translate into practice on several programme features (targeting, private-sector involvement, duration and costs) provides a detailed example (**Box 8**).

Box 8: Challenges of making smart design work in practice: the example of the Zambia FISP

Objectives of the subsidy. The FSP programme has been operating in Zambia since 2002, when it was conceptualized as a programme that would build both smallholder farmer and private-sector capacities (promotion of the participation of private traders in supply) as part of a transition to full market liberalization. The objectives are therefore fully in-line with "smart" subsidy schemes.

Subsidized input pack and number of beneficiaries.

- The input pack subsidized under the FSP is geared towards maize. Initially, it comprised 8 bags of 50 kg of fertilizer (4 + 4 bags of two types of fertilizers) and 20 kg hybrid maize seeds, for 1 ha equivalent of maize cultivation. It provided for 125 000 households by then.
- Starting 2009, total volume of fertilizer subsidized doubled (from 50 000 to 100 000 tonnes). At the same time, the programme halved the input pack it used to supply. As a result the number of beneficiaries rose to 500 000 households, that is, nearly half of the farmer population.

Pro-poor targeting.

- The programme is theoretically targeted at smallholders in the 1-5 ha category, but in practice this criteria is not enforced and one sees that among the 1-20 ha landowners, farmers with the greatest landholdings receive disproportionately more inputs from the subsidy (Minde *et al.,* 2010).
- Unlike most other recent targeted schemes, the scheme does not use vouchers. Inputs are to be accessed directly through approved farmer cooperatives or other registered farmer groups who procure the fertilizer at the local decentralized state offices.

Programme duration, exit strategy, programme costs.

- The programme was meant to be temporary but it has now operated for ten years. When the FSP was announced, the Government indicated that farmers would be eligible to

receive support for two consecutive seasons only and that the subsidy level would be reduced by 25% per year, with a view to phasing it out after three years (at the end of the 2004/05 farm season). None of this happened and the 50% price reduction granted under the subsidy, instead of being reduced, went up to 50-60%. In 2008/09, it even rose to 80% to account for the particularly high fertilizer prices.

- Programme costs have grown considerably since the FSP was launched and risk displacing other development priorities. Between 2000 and 2008, input subsidies accounted for roughly 38% of MACO's total budget. The 2007/08 FSP cost 23% more than expected (World Bank, 2010).

Participation of the private sector (World Bank, 2010).

- Only two private-sector firms have been involved with the procurement of FSP fertilizer. With seed, the FSP is regarded as being more competitive and seven private firms were awarded contracts in 2007/08.
- The geographic allocation of FSP inputs has been determined without consideration for the level of private-sector development in different parts of Zambia. The risk of displacement of the nascent private sector could be reduced by including geographic criteria relating to the presence of private suppliers in the targeting of the FSP programme.

Source: NEPAD (2011); Minde et al (2008); World Bank (2010)

Smart schemes can also provide complementary inputs (i.e. seed subsidy/distribution and extension) when high prices are not the only reason behind low fertilizer use. In the case of Rwanda, the input subsidy was one of five measures of a comprehensive integrated technical package, the Crop Intensification Program, which included a) crop regionalization (matching eligible crops to ago-ecological conditions across regions; criteria for subsidy eligibility), b) land use consolidation (consolidation of neighbouring plots; 0.5 ha minimum for subsidy eligibility), c) extension services; d) seed subsidy (maize, wheat and potato; eligible target crops for subsidy); and e) fertilizer subsidy.

3. *Evidence on programme impacts*

Understanding of input subsidy programmes remains quite limited due to large information gaps on their results and impacts, as rigorous impact evaluations are lacking. Even basic information on design and immediate results of those programmes is sometimes hard to find. This can be explained by the fact that programmes are emerging rapidly and that they are led and funded primarily by national governments, rather than donors. Finally, this is also linked to the inherent complexity of evaluating subsidy programmes that have multiple objectives and involve multiple stakeholders. An exception to this general situation is Malawi, where a rigorous impact evaluation was led for the 2005/06 iteration of the Malawi Agricultural Input Subsidy Programme (SOAS *et al*., 2008; Dorward and Chirwa, 2011). The FISP in Zambia has also been subject to detailed evaluations (Minde *et al.,* 2008; World Bank, 2010). Other evidence on programme impact is more limited. It should be noted that a set of studies was recently commissioned in eight African countries by NEPAD (with technical oversight by FAO and IFDC) and is an attempt at filling information gaps on the results of recent programmes.

Some of that information is also reported in our analysis.[8] In this section we provide some new analysis of programme effectiveness and review the available literature to obtain a systematic picture of fertilizer subsidy performance.

i. Agricultural productivity and food security outcomes

- Evidence from country national statistical data

As a first analysis on whether fertilizer subsidies have performed, we compare aggregated yield trends for selected countries. In order to partially account for agro-ecological zone and climatic differences we have undertaken this analysis by sub-region, using FAOSTAT data. Comparisons are made between the increase of yields for targeted crops before and after the fertilizer subsidy was introduced and the increase, for the same crops and the same period, in the countries where no subsidy was in place. The data and results per country are available in **Annex 1.**

The picture for East Africa is not a uniform one: five of the eight analysed crops had yield increases above countries without a subsidy. In Zambia, Rwanda and Malawi, yield increases after the subsidy are clear and significantly higher than the counter-factual. In Kenya and the United Republic of Tanzania, however, we observe the opposite. It should be noted that these two countries, as many others, have experienced a significant increase in areas devoted to the targeted crops under the fertilizer subsidy (Kenya 15% increase in maize area; the United Republic of Tanzania 48% increase in maize and 44% in rice) (FAOSTAT, 2011). Thus the observed yield decreases could possibly be interpreted as an indirect effect of allocating less suited soils to subsidized crops but this cannot be tested for with the data available. However, agricultural production did not decrease in the United Republic of Tanzania and Kenya: production was more or less stable in Kenya (+ 3%) and increased in the United Republic of Tanzania (9% more for maize and 37% more for rice). Moreover, we see that countries with yield increases also experienced an increase in area planted (up to 50% in maize in Rwanda), which further raised domestic food availability of targeted crops. An additional check shows that for those same countries total food production also grew, so production increase for targeted crops did not happen at the expense of decreases in other crops.

As far as **West Africa** is concerned, for most of the analysed crops (14 out of 17), yield increases after the introduction of the fertilizer subsidy were higher than in countries where no subsidy was in place, indicating here too a clear positive effect of the subsidy. This conclusion is not supported, however, in the case of maize in Burkina Faso and in the case of rice and sorghum in Nigeria. In Burkina Faso, we see that the subsidy period also meant substantial increases in land allocated to maize, but not in Nigeria. As above, we can conclude that overall food production (availability) for the targeted crops increased more than in non-subsidized countries.

[8] The case studies are referred to as NEPAD, 2011 and the summary paper as Wanzala-Mlobela *et al*., 2011. See also list of references.

- Evidence from impact evaluations

The evaluation of the AISP in Malawi found a broadly positive impact of the subsidy on input use, agricultural output and national food security, although the impact of the subsidy itself on both national and household food security and poverty could not be isolated in the analysis.

Incremental use of inputs is determined by the volumes of sales of subsidized input and the level of displacement from commercial sales as a result of the subsidy. The review of the targeted AISP found that subsidized fertilizer sales rose by 34% in the first year and by 54% in the third year of the programme. Effects on incremental input use were reduced by quite substantial displacement, 20-30% in 2005 and 2006 (SOAS *et al.*, 2008). It is challenging to isolate the effects of incremental use on agricultural production, as yield response depends on efficiency of input use and on weather conditions. Overall, agricultural production grew during the programme, as did input sales and Dorward (2009) estimates that the subsidy programme incremental production was about 400 000 tonnes of maize in 2005/06 and 950 000 tonnes in 2008/09, with a steady growth throughout the period (Dorward and Chirwa, 2011).

Evidence on more indirect impacts and multiplier effects within the rural economy (e.g. wages and labour) was more limited. Maize prices rose by 38% from their long-term average, which undermined directly the programme's impact on poverty reduction and food security for the poorest farmers who are net maize buyers. Simulations seem to show a positive impact on livelihood and labour for beneficiaries and non-beneficiaries but the overall impact of the subsidy on real incomes could not be determined (poverty declined in the country over the period but the effects of the subsidy on this could not be isolated). Dorward (2009) argues that real income increases have progressively matched output price increases over the period.

A good correlation between the introduction of the subsidy and agricultural production increase outcomes was found in Malawi and Zambia, but below the national government's estimates. According to Minde *et al.* (2008), in Zambia the subsidy increased fertilizer use by 12.5% among smallholders and raised their maize yields by 14.6% between 2002 and 2007. This good performance can, however, be attributed in part to good rainfalls in the 2005 to 2007 agricultural seasons.

In Malawi, overall impact on household food security is unclear: greater availability of maize and lack of food shortages were reported in focus group discussions but, at the same time, this was compromised by output price rises. Household survey data underline that increases in food production translated into better household welfare as measured by the number of daily meals consumed, the number of malnutrition cases, the length that food stocks lasted post harvest and in terms of household perceived food security and well-being; nonetheless it was not possible to establish more rigorously a trend of improvement in household food security status (Dorward and Chirwa, 2011).

- Evidence from other sources (reviews, etc.)

