GHANA

Assessing Economic Benefits: The Case of Banana, Mango, and Rice

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EXECUTIVE SUMMARY

Assessing Economic Benefit: The Case of Banana, Mango, and Rice

The objective of this study was to identify, and where possible quantify, the economic benefits arising from expanded banana, mango, and rice sectors in Ghana. These economic benefits can be measured in terms of *monetary value,* in *number of people* (additional employment and additional dependents supported), and in less quantifiable aspects, such as strengthening Ghana's internal economic linkages and enhancing the country's commercial reputation.

This study also illustrates the important role of evidence-based policy making in government decisions regarding where best to apply limited economic resources. In this case, support for banana, mango, and rice production can each produce positive economic benefits for the Ghanaian economy and the Ghanaian people, but the techniques described in this paper can provide better information regarding *which* of these three sectors would generate the most benefit given the physical, technological, and commercial circumstances of each product. With such results, policy support — constrained by limited resources — can be more effective.

Direct economic benefits are those expenditures made in the production of the commodity in question — bananas, mangos, or rice — for Ghanaian labor or for inputs produced in Ghana. The Ghanaian workers and companies receiving such payments will, in turn, spend a portion of these proceeds on other goods and services in Ghana, thus giving rise to *indirect* economic benefits. Often indirect benefits exceed direct benefits as increased expenditures lead to increased incomes, which in turn lead to yet higher expenditures elsewhere in the economy.

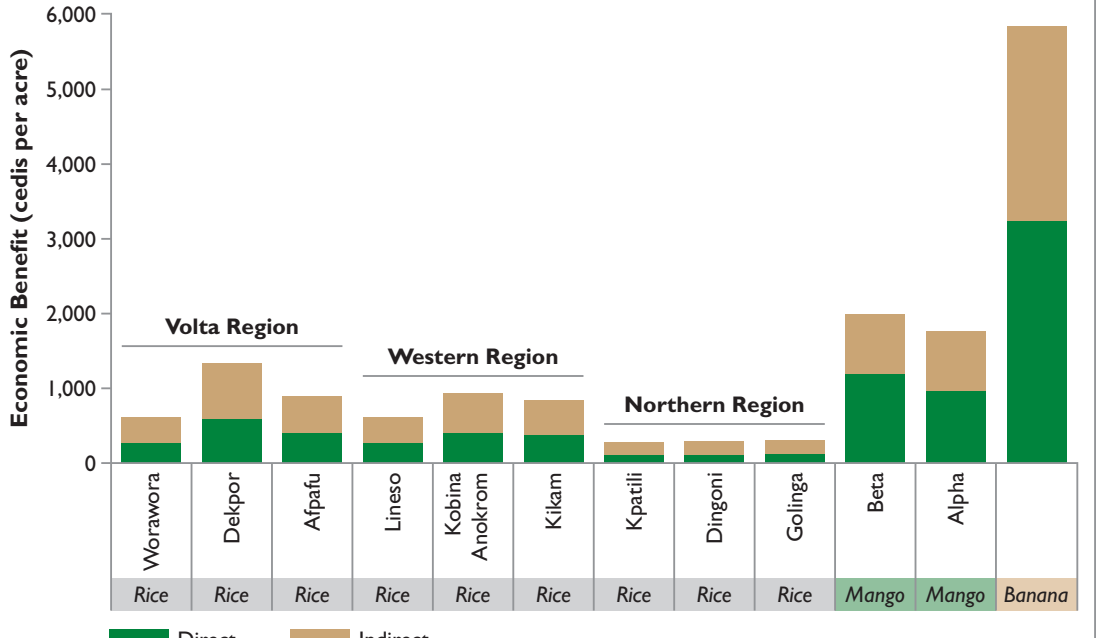
Figure 1 presents one estimate of the direct and indirect economic benefits from a single planted acre, after the initial start-up investment phase, derived from nine rice crop bud-

gets from three Ghanaian regions, two crop budgets for mangos in Ghana, and a composite crop budget for bananas based on international experience likely most applicable to large-scale banana production in Ghana. For any given acre on which bananas, mangos, and rice can all be grown and sold commercially and competitively, bananas produce the largest economic benefits to Ghana, mangos the next largest, with rice producing the least benefits.

Comparing the potential economic benefit from these three commodities is complicated by several important differences among the three crops, including whether the crops can be *competitively produced* in Ghana, the timing of economic benefit arising from the sector's expenditures after the initial investment, the potential volume of crop production, the future *price* of the product, the share of *value-added* inputs from Ghanaian labor and investment, and other, less quantifiable economic benefits. This report will review these factors for each of the three products.

Other policy factors may weigh heavily in determining where economic-development resources are best devoted, but estimating total economic benefit (direct plus indirect) of

Figure 1. Economic Benefit by Crop Budget: Banana, Mango, Rice



potential increases in agricultural commodities is a key element in evidence-based decision making.

I. Introduction

The objective of this report was to identify, and where possible quantify, the economic benefits arising from an expanded horticultural sector in Ghana, with particular reference to bananas, mangos and rice. These economic benefits can be measured in terms of value, in terms of people (additional employment and additional dependents supported), and in terms of stronger political, social, and economic structures. Moreover, the techniques illustrated here can play a key role in evidence-based economic policymaking.

Selection of three products. The economic-benefit techniques employed in this paper are applicable to any good or service that is produced for sale, either domestically or for export. The three horticultural products examined here — bananas, mangos, and rice — were chosen for several reasons. First, bananas and mangos are non-traditional sectors for Ghana and the role of domestic rice in Ghana's food supply is not as prominent as it once was, thus suggesting each of these products could play a larger, more beneficial role in Ghana's agricultural economy.

Indeed, each has already shown some potential for a larger contribution to Ghana's economy. In the case of bananas, two enterprises — Volta River Estates Limited and Golden Exotics — began operations in Ghana, growing bananas for export to the European market, producing foreign exchange, revenues, and employment where none existed before. Exports to the EU rose from near zero in the mid 1990s to nearly 5,000 metric tons in 2008.

Similarly, Ghanaian mango production and exports to the European market have grown considerably; Ghana exported 1,071 MT of mangos in 2007, nearly all to the European Union, and the Ghanaian mango industry has identified 6,000 MT as its near-term export target. This production growth is, as discussed below, in many ways "in the pipeline" because the mango trees to support this increased production already exist and are at the front end of a rising yield curve, supporting credible projections of rising exports.

Ghana's rice production has not shown significant increases, but unlike commercial banana and mango production, rice production in Ghana has a long history. Like many similarly situated developing countries, Ghana has the theoretic potential for expanded yield and acreage, leading to important increases in production of this key staple food crop.

