

AGRICULTURAL INTENSIFICATION, TECHNOLOGY ADOPTION, AND INSTITUTIONS IN GHANA

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Agricultural production in Ghana has been growing steadily, although this has largely been due to an expansion of cultivated area rather than productivity increases. Over the past few decades, Ghana has experienced sound and persistent economic growth (Breisinger et al. 2011). In common with experiences of significant economic growth in other developing countries historically, the share of the total value of Ghana's economy made up by output from the agricultural sector has decreased from 40 percent in 2000 to 23 percent in 2012 (World Bank 2012). Overall, Ghana's path to economic transformation has been characterized by high growth in the service sector, stagnation in the manufacturing and industry sectors, and a weak transformation of the agricultural sector (Kolavalli et al. 2012). From 2002 to 2013, yields of major cereals, such as rice, maize, sorghum, and millet, increased only marginally and remained well below their potential (Houssou and Chapoto 2014). Productivity has remained low in the agricultural sector, owing to low levels of intensification, including low or inappropriate use of inputs (improved seed, fertilizer, herbicides, and pesticides), dependence on rainfed agriculture, high post-harvest losses, and low levels of agricultural mechanization.

Attempts to intensify and transform Ghanaian agriculture date back to the post-independence period when government invested in the supply of private goods, such as fertilizer, seed, and agricultural machines, and public goods, such as agricultural research and rural infrastructure, to increase farm productivity. While progress has been made, the supply of agricultural inputs and public goods is still not enough to promote widespread intensification.

Ghanaian farmers have been dynamic in their response to declining soil fertility, changes in the local availability of labor, and increasing market opportunities, but their response has not involved significant intensification of production. Rather, they are increasingly changing the mix of crops they produce towards those that offer significant market opportunities, such as soybean, cotton, and maize, and away from crops that require intensive labor or highly fertile soil, such as yam. This brief synthesizes findings emanating from research on farming systems, the adoption of agricultural technologies, and the institutions involved in agricultural transformation in the country over the past ten years to shed more light on these issues.

AGRICULTURAL INTENSIFICATION

Here, we define intensification broadly to include more frequent use of land and increasing use of yield-enhancing inputs in order to increase land productivity. Ghanaian farmers are steadily expanding the land that they farm without much increase in the inputs that they use to farm that land. Changes in Ghanaian farming systems are primarily characterized by a gradual process of increased use of labor-saving technologies (such as mechaniza-

tion and herbicides), rather than land-saving inputs (such as improved seed, inorganic fertilizer, and irrigation). This enables farmers to increase production through area expansion, but results in only limited increases in crop yields.

One reason for limited agricultural intensification so far in Ghana is that land pressure and market demand may not be inducing farmers to intensify how they produce their crops (Nin-Pratt and McBride 2014). However, in areas with significant land pressure and good access to agricultural markets, the concern is that farmers are not able to access the inputs and infrastructure necessary to intensify their crop production (Diao and Silver 2016). Moreover, intensification will become increasingly necessary as Ghana attempts to replace food imports through domestic agro-processing.

Exceptions to the generally low level of intensification of farming systems can be observed, however, in cocoa and lowland irrigated rice production. Cocoa yields nearly doubled between 2000 and 2010 because of rising producer prices, the introduction of improved technology, subsidized fertilizers, and public pest and disease control programs. The intensification process in lowland rice production has been especially significant in some irrigation schemes, notably Kpong, where land and labor productivity reaches levels as high as those of Asian countries (Takeshima et al. 2013). Also, rice production is fully mechanized on these schemes. The challenge is to replicate this success in the intensification of irrigated rice production on other public irrigation schemes which are largely underutilized and where only low crop yields are achieved (Regassa et al. 2011). Moreover, the successful intensification of lowland rice production in Ghana can be instructive for intensifying the production of other crops.

SEED

Farmers have moved from the use of long to short-maturing varieties of crops and have incorporated new crops, such as soybean and cotton, into their crop mixes (Houssou et al. 2016a). However, they are not replacing their old crop varieties with improved varieties rapidly enough. Crop yields are further constrained by the low availability and use of certified seeds, which results in farmers not replacing seed at recommended rates.

Maize is one example of the seed sector's failure to take off. Other countries that have increased maize productivity have been able to do so because of increased adoption of hybrid maize varieties. But less than five percent of Ghanaian maize producers use hybrids (Ragasa et al. 2013a). Moreover, the average age of improved maize varieties planted in the country is 23 years (Ragasa et al. 2013a). *Obatanpa*, which is an improved maize variety and more than two decades old, is planted on over three quarters of the national maize area. Many locally developed improved maize varieties, including hybrids that have been released in the last decade, have not been adopted by farmers.

SARI/IPA maize trials of hybrid varieties, Nyankpala, Ghana



Source: Field trip, 2015

Recently conducted trials by Savanna Agricultural Research Institute and Innovation for Poverty Action (SARI/IPA) at ten locations in northern Ghana suggest that none of the recently released local hybrids outperform the decades old *Obatanpa*. Two imported hybrids, which have been planted on small areas in recent years, outperformed local varieties, but they are only now being made available to farmers.