Evidence on the impact of the subsidy itself from other sources is generally positive but inconclusive. While it seems that fertilizer use increases everywhere (300% in Rwanda, 20% in Mali) albeit with varying degree of market displacement, effects on production are varied. Positive impacts were found in Rwanda, Mali and the United Republic of Tanzania, among others. Rwanda maize production rose by 7.9% up from 3.8% before the programme was implemented. This growth came from increases in cropped maize areas that could be attributed to individual measures other than fertilizer use (the package included land consolidation)or be the result of the combination of several measures in the technical package. Impact on yields of fertilizer use has not been clarified. In the case of the United Republic of Tanzania, production results apparently followed the evolution of weather conditions. In Mali, rice production increased significantly, although production data is contested by some stakeholders. Also, production increases resulted mainly from an increase in area planted in southern regions (*bas-fonds*, as opposed to irrigated perimeters near the river Niger) (Roy, 2010). Impacts on food security are less clear, as the expected decrease in output prices did not occur and benefits did not spill over to urban consumers (Kelly *et al*., 2011).

As far as economic efficiency is concerned, case studies led by NEPAD (summarized in Wanzala-Mlobela *et al.,* 2011) provide annual estimates for the benefit-to-cost ratio (BCR) in the eight countries where fertilizer subsidies have been reviewed. The evidence shows that efficiency does not seem to be a major characteristic of these programmes. In only 3 out of 20 years[9] analysed did the value of average maize yield increase cover twice the additional cost of fertilizer at market prices. This goes up to 8 out of 20 when the BCR is calculated against subsidized prices. Higher BCRs are obtained for those countries where fertilizer subsidies were part of a broader agricultural policy effort (e.g. Rwanda, and to a lesser stand Malawi and Senegal). Even a BCR higher than 2 for market price does ensure that farmers will keep on using fertilizer when the programme ends.

ii. Targeting and distributional impacts

- Targeting, Impact

There is relatively clear evidence from both Malawi and Zambia that targeting the poor will bring the greatest benefits in terms of distributional impacts and impact on aggregate food production:

[9] There are several observations for each country.

- Focusing on poorest farmers is expected to be more efficient at raising fertilizer use as they are less likely to be able to acquire the inputs from the market (Dorward, 2009). Evidence from Malawi and Zambia confirms that subsidies targeted to the poor will indeed be more efficient at raising fertilizer use. In Malawi, displacement was lower (18%) for the poorest quintile and higher (30%) for the richest (Ricker-Gilbert *et al.*, 2011). Similar evidence was found for Zambia, where incremental use of fertilizer per unit was found to be higher among the poorest farmers (Minde *et al.,* 2008).
- Interestingly, the example of Zambia also demonstrates that smallholders tend to use fertilizer more efficiently as maize yield increases per tonne of fertilizer used were higher in the 1-5 ha category (4.21 to 5.33 tonnes/ha yield increase) and in the very small farms of less than a hectare (4.55 tonnes/ha) and lower for the 5-20 ha category (3.32 tonnes/ha).[10] Nonetheless, it should be noted that these estimates do not control for factors other than fertilizer use. Interestingly, the Zambia FSP programme is theoretically targeted at the most efficient landowners in the 1-5 ha category, but in practice this criteria is not enforced and one sees that among the 0-20 ha landowners, farmers with the greatest landholdings receive disproportionately more inputs from the subsidy (*ibid*.).

- <u>Targeting, Implementation</u>

On the downside, the experience with implementing household targeting objectives has not been conclusive. Failure to reach the intended smallholders and leakage to non-beneficiaries strongly reduces the impact of the subsidy programme. It results in regressive outcomes in distributional terms and a "crowding out" of demand that would normally be satisfied through commercial channels. This means as a consequence smaller increases in fertilizer use and higher programme costs per fertilizer effectively distributed.

The literature reports poor targeting of smallholders and leakages to richer non-targeted farmers, which "crowds out" demand that would normally be satisfied through commercial channels. A recent review estimated that 76% of the targeted FISP in Zambia in 2007 went to the richest third of households, who hold nine times more assets and 2.5 times more area cultivated than others (Kelly *et al.,* 2011). In Malawi, household surveys found a high correlation between acquisition of subsidized fertilizer and household wealth, land holding and gender, indicating that non-targeted less-poor households and male-headed households were largely the recipients of the subsidy (SOAS *et al.*, 2008). Finally, there is also evidence that the difficulties with administrative targeting are compounded by fraud and political interference (see below, *implementation*). Pan and Christiaensen (2011) show that decentralizing targeting to local authorities does not improve targeting efficiency. Compliance with programme guidelines is not assured and local elites capture most of the benefits, reducing targeting performance both for poverty alleviation and increased production objectives.

[10] Data obtained from household survey data for year 2007/08.

Programmes innovate constantly to improve on the targeting criteria, the selection criteria and the actual distribution and allocation of vouchers/benefits to the end users. New allocation methods in Malawi, for instance, have improved the allocation of coupons: the use of farm household registration prior to coupon distribution or the use of open meetings at the time of coupon allocation (Dorward and Chirwa, 2011). In Burkina Faso, informants reported that decentralized government authorities were excluded from beneficiary selection and needs assessment, as their previous involvement had led to the politicization of benefit allocation.

iii. Implementation performance

Most programmes have faced significant implementation problems, exacerbated by a) low administrative capacity to enforce targeting, b) suboptimal choice of distribution channels and c) widespread political interference. All of these provide an important explanation why the theoretical virtues of the newly designed smart schemes have not translated systematically into clear success stories.

We have reviewed above implementation issues linked to targeting. We look here into other typical issues – namely fraud, politicization and timeliness.
Fraud is reported almost everywhere and may arise through voucher allocation to "ghost" beneficiaries, diversion to others, allocation to non-beneficiaries and printing of extra or counterfeit vouchers (Dorward and Chirwa, 2011). Counterfeit coupons circulating in Malawi pose one of the recurrent challenge to government(in 2008/09 reprinting of vouchers had to be done in two regions; the issue of reselling of fertilizer is particularly acute in Ghana. In Malawi, side payments (or "tips") were requested to 5% of recipients to receive coupons and to 15% of retailers to redeem them (Dorward, Chirwa, 2011).[11] Political interference is also reported in all country case studies. Banful (2011) found that during the 2008 FSP Ghana programme, priority in voucher allocation was given to districts with lower rates of support to the ruling party; in Malawi, areas where members of parliament had their residence received relatively more vouchers (SOAS *et al.*, 2008).

Another typical implementation issue is the late delivery of (i) subsidized fertilizer (when there is direct distribution of inputs) or of (ii) vouchers, reported in many instances (i.e. Ghana, Mali, Malawi, Senegal). This results in regular shortages and queues (experienced by 75% of – parastatal or private – suppliers in 2008/09 in Malawi). Delays in programme implementation and poor administrative management has important direct impacts: as an example, in Ghana, only half of the vouchers that were distributed were redeemed due to the late start of the programme (Banful, 2008).

[11] Household survey and key informant interviews, 2006/07 and 2008/09.

Although evidence on the above often comes from rather anecdotal sources (press, reports),[12] these issues seems to be systematic (all countries, each year) and, in several cases, to reach preoccupying scales. In Nigeria, for instance, several reports (quoted in Banful and Olayide [2010]) as well as key informant interviews reported serious shortages of subsidized fertilizer at the local level as a result of diversion, fraud and logistical constraints (**Box 9**). As a result beneficiaries indicated that, basically, the subsidized fertilizer does not reach the intended farmers, and that under the current circumstances, they would be willing to pay fertilizer even at market prices provided that it would be available.

Box 9: Beneficiaries' access to subsidized inputs: results from interviews in Nigeria

"Cases of abuses and inefficiencies in the federal fertilizer subsidy programmes range from delays in the delivery of fertilizer to politicians and officials diverting fertilizer from the legitimate beneficiaries. […]

- There are consistent delays in fertilizer delivery because of bottlenecks in government procedures and from a lack of capacity of contracted transportation companies to deliver the product as scheduled. As a result every year, much of the fertilizer arrives after the ideal treatment period. […] In each state, the majority of interviews stakeholders thought it difficult for farmers to get access to fertilizer, subsidized or otherwise.
- Interviewees indicated also that there was a persistent shortage of fertilizer and few locations where fertilizer could be purchased, requiring farmers to travel long distances to reach a fertilizer retail point.
- Regularly, only part of the fertilizer purchased by the state is delivered to state warehouses, the rest is diverted to unknown locations. It is not uncommon for tens of thousands of tons of fertilizer (and the trucks on which they were being carried) to go "missing" and never be accounted for. Fertilizer is regularly stolen from the state government fertilizer depots and thousands of bags of subsidized fertilizer have been discovered in unauthorized depots around the country.
- There is also widespread evidence that subsidized fertilizer is often captured by wealthy local elites and politicians. It is an open secret that subsidized fertilizer is used to reward officials for providing political support, or to garner new support. […] In all states, political manipulation is cited as the reason why fertilizer does not reach the rural poor. […]"

Source: Banful and Olayide (2010)

[12] In Malawi there was no sufficient evidence to suggest that fraud is widespread (SOAS et al., 2008) however an overall appreciation is made difficult anyhow in the absence of consistent national statistics on the number of farm families.

iv. Development of fertilizer supply markets

Whether this is included or not as an explicit subsidy objective, in measuring programmes' impacts, it is essential to analyse whether subsidies are conducive to promoting the development of the supply chain – or, at least, to maintaining it – in ways that can ensure proper functioning of markets once the subsidy is removed.