Rice is a different agricultural product from bananas and mangos, and therefore useful in illustrating many of the concepts in this study. For example, Ghana is a net rice importer, and therefore expanded rice production does not provide economic benefits arising from export earnings, although there can perhaps be some savings in foreign exchange to the extent (perhaps very limited extent, as discussed below) that increased rice production can substitute for imports. Moreover, rice farms typically have less of a distinction between labor and ownership than do mango and banana export enterprises, and thus the distinction between economic benefits from "wages" and "profits" is somewhat blurred. Whereas mangos and bananas have demonstrated their potential for growth by their recent increases in export earnings, Ghana's rice production has been somewhat stagnant, although the potential for growth exists. Finally, as will be discussed in Section VII below, acreage in Ghana is often suitable for competitive, commercial rice production but not for either mango or banana production — an important consideration when comparing economic benefits among the three products.

As a final point, these three products sometimes compete for the same input factors — the most important such factor being land. A quantitative economic benefit analysis for each product is thus important for determining which product can produce the greatest benefit for Ghana from such land.

Evidence-based policy making. The economic-benefit measurement techniques presented in this study are an important part of economic policy-making process. Policymaking that is "evidence-based" can be distinguished from policy decisions based on, for example, economic theories adopted without benefit of data from the actual circumstances of the sector of the economy at issue. Indeed, reliance on actual data from the field is the core element of the economic-benefit approach used in this paper.

Ghana's Ministry of Food and Agriculture has adopted the concept of evidence-based policy making. For example, in the discussion of effective policy implementation and monitoring, MOFA's August 2007 Food and Agriculture Sector Development Policy (FASDEP II) calls for a "[c]onsultative *evidence-based* revision process coherent with national policies" associated with "[i]mproved data collection and analysis" leading to "[b]eneficiary assessment of implementation…."[1]

Evidence-based policymaking that depends on the type of economic-benefit estimates presented in this study can also help facilitate effective implementation of the chosen

[1]Ghana Ministry of Food and Agriculture, *Food and Agriculture Sector Development Policy* (FASDEP II), August 2007, Objective 6, page 67.

economic policy because the analysis focuses on the benefits specific to the Ghanaian populations and regions subject to the policy. In this case, the analysis largely focuses on the benefits to banana, mango, and rice workers, their families, and the economies in the communities in which they live and work. This can boost the level of stakeholder acceptance for the ultimate policy arising from the analysis, thus increasing the policy's prospects for success.[2] The methodology employed in this report made use of this potential strength of evidence-based policymaking by conducting seminars during the research phase wherein Ghanaian experts and stakeholders for these three products were given the opportunity to comment on interim results and provide key data and insights to improve the accuracy of the final results.

Finally, evidence-based economic policymaking using the economic-benefit methodology employed here can also help examine the potential economic benefits from strengthening linkages to other sectors beyond bananas, mangos, and rice. As discussed below, the economic-benefit methodology captures the benefits to, in this case, Ghana's packaging industry and transportation sector, and thus can be an element in the proper formulation of, for example, an agricultural-demand-led industrialization (ADLI) strategy based on linkages between agricultural and non-agricultural sectors.[3] This methodology helps quantify those linkages.

II. Defining Economic Benefit

Economic benefit as defined for this paper includes direct and indirect benefits, which are quantifiable, and other economic benefits that are difficult to quantify but no less real. This section discusses the nature of these quantifiable benefits, which are estimated for bananas, mangos, and rice in the subsequent sections of this paper.

A. Direct Economic Benefits

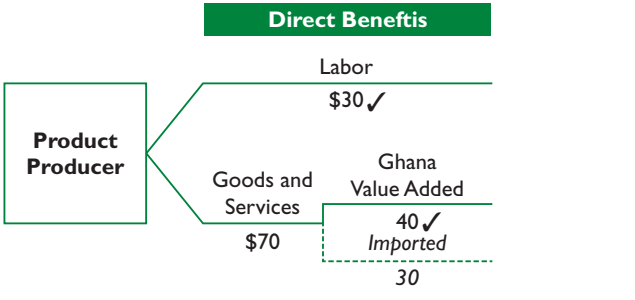
In simple terms, when a horticulture producer spends $100, the direct benefit to the Ghanaian economy is (a) the amount paid to labor plus (b) the portion of purchased

[2]For a discussion of this phenomenon, see Catherine Hine, Oxfam, "Evidence-Based Advocacy in Development Practice Experiences from HelpAge International in Eastern Europe and Central Asia," February 2008. www.comminit.com/en/node/277865.

[3]See discussion of such ADLI linkages in Food Agriculture Organization, *World Agriculture: Towards 2010,* Chapter 29, and Vicente Ferrer, World Bank Institute, "Agriculture Led Industrial Development," (2002), www.worldbank.org/etools/docs/library/88685/Et_1002/ferrer.pdf.

goods and services that represents Ghanaian value-added (which excludes any imported goods purchased). This concept is illustrated in Figure II-1. The rationale behind this conventional economic approach to quantifying economic benefits is that (a) laborers (broadly defined as including managers) receiving income consider the entirety of the income as an increase in their economic well-being and (b) the value-added portion of purchases represents (ultimately) newly generated wealth by labor and capital (investors). Value not "added" in Ghana, such as imports, benefit economic actors other than those in Ghana (mostly foreign workers and foreign investors).

Figure II-1. Direct Benefits: Schematic Example



Direct benefits from sectoral expenditures can be divided into payments for labor (top path) and purchases of goods and services inputs (bottom path).

Although the entire labor payment benefits Ghana, only that portion of the goods and services inputs that are value-added in Ghana are counted as benefitting the Ghanaian economy. These benefits are shown here by check-marks.

✓ Total direct benefits from sector's expenditures on:

Labor	30
Goods and services	40
Combined	**70**

Such direct economic benefits are therefore estimated by examining the cost structure of the sector in question. In horticulture the needed production-cost structures are reported in crop budgets, which typically provide the amount of input (*e.g.,* kilograms of seeds per hectare, or person-days per hectare) and the unit cost of that input (*e.g.,* 2 cedis per kilogram of seed, or 2 cedis per person-day). Costs related to activities away from the farm, particularly transport, also need to be included and are often found separately from crop budgets.