Rice farmers have been more dynamic in adopting marketable varieties, but the rice varieties available to farmers do not balance a broader set of desirable traits, such as high-yield, disease resistance, and marketability. Similar to maize, there is low use of certified rice seed in Ghana, although there is evidence that the use of such seed is strongly associated with higher rice yields (Ragasa et al. 2013b).

There are difficulties with commercializing seed for newly developed crop varieties, both because of their generally low performance and because of the underdevelopment of the national commercial seed sector. Although Ghana has now a seed policy that permits greater private sector participation, the public research system has not consistently been able to make available better maize varieties to both commercial seed producers and suppliers and, hence, to farmers (Ragasa et al. 2013a; Tripp and Ragasa 2015).

FERTILIZER

The use of fertilizer in Ghana is widespread where soil fertility is poor, but farmers increase the amount of fertilizer that they apply only to offset soil nutrient depletion from repeated cropping of the soil. While more farmers are applying fertilizers, they are still doing so at far below the recommended rates. Public efforts to promote fertilizer use have focused on fertilizer subsidies as the only policy instrument for improving soil fertility management, without paying sufficient attention to the financial returns to farmers of fertilizer use. Current blanket fertilizer recommendations do not match current soil fertility patterns in the country or crop nutrient needs, leading to low crop yield responses to fertilizer (Chapoto and Tetteh 2014). There is a need to localize fertilizer recommendations while also incorporating better soil fertility management practices in order to combat soil fertility degradation and declining crop yield responses to fertilizer. The response to fertilizer also depends on the use of quality seeds, so improvements in Ghana's seed systems are also implicated in increased uptake of inorganic fertilizer. Without taking such steps, the use of fertilizers for many Ghanaian farmers may prove not to be profitable. Strategies to increase the returns to fertilizer use should adopt an integrated approach that includes soil testing, increased use of organic matter in soil fertility management, and better targeting, among others (Jayne et al. 2015).

Since global fertilizer prices increased in 2008, fertilizer subsidies have prevented major rises in the cost of fertilizer for Ghanaian farmers. Although these subsidies have led to increased production, there are issues with the sustainability of the program, given its rising cost, and the realization that the program primarily benefits well-off farmers while not sufficiently reaching farmers in remote areas (Benin et al 2012; Houssou et al., forthcoming). Other impediments are related to the implementation of the fertilizer subsidy program, such as late announcements on how the program is to be implemented each year. The uncertainty associated with how the fertilizer subsidy program will be implemented each year also increases the risks to increased investments in their businesses by private fertilizer supply firms, hinders the development and strengthening of private fertilizer supply channels nationally.

MECHANIZATION

In contrast to their low adoption of improved seed and fertilizer, farmers have embraced labor-saving technologies, such as herbicides and mechanization, much more widely. With increased urbanization and increasing rural labor costs, the demand for agricultural mechanization is rising (Diao et al. 2014), but limited to primary tillage operations, mainly plowing. Herbicides and tractors have enabled many small farmers to increase their farm size and successfully transition to being medium or even large-scale farmers, breaking through the barriers of subsistence agriculture into more commercialized production systems (Houssou et al. 2016b). But, the supply of mechanization services is still inadequate. Over the years, government has imported tractors via bilateral arrangements to supply farmers at subsidized prices. Since 2007 they have supported the establishment of private mechanization centers, Agricultural Mechanization Service Enterprise Centres (AMSEC) by providing them with machines on credit. These centers offer tractor services to smallholder farmers. However, these AMSEC centers generally have not been viable because of low capacity utilization of their tractors, high overhead costs, and lack of a spare parts network, as a result of importing small volumes of tractors from different countries under bilateral agreements (Houssou et al. 2016c).

However, the bulk of agricultural mechanization services are provided, not by the AMSEC centers, but by medium-scale farmers who buy cheaper used tractors that are privately imported into the country. (Houssou et al. 2015). Their operations are profitable and on a per tractor basis they offer more services

Private tractor operator with poor plowing skills, Upper East region, Ghana



Source: Field trip, 2013

than mechanization centers. Repair services and spare parts are widely available for their tractors since they are privately imported and are brands of tractors already established on the market.

The viability of the supply of mechanization services could be increased if tractors are used to mechanize other operations beyond tillage alone, such as harvesting and shelling. Other areas that require attention in expanding agricultural mechanization are the technical skills of tractor operators and mechanics. The recent importation of tractors from Brazil with a wide range of attachments has the potential to expand the range and increase the profitability of agricultural mechanization service provision (Houssou et al. 2016c).

IRRIGATION

There has been much past investment in irrigation in Ghana. Irrigation directly contributes to increased yields while also facilitating the adoption of other yield-increasing inputs and practices. However, there has not been any recent expansion of public irrigation systems nor is the existing irrigation capacity of the country being fully used. Despite the pocket of success in high-productivity irrigated farming observed in the Kpong irrigation scheme, yields in other irrigation areas, such as Afife, Ve, and Tono, still lag far behind their potential. This is an outcome both of ineffective irrigation management and the use of inappropriate crop varieties that is a result in part of a lack of on-site certified seed production.