- Retail

The Malawi experience shows that **retailers participating in subsidized sales** experienced increases in unsubsidized sales as a result of the demand pull generated by the subsidy. The same was observed in the United Republic of Tanzania. In Zambia, private supply networks were reported to be stronger in many locations five years after the programme was launched, with enough business in some locations to sustain the private vendors (World Bank, 2010). The issue is that this benefit may not be realized for many, as in practice in many countries a large portion of agro-dealers are excluded from the schemes:

- In Ghana, Malawi and Mali, agro-dealers are required to be affiliated with the main participating importers. In Ghana in 2008, this excluded 60% of them in practice (Banful, 2008).
- In other countries (i.e. Burkina Faso or Nigeria), distribution at wholesale and retail is done physically by the regional administration or at designated public outlets, which are often quite remote (farmers not affiliated to a producers' organization would have travel long distances or to pay for an individual to pick up the good).
- In Kenya or the United Republic of Tanzania, private agro-dealers' participation was, on the contrary, encouraged both by design and in practice. In the United Republic of Tanzania, the programme involved over 2 000 agro-dealers who benefited from a dedicated capacity-building programme (training in business skills, facilitating links with private suppliers and banks/microfinance institutions providing some of them with credit). As a result about 610 200 additional farmers in remote were reached by agro-dealers (NEPAD, 2011).

Whether or not they participate, **retailers may suffer from a crowding out of part of their commercial sales** as a result of the introduction of the subsidy, when the latter benefits farmers who would have purchased fertilizer at market price. The extent of displacement will depend on the effectiveness of targeting or the extent of fraud (see above), As demonstrated by Xu *et al.* (2009) in the case of Zambia, the impact on commercial sales will vary from one region to the other depending on whether the private sector is active or not: with low private-sector activity, displacement was quite limited or even crowded in the private sector (1.1 kg incremental use per kg of subsidized fertilizer), but with high activity, displacement was much higher (0.01 kg incremental use per kg of fertilizer distributed) – and sometimes total fertilizer use was even reduced. Results also seem to indicate varying degrees of displacement depending on input and crop (staple/cash crops). Dorward and Chirwa (2011) found in Malawi that, compared to fertilizer vouchers for maize, displacement was higher for fertilizer vouchers for tobacco and lower for maize seed vouchers.

- Import/Distribution

It has been observed that subsidies can strengthen large importer/distributor's market positions as a result of the introduction and negotiations of subsidized volumes on the market. This can lead to higher fertilizer prices due to abuse of dominant market positions. Typically, one observes that only a few companies are selected through tenders as participating producers or importers. Additionally, procurement rules and outcomes are not necessarily transparent. Kelly *et al*. (2011) report that, as a result, in Senegal and Mali the subsidy largely benefited a few importing companies that had close ties to government.

As firms face greater guaranteed demand but also a number of uncertainties in engaging on the subsidized market (uncertainties on the outcomes of tendering processes, on government payments as well as on exchange rate fluctuations), it has been observed that competing suppliers tend to raise their margins. One result is that, in many countries, the fertilizer that will be subsidized is actually **procured at significantly above market prices** (in Zambia, inputs were more expensive than the private-sector benchmark in 4 out of 5 provinces surveyed by the World Bank (2010)). The effect is to reduce the actual percentage subsidized for farmers (i.e. Filipski and Taylor (2011) estimate that the subsidy was effectively lowered from 50% to 30% of the price in Ghana) and to raise subsidy costs for the government (by an additional ZMK 15.5 billion, or USD 4.03 million in Zambia (World Bank, 2010)).

v. Programme sustainability

In the absence of more evidence, we examine programme sustainability through two entry points: financial sustainability (costs as a percentage of agricultural/national budgets and GDP) and at the strategies put in place for phasing out subsidies over time.

- Programme costs

Growing programme scale and costs put great **fiscal pressure** on national budgets and it risks raising the magnitude of implementation issues (diversion, displacement and market distortions risks). In Malawi, total programme costs grew regularly from 2005 to 2008 from over 60% of the national agricultural budget to 74% in the peak year of 2008/09. This represented an increase from 6% of government expenditure (or 2.1% of GDP) to 16% (or 6.6% of GDP) (Dorward and Chirwa, 2011). This is due to a combination of increasing volumes resulting from higher demand, large increases in national fertilizer prices but also difficulties in controlling volumes and keeping prices under control (as explained in the previous section). As an example, in 2007 in Malawi, volumes overshot yearly targets by 27% and costs by 16%. Cost overruns are in part due to the higher prices paid by governments for fertilizers and/or the political pressures for expanding the programme or delivering political patronage (especially at the time of elections). As a result, estimated funding levels are inadequate, which often leads to the late payment of suppliers who might in turn increase their prices over the next season to compensate (Kelly and Crawford, 2011). Overcharges may also be imputable to poor subsidy management as was spotted in Mali by the Verification Bureau (Government of Mali, 2009b).

- Exit strategies

At programme design level an exit strategy is key to assure that the fertilizer subsidy does not become a structural feature of input markets in the country. For example, Rwanda has put in place a three-year programme with a progressive phasing out embedded in the degressive level of subsidy (75-50-25%). The United Republic of Tanzania has also adopted an explicit exit strategy: the programme was to last three years, with external donor funding, followed by two years of phasing out to be funded by the national government's budget. However, the success of the subsidy is leading to its re-conduction and the strategy for phasing out the subsidy is to be redefined.

Whether exit strategies assure higher fertilizer use when the subsidy disappears is still to be confirmed by empirical data.

C. Which role for fertilizer subsidies in food security?

The contribution of fertilizer subsidies to national food security strategies remains highly controversial. Nevertheless, such programmes have become unavoidable in the agricultural policy portfolio. They have become a widely used policy instrument, to which governments devote very large shares of their national budgets. This makes them *de facto* central to supporting national agricultural and food security strategies.

Most of the reviewed subsidies have been successful at meeting their primary objective, raising national agricultural production and productivity. Smart schemes have brought about innovations in terms of targeting smallholders and supporting the development of private-sector-led distribution markets. On the downside, their success is affected by exogenous factors (mainly rain) and is largely dependent on design and implementation. Recent experience demonstrates that, indeed, there has also been poor practice both in designing the programmes and in implementing them, and that under such circumstances, the new subsidies carry many of the problems of the past. All of the reviewed schemes appear highly politicized, very costly and, in the absence of a clear strategy for phasing out, unsustainable in the long term. In view of this mixed record, it is widely acknowledged that subsidies must be improved in order to raise their efficiency and benefits.

4. Some lessons learned from recent experience

Current fertilizer subsidy programmes provide multi-year price support, which, if implemented with a smart design, will foster productivity increases and kick-start input market development. This model fully recognizes that such benefits will not be achieved unless a number of *complementary measures*, sometimes structural, are conducted in parallel on both input and output markets. The following paragraphs summarize some of the lessons learned from country case studies (section B) on subsidy design and implementation.

i. Objectives and design

With regards to **programme objectives**, governments tend to assign multiple objectives that are often poorly defined. This has resulted in conflicting objectives assigned to the same instrument and problems with implementation that can be traced back to a lack of clear and agreed objectives (Kelly *et al.*, 2011). Pan and Christiaensen (2011) show that, even if implementation guidelines had been strictly followed, overlapping of households best suited for poverty and production objectives is far from complete. A clear prioritization of programme objectives therefore seems necessary. For example, the objectives of boosting production and reducing poverty might not be best achieved with fertilizer subsidies if poor farmers have worse quality soils where fertilizer impact on production is lower. As Wiggins and Brooks (2012) show, programme objectives do not affect only the programme design (i.e. targeting versus universal) but also exit strategies and complementary investments.

With regards to **programme design**, governments have embraced smart subsidies in design but the tendency has been to adopt only some of the recommendations for making subsidies smarter (Banful, 2011) or practice has not followed design. One example of this is implementation of the Malawi AISP: it claimed to support fertilizer supply markets but from year 2 the programme sidelined many private distributors in practice. However, it must be acknowledged that the smarter the programme design the more challenging the implementation.

ii. Lack of complementary measures

In practice, subsidies have focused on reducing fertilizer price and have not been systematically and effectively accompanied by **complementary measures** to address other constraints for fertilizer use as part of a **comprehensive strategy** for promoting fertilizer use sustainably:

- On the **demand side**, we find that programmes are generally coupled with improved seed inputs, and sometimes with training/extension (see **Annex 1** for more details). Yet the linkages with localized agronomic research and the effective promotion of good agricultural practices as part of an integrated soil fertility management strategy seem are not yet systematic enough to reap off the benefits of the large price reductions on fertilizer inputs.

- On the **supply side**, failure to promote efficiency and competition in procurement (transparency, timeliness and number of importers involved) and in distribution (public versus private, participation of agro-dealers) resulted in rigidities in supply and in high prices. This is all the more problematic as experience shows that lack of flexibility in supply response to increased fertilizer demand would become akin a subsidy to participating *suppliers* (Filipski and Taylor, 2011).

iii. Targeting

While five countries in our review have adopted smart schemes, in another five, governments have maintained the focus on **universal (versus targeted)** subsidy programmes. This might be an explicit policy decision as they saw it more relevant to promote quick gains in farm productivity and national production or because administrative costs associated with targeting would be higher than the benefits.