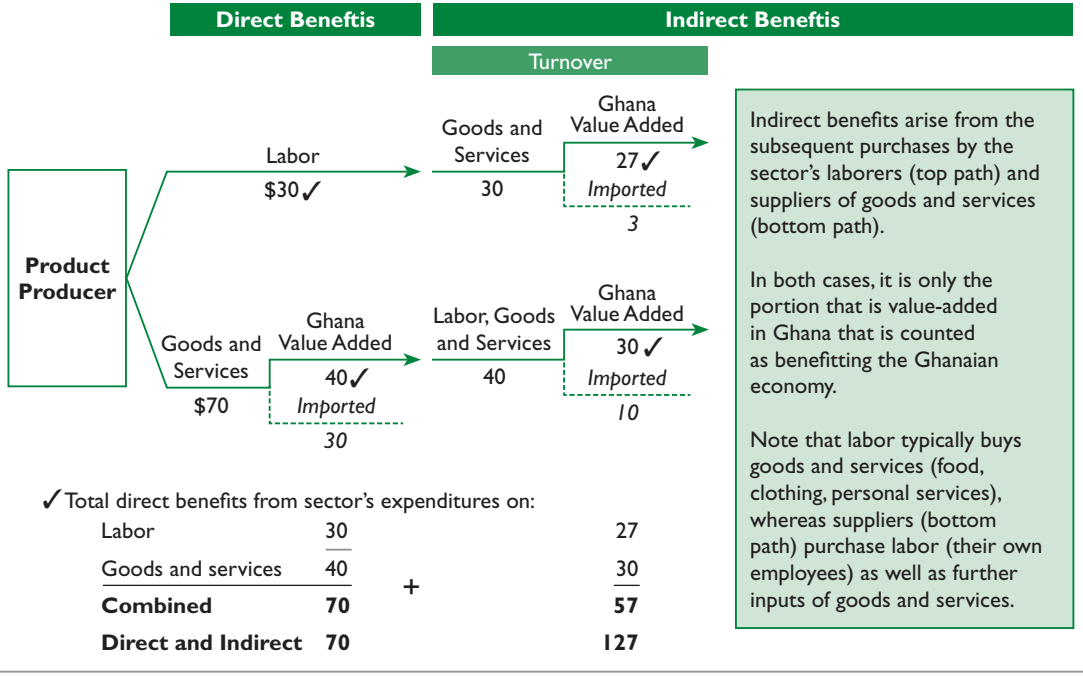
Value-added from input goods and services. Determining the portion of goods and services (as opposed to labor) that is value-added within Ghana is the trickiest part of the calculation of direct benefit. For example, fruit-packing material (boxes) manufactured in Ghana may contain a large portion of Ghanaian value-added, yet if the paper fiber is imported then the value of the paper fiber is not included in the direct benefit to the Ghanaian economy from the expenditures by the horticulture sector in question. Con-

versely, the farm gate cost of what appears to be a wholly imported product — such as an agrichemical made in Europe — might contain a significant portion of Ghanaian value-added related to the marketing, packaging, and transport activities that occur within Ghana (from port to farm) and are included in this farm gate cost.

B. Indirect Economic Benefits

Indirect economic benefits are those benefits that arise from expenditures by the laborers and suppliers who are the beneficiaries of the direct benefits, as described in the previous section. Schematically, these indirect benefits are shown in Figure II-2. As with the expenditures that give rise to direct benefits, the expenditures that give rise to indirect benefits must also be made within the Ghanaian economy (rather than for imports), and include only Ghana's value-added portion of those expenditures.

Figure II-2. Direct and Indirect Benefits: Schematic Example



For example, when a horticulture-farm worker who is the direct beneficiary of horticulture-sector expenditures uses his or her income to purchase additional food from

local farmers, this local farmer's income[4] constitutes an indirect benefit to the Ghanaian economy. This benefit is indicated by the top pathway in Figure II-2. What makes this benefit "indirect" is that the expenditure was not made by the horticulture sector per se, but by a worker who received the funds from the horticulture sector. This subsequent expenditure by the horticulture worker is called a "turnover" of the money involved in these transactions.

Similarly, another channel of indirect benefit stems from expenditures by the horticulture sector's domestic suppliers of goods and services on these suppliers' workers and upstream suppliers, as shown by bottom path in Figure II-2. For example, if the horticulture sector spends $7,000 on a pesticide application by an agrochemical-service provider, $3,000 of that amount might be accounted for by the cost of imported chemicals,[5] which are not part of Ghana's value-added economy, with the remaining $4,000 arising from the internal transportation of the chemicals, repackaging, sales, and the physical application itself — thus $4,000 in Ghanaian value-added.

Figure II-3 illustrates the concept of indirect benefits from *subsequent, recurring turnovers* initially sparked by the horticulture-sector's expenditures. Just as Figure II-2, above, identified the first level of indirect benefits to the economy from purchases made by horticulture workers and suppliers, Figure II-3 shows how this same money continues to circulate in the economy through second-level expenditures by the first-level workers and companies. As always, only the portion the expenditures associated with Ghana's value-added can be counted as benefits at that same level,[6] and all expenditures on labor are counted as Ghana's value-added, and thus benefits to the Ghanaian economy.

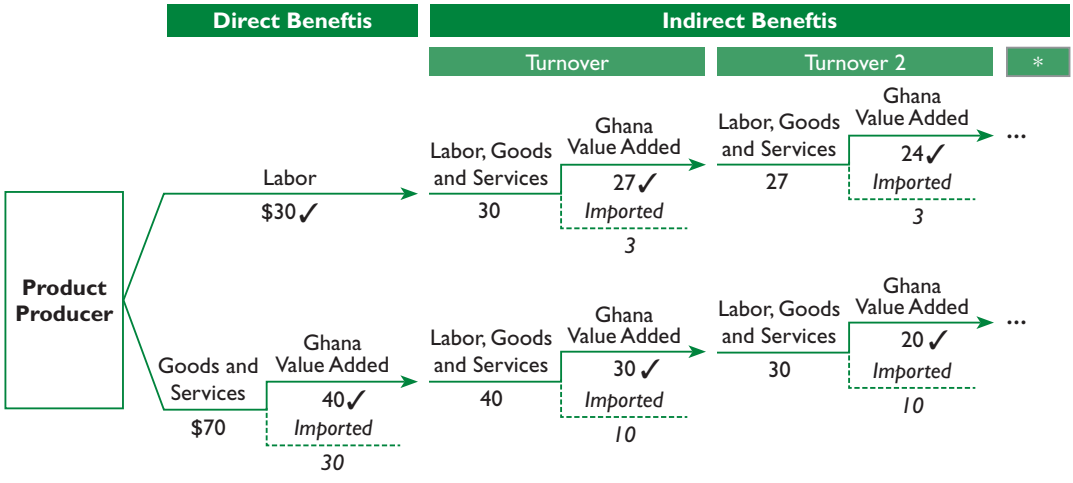
As is clear from Figure II-3, the economic benefits from the initial, direct horticulture-sector expenditures tend to multiply into indirect benefits as subsequent turnovers are generated. This is known as the *multiplier effect.* In the example in Figure II-3, in which only two turnovers are considered, the multiplier is 1.71 because (as is shown in the lower right corner) the horticulture-sector's initial $100 expenditure generated $171 in direct and indirect benefits after two subsequent turnovers.

