

Soil Fertilizer Consumption and Distribution Chains in Ethiopia: A Review

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Abstract: Fertilizer use in Ethiopia has almost quintupled since the official elimination of input subsidy programs. Yet, application rates remain far below the recommended level and, given the limited scope for area expansion, fertilizer promotion continues to be the central focus for enhancing agricultural productivity. Unlike many other developing countries, Ethiopia has moved from partial liberalization in the 1990s to government monopoly control over imports, with exclusive marketing through farmers' organizations, since 2008. In 2010, the government embarked on a new policy initiative, Growth and Transformation Program, which sets annual production targets for cereals by region. In Ethiopia, less than 40% of farmers use fertilizer and those who do, apply rates significantly below those recommended. This low fertilizer use is primarily due to prices being two to three times higher than prices on the world markets. Reducing the price of fertilizer requires a sound understanding of the product's supply chain. This review focuses on fertilizer distribution chains, fertilizer consumption and governmental policies on the fertilizer market system in Ethiopia.

Key Words: Distribution, Fertilizer, Market policy

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1. INTRODUCTION

Ethiopia is one of the most populated countries in the world. It is the 14th largest in the world and the second largest in Africa. To feed the growing population, agricultural production has to be increased by improving the agricultural productivity per hectare, because most of the accessible fertile lands have been cultivated. In Ethiopia, agriculture accounts for about 41.6% of the GDP, employs about 83 percent of the labor force and contributes around

90% of the total export earnings of the country (MOFED 2005; RATE 2003; NBE 2007/08). The sector is dominated by about 11.7 million smallholders cultivating about 95% of the national agricultural production and large farms contributed to only 5% of the total production (MOA, 2011). About 80-85% of the population depends on agriculture for livelihood. Increased agricultural productivity in Sub-Saharan Africa (SSA) requires a range of measures

including crop protection innovations and improved agronomic husbandries, but also the appropriate use of fertilizer (Vanlauwe *et al.*, 2014; Howard *et al.*, 2003). An increase in and efficient use of fertilizer has great potential to increase crop yields and improve land productivity (Barbier, 2000). Additionally, fertilizer use in SSA is very low and inadequate to compensate for the nutrients removed in harvested crops (Yamano & Kijima, 2010). Indeed, the average fertilizer use intensity from 2000 to 2003 in SSA was 9 kg of nutrients per hectare (kg/ha), whereas it was 86 kg/ha in Latin America, 104 kg/ha in South Asia and 142 kg/ha in Southeast Asia (Crawford *et al.*, 2006). In high-income countries (Western Europe and USA), fertilizer use intensity is up to 288 kg/ha on average (Hernandez and Torero, 2011). Therefore, potential productivity gains can be achieved by increasing fertilizer use in many parts of SSA without adverse environmental consequences (Mwangi, 1996). The growth in fertilizer use has been remarkable.

Fertilizer use in Ethiopia, as in most SSA countries, is very low due to several constraints. Matsumoto and Yamano (2009) summarized these constraints pointing to two groups. The first group is the market-based constraints, which suggest that farmers do not use fertilizer because of a relatively high fertilizer-to-crop price ratio. The second group, the non-market-based constraints, emphasizes farmers' lack of knowledge about fertilizer as well as land degradation, which lowers the returns to fertilizer application. In the Ethiopian case, although non-market constraints play a role, Dercon and Christiaensen (2011) clearly showed that the crucial point is market constraints. They demonstrated that over time the fertilizer-to-output price ratio has increased substantially. Thus, the search for effective and sustainable policies to promote fertilizer use in Ethiopia should involve measures to lower this price ratio. This means either reducing fertilizer purchasing prices or increasing farm gate output prices, or both (Namazzi, 2008). Previous studies found farm gate prices of fertilizer in Ethiopia to be two to three times higher than prices on world markets (Gregory & Bumb, 2006). However, none of these studies analyzed the structure of the supply chain for fertilizer in Ethiopia, in order to point out the constraints resulting in the observed high prices.