Not surprisingly, the debate on input subsidies revolves very much around that of **targeting**. Both the theoretical and empirical literature clearly indicate that targeting (and/or rationing) subsidies will raise their efficiency. Targeting specific crops (main staple crops), specific farmers (those who cannot afford fertilizer, i.e. smallholders), in areas where fertilizer response will be higher and with market access for surplus production and will reduce input market displacement, it will maximize distributional impact, and it is also more likely to raise food production more efficiently. At the same time, targeting subsidies does not imply that schemes are not subject to political economy and implementation issues.

Strengthening administrative targeting, allocation of vouchers or fertilizer bags and fraud control have become central to subsidy programming. **Vouchers** are one way to reach the targeted populations and also potentially to allow more private dealers to participate; they seem desirable for improving the distribution, allocation and monitoring of the subsidy in practice. However vouchers do not constitute per se a targeting instrument nor do they guarantee to improve targeting practice if targeting has been poorly designed and administrative issues remain.

iv. Exit strategy and monitoring and evaluation

While this is a clear recommendation for making subsidies *smart*, few countries have adopted a realistic **exit strategy** and none has implemented it. The exit strategy actually means that after the programme, optimal fertilizer use would be higher than before due to increased benefits (due to increased knowledge), decreased cost (due to market development) or a mix of both.

Absence of exit strategies creates extreme difficulties as exiting the programme becomes ever more difficult over time due to increasing politicization of programmes and continued high fertilizer prices at the international level. This is all the more problematic as recent subsidy schemes, both universal and targeted, are operating at very large scales without sufficient cost control, which jeopardizes sustainability and increases risks of displacement. In addition, weak **monitoring systems** in programme management and monitoring are not helping improve the programmes over time. One benefit of smart schemes, however, is the way in which it has promoted **stakeholder participation** (farmers, input dealers, farmer organizations, etc) in scheme implementation and monitoring (in Malawi, Zambia, the United Republic of Tanzania, Kenya). This provides more checks and balances and regular user feedback to the authorities.

5. *Alternative instruments or policy options*

Because the success of subsidies is not straightforward and their impacts are not well known, some observers have questioned the opportunity cost of devoting public resources to subsidizing a private good, fertilizer, at the expense of global public goods (e.g. infrastructure, education), social safety net programmes or other interventions on input and output markets. In Poulton *et al*. (2006), Guy Evers (FAO) questioned whether "*the attractiveness of rapid impact [from subsidies] may constitute a disincentive for farmers, policy makers, politicians and development partners to address long term soil and land health problems (such as lack of soil organic matter, soil compaction, poor biological processes, high water run-off and soil erosion, etc*." (page 21). He argues that the resources that would be spent on subsidies could be better invested elsewhere, not just in research or roads, but in subsidizing animal traction or reduced tillage mechanization, or in promoting farmer groups.

Even after a subsidy has been implemented, fertilizer use may remain unprofitable for some smallholders. Implementation challenges may be so large that efficiency and sustainability of the subsidy programmes are compromised. In such cases, fertilizer subsidies would be crowding out public resources from other productivity-enhancing investments or social protection measures that could promise higher or longer-lasting pay-offs for food security. If the policy objective(s) of the fertilizer subsidy is(are) to reduce poverty then *social transfers* could well be a preferable option. Theory and evidence indicate that input subsidies are rather inefficient at fulfilling poverty reduction objectives *stricto sensu*. As explained by Ellis (2009), the impact of subsidies on truly poor households (the urban poor or the rural landless) is indirect. It is channelled through: a) lower food prices resulting from higher agricultural production; b) impact on labour markets and wages resulting from a more dynamic agriculture sector; and/or c) cash transfer resulting from reselling of vouchers by the poorest. Such outcomes require flawless implementation – while we have seen that, in practice, implementation is subject to administrative and political economy issues that will directly reduce the income transfer to the poor. This makes input subsidies an inferior transfer: as an example, in Zambia, 70% of the intended volumes were effectively delivered to 30% of the intended beneficiaries (Minde *et al.,* 2008); this compares poorly with the performance of social programmes, estimated on average to distribute about 80% of the benefits to the 40% poorest. In conclusion, both policy instruments should rather be considered as complements rather than as substitutes (*ibid*).[13] Moreover, fertilizer subsidies were not sufficient to avoid higher food prices during the 2008 spike as shown in Malawi.

If the policy objective of the fertilizer subsidy is to increase agricultural production, subsidies might be justified but they should be explicitly benchmarked with other possible market interventions. First, one should consider whether technology subsidies could be an option.[14] Experience in Zimbabwe shows that when subsidies are not targeted to a specific input farmers, even in relatively homogenous areas, purchase different technology mixes (FAO, 2012). While a thorough evaluation of such an option is yet to be done, results point to farmers recognizing flexibility and taking advantage of it. The example of Kenya is regularly quoted to demonstrate that the joint liberalization of input and output (maize) markets and other public investments in support of smallholders yielded positive results in terms of input adoption and increased productivity (see **Box 10**).[15] This demonstrates that interventions on fertilizer markets without subsidies could have superior and lasting effects on raising fertilizer use. Nonetheless, these interventions will eventually increase fertilizer use only if farmers can access the cash or credit to ultimately buy inputs on the market (Minot and Benson, 2009); in other words, farm household wealth being endogenous to the intervention, the problem of affordability of inputs will remain a compelling issue for policy-makers when weighing different policy instruments. Additionally, the impact of market interventions will be diffuse and effective on the long term, while subsidies will bring possibly inferior, but more immediate and visible returns.

[13] Social cash transfers and input subsidies address different vulnerabilities: input subsidies help active farmers with land while social cash transfers provide primarily for those that may not be in the labour force.
[14] In a sense it would be a kind of constrained cash transfer, as the subsidy would only be redeemable for farm related inputs.
[15] Despite this widely cited market led development success, Kenya reverted to fertilizer subsidies in 2008. Surprisingly enough, statistical data indicates that this led to reduced yields.

In spite of the above, subsidizing fertilizer is likely to remain attractive to policy makers. Governments will prefer them over other market interventions because of their quick and visible results and direct political payoff. They may also favour them over cash transfers because they think the latter may create welfare dependency and hands-out to non beneficiaries. Finally, in the current context of high input prices and high and volatile output prices, affordability issues are higher for poorer farmers who do not have access to credit and seasonal finance (Dorward, 2009). The issues that subsidies directly address will therefore remain particularly acute both at the national and international levels.

Box 10: Market liberalization, the experience of Kenya

Growth in fertilizer use and maize productivity was achieved between the early 1990s up to 2007 thanks to the joint liberalization of input and output (maize) markets and other public investments in support of Kenyan smallholders, leading to tangible private-sector investments in fertilizer retailing and maize marketing.

From the 1990s, Kenya had a stable policy of liberalization of its fertilizer market (suppression of import licensing quotas, foreign exchange controls and retail price controls). The government also encouraged competition in importation and wholesaling which led to reductions in transportation costs. The network of agro-dealers in rural areas increased, increasing smallholder's physical access to inputs (Minde *et al.,* 2008). Additionally, "donor-financed programmes aimed at reducing fertilizer affordability issues and promoting the marketing of response crops was implemented through public-private partnerships, including demonstration programmes to improve both farmers and agro-dealers knowledge of the improved products" (Kelly *et al.*, 2011; page 3).

This yielded positive results in terms of input adoption and higher productivity: maize fertilized areas rose by 56% between 1996 and 2007 (with an 18% increase in fertilizer use intensity for maize for smallholder farmers) and a strong correlation between fertilizer use and yield increase (20% on average) was established. The impact was most noted in high potential areas where fertilizer use reached 90% of total farmers versus 57% on average nationally (Ariga and Jayne, 2009).

6. *Improving subsidies: design, implementation and strategic approach*

Fertilizer subsidies can be an instrument to increase productivity in SSA and thus help solve the food availability dimension of food security. However, their design needs to be improved to raise their efficiency and allow tacking other dimensions of food insecurity. FAO has a role to play in supporting governments in this task.

The debate on the role of subsidies to intensify agricultural production and improve food security should focus on clearly identifying objectives and improving targeting to reach those farmers who have the greatest potential to increase fertilizer use and improve productivity. Those programmes should also be considered explicitly in relation to a range of alternative and complementary investments and policy tools, including social cash transfers, that will contribute overall to the national food security objectives. The literature reviewed in this paper (Dorward 2009; Dorward and Chirwa 2011; Kelly *et al.,*

2011; Morris *et al.,* 2007) converges on recommendations to improve the design and performance of subsidies, which include:

a) assign clear, explicit and non-contradictory objectives and align design and targeting;

b) promote targeting to those farmers, regions and crops that will maximize impact;

c) promote greater market-friendliness (procurement, distribution);

d) support implementation to raise efficiency (fraud control; monitoring and evaluation, etc.);

e) balance expenditure on subsidies against complementary or alternative public policies to raise the technical efficiency of input use (agro-research, extension, irrigation etc), increase farm income (cash transfers) and to establish strong, private-sector-led input supply markets (market liberalization, infrastructure development etc).

The following paragraphs describe some of the critical steps and recommendations for assessing the value of subsidizing inputs and for improving the efficiency of subsidy schemes.

a. *Subsidies should be assessed within the framework of the national strategy for food security*

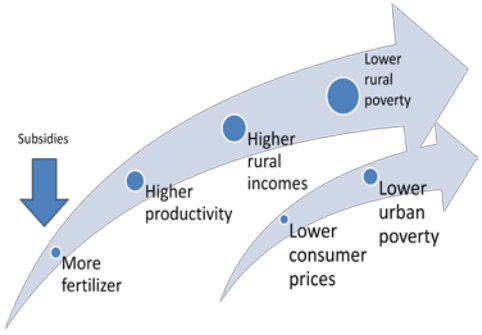
The choice of opting for a subsidy must be weighed against national strategic objectives for reducing food insecurity and the range of available policy options to support those objectives.

