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Food Processing and Agricultural Productivity Challenges: The Case of Tomatoes in Ghana

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INTRODUCTION

In Ghana, tomato is important both as a cash crop and in diets. Yet despite its importance, tomato production in the country appears to have stalled or even declined, while imports of tomato paste surged in the 2000s and continue to increase. As Ghana urbanizes and consumers become richer and look to the convenience of processed over fresh food items, opportunities for domestic processing should increase. But concerns are mounting that Africans are meeting increasing proportions of their demand for processed foods from imports, particularly as trade policies increasingly constrain Ghana's options to protect its domestic food processing industry. This not only puts pressure on domestic processing but on domestic agriculture, which is typified by low productivity and high prices (Wilkinson and Rocha 2006).

The experience of tomato in Ghana typifies this trend, which is characterized by increasing demand for imported paste over domestic fresh tomato, the highly publicized clashes between tomato farmers and traders in Upper East Region, the reported suicides of tomato farmers who cannot find a market, and the multiple attempts by the government to reopen previously state-owned processing plants (ostensibly to mop up the oft-reported glut and provide a market for farmers). These troubling developments exemplify what is likely to be an increasing issue for agriculture in Ghana and other African countries. Ghana's agriculture sector appears to be losing out to imported processed food products, and is unable to compete because of low productivity.

MULTIPLE DIMENSIONS OF FOOD PROCESSING

The food processing industry can be characterized along a number of dimensions: processing of imported agricultural commodities for the local market (global-to-local), processing of locally grown commodities for export (local-to-global), and processing of locally grown commodities for domestic consumption (local-to-local) (Sautier et al. 2006). Whereas we find many examples of large-scale global-to-local and local-to-global food processing, local-to-local food processing tends to be dominated by informal sector activities that account for the bulk of informal employment and manufacturing in Ghana. These activities include cassava processing into flour, dried cassava and starch; fish processing, including smoking; groundnut oil extraction; and milling or grinding millet, sorghum, and maize for own use. Documented cases of large-scale local-to-local processing tend to be less common, the key exceptions being sugar and tomato paste (Sautier et al. 2006).

Much of the small-scale food processing can be termed "autarkic" processing which involves a commodity for which neither the fresh nor the processed product is traded significantly (such as *kenke*, *shitoh*, and dried fish). In contrast, tomato processing is an example of import substitution where the fresh agricultural product is nontradable (because it is bulky or highly perishable) but the processed product is tradable. Fresh tomato is highly perishable, particularly in West Africa where temperatures are high and access to cold storage (or often even shade in the markets) is lacking. Moreover, the varieties grown and the growing techniques used often result in a shelf life of less than a week.

The trade in fresh tomato is predominantly domestic with some limited regional trade with Ghana's closest neighbors (Burkina Faso, Côte D'Ivoire, and Togo). Tomato paste is a close substitute for fresh tomato in Ghanaian diets, both used for preparing sauces and soups. In Ghana, whilst efforts to process tomato domestically have failed in the main, imports of tomato paste have surged.

If a nontradable is processed and becomes tradable, world prices and productivity matter for both the processed product and the raw input—fresh tomato in this case—whereas without processing, the price is determined locally and often isolated from world prices. The current reality for Ghana is that the farmgate price for tomato, which is set by domestic supply and demand, is considerably above the price in the key tomato processing countries such as the USA, Italy, Spain, and China. With these facts regarding local-to-local processing in mind, in the next section we explore Ghana's tomato value chain in more detail, beginning with production, then addressing marketing, and finally processing.

THE IMPORTANCE OF TOMATO IN GHANA

Tomato is an important cash crop and a key element of local diets.

Over 90,000 farmers are estimated to be involved in tomato production, as are 5,000 traders and more than 300,000 individuals in the retail and wholesale sector (Robinson and Kolavalli 2010c). An estimated 25 people are involved in getting one tomato from plot to plate. These include day laborers working in the fields, haulage truckers, the men who load and unload the tomato crates on and off trucks, porters, and the restaurant and chopbar owners (Robinson and Kolavalli 2010c). Tomato accounts for approximately 38% of household spending (including imputed value of own consumption) on all vegetables, both fresh and processed (GLSS3 1995; GLSS4 1999). Fresh tomato and tomato paste are both important in Ghanaian diets and cooking. Yet accurate estimates of production and consumption within the country are hard to come by.

While domestic production of fresh tomato has stalled, imported paste has surged

Despite its importance, tomato production in the country appears to have stalled or even declined (Table 1 and Figure 1). Ghana currently imports virtually all its tomato paste, some in bulk form for repackaging, some ready to sell to consumers, and often featuring in the top 10 global importers (FAOSTAT).