[4]Typically, local food crops are almost entirely Ghanaian value-added. To the extent the local farmer uses imported inputs such as agrochemicals, the value of these inputs must be subtracted from calculation of indirect benefits. See Technical Note A.

[5]These numbers are illustrative and depend on the cost structure and import-dependence of the service provider.

[6]See Technical Note B.

Figure II-3. Direct Benefits: Schematic Example with Two Turnovers



✓Total direct benefits from sector's expenditures on:

Labor	30		27	24
Goods and services	40	+	30	+ 20
Combined	**70**		**57**	**44**
Direct and Indirect	**70**		**127**	= **$171**

*Continued

This concept is so important to understanding the total economic benefit that arises from initial expenditures by any sector that it is worthwhile to consider another arithmetic example of how subsequent turnovers generate additional indirect benefits, depending on the share the each expenditure that is associated with value-added in Ghana.

Figure II-4 assumes that $100 is spent and is entirely a direct benefit. Half of this $100 (including, for example, people who sell food to horticulture workers) is assumed to have been Ghanaian value-added. Thus, at this first level of turnover there is another $50 of

Figure II-4. Indirect Benefits: Another Look at the Arithmetic

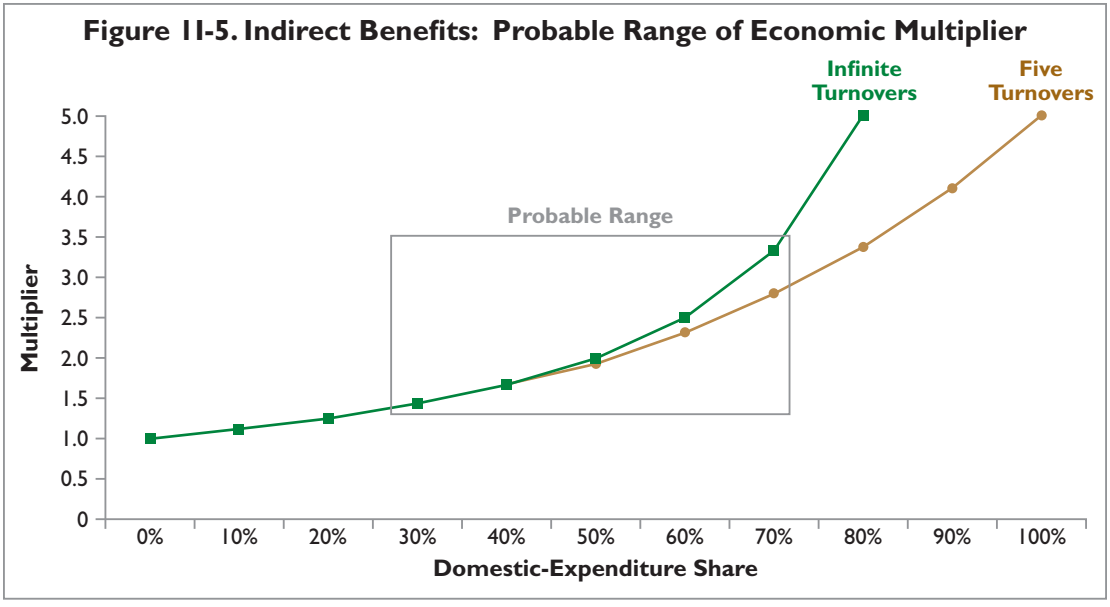
	Turnover				
	1	2	3	4	5
Share of Ghana value-added (for example)	50%	50%	50%	50%	50%
Benefit from turnover	50.000	25.000	12.500	6.250	3.125
Cumulative indirect benefit		75.000	87.500	93.750	96.875

indirect benefits. The same logic applies to the next turnover, when this $50 is spent on another productive activity (labor, goods, and/or services) that is also 50 percent Ghanaian value-added, thus generating another $25 (50 percent of $50) in indirect benefits, resulting in $75 of total cumulative indirect benefits after two turnovers. As can be seen on Figure II-4, after five turnovers, more than $96 in indirect benefits are generated — nearly a doubling of total benefits from the sector's initial expenditures.

This arithmetic shows that *the ultimate magnitude of the multiplier effect of indirect benefits depends on (a) the number of turnovers and (b) the average share of Ghana's value-added at each turnover.* The more turnovers that occur in one year and the greater the share of expenditures accounted for Ghana's value-added production, the higher the multiplier. Figure II-5 shows this relationship: the x-axis at bottom gives various levels of average Ghanaian value-added for turnover transactions, with the height of the lines showing the resulting magnitude of the total multiplier effect under two scenarios: after five turnovers (lower line) and after an infinity of turnovers (upper line).

For example, if there is zero Ghanaian value-added in subsequent purchases (say, if the first round of money spent on inputs is entirely on the purchase of an import) then indirect benefits do not exist, so the multiplier equals 1.0 (in other words, *direct* benefits multiplied by 1.0 equals *total* benefits — the same number — implying no indirect benefits). If the average Ghanaian value-added share is 70 percent, then after five turnovers the multiplier is about 2.8, and after an infinity of turnovers the multiplier would approach (but never reach) 3.4. To reiterate, this would mean *total* (direct plus indirect) economic benefits would be 2.8 (or eventually 3.4 times) the level of *direct* economic benefits generated by the sector.

This graphic provides an important insight to estimating the indirect economic benefits from an expanded horticulture sector in Ghana. Note that regardless of the number of turnovers considered, the probable range of multipliers is in the 1.5 to 3.0 range for average value-added shares in the most likely 30-percent to 70-percent span. It is unlikely in any open economy that is integrated with a larger surrounding economy to have value-added rates much in excess of 70 percent (because of the presence of imports), and it is difficult to sustain a viable economy by producing less than 30 percent of value-added of a broad range of expenditures. For a reality check, it is useful to note that the value of Ghana's imports are approximately half the level of Ghana's gross domestic product (GDP), implying a domestic value-added share of about two-thirds of total domestic purchases (GDP divided by GDP plus imports), suggesting that Ghana's economic multiplier as a whole lies within the probable range shown in Figure II-5.



(Specific estimates for the banana, mango, and rice sectors are addressed in the next sections).

Separate average economic-benefit multipliers were derived for labor expenditures and for other inputs of goods and services. These variables were derived from discussions with executives of Ghana's horticulture producers in 2007 and early 2008, and further reviewed during roundtable discussions with knowledgeable officials and researchers in January 2007 and April 2008 in Accra.[7] The discussions focused on the nature of expenditures in rural areas, and the conclusions were supported by literature on Ghana's rural economy, some of which is noted below.