As depicted in Box 11, far from being a magic bullet, subsidies constitute one of the possible instruments in the rural development and poverty reduction toolkit. Subsidies can reach out to agricultural production and/or poverty reduction objectives but will be inefficient alone in achieving these objectives. Rather than being considered a quick fix for one of these objectives, they should be viewed as one possible intervention for achieving pro-poor agricultural growth for food security. Their short-term effects on farmers' incomes and longer-term effects on input markets should be factored in.

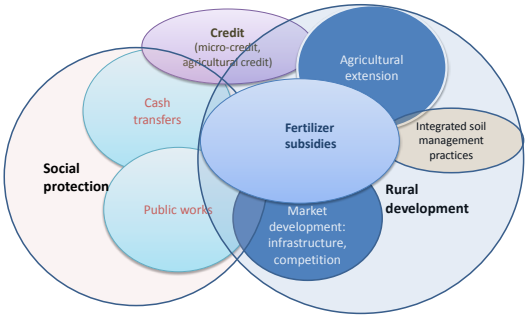
Thinking of subsidies as part of an integrated strategic approach for national food security will help put into the picture alternative investments (e.g. infrastructure development; social transfers) and the critical complementarities with other interventions (extension/training, good soil management practices, access to credit, etc.). If a subsidy is deemed relevant, this will help ensure that other farmers' constraints are relieved, that the agricultural production increase potential is stronger and that, eventually, the chances of decreasing food prices for consumers are realized.

Box 11: **Where should subsidies fit?**

A magic bullet?



Reality is more complex…



When considering fertilizer as a tool to increase production, its use must be seen as a tool for integrated soil health and fertility management rather than as a goal in itself. In particular, subsidy programmes must be implemented concurrently with programmes promoting agronomic best practices. Farmers need to be taught about the use of mineral fertilizers in the context of their specific farming systems. In particular, knowledge on current soil properties, balanced fertilization, site-specific nutrient management and combination of inorganic and organic fertilization are all options to be considered. If local organic materials are not available, the cropping system has to be diversified so as to include soil-improving crops.

b. Objectives of input subsidies should be clear, explicit and non-contradictory

- Programme objectives should fit into broad strategic frameworks for promoting efficient fertilizer markets *as part of a national food security strategy*.
- If the national food security strategy focuses prominently on increasing national agricultural growth, then subsidies can be instrumental in reaching this objective, provided they are implemented temporarily and sensibly.
- Complementary objectives may be added but they should be carefully enounced. Subsidies will perform poorly as a pure poverty reduction instrument, but well-targeted subsidies can indeed support pro-poor agricultural growth, led by smallholder subsistence farmers[16]. Support to the development of input markets is a possible objective but it should be clear whether this is a primary or secondary/complementary objective for the subsidy programmes.
- Then final set of objectives must be clear, explicit and non-contradictory.

[16] As Pan and Christiaensen (2011) show for Tanzania, overlap of individuals who should be targeted for different objectives is far from complete.

c. Design should be "smart" and aligned with programme objectives

If a subsidy is deemed relevant, design and, in particular, targeting should be carefully aligned with strategic objectives.

Targeting:

- Promote targeting of those farmers, regions and crops that face the constraints relating to market failure and that will maximize impact:
- **This requires thorough research/analysis of farmer s' constraints and incentives** regarding fertilizer use under specific local conditions (national and sub-national levels): what are the perceived and actual constraints on fertilizer use? Who is using fertilizer? How? Is it done well? Is it efficient? Is it sustainable? What are the observable differences according to geography, land size, wealth group, etc?
- Against the above analysis of farmer s' constraints and incentives, geographic targeting as well as the choice of targeted crops and farmers groups should be designed to match the objectives of the subsidies. Some general considerations are presented here in terms of the choice of farmers' groups:
  - If the objective is towards *raising production*, target farmers whose marginal increase in production due to increased use of fertilizer will be greater.
  - If the objectives are focused on *poverty reduction*, target farmers who cannot afford the fertilizer (Minde *et al.,* 2008). However, make sure that fertilizer use will increase production and that their production can be marketed.
  - But if implementation issues are expected to be too large and targeting will not be feasible in practice (leakages, fraud and displacement), universal subsidies with stringent rationing (small quantities), even when potentially creating confusion due to double pricing and eroding part of the commercial demand for fertilizers, can be the "smart" option to reach the objective of channelling benefits only to those smallholders who need them most (Dorward and Chirwa, 2011; Minot and Benson, 2009). Alternatively, analysing household data can lead to the identification of easy-to-observe targeting indicators that can be as efficient (Pan and Christiaensen, 2011).
- The magnitude of price support (from say 25% to 100%) and the authorized ration should be designed to support the targeting objectives. Taking into account the government's financial resources, this will all help determine the size of the subsidized market (volumes, number of beneficiaries).
- In targeting the subsidy, it is essential to take into account the size/nature of the local retail sector for fertilizer, to preserve private-sector delivery at market prices where it is efficient to do so.

Markets:

- Promote market-friendliness by including private-sector actors in the scheme (importers, wholesalers and retailers/dealers) and by promoting competition. In this sense the experience of FAO in Zimbabwe (FAO, 2012) has shown that allowing flexibility in what kind of agricultural inputs farmers can purchase with their subsidy might be a promising way forward, allowing to combine access to inputs with farmer knowledge and agronomic needs.
- **This requires improving the understanding of the complementarities and trade-offs between public and private provision** as well as the contribution of different supply systems (independent agro-dealers versus vertically integrated distributor networks).
- Greater private-sector participation may be achieved by i) promoting greater transparency and rigour in procurement processes to promote competition and ii) deciding on the most appropriate distribution channel(s) (public versus private) depending on market conditions. Promoting vouchers (as opposed to direct distribution) that can be redeemed at the full range of 'reliable' local agro-dealer outlets is one way to promote private-sector distribution.

Timeline: devise a clear timeline for the programme with a workable exit strategy

Flexibility and adaptation to local conditions: much more so than today, strategic objectives and subsidy design may need be differentiated geographically depending on the specifics of local conditions – soils and farming systems, input and output markets.

- In Zambia, for instance, it was recommended to implement a dual approach with differences between remote and non-remote areas, depending on the level of private-sector development in each district. Where private networks are severely constrained, direct supply by governments (as in the current system) is adapted. In other parts of Zambia where private supply networks are emerging, however, the programme could move away from direct procurement and promote a voucher system that is redeemable at existing private dealers (World Bank, 2010).

d. Implementation must be supported to raise efficiency.

Efficiency will be raised by reducing displacement, improving targeting, reducing fraud and controlling costs (Dorward and Chirwa, 2011). Some examples are:

- Innovate on administrative targeting. Self-targeting, for example, by linking public works to voucher distribution, is one way to exclude those better-off farmers that should not receive the targeted input (Minot and Benson, 2009). Universal subsidy with rationing is another option (see above).

- Innovate in allocation of benefits, also provide venues for improving farmers' access to inputs. For example in Malawi, farm household registration ahead of coupon distribution was requested. As an alternative, open meetings could be used for coupon allocation; men and women could be targeted separately when redeeming coupons, etc.
- Use secured entitlement systems (vouchers, smart cards, mobile phone-based systems, etc.), which allow for better monitoring and reducing fraud.
- Strengthen monitoring and evaluation systems. Involve farmers' organizations, the private sector and other stakeholders in programme monitoring to raise users' feedback**.**
- Enhance administrative and managerial capacity of the subsidy programme.
- Train and empower key actors (suppliers, farmers) through capacity-building, information/communication to ease implementation and support more sustainable supply and demand when the subsidy ends (Jayne *et al.*, 2011).

e. ***Subsidies should be included in a holistic approach for the promotion of fertilizer use.***

On the demand side, subsidy programmes must be coupled with the **promotion of agronomic best practices**. Farmers need to be taught about the use of mineral fertilizers in the context of their specific farming systems. In particular, the combined use of mineral fertilizer with existing organic fertilizers, e.g., manure, is of high importance. If local organic materials do not exist, the cropping system has to be diversified so as to include soil-improving crops. Only such a parallel approach has a chance of sustainable use of fertilizers, once the subsidy programme has stopped – provided the agronomic affect of using mineral fertilizers turned out to be positive.

Complementary interventions that further **strengthen farmers' long-term fertilizer demand** and that raise the technical efficiency of fertilizer use to maximize productivity should also be considered (improved/responsive seed distribution; soil-crop research; but also rural infrastructure and education development and irrigation and efficient water use).

On the supply side, subsidies must be weighed against or complemented by interventions that will encourage the development of strong supply markets, to sustain the effort once the subsidy has been removed. Interventions include:

i) encourage stable and transparent policies and practices on fertilizer supply markets;
ii) improve the overall business financing and risk management environment;
iii) improve the environment for supply chain coordination;
iv) reducing fertilizer sourcing and distribution costs (e.g. infrastructure development).

Finally, interventions that maximize the opportunities for farmers to market their new production surplus will raise the profitability of fertilizer and should also be considered:

i) support farmers' ability to manage price and production risks (e.g. insurance);
ii) promote producer organizations;
iii) promote warehouse receipt systems.