TABLE 1—URBAN AND RURAL CONSUMPTION OF FRESH AND PROCESSED TOMATO IN GHANA (%)

	GLSS3 (1995)			GLSS4 (1999)		
	Urban	Rural	Ghana	Urban	Rural	Ghana
Fresh tomato	38	26	31	37	29	33
Tomato paste	2	1	1	9	5	7
Other vegetables	60	72	68	54	66	60

Source: GLSS3 and GLSS4.

Ghana's tomato paste imports surged in the 2000s, reaching 78,000 tonnes in 2007, driven by:

- increased demand;
- substitution for fresh tomato in between harvest periods;
- the closure of the domestic processors;
- increased urbanization;
- the elimination or reduction of state policies during the 1980s and 1990s that covered agricultural production, marketing, pricing, and direct subsidies; and
- relaxation of trade restrictions on the import of tomato paste (Khor and Hormeku 2006) (Figure 2).

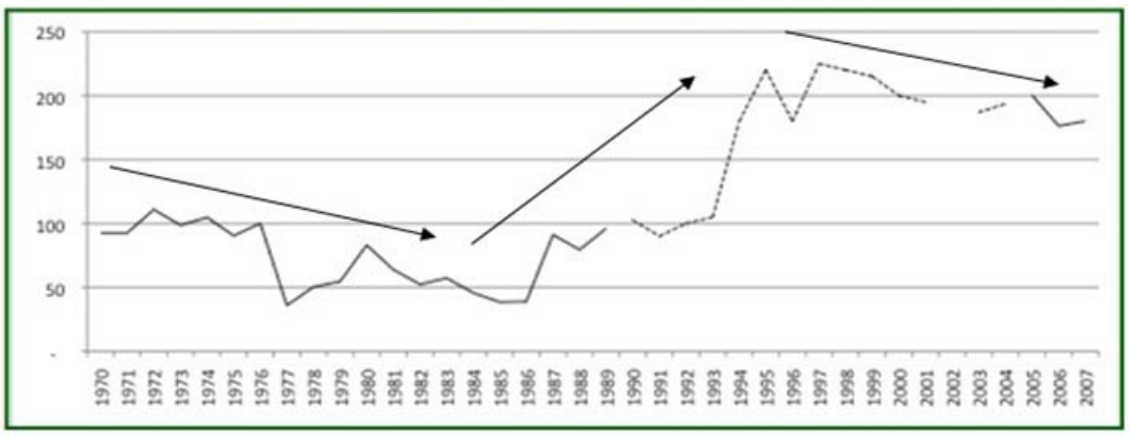
WHY ISN'T GHANA'S LOCAL TOMATO PROCESSING COMPETITIVE OR VIABLE?

For local tomato processing to be competitive and viable there are three key elements to consider.

1. The price of imported tomato paste limits the amount processors can pay for fresh tomato and thus remain competitive with imports.
2. This limit on the price that processors can pay tomato farmers in Ghana sets a lower limit on tomato productivity. If the cost of producing tomato in Ghana is greater than this upper-limit price, domestic processing will not be viable unless imports are restricted

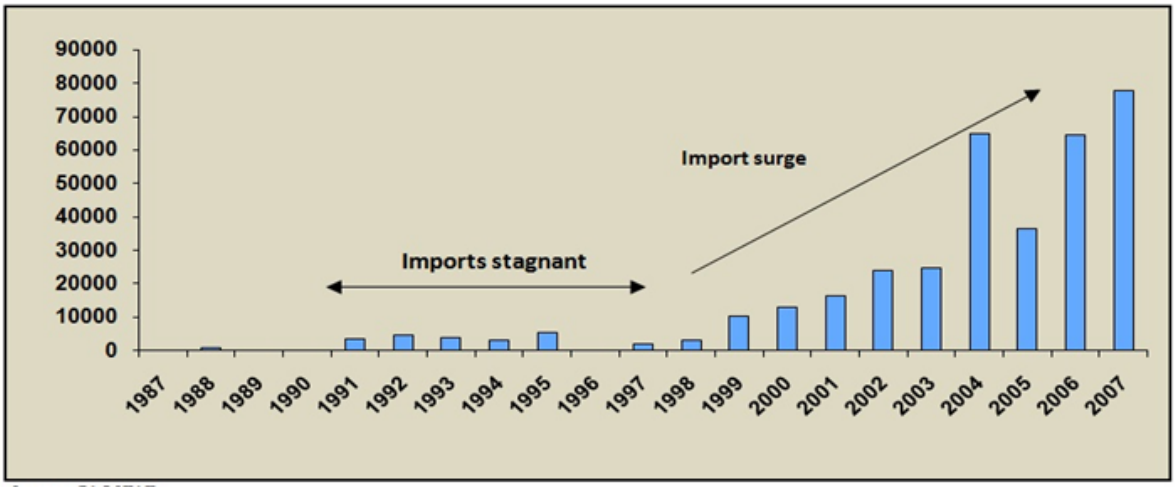
Even if farmers can supply the processors and remain profitable, the market for fresh tomato remains, so they have the option of selling in the fresh markets if the price is greater than the processor price. Although farmers and processors typically enter into agreements that fix the selling price at the start of the season, the reality in Ghana, as in many low- and middle-income countries, is that such contracts are rarely enforceable.