The structure of the fertilizer market in Ethiopia has changed over time. After its introduction in the country in 1967, fertilizer importation and distribution was controlled by the government company known as the Agricultural Input Supply Corporation (AICO) and later renamed Agricultural Inputs Supply Enterprise (AISE). This state monopoly prevailed until the fall of central planning in 1991 (Matsumoto & Yamano, 2009). Subsequently, the market was liberalized and private companies became involved (Spielman *et al.*, 2010). However, in 2001, the private companies exited the market because of strong competition from companies subsidized by regional governments which entered the market in 1996 (Demeke *et al.*, 1997). By 2005, facing an increasing deficit in their budget

due to subsidies granted to their regional companies, regional governments decided to support agricultural cooperatives which were expected to be more efficient in delivering fertilizer to farmers. From 2006 onwards, cooperative unions (CU) became dominant actors of fertilizer import and their market share reached 75% in 2007/2008 (IFPRI, 2012). However, in 2008, the Ethiopian federal government decided to coordinate all fertilizer imports through only one company, in order to benefit from economies of scale by purchasing in bulk and saving foreign currency (World Bank, 2011). The selection of the sole importer would be done every year by representatives of previous importers.

Since the "sole importer" policy has come into force, the AISE has been awarded the position of importer every year, leaving the cooperatives with the role of fertilizer distribution (IFPRI, 2012). Consequently, there is an implicit monopoly at each stage of the supply chain. Along with the new policy, government offices play a major role by regulating the chain, fixing marketing margins and prices, and monitoring the AISE and the cooperatives. Fertilizer use and distribution chain and governmental market policies are not yet assessed in Ethiopia. Therefore, this review paper focuses on assessing the consumption, distribution chain and market policies of soil inorganic fertilizer in the Ethiopian Agriculture sector.

2. Literature Review

2.1 Policy Evolution of Fertilizer Distribution in Ethiopia

From the field-level demonstration to the collapse of central planning in 1991, fertilizer markets in Ethiopia have been controlled by the government through its input marketing agency, called Agricultural Input Supplies Corporation, later renamed Agricultural Input Supplies Enterprise in 1992. This agency had its own marketing network throughout the country, which included marketing centers and service cooperatives for distributing fertilizers to the farmers. As in many other African countries, Agricultural Input Supplies Corporation's controlled marketing was inefficient, involved large direct subsidies, and incurred large administrative costs. In the new marketing system introduced in 1992, the transitional government articulated its desire to end government monopoly as part of its overall market liberalization policies. The private-sector entry, however, was slow in the early years: Only one private company (Ethiopian Amalgamated Limited) actively participated in fertilizer marketing up until 1996. Subsequently, three other companies entered into the markets and attempted to develop their own marketing network. Around this time, a new breed of companies, owned by the regional governments, started to flourish. The first such company to enter was Ambassel Trading, a private limited company owned by the Amhara regional government. In the initial years, until 1995, Ambassel

worked mainly as an agent to AISE, but it began importing in 1996 and started serving as the sole distributor and wholesaler of AISE in the Amhara region. Inspired by Amhara, other regional governments started launching their own companies. By 1998, companies of all four major grain-producing regions in the country were importing and distributing fertilizers alongside AISE and four private companies. However, competition among government, private, and holding companies was short-lived. Shares of private companies in total fertilizer imports dropped from 28 percent in 1996 to zero in 2002 (Figure 2.1). It is commonly argued that the indirect support of the government to holding companies made it difficult for the private sector to operate profitably (DSA 2006; Byerlee *et al.*, 2007).

Cooperatives have been involved in input marketing in Ethiopia since the 1970s, but they were never involved in imports until recently. In the new millennium, the government adopted a strategy to develop an input marketing system with the strong participation of farmers' organizations. The initiative was welcomed because it was also one of the policy prescriptions emerging from the development partners for addressing the problems of thin markets and product aggregation problems. This was an aggressive strategy, and the cooperatives' market share grew rapidly, reaching almost 75 percent of the total fertilizer use in 2007/2008. This rapid growth was promoted by providing subsidized credits to the cooperative unions to import and distribute fertilizer. However, the policy faced problems due to the rising cost of fertilizer and a balance of payment problems during 2007/2008. The government requested financial support from its development partners for and managed to receive \$250 million from the World Bank and another fund worth 100,000 tons of fertilizer from the African Development Bank. Through some negotiations, the government and the two banks agreed to coordinate all fertilizer imports through AISE. This policy decision resulted in the withdrawal of all holding companies except Wondo from fertilizer markets in Ethiopia (World Bank 2009).