Annex 1 – Data, fertilizer subsidy impact on yields.

ANNEX I.

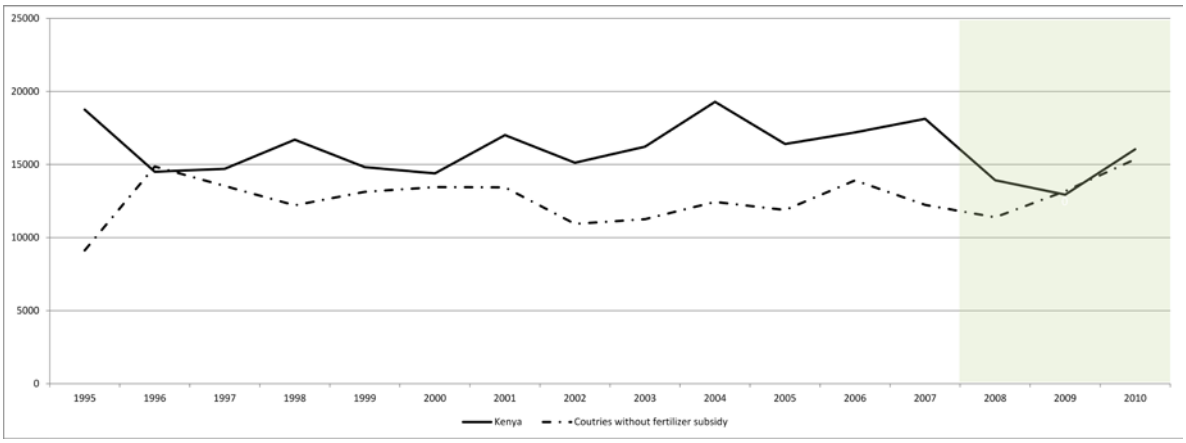
East Africa

Table A1. Summary table for assumptions made for the analysis of fertilizer subsidies impact on yields for East Africa

Large-scale fertilizer in place	Country	Pre-subsidy period	Post-subsidy period	Targeted crops
NO	Burundi	Not applicable		
	Eritrea			
	Ethiopia			
	Mozambique			
	Zimbabwe			
YES	Kenya	1995-2006	2007-2010	Staples
	Malawi	1995-2004	2005-2010	Maize
	Rwanda	1995-2006	2007-2010	Maize, wheat, potato
	United Republic of Tanzania	1995-2007	2008-2010	Maize, rice
	Zambia	1995-2001	2002-2010	Maize

Source:: own elaboration

Figure A1. Yield (hg/ha) trends in Kenya for crops targeted in the fertilizer subsidy (NAAIP)



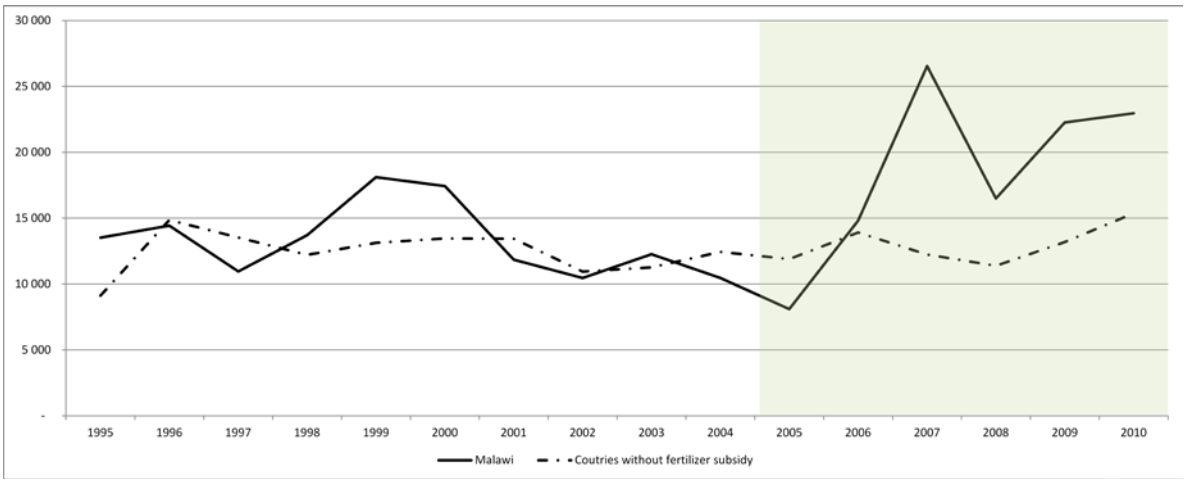
Shaded area represents period for which fertilizer subsidy was in place.
Source: FAOSTAT

Table A2. Yield averages for Kenya and East African countries without fertilizer subsidy (kg/ha)

	Pre-subsidy period	**Subsidy period**	**% change**
Kenya – maize	1 640	1 430	-12
Countries without fertilizer subsidy – maize	1 249	1 331	6

Source: FAOSTAT

Figure A2. Yield (hg/ha) trends in Malawi for crops targeted in the fertilizer subsidy (AISP)



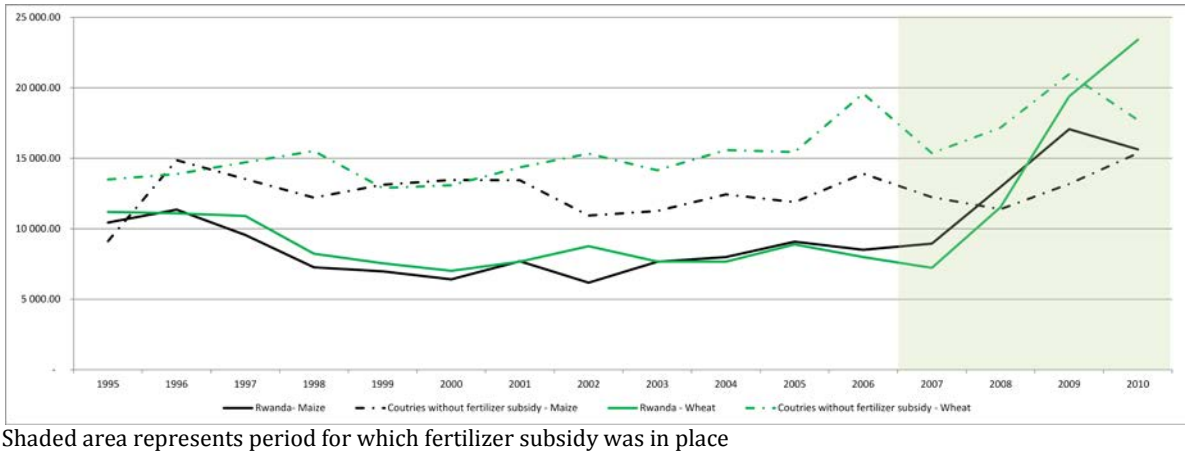
Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table A3. Yield averages for Malawi and East African countries without fertilizer subsidy (kg/ha)

	Pre-subsidy period	**Subsidy period**	**% change**
Malawi	1 331	1 853	24
Countries without fertilizer subsidy	1 243	1 299	4

Source: FAOSTAT

Figure A3. Yield (hg/ha) trends in Rwanda for crops targeted in the fertilizer subsidy (CIP)



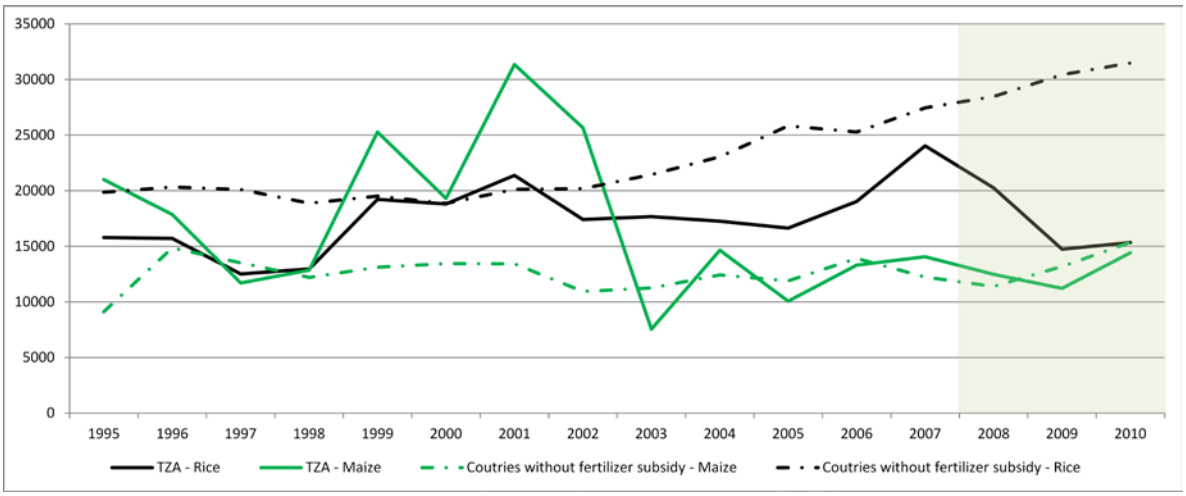
Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table A4. Yield averages for Rwanda and East African countries without fertilizer subsidy (kg/ha)