Based on this process, it is estimated that the average share of domestic value-added arising from direct labor expenditures was (a conservative) 50 percent. This means that no more than 50 percent of labor's subsequent expenditures were on Ghanaian value-added goods, services, or labor.[8] Those familiar with local economies of Ghana's agricultural regions believe that this is a low-end estimate given the few opportunities for import

[7]See Technical Note B.

[8]See Technical Note D.

purchases and the high degree of self-sufficiency in local foodstuffs. Thus the implied economic multiplier after five turnovers is 1.97, meaning that indirect benefits would nearly double the direct benefits.

The share expenditures by other agricultural-input providers (goods and services such as packaging and agrochemical providers) of Ghanaian value-added products and labor is less than that for farm workers, with 30 percent considered to be a reasonable conservative average, resulting in a 1.43 average economic multiplier.[9] Given the pattern of expenditures by the agricultural sector, the weighted average of these two multipliers equals 1.8, which is on the conservative end of the probable 1.5 to 3.0 multiplier discussed in the previous section.

Such an economic benefit multiplier can be considered to be conservative when compared to independent research on the economic benefits of Kenya's horticulture-export sector:

> Although less visible, it is likely that the indirect benefits associated with horticultural exports [from Kenya] are greater than the direct benefits. First, the multiplier effect of injecting US$46 million annually into the rural sector generates benefits for other households and sectors that produce goods purchased by export producers.[10]

This conclusion implies an economic benefit multiplier in excess of 2.0 for the Kenyan horticulture-export sector. As another point of reference, the U.S. Department of Agriculture's Economic Research Service's economic-benefit calculator, when provided with economic variables that attempt to mimic Ghana's fact pattern in a U.S. economic context, gives a multiplier of 2.3.

C. The Common Yardstick for Product Comparisons: Per-Acre Analysis

When making comparisons of the economic benefit arising from different sectors — here, bananas, mangos, and rice — it is useful to use a common "yardstick" for comparison among the products. In particular, simply comparing "total industry benefit" is misleading because the industries are likely to differ in current size as well as potential size over time, and have differing policy requirements for growth. Typically, the most

[9] See Technical Note E.

[10] Nicholas Minot and Margaret Ngigi, "Are Horticultural Exports a Replicable Success Story? Evidence from Kenya and Cote d'Ivoire," (December 2003) p. 39.

useful yardstick to use for comparing the economic benefits of different industries is *the scarce resource that is common to the industries yet can be affected by policy.* All resources are scarce in the economic sense, but the scarce resource that is important here would be the one that is crucial for production and the acquisition of which is hindered by more than what may be considered the usual workings of the marketplace (*i.e.,* not just expensive).

In the case of Ghanaian agricultural policy, the scarce resource that meets this definition is land.[11] On its face, Ghana seems to have an enormous amount of land. Yet of Ghana's 23 million hectares, less than 11 million hectares are arable and less than 40,000 hectares are irrigated, according to the Food and Agriculture Organization. This is not just an issue of market-based scarcity: at its base, the challenge for optimal use of Ghana's land arises from the country's unclear and often unenforceable property rights over any given potential agricultural tract. Although a full treatment of the land issue is beyond the scope of this paper, the existence of the problem is clear and helps define the best yardstick for comparing economic benefits across agricultural products. The difficulty of acquiring land in Ghana for agricultural purposes was widely cited by interviewees, is acknowledged in government documents,[12] and is cited in literature by foreign investment advisors[13] and academic researchers.[14]

The question, therefore, is for a given acre of land that is available for cultivation for all three crops, which crop produces the highest economic benefit for Ghana?

D. Other Considerations in Assessing Benefits

The economic benefit numbers generated by the analysis discussed in the previous section must be assessed in light of several other considerations regarding the products in question, namely: the ***competitiveness*** of the industry; the ***timing*** of economic benefits subsequent to the establishment of the crop; the suitable ***acreage*** that can be planted with the crop; the ***yield*** that can be achieved for the crop (acreage times yield resulting in

[11]In a country where land was abundant and people were limited, the appropriate yardstick for analysis might be economic-benefits generated per person to assess the best application of people's labor across various industries.

[12]Ministry of Food and Agriculture, "Food and Agriculture Sector Development Policy (FASDEP)" September 2002, p. 14. MOFA identifies what it calls the "absence of a land use policy" (p.14) for agriculture and a "difficulty in acquiring agricultural land" (p. 13).

[13]Global Advice (a investment consultancy based in Denmark), "Ghana Country Profile 2005."

[14]Dirk Willem te Velde, Overseas Development Institute, "Foreign Direct Investment for Development: Policy Challenges for Sub-Saharan African Countries" (2001), p.11.

total output volume); the ***price*** of the crop (which can change over time and affect total economic benefits); and the share of the crop's cost structure that is attributable to ***Ghanaian value-added*** (the higher the share, the greater the economic benefit).

Competitiveness. An industry can generate economic benefits only if it remains commercially competitive over the long run. For example, industry ***A*** might have higher per-acre expenditures on domestic labor and materials than industry ***B,*** but if the revenue in industry ***A*** is less than these total costs over the long run (implying losses rather than profits), the industry will eventually fail. Nor can a government provide subsidies to help industry ***A*** overcome this problem, since the amount of the subsidy must be subtracted from the industry's benefit calculation because the subsidies must be financed through taxing other sectors (reducing their economic benefit). Therefore: long-term profitability of an industry is a necessary condition for positive economic benefits, regardless of the arithmetic described above.

Timing. Once new investment in the expansion of an industry has been made, the flow of benefits from that industry is not necessarily the same from year to year. Industries that require larger up-front investments generate a initial "bump" in economic benefits, which then settle-down to a more continuous annual flow associated with the harvest and sale of the crop. By contrast, an industry like mangos requires less of a relative up-front investment (generating less in purchases from the Ghanaian economy), and provide little economic benefit until around the fourth year of production when yields begin to reach their mature levels. Rice tends to produce a more even stream of annual benefits from the start, as will be detailed below. Moreover, over time there can be improvements in cultivated acreage, yields, price, and the portion that is Ghana's value-added. Thus, when comparing economic benefits among various industries it is important to specify the timeframe under consideration, and to look forward.

Volume Potential. The magnitude of economic benefit is tied to the level of the industry's production. In the case of agricultural goods, production is, in turn, tied to the number of acres under cultivation and the average yield of those acres.