Recession agriculture – farming on seasonally flooded lands after the rainy season – offers an opportunity to more effectively utilize all available water resources for agricultural production. However, there are several obstacles and knowledge gaps which need to be addressed to realize the full potential of such farming systems (Yoro et al. 2016). Some of these obstacles include the limitations posed by current land tenure and property right regimes, the poor understanding of the hydrological patterns of the Volta river, the lack of access to crop varieties adapted for use in recessionary agricultural systems, and a lack of appropriate advisory services and risk management measures in the context of such systems.

ACCESS TO FARMLAND

Other inputs, such as land, appear to be less of a limiting factor to increasing farm productivity in Ghana in the short to medium term. Neither the current customary land right system nor the statutory system are sufficiently able to provide tenure security for farmers (Lambrecht and Asare 2016). Yet, land issues, such as concerns over boundary disputes, encroachment, or multiple sales of land, do not necessarily inhibit active investment in land.

Likewise, the individualization of land rights and the increase in land market transactions are not deteriorating women's access to land in Ghana (Lambrecht 2016). Stronger individual rights to land, more active land markets, more off-farm income-earning opportunities, and the rising value of female labor are linked to greater access to land for women. Moreover, many women are intensifying their fields as a response to their household's rising expenditures on non-food items. These trends may result in increases in the adoption of intensive farming technologies among rural women.

INSTITUTIONAL FACTORS

The persistent development challenges facing the agricultural sector have also led policymakers to seek options for increasing Ghana's budgetary allocations to agriculture in order to

Mechanized tillage on lowland rice field, Asutsuare, Ghana



Source: Field trip, 2012

raise farm productivity. Ghana has signed the Comprehensive Africa Agriculture Development Programme (CAADP) compact, one of whose targets is to raise public agricultural spending to 10 percent of total government expenditures. Despite these commitments, there does not seem to be room for further spending whether on agriculture, on social welfare, or on infrastructural improvements, among other development objectives (Younger 2016). Significant fiscal expansion and increases in development spending will only be possible by reducing the public-sector wage bill, which now is much larger than it has been even in the quite recent past. As the country is in the midst of a severe crisis in its public finances, government is cutting most spending in order to bring fiscal and current account deficits to sustainable levels. Few additional public resources for agricultural or other development efforts should be expected in the near term.

There have also been concerns over how recent government decentralization may affect Ghana's agricultural performance. District agricultural staff have repeatedly expressed their worry that agriculture will receive less attention when greater prioritization powers for the allocation of public resources are put into the hands of local Metropolitan, Municipal, and District Assemblies (MMDA) and their chief executives (Mogues and Omusu-Baah 2014). Cuts and delays in funding exacerbate these concerns, as they are primarily a result of serious fiscal problems at the central government level.

Grassroots associations, such as local farmer-based organizations (FBOs), which facilitate agricultural intensification and enable cost-effective delivery of extension services, have not been able to raise resources on their own for collective activities (Salifu et al. 2012). Training that goes beyond bookkeeping to focus on the business skills required for individual FBO members to be successful commercial farmers, such as profit-loss analysis, entrepreneurial skills, and future business projections, are some of the areas where capacity needs to be built to improve the contribution of FBOs to farm productivity and profitability.

CONCLUDING REMARKS

Agricultural intensification has only taken off to a very limited extent in Ghana. Adoption of land productivity-enhancing technology is low, even in areas with proximity to urban markets. Rather, farmers have increasingly been adopting labor-saving technologies such as herbicides and mechanization, for which vibrant private supply channels are emerging. Further efforts to strengthen the private mechanization supply chain would help meet the rising demand for tractor services. Furthermore, mechanization could also help free up agricultural labor to perform other more labor intensive tasks.

While in some cases, local conditions have not yet induced farmers to intensify, the demand for intensification has risen in many areas and will continue to grow. Moreover, intensifying agriculture is necessary to achieve Ghana's objective of substituting for imported food products through domestic agro-processing. However, public efforts to promote intensification have not yet enabled farmers to transform their production practices. Farmers do not have access to enough high yielding varieties and certified seed to enable widespread yield increases. While the fertilizer subsidy has increased production, questions remain

about how to increase the return to fertilizer use, as well as the financial sustainability of the subsidy and the adverse effects it has on private sector firms engaged in agricultural input supply. For irrigation, lessons need to be drawn from Ghana's few success stories in order to enhance productivity, particularly for rice, throughout the country. Input supply channels and broader support for intensification will need to improve in order to achieve an agricultural transformation in Ghana.

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This publication of the Ghana Strategy Support Program is made possible by the generous support of the American people through the United States Agency for International Development (USAID). It has not been independently peer reviewed. The contents are the responsibility of the author(s) and do not necessarily reflect the views of USAID, the United States Government, or the International Food Policy Research Institute.