		Pre-subsidy period	**Subsidy period**	**% change**
Rwanda	Maize	815	1 203	30%
	Wheat	877	1 307	31%
Countries without fertilizer subsidy	Maize	1 243	1 299	3%
	Wheat	1 430	1 771	15%

Source: FAOSTAT

Figure A4. Yield (hg/ha) trends in the United Republic of Tanzania for crops targeted in the fertilizer subsidy (NAIVS)



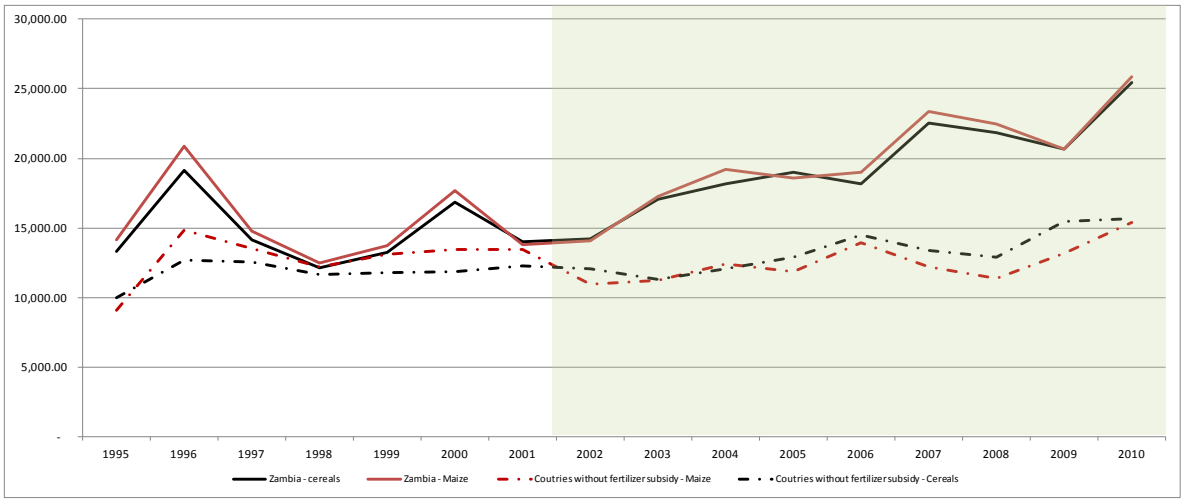
Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table A5. Yield averages for the United Republic of Tanzania and East African countries without fertilizer subsidy (kg/ha)

		Pre-subsidy period	Subsidy period	% change
United Republic of Tanzania	Maize	1 728	1 271	-26%
	Rice	1 757	1 678	-4%
Countries without fertilizer subsidy	Maize	1 249	1 331	7%
	Rice	2 161	3 013	39%

Source: FAOSTAT

Figure A5. Yield (hg/ha) trends in Zambia for crops targeted in the fertilizer subsidy (FISP)



Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table A6. Yield averages for Zambia and East African countries without fertilizer subsidy (kg/ha)

		Pre-subsidy period	Subsidy period	% change
Zambia	Maize	1 537	2 005	30%
	Cereals	1 468	1 967	34%
Countries without fertilizer subsidy	Maize	1 282	1 251	-2%
	Cereals	1 183	1 335	13%

Source: FAOSTAT

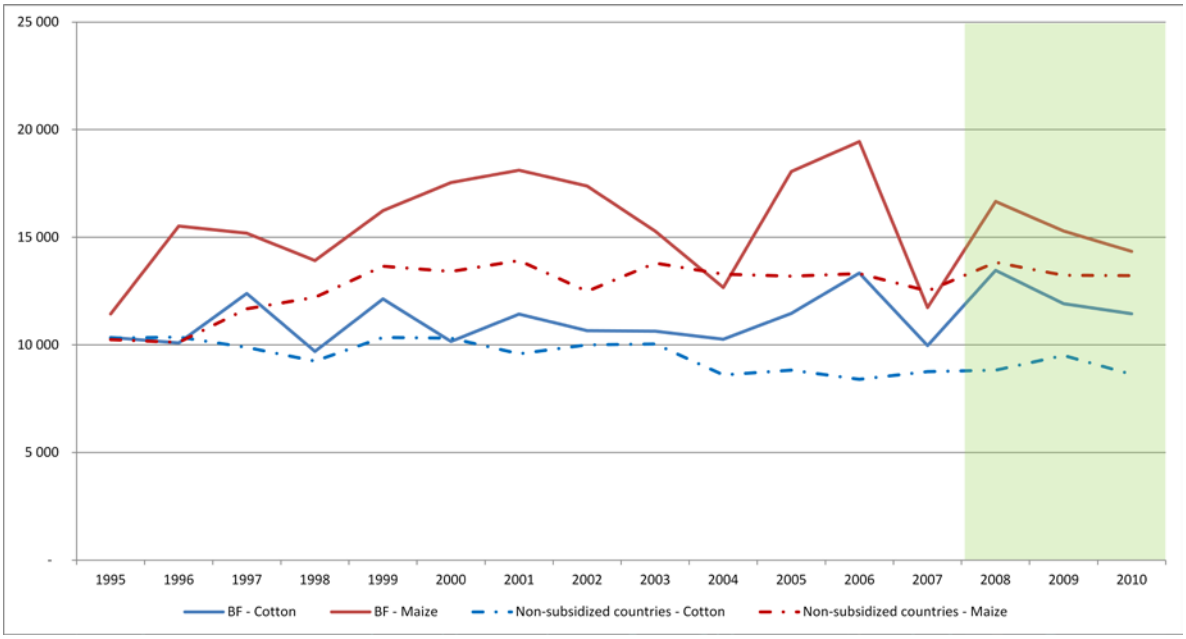
West Africa

Table A7. Summary table for assumptions made for the analysis of fertilizer subsidies impact on yields for West Africa

Large-scale fertilizer in place	Country	Pre-subsidy period	Post-subsidy period	Targeted crops
NO	Benin	Not applicable		
	Côte d' Ivoire			
	Gambia			
	Guinea			
	Niger			
	Togo			
YES	Burkina Faso	1995-2007	2008-2010	Rice, maize, cotton
	Ghana	1995-2007	2008-2010	Staples
	Mali	1995-2007	2008-2010	Rice, maize, cotton
	Nigeria	1995-1998	1999-2010	Staples
	Senegal	1995-2007	2008-2010	peanuts

Source: own elaboration

Figure A6. Yield (hg/ha) trends in Burkina Faso for crops targeted in the fertilizer subsidy



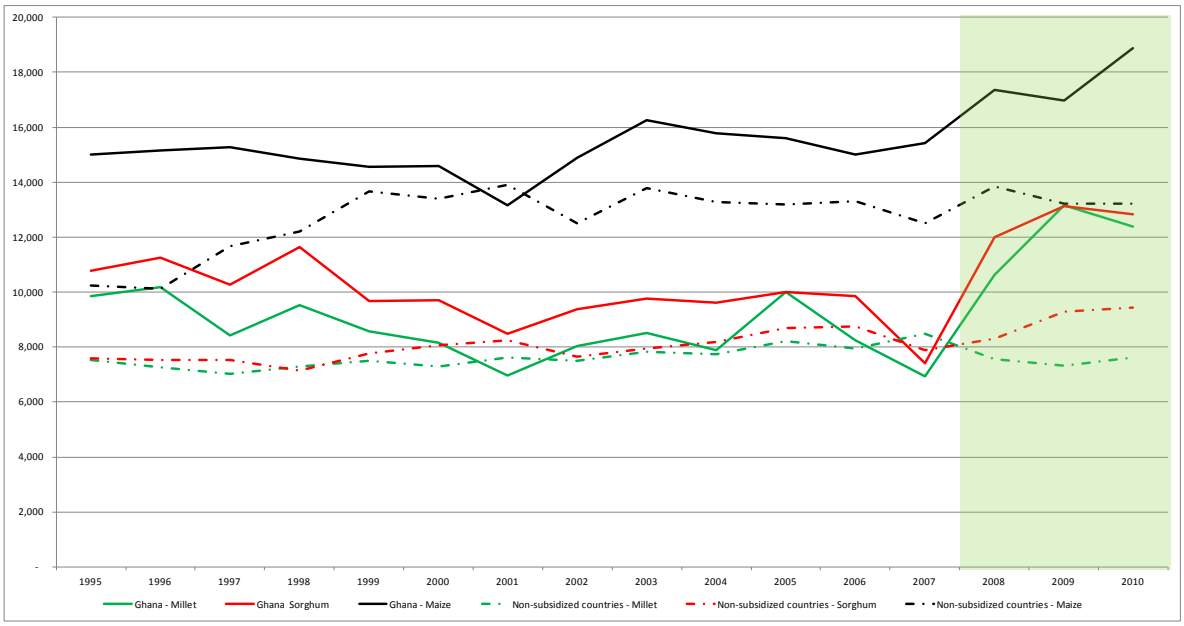
Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table A8. Yield averages for Burkina Faso and West African countries without fertilizer subsidy (kg/ha)

		Pre-subsidy period	**Subsidy period**	**% change**
Burkina Faso	Cotton	1 097	1 227	12%
	Maize	1 558	1 543	-1%
Countries without fertilizer subsidy	Cotton	959	899	-6%
	Maize	1 260	1 343	7%

Source: FAOSTAT

Figure A7. Yield (hg/ha) trends in Ghana for crops targeted in the fertilizer subsidy