Thus, total product *acreage* is a key variable in the total (as opposed to per-acre) economic benefit that an industry can generate. The economic benefit of a product for which the number of cultivated acres is changeable should be therefore analyzed over a range of potential acreage levels, particularly if government policy affects the growth of acreage available to the product in question. As discussed below, the range of potential acreage levels is very different among the three products examined here.

Changes in the *yield* per acre (metric tons per acre) also affect the magnitude of economic benefit in two ways. First, higher yields can mean greater *profit* per acre by increasing output per unit of land-area input. Second, achieving higher yields often requires changes in the combination of production inputs such as labor, machinery, irrigation, fertilizer — collectively known as the *technology* of the production. Such different patterns of expenditures on labor and Ghanaian value-added input goods mean different levels of economic benefit for the surrounding Ghanaian economy, as discussed above. It is important to note that these two factors — profits from greater yields and the technology fostering these greater yields — might work in opposite directions.

For example, a farmer might divert his expenditures from three local Ghanaian laborers to a single imported piece of capital equipment that performs the same task slightly better, thus reducing the economic benefit for Ghanaian labor yet, through higher profits from the more efficient application of equipment, greater economic benefits for the farmer. Whether one factor is higher or lower than the other factor depends on the circumstances. Finally, yield can differ greatly depending on the location of the crop within Ghana (for these three products, this is most true for rice).

Price. An economic-benefit analysis undertaken for the purpose of supporting evidence-based policymaking should take into account possible changes in the output price of the industry's product over the longer term. As discussed above, economic-benefit analyses of agricultural products begin with a crop budget. The economic benefit that arises from the "profit" accruing to Ghanaians is proportionate to the price the crop enjoys. It is prudent to consider likely swings in the product price of the good in question in the coming years. Failure to consider this point has, on occasion, led to policy support for products whose markets have become saturated, while policy support has been withheld from product areas with more favourable price outlooks.

Ghana Value-added. As discussed above, a key variable in determining total economic benefit from a given industry is the share of the industry's cost structure that goes for expenditures on the Ghanaian value-added portion of input products. This is a variable that is changeable over time, and a variable that government policy can affect, for better or worse. In the case of bananas, mangos, and rice, perhaps the foremost input for which the Ghanaian value-added portion can grow over time is packaging, as discussed below.

Ghanaians Benefited. Economic benefit also can be measured in terms of the number people benefited, rather than in terms of money. Ghanaians directly employed by the sector are of course beneficiaries and the number of these individuals is somewhat easy

to estimate from any crop budget that contains labor information, such as person-days per input activity (*e.g.,* "seeding — 5 person-days"). The economic dependents of these laborers — spouses, children, parents — also benefit from the laborers' employment and can be estimated from typical worker-dependent ratios in the region at issue. The *indirect* benefits discussed above in Section II-B (benefits from industry purchases of upstream goods and services) also benefit people, although estimates of these numbers become increasingly tenuous as the further upstream (the more "turnovers") one examines. Nonetheless, these upstream workers and their dependents benefit from the increased economic activity.

It is important to note that the number of *people* benefiting is not the same thing as counting the number of *jobs* generated by the sector. For the direct beneficiaries (here: banana, mango, and rice workers), it is quite likely in an economy with significant rural unemployment that these workers who benefit represent workers with "new jobs." Yet true, complete "unemployment" is rare in Ghana's rural areas because nearly all adults must undertake some form of economic activity to survive and contribute to the family. Thus, the "new job" that expanded banana, mango, or rice production generates is, for many individuals, an economic activity in addition to other, less-formal economic work that may or may not be replaced by the new employment. Nonetheless, these Ghanaians are certainly beneficiaries of the new employment opportunities. In addition, many if not most, of the Ghanaians who are counted as benefiting *indirectly* (from the sector's upstream expenditures on inputs) may simply earn more income rather than have a new job, although many new jobs may be generated. Finally, the number of *dependents* counted in this estimate does not represent "new jobs."

Each of these economic benefit considerations is related to the others. In simple terms, these interrelationships can be summarized as follows. *Competitiveness* means that revenues must exceed total costs over the long run. Revenues equal total volume times *price,* and volume equals *acreage* times *yield* per acre. And direct economic benefits accrue from the portion of revenue that is attributable to *Ghana's value-added* portion of the product's cost structure. Finally, all of these variables can evolve over *time.*

III. Bananas

Although Ghana has long produced bananas for domestic and regional consumption, the bananas discussed here are international-grade bananas produced on a large scale for export, almost entirely to the European Market. For commercial success, such production requires large, contiguous tracts of plantation land, an organized, dedicated workforce,

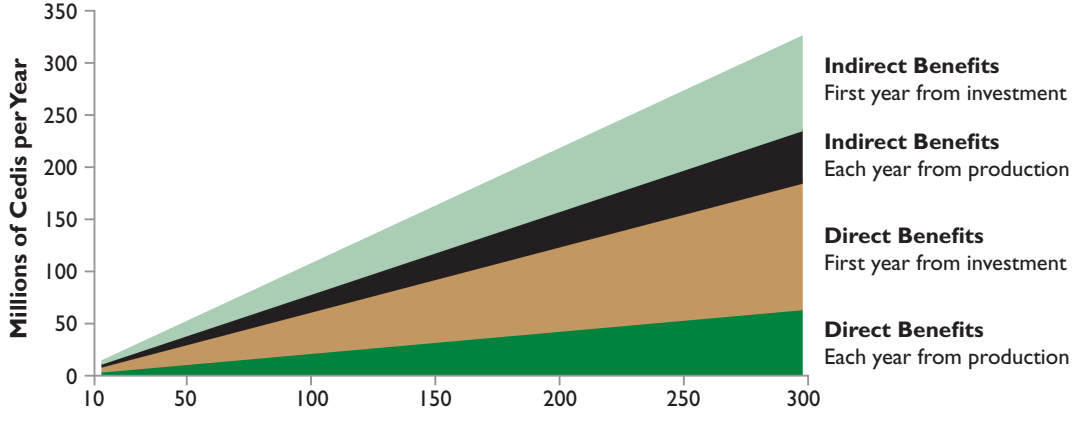
and a formal relationship with a multinational fruit company that can provide technical and marketing support, as well as perhaps capital.

Two banana companies provided confidential cost information as a basis for this analysis. One of the companies currently operates in Ghana, and the other is one of the four major banana multinationals. Because the two companies maintain their cost information in different formats using different cost categories, it was necessary to synthesize the information into a uniform set of cost categories, and then assign average costs to these synthesized categories based on the two companies' cost data.