FIGURE 1 - GHANA'S TOMATO PRODUCTION TRENDS ('000 TONS PER YEAR)



Source: FAOSTAT-SRID 2010; Asuming-Brempong and Asuming-Boakye 2008.

FIGURE 2 – GHANA'S IMPORTS OF TOMATO PASTE (TONNES PER YEAR)



Source: FAOSTAT

The price of imported tomato paste limits what local processors can pay for fresh tomato

Tomato paste is a commodity. The market is characterized by a large number of brands, little differentiation, and little if any consumer pressure to ensure a high-quality product. Producing a low-cost product is therefore key for competitiveness. Here we address the economics of tomato processing, comparing the cost of imported bulk paste from China with the local cost of processing local tomatoes. We choose China as a benchmark because of the dominance of low-cost bulk tomato paste imports from China and our access to detailed data (Table 2).

Productivity is not sufficiently high to supply tomato at viable prices

Although Ghana's yield is comparable with other Sub-Saharan African countries, at 14 tonnes per hectare (t/ha) it is only about one third to one half of the yields seen in many other countries, such as Mexico (25 t/ha), Turkey (>36 t/ha), and Brazil (55 t/ha) (Robinson and Kolavalli 2010a).In our survey of three regions in Ghana, most farmers' yields are well below 10 t/ha and at least two thirds of the farmers we surveyed have per unit production costs above 100 Ghana cedis (GHC) per tonne (Figure 3), even not accounting for own labour costs.

Within Ghana several different tomato production systems coexist that are differentiated both spatially and temporally. In the southern part of the country, tomato is predominantly rainfed, characterized by low input, low yields and low cost per tonne relative to the rest of the country. Irrigation is limited and only functions during the dry season. Irrigated production costs are high but yields are no higher than in the rainfed season, suggesting that farmers are aiming for higher off-season prices to offset the cost of irrigation. In a few cases, irrigated tomatoes are grown by contract farmers for nearby processors. Our field visits and on-farm interviews reveal that the prices farmers receive in the south are highly variable and for some farmers tomato farming is unprofitable (Robinson and Kolavalli 2010a).

TABLE 2—COMPARISON OF THE COST OF PRODUCING TOMATO PASTE FROM FRESH TOMATOES WITH IMPORTING TOMATO CONCENTRATE FROM CHINA

Processing costs of 1 tonne of tomato paste (36–38% brix)

Item	Quantity	Cost (GHC)	% of cost
Fresh tomatoes	8 MT at GHC150/MT	1200	61
Water	70m^3/MT	168	9
Fuel	94.5 l/MT	480	24
Labor	-	50	3
Electricity	6 kw/MT	8	0
Maintenance of equipment	-	38	2
Depreciation of equipment	-	25	1
Processing overheads	-	769	39
Total processing cost	-	1969	100

Landed cost of imported tomato concentrate (36–38%) from China (1 MT)