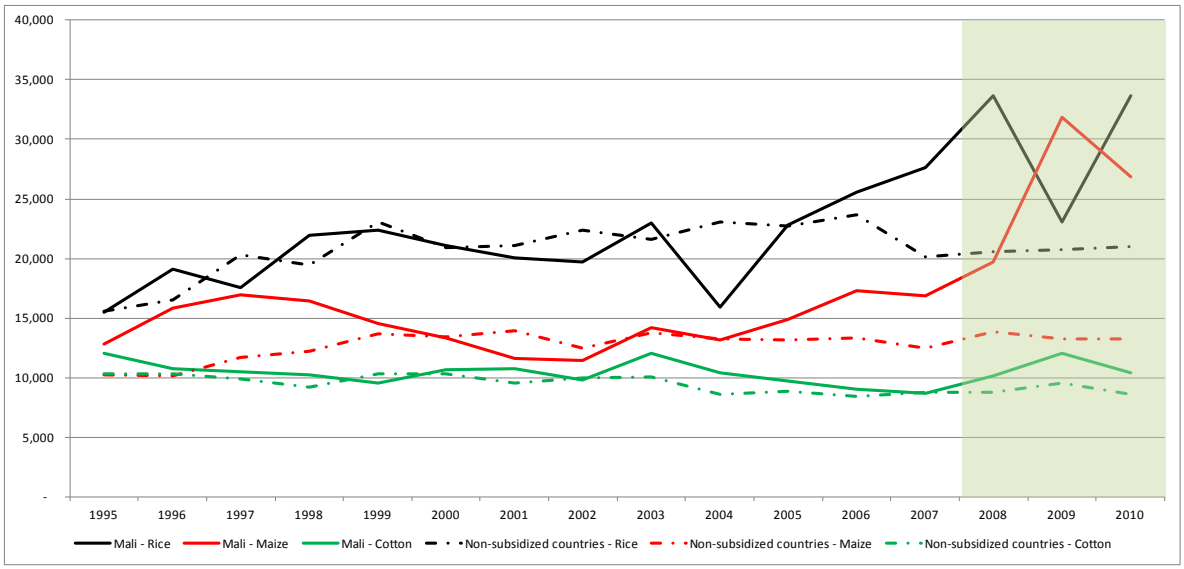
Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table A9. Yield averages for Ghana and West African countries without fertilizer subsidy (kg/ha)

		Pre-subsidy period	Subsidy period	% change
Ghana	Millet	856	1 206	41%
	Sorghum	984	1 265	29%
	Maize	1 505	1 774	18%
Countries without fertilizer subsidy	Millet	763	750	-2%
	Sorghum	793	901	14%
	Maize	1 260	1 343	7%

Source: FAOSTAT

Figure A8. Yield (hg/ha) trends in Mali for crops targeted in the fertilizer subsidy (Rice Initiative)



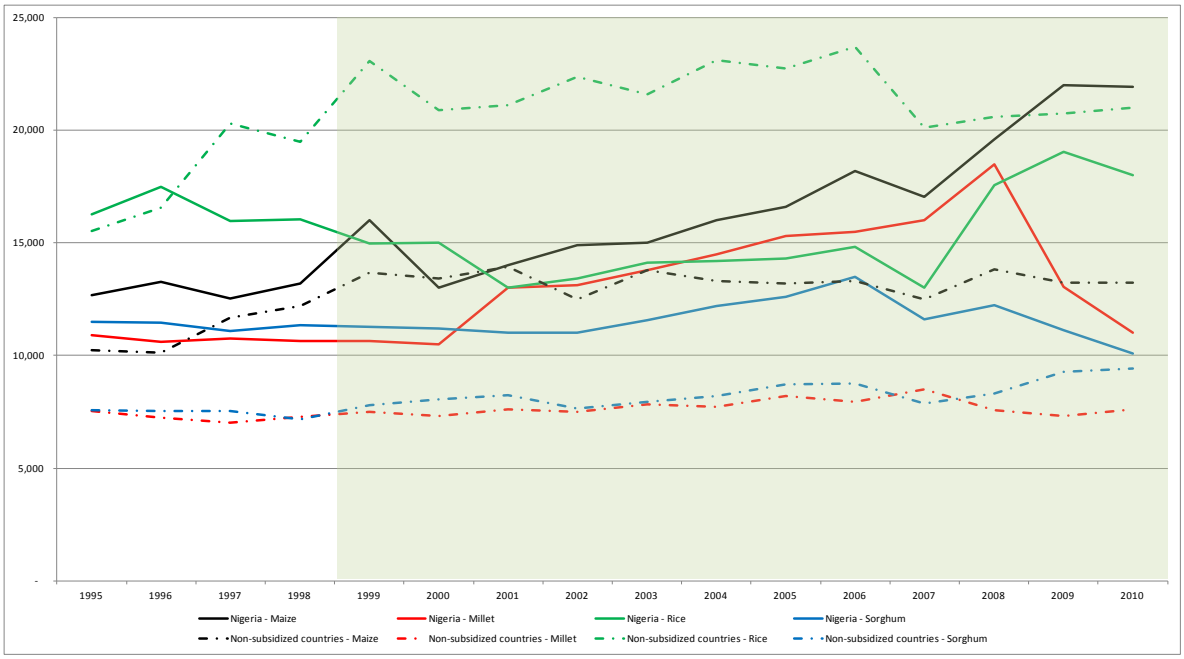
Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table A10. Yield averages for Mali and West African countries without fertilizer subsidy (kg/ha)

		Pre-subsidy period	Subsidy period	% change
Mali	Rice	2 095	3 012	44%
	Maize	1 457	2 614	79%
	Cotton	1 032	1 088	5%
Countries without fertilizer subsidy	Rice	2 081	2 077	0%
	Maize	1 260	1 343	7%
	Cotton	959	899	-6%

Source: FAOSTAT

Figure A9. Yield (hg/ha) trends in Nigeria for crops targeted in the fertilizer subsidy (FMSP)



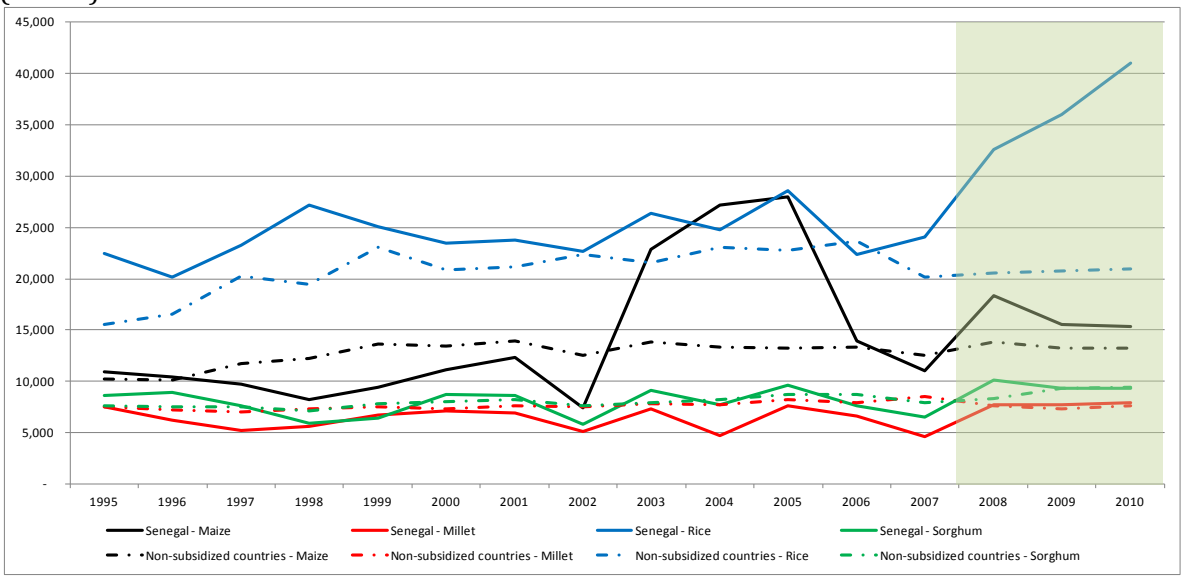
Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table A11. Yield averages for Nigeria and West African countries without fertilizer subsidy (kg/ha)

		Pre-subsidy period	Subsidy period	% change
Nigeria	Maize	1 291	1 702	32%
	Millet	1 072	1 374	28%
	Rice, paddy	1 643	1 511	-8%
	Sorghum	1 133	1 161	3%
Countries without fertilizer subsidy	Maize	1 106	1 332	20%
	Millet	727	772	6%
	Rice, paddy	1 797	2 175	21%
	Sorghum	745	835	12%

Source: FAOSTAT

Figure A10. Yield (hg/ha) trends in Senegal for crops targeted in the fertilizer subsidy (Goana)



Shaded area represents period for which fertilizer subsidy was in place
Source: FAOSTAT

Table 12. Yield averages for Senegal and West African countries without fertilizer subsidy (kg/ha)

		Pre-subsidy period	Subsidy period	% change
Senegal	Maize	1,403	1,642	17%
	Millet	624	775	24%
	Rice, paddy	2,417	3,654	51%
	Sorghum	779	959	23%
Countries without fertilizer subsidy	Maize	1,260	1,343	7%
	Millet	763	750	-2%
	Rice, paddy	2,081	2,077	0%
	Sorghum	793	901	14%

Source: FAOSTAT

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