A. Benefit Estimate

Each acre of Ghanaian banana production is estimated to generate 3,240 cedis of annual direct economic benefit after the initial start-up investment is completed, with indirect benefits adding another 2,590 cedis per acre.[15] Given an average yield of approximately 16 metric tons per acre, the total economic benefit potential for a range of potential output levels by the Ghanaian banana sector is shown in Figure III-1. The likelihood of reaching these volume levels is discussed in the next section on Ghana's banana competitiveness and in section III-D on potential volume levels. Figure III-2 shows the major

Figure III-1. Bananas: Potential Economic Benefit



[15]Reported in crop budgets as metric tons per hectare, the standard area unit in the banana industry. Acre is used in this report for consistency between all crops.

cost categories from a banana crop budget that gives rise to these benefit estimates.

Figure III-2. Bananas: Elements of a Crop Budget

Phase		Input	
Initial Investment	Hectare Variable	a	Soil prep
		b	Planting
		c	Irrigation
		d	Infrastructure
		e	Equipment
		f	Bring to bearing
		g	Project supervision
		h	Misc.
Production	Hectare Variable	i	Farm maintainance
		j	Water management
		k	Disease control
		l	Farm administration
		m	Reinvestment
	MT Variable	n	Harvesting
		o	Packing labor
		p	KD box
		q	Palletization
		r	Packing - other
		s	Transport to wharf
		t	Wharf load
		u	Port cold storage
		v	Fixed costs

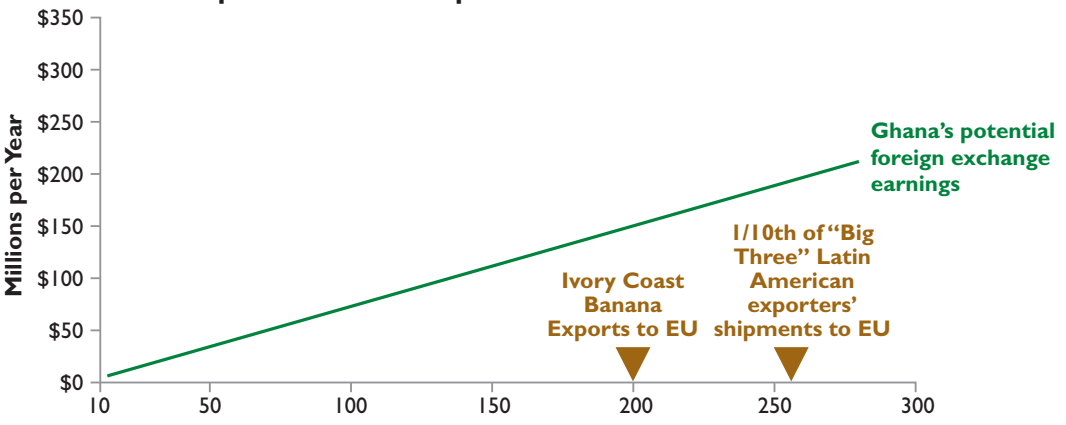
B. Competitiveness

The European Union (EU) is a potentially large market for bananas grown in Ghana. Prior to 2006, such exports were restricted by the EU Banana Regime, which placed restrictive quotas on the volume of bananas that could be imported from African-Caribbean-Pacific (ACP) countries without being subject to a prohibitive tariff, while exports from non-ACP Latin American countries enjoyed a much larger quota and constituted more than 80 percent of EU imports. Thus, the major multinational banana companies selling into the EU — Chiquita, Dole, Del Monte, and Fyffes — did not develop Africa as a major source for their banana supplies.

Ghana has demonstrated its ability to compete in the European banana market through exports from the country's two existing banana-export companies, Volta River Estates Ltd and Golden Exotics. Figure III-3 shows that Ghana remains a small player in the EU market, but that its position vis-à-vis comparable suppliers suggests a significant margin for competitive growth. Ghana exported more than 34 thousand metric tons of bananas to the European Union in 2007, with export volumes continuing to rise.

Aside from this demonstrated export capability, a detailed assessment of Ghana's banana-export potential concluded that Ghana meets all of the requirements necessary to produce an international-grade banana. Such a competitive ability is a prerequisite to generating sustained economic benefits, as explained above. Importantly, this assessment provided important information regarding *which* acres are particularly suitable for banana production. As a threshold matter, bananas for export must be grown within 150 kilometers of a port to achieve cost-competitiveness for transport. The study then considered a variety of other factors to help identify those acres in Ghana suitable for production, as shown in Figure III-4 banana suitability factors by region.

Figure III-3. Bananas
Exports to the European Market: Ghana's Potential



Source: Eurosat 2007

For purposes of this report, this table is given only as an example of factors that constitute a complete competitiveness analysis. Moreover, the suitability of a particular site requires site-specific analysis by investors. Such site-specific analysis should account for all

Figure III-4. Bananas: Suitability Factors by Region

Criterion	Unit	Sustainability	Greater Accra Region	Southern Volta Region	Eastern Region	Central Region	Afram Plains District
Elevation	Meters	20 to 75	▼	●	▼	●	●
Rainfall	Millimeters per month	150 to 180	◆	◆	◆	◆	◆
Temperature	Degrees centigrade	25 to 30	●	●	●	●	●
Wind velocity	Maximum kilometers per hour	10	●	●	●	●	●
Sunshine	Minimum hours per day	4	●	●	●	●	●
Slope	Percentage rise	0 to 1	●	▼	▼	▼	●
Relief		Flat	●	▼	▼	▼	●
Distance to closest port	Maximum kilometers to port	150	●	▼	▼	▼	▼

● Suitable ▼ Suitable in some locations ◆ Seasonally unsuitable (monthly rainfall can fall below monthly minimum)

factors and be undertaken with local input and cooperation. In addition, analyses should recognize trade-offs among factors for optimal banana production.

Ghana enjoys several key attributes that point towards a large potential for a Ghanaian banana sector. This potential is likely to be realized in a certain form of industry structure in which there is a division of responsibility (and rewards) between multinational banana companies and domestic Ghanaian interests.

Changes in the EU Banana Regime, which currently places a €176 tariff per metric ton on most bananas from Latin America and removes previous limits on imports from Africa, is the major force behind Ghana's potential as a major banana exporter. Moreover, there could be some shipping-cost advantages vis-à-vis shipments from Latin America to the EU (although this may depend on improvements in Ghana's own port costs) and, in some cases, a more stable and responsible political and social environment in Ghana than in the traditional banana-exporting countries.

Although the Ghana's potential for growing bananas for large-scale export is beyond the scope of this report, it should be noted that Ghana has two key physical features that, from the perspective of a multinational banana company, are attractive relative to the traditional banana-export countries of Latin America. First, banana production in Latin America is plagued with black sigatoka disease, which is far less prevalent in Ghana. This means a significant cost savings for the producer.