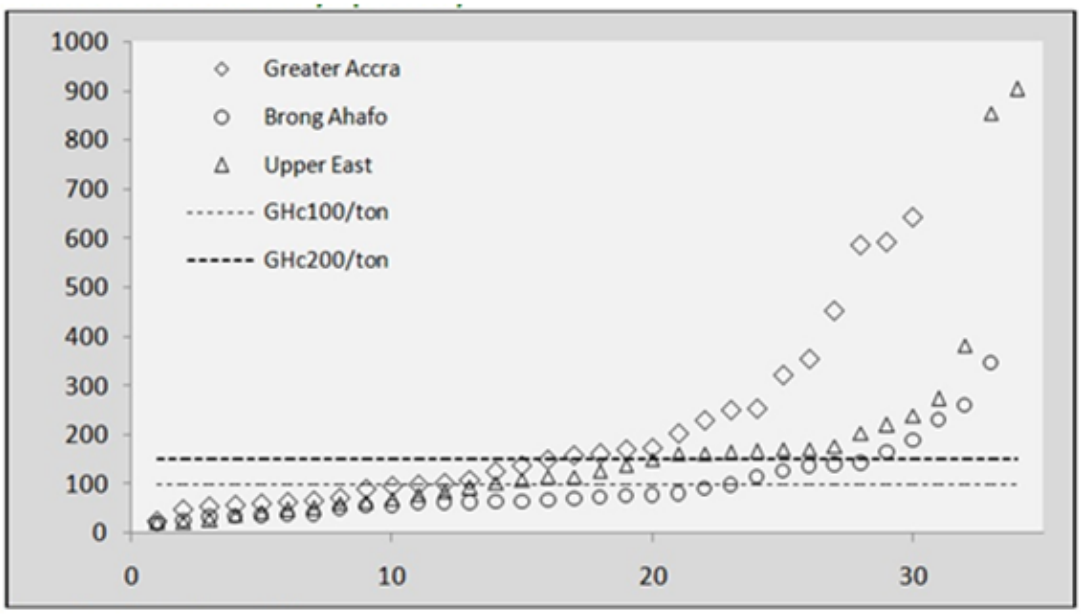
Item	Cost (USD)
FOB cost of tomato concentrate	880
Freight	300
Customs duty and clearance (12.5%)	148
Landed cost	1328
Landed cost in GHC (GHC 1.5 = USD 1)	1991

Source: King Food International, China; Personal communication 2009.

In central Ghana, rainfed production similarly dominates. Here farmers are more likely to grow local varieties, and although input costs per hectare are higher, so are yields, resulting overall

in lower costs per tonne of tomato. Though prices in the central region are also variable, for almost all farmers in this area tomato farming seems profitable with relatively low risk. In the northern part of the country, tomato is almost exclusively irrigated, undertaken in the dry season between late December and early May. In this area, farmers use improved varieties, yields are higher, and input costs relatively low, though there are relatively high demands on family labor where irrigation is manual. However, farmgate prices are often low and sometimes lower than production costs, making tomato farming risky and often unprofitable. With different production systems at the different locations with different agroecological conditions, Ghana therefore produces toma-

FIGURE 3 - PRODUCTION COSTS PER TON OF TOMATO, EXCLUDING OWN LABOR, GHC/MT (AUTHORS' DATE, 2009; FARMERS ORDERED ON X-AXIS BY INPUT COSTS



Source: Three Region Survey 2009.

to year round for domestic consumption.

Agronomic reasons for low and varied productivity

There has been some limited adoption of new technologies within tomato production. The most common varieties used by southern farmers were developed in the 1960s and 1970s when there was active breeding work undertaken by Ghana's agricultural research organizations. Since then, however, no public breeding programs for tomato have been implemented.

Because almost all the local varieties are open-pollinated, a range of varieties have emerged from uncontrolled crossing that dominate rainfed production in southern and central Ghana. In the irrigated north of the country, farmers mainly use an improved imported variety called Pectomech (a roma type). As a result of various evaluation trials conducted over the past two decades by multinational firms interested in investing in processing, other varieties are in the system. These include varieties from the trials undertaken by the UK's Natural Resources Institute and Heinz USA in the 1980s. More recently, Trusty Foods, a processor located in the southern town of Tema has been distributing various improved varieties to farmers across the different production zones, including the potentially high-yielding Nemagent F1. Traders are also known to supply some farmers with improved seeds. But overall, more than half of all farmers still wash and recycle at least some seed from previous cultivations.

Almost all farmers apply granular fertilizers to their tomato fields, but application is not based on any form of soil analysis (Horna et al. 2006). Around a quarter of farmers use foliar fertilizers containing calcium, boron, and magnesium because the soils are becoming deficient in these micronutrients. Diseases are an increasing problem. The practice of recycling seeds perpetuates inbreeding and disease transmission, particularly of fungal diseases. Poor nursery management practices also encourage fungal and viral infestation. Repeated cultivation of tomato on the same piece of land often exacerbates disease problems. In central Ghana (Ashanti, Brong-Ahafo and part of Volta) where access to land is not a major problem, farmers practice crop rotation and the problem of disease is not as severe as it is elsewhere. However, in the northern part of the country farmers are much more likely to cultivate on the same piece of land, and soil-borne diseases such as *Schlerotium*, *Fusarium*, and bacterial wilt are becoming more common.