2.1.1 Fertilizer and Credit Policies in Ethiopia

Even when new technologies appear to be very profitable to crop scientists and economists, farmers may not adopt them (Feder *et al.*, 1985; Munshi, 2007; Duflo *et al.*, 2008). One of the major constraints for small-scale farmers to adopt agricultural technologies is credit (e.g. Croppenstedt *et al.*, 2003; Gine and Klonner, 2006; Zerfu and Larson, 2010) since cash resources are generally insufficient to cover high-yielding variety seeds and chemical fertilizer purchase for small-scale farmers at the planting season. Despite the importance of credit, the private financial sector is underdeveloped especially in rural areas due to high and correlated risks in smallholder agri-

culture, asymmetric information between borrower farmers and credit providers as well as incomplete enforcement of credit contracts. Thus, public intervention to credit market has been justified for on the purpose of improving formal credit access of small-scale farmers. In spite of the potential of public intervention in on financial services for small-scale farmers, however, such an intervention has to be considered with caution because there are some drawbacks. Firstly, it may crowd out private financial service providers that would be more efficient than public providers. Secondly, a certain type of public intervention such as agricultural lending and input credit is often used as an instrument of political capture and, hence, persistently continued even when it does not have measurable impact on agricultural output (Cole 2004).

Historically in Ethiopia, a government parastatal called Agricultural Input Supply Enterprise (AISE) controlled the importation, distribution, and pricing of inorganic fertilizer during the Dergue regime (1974-1987). The Ethiopian government began curtailing the operation of the official state marketing board under foreign aid - conditionality agreements with donors since 1993. The private sector was allowed to participate in fertilizer importation and distribution following the issuance of the National Fertilizer Policy (Jayne *et al.*, 2003). As a result, some private companies entered into the sector. The government, however, gave favorable treatments toward regional holding companies which competed with the private companies. The favorable treatments included the allocation of foreign exchanges for the importation and distribution of fertilizer through government administered credit to farmers. Because of these favorable treatments toward regional holding companies, private companies found it impossible to compete with them, and all of the private companies exited from the market by 2000. Since then, the distribution system of inorganic fertilizer has been dominated by AISE and a small number of regional holding companies (Spielman *et al.*, 2010).

2.2 The Modern Concepts of Supply Chain of Fertilizers and Comparison with Ethiopian Context

Ethiopia is a landlocked country and the movement of the import and export commodities depends on parts of neighboring coastal countries. There are four main ports that are currently accessible to Ethiopia for foreign trade. Djibouti port is the primary port that currently comprises about 93% of the import-export flow of commodities (Afro Consult & trading plc, 2010). The other three, Berbera, Mombasa and Port Sudan are optional ports that are not as viable as that of Djibouti port in the current situation. Fertilizer marketing in landlocked countries is a low-margin and high-risk commodity. Fertilizer transport costs are high because it is a bulky product and the distances transported are great. In addition, risks are

high in investing in fertilizer due to the seasonality of demand, storage costs and bank interest incurred. Due to these factors and the political importance of the provision of low-cost and stable fertilizer prices has usually meant heavy government intervention in setting prices and organizing distribution systems.

The seasonality of demand is also a basic condition that plays out in shaping market structure. Stepanek (1999) stated that fertilizer is consumed primarily during the larger, Meher season (roughly July to November), but also during the earlier belg (April to July). Most fertilizer is actually applied between March and July. All fertilizer consumed in a given season cannot be offloaded in the months immediately prior to distribution. Thus, coordination of imports is required in order to ensure sufficient fertilizer supplies by scheduling over the quarters of a year. Stepanek (1998) also sorted out that organizational fertilizer market structures of all regions were almost similar but differing only in the number of wholesalers and retailers. In 1998, nationally, there were 7 large wholesalers (AISE, EAL, Fertiline, Guna, Ambasel, Dinsho, and Guna-5) and also worked as importers. However, only one to three companies may have operated in any zone. Primarily one company in Amhara: two companies in the south; three companies in Oromia and Tigray.

2.3 Trends on Fertilizer Import and Distribution System

The entire required fertilizer amount is imported annually. The Agricultural Inputs Supply Enterprise (AISE) is responsible for the import and distribution of fertilizers to farmers directly and through primary farmers' cooperatives and cooperative unions. AISE imports the fertilizer through Djibouti port, discharges the cargo at the port, and delivers the product directly to the cooperative union warehouses if they are ready or stored in its 33 warehouses located in different parts of the country to be transferred later to the cooperatives. The quantity of fertilizer to be distributed to woredas is pre-determined according to a plan aggregated from woreda to the Federal level. Farmers, or the cooperatives on their behalf, take delivery from AISE warehouses. Cooperatives' role in most cases is limited to physical facilitation involving no advance purchase, storage, and working capital investment. The 10,000+ primary cooperatives and 180+ farmers' cooperative unions (Bezabih and Mengistu, 2011) in the country play an important part in facilitating the redistribution of fertilizers from AISE to farmer members. Farmers wishing to purchase fertilizer on cash or credit terms go to the nearby cooperatives and buy the quantity of fertilizer they need.