Second, Ghana does not suffer from the devastating hurricanes as do the eastern regions of Latin American production. Unusually bad weather over the past decade in those regions is not believed to be a temporary phenomenon, and the multinational banana companies have curtailed production in many areas there as a result. Although the October 2002 wind storm that devastated VREL's crop looms large in the experience of Ghana's small banana industry, the episode was in fact (typical of Ghana's wind storms) highly localized and did not even reach all of VREL's five plantations, which are located in close proximity. This stands is sharp contrast to the vast areas vulnerable to a single hurricane in Latin America. Moreover, the 2002 storm experience resulted in the development of several countermeasures now being deployed by Ghana's industry, and scientists interviewed at the University of Ghana said more could be done in this regard as research continues.

In contrast to the two companies currently producing bananas in Ghana, significant expansionary investment and/or sales arrangements could originate from one of the four major multinational banana companies. For Ghana, the key missing factor is expertise,

but Ghana is strengthening its banana knowledge base each year with its existing production and could leverage future activities in Ghana by major banana multinationals to improve its indigenous knowledge further.

The benefits of a multinational's presence in the Ghanaian banana sector cannot be overstated: these companies can bring changes in technology, can improve Ghana's human capital through employment and training, and can provide a ready market in developed-countries for Ghana's production.

C. Timing of Benefits

Economic benefits arise over time from the annual expenditures that the banana sector is making as well as the flow of profits arising from the sale of the resulting bananas. For bananas in particular, there are more significant upfront investment costs, followed by a flow of smaller production costs.

Investment costs. Key investment items are irrigation, pack houses, and cabling (the latter two being infrastructure and equipment).

- *Irrigation.* As discussed in detail in the research paper on the suitable areas of Ghana for commercial horticulture production,[16] Ghana possesses all of the natural physical characteristics for commercial horticulture production with the exception of adequate, consistent rainfall. Thus, irrigation is an important investment component, perhaps constituting a quarter of non-land investment. Much of the physical irrigation equipment may be imported, whereas the construction of the system is high in domestic value-added.

- *Pack houses.* Bananas are separated from bunches, washed, checked for quality, and packed in boxes in pack houses located on the horticulture farm. Much of the physical construction of pack houses is based on domestic building materials and thus constitutes largely Ghanaian value-added.

- *Cabling.* Bananas are brought to the pack houses on cabling systems that extend throughout the horticulture farm. Much of the physical inputs to this system are imported, whereas the installation is domestic-value-added.

[16]Steve Duadze, "The National Banana Plan: Report on the Mapping of Agro-Ecological Variables in Part of Southern Ghana," 2007. See also Figure III-4.

Each of the investment-cost variables is on a per-hectare basis, meaning that the costs vary in relation to the physical area of the farm, rather than the volume of bananas grown or harvested. Thus, the investment costs depend little on productivity of hectares (although productivity obviously depends on adequate investment per hectare).

Production Costs. Cost items ***i*** though ***v*** shown in Figure III-2, above, are for the production phase after the investment has been made. Note that cost items ***i*** though ***m*** vary by area and not by the volume of bananas grown or harvested, whereas cost items n though ***u*** vary by harvest volume. Item ***v*** is a single fixed-cost amount that is necessary to operate a horticulture production company in Ghana and contains all of the volume-independent overhead costs. Together, these include all the costs necessary to deliver the banana to shipside.[17]

D. Volume Potential

The actual economic benefits will depend heavily on the scale of the banana-export sector created. As a starting point, Figure III-3, above, shows the amount of foreign exchange that would be earned by the Ghanaian economy at various levels of exports, assuming an average unit value of banana exports at $300 per metric ton (MT). The two volume levels in Figure III-3 provide some context for Ghana's longer-run potential to supply the European market. First, the Cote d'Ivoire ships more than 200,000 MTs of bananas to the European Union each year. Thus, if Ghana simply matches its neighbor's export levels, Ghana will be only two-thirds the way along the range of hypothetical exports on this chart, and this range is used throughout this report.

The second indictor on this chart is the amount Ghana could export — more than 260,000 MTs — if only 1/10th of Latin American banana exports to the European Union were supplied by Ghana instead. This is not implausible: Chiquita has stated that it intends to shift about 20 percent of the company's sourcing from Latin America to Africa over the next five years.

Such volumes are the result of the acreage bananas cover multiplied by the average yield from these acres, as discussed in the next two sections. Then the percentage of this total

[17] It is possible that Ghana's banana sector could undertake its own investments (and thus expenditures) for the transport of bananas to the European market after the fruits reach shipside. This is unlikely in the near future for Ghana because of the scale and diversity of export necessary to be competitive in these commercial functions. See the research report, Brent Bartlett, "Policies Affecting the Development of Ghana's Banana-Export Sector," December 2006, section III.F regarding the "division of responsibility" strategy being pursued by the banana multinationals.

production that is suitable for export is considered. With these hypothetical export scenarios in mind, this report estimates the direct and indirect economic benefits that would arise from this range of possible Ghanaian exports.

Acreage. There is another issue related to land that must be taken into account: commercially viable banana production for the international market requires large contiguous tracts of land and, of course, that land must be suitable for banana production. The land-acquisition strategies of the two existing Ghanaian banana companies are not easily reproducible on an unlimited scale for additional banana-production. VERL obtained five geographically separate parcels through negotiations with a chief whom the company believes is particularly responsible and authoritative. Golden Exotics signed a lease agreement with the Irrigation Development Authority — thereby minimizing the need for agreements with local authorities — for 1,760 hectares in the Kong Irrigation Project in February 2005. The experience in the pineapple sector suggests that land acquisition for production is difficult, time-consuming, but nonetheless do-able: new parcels are constantly acquired, albeit in a patchwork fashion. (The apparent reluctance of the multinational banana companies to replicate immediately their Latin American plantations on a vast scale in Ghana may be a favorable factor in this regard.)

Yield. Once the acreage is known, total volume defined by yield was set at 40 metric tons (MT) per hectare for purposes of this report. Although this level of productivity can be considered somewhat ambitious from the standpoint of production efficiency — levels often average lower in newer production areas — the arithmetic of estimating economic benefits implies that a *higher productivity* (MT/hectare) assumption provides a *more conservative* benefits estimate. This perhaps counter-intuitive notion arises from the fact that benefits arise from expenditures by the horticulture company on inputs from the local economy: the more expenditures required, the greater the benefit calculation *for each unit of volume.* This dynamic should not be misinterpreted as an argument for planned inefficiency: higher productivity leads to higher volume (more multinational purchases, more investment, and so on), which generates more benefits in total. Lower productivity depresses output volume and therefore reduces total benefits.

E. Price