Institutional support with respect to technical assistance in controlling pests and diseases has been lacking. However, some efforts were made in the north of the country after a disease breakout in 2003 that devastated yields. Collaborating with the Ministry of Food and Agriculture (MoFA), the Savanna Agricultural Research Institute in northern Ghana made efforts to help farmers reduce losses to disease and generally improve their agronomic practices. Their efforts resulted in a series of recommendations, which the Irrigation Company of the Upper Region, an organization that manages two of the public irrigation systems in the region, helped to implement through extension activities. Farmers were encouraged to implement several key agronomic practices. These included rotating their cropping to reduce soil-borne diseases, reducing their water application so as to avoid over-ponding, refraining from planting pepper and tomato to-

gether to avoid whitefly infestation, and planting maize along the border to attract the whitefly away from the tomato. Farmers were also encouraged to adopt varieties such as Pectomech, to protect their nurseries to reduce diseases, to spray recommended insecticides weekly, and to practice good field sanitation. Consequently, yields improved. The two-level marketing system tends to discourage quality upgradation by farmers

Tomato in Ghana is characterized by a two-level marketing system whereby itinerant traders—the market queens—are the direct link between rural farm producers and urban consumption, rather than by a set of assembly markets which bulk the produce before it is sold to urban wholesalers at relay markets. The traders travel from the large urban markets in central Ghana (Kumasi) and in the south (Accra) to the key production areas. The traders are well-organized and effectively control distribution networks and the number of truckloads of tomatoes that can enter the larger wholesale markets on any particular day, purportedly to reduce the risk of not selling a highly perishable crop. But this practice results in much higher prices in the urban markets than would be expected if trade arbitrage conditions held, even allowing for transport costs (Robinson and Ngeleza 2011). Farmers who are unable to sell to the market queens must therefore take their tomatoes to the nearby local markets.

Such a two-level marketing system tends to discourage quality upgradation along the value chain. Tomatoes are collected by the traders in large crates (often weighing over 100kg when loaded), transported to the urban wholesale markets, and sold in full crates. This marketing system also appears to reduce farmers' incentives to innovate and increase production, particularly in the northern part of the country where the harvest season coincides with that of neighboring Burkina Faso, where traders are increasingly sourcing tomato to take to the urban markets, particularly following the 2003 disease outbreak in northern Ghana (Robinson and Kolavalli 2010b). Although farmers need to produce in sufficient quantities to attract traders to gain access to larger markets, it is a risky strategy if the traders do not come.[1] Despite this, there has been some improved quality at the farmgate as women are increasingly being hired by the traders to sort (though not grade) the tomatoes before loading them into the crates.

INSTITUTIONAL FAILURES

Even if the processors can identify farmers who could profitably supply the processors at a price that allows the processors to be internationally competitive, the price of fresh tomato in Ghana is rarely below this threshold (Figure 4). Indeed, over a 2-year period between March 2007 and March 2009, the price for fresh tomato dropped below GHC150 for only one month, and in Navrongo, which is near to the Pwalugu processor in the north of the country, was never below GHC200. As a point of comparison, recent negotiations between farmers and the Pwalugu factory resulted in an agreed price of GHC5.40 per 40kg crate, or GHC135 per tonne.

If contracts were enforceable, farmers might choose to contract with processors despite lower prices, because the farmers have access to credit and technologies from the processors that could increase yields and therefore profitability per hectare. But contracts with smallholder farmers are not enforceable, so farmers have little incentive to honor contracts made with processors at planting time.

CONCLUSIONS

Ghana has repeatedly tried to relaunch viable large-scale tomato processing, but its efforts have failed. Farmers are either unable to sell tomato at prices that allow the processors to compete with imported processed tomato products, primarily from China and the EU, or unwilling to sell to the processor because for most of the year prices in the fresh market are higher. The root causes of this failure are the lack of success in increasing productivity levels and overall volumes in tomato production to those that would allow domestic processors to have a reliable source of tomatoes at competitive prices. Tomato quality is too low even for processing, and it is not possible to enforce contracts between farmers and processors when price differentials with the fresh market are so high. Tomato production requires a transition from the high-price/low-productivity/low-quality situation to a low-price/high-productivity/high-quality equilibrium for processing to coexist with a fresh tomato market.

[1] The traders claim that tomato from Burkina Faso is of a higher quality, especially with regard to shelf life, which is particularly important given that it takes several days to transport tomato from northern Ghana or Burkina Faso to the southern markets.

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