Ethiopia has moved from partial liberalization in the 1990s, to exclusive marketing through farmers' organizations, since 2008. As a result, private sectors, endowments and farmers' cooperative unions (FCUs) have been

involved in fertilizer import between 1996 and 2007. Private sectors were the first sectors engaged in fertilizer import in 1996 followed by holdings involved a year later. Farmers' cooperative unions joined the import business in 2005/06 and stayed for three years. The 2007/08 season then became the end of the involvement of other sectors and AISE became the sole importer again. North Africa, East Europe and Russia are the main sources of fertilizers imported which offer the advantages of short voyage time and distributed deliveries in lots of 12,500 - 60,000 tones. There is no major constraint of truck availability from the port to the central warehouse (AISE, 2014). This will be facilitated further when the Ethio-Djibouti railway starts in a year time, which is expected to shorten the 4-5 days of transportation by trucks to about 10 hours. Concerning the adoption and use of new fertilizers, the MoANR and the Agricultural Transformation Agency have jointly introduced new fertilizer sources through demonstrations on farmers' fields with the aim of testing their performance as well as creating awareness to farmers. By doing so, they were able to demonstrate new fertilizer sources that has nutrients in addition to N and P to more than 40,000 farmers plots in four major crops (maize, teff, wheat and barley) and in four major regions (Amhara, Oromiya, Tigray and SNNPR) where the majority of the fertilizer is consumed in Ethiopia. As a result, the DAP is gradually being replaced by NPS (sulfur containing DAP) for the time being and tailored blends will be produced based on the soil fertility condition of the different woredas using the already established and the to be established fertilizer blending facilities, which are owned and run by the FCUs. The FCUs receive the ingredients for the blends from AISE as they used to for the straight fertilizers.

2.4 The Fertilizer Consumption

Until 2013, urea and DAP (di-ammonium phosphate) fertilizers have been the only fertilizer sources that have been in use in Ethiopian agriculture for more than four decades. None of these are locally produced and should be supplied by imports to meet the demand. From Figure 1 it can be seen that N and P consumption steadily increased from 1980/81 to 2014/15. Mean fertilizer consumption in Ethiopia has risen from 132,522 MT (1995/96) to 858,825 MT (2014/15) period. Even though the amount of fertilizer imported increases every year, Ethiopian farmers still lag far behind other developing countries in fertilizer use. The average intensity of fertilizer use in the country (which is roughly less than 40 kilograms per hectare) remains much lower than elsewhere (e.g., 54 kg/ha in Latin America, 80 kg/ha in South Asia, and 87 kg/ha in Southeast Asia). Going by the recommended usage dosages of N, and P for different crops, teff, wheat, maize and barley are the main consumers of fertilizers.

As the above data suggest, the major source of fertilizer sales in Ethiopia are urea and DAP since the 1960s and there has been no change in the composition of the use of fertilizers in Ethiopian agriculture until 2014/15 cropping season. The average share of urea in total use of fertilizers remains much lower than DAP; accounting for 15% of the total use of fertilizer in 1980-1999 while it was 35% between 2000-2015. The scenario fairly suggests that there was not much effort to improve fertilizer use in a country that has variable agroecology and soil conditions. The unbalanced use of fertilizer in the sense of soil fertility (which is assessed according to the gap between recommended dose and type of fertilizer and its actual use in fields) became evident in recent years. The significant gap between the recommended dose and the actual amount of fertilizer given to land is very high in the case of urea. Due to the unbalanced use of fertilizer; the loss in soil fertility is also significant in Ethiopia.

2.5 Fertilizer Value Chain

2.5.1 Key Actors and Decision-making Process

The fertilizer value chain in Ethiopia involves numerous actors who perform three broad sets of activities: (1) import planning, (2) import execution, and (3) marketing and distribution. The import planning begins with a demand assessment, conducted by the woreda (district) agricultural bureau based on primary data collected with community surveys by the extension workers, called development agents. Some primary cooperatives also conduct demand assessments. The estimates by the development agent and cooperatives are reconciled by the woreda bureau offices and then sent to the zonal offices. The zonal offices aggregate woreda-level data and then send the estimates to the Bureau of Agriculture and Rural Development (BoARD).

Since the adoption of the Growth and Transformation Program in 2010, production targets set by the program over a five-year plan are also factored in when finalizing the estimates at the Bureau of Agriculture offices. Finally, the Ministry of Agriculture and Rural Development aggregates the regional estimates and comes up with the national demand estimates. The net import requirement is determined by deducting the previous year's carry-over stocks from the current year's demand. In executing the imports, the Ministry of Agriculture (MoA) prepares tender documents and invites a consortium of public institutions (Ministry of Finance and Economic Development, National Bank of Ethiopia, Commercial Bank of Ethiopia, and Quality and Standard Control Office) to review and approve the projected demand, necessary foreign exchange requirements, and opening of international procurement tender. As indicated previously, since 2008, the execution of imports has been carried out exclusively by AISE.

The logic for giving monopoly power to AISE is to take advantage of economies of scale. The idea is simple: Importing in large quantities gives a buyer more bargaining power to negotiate lower prices. In addition, large-scale imports can arguably reduce transaction costs and make value chain management more efficient. A recent MoA report argues a discount of 2–4 percent per ton could be obtained for a bulk purchase of 25,000 metric tons (mt) or more (Ethiopia, MoARD 2012). However, this is hard to validate. In 2011, several regional cooperative unions wanted to break out of AISE and requested the MoA to import fertilizer by forming a regional federation of cooperatives.

The MoA, however, decided that allowing three or more cooperative federations to import would be inefficient. Therefore, the AISE was nominated again as the sole importer of fertilizer on behalf of farmers' cooperative unions. After imported fertilizer arrives at Djibouti port, the AISE informs the regional cooperative unions to transport the consignment to the central warehouses. The cooperative unions determine where to store it, depending on the storage capacity. The option given priority is to deliver fertilizer directly from the Djibouti port to the warehouse of the cooperative unions. If the unions do not have storage capacity or are not ready to receive the shipments, AISE stocks fertilizer in its central warehouses. From central warehouses, the union distributes to the primary cooperatives, from which farmers can get direct access to buy. In regions that have no cooperative unions or are inaccessible, AISE takes the responsibility to deliver, with primary cooperatives acting as a wholesaler. The BoARD plays an active role in the marketing and distribution of fertilizers. This includes facilitating the input credit guarantee to the Commercial Bank of Ethiopia, providing transportation facilities if needed, and ensuring on-time delivery of fertilizer.

The BoARD is also involved in the determination of prices and margins. The AISE determines the weighted average price of fertilizer at the central warehouse level. The BoARD then adds margins (both for unions or federations and for primary cooperatives) and determines loading and unloading costs, warehouse rent, bank interest rates, and other administrative costs. During our interview, the regional BoARD officials indicated that the price determination in each region is made in consultation with the unions. In Tigray and SNNPR, price determination is done twice a year for meher (the main cropping season) and belg (minor season in selected areas from February to May) seasons. The Meher season prices are set by taking into account the weighted average prices of carry-over stock and compensating for storage and other administrative costs and new import. The belg season prices (September–April) are set using the Meher season price plus the bank interest and administrative costs.

3. CONCLUSION

Increased agricultural productivity in Sub-Saharan Africa (SSA) requires a range of measures including crop protection innovations and improved agronomic husbandries. Ethiopian soils have been subjected to severe degradation caused by natural and man-made factors. The use of chemical fertilizer and improved seeds is quite limited despite Government efforts to encourage the adoption of modern, intensive agricultural practices. Smallholder farmers still use lower fertilizer application rates compared with their counterparts in east Africa. Urea and DAP (di-ammonium phosphate) are the only fertilizer sources that have been in use for the past four decades in Ethiopia.

Fertilizer is a key input in boosting agricultural production in Ethiopia. Hence, increasing its use in the country has been targeted as a strategic goal. To achieve that goal, the government has implemented over time various policies on the fertilizer market. The last policy shift was characterized by the state control of the chain, control over prices but also the involvement of non-state organizations such as agricultural cooperatives in the chain. So the government of Ethiopia should design another fertilizer Market policy considering the current fertilizer cost.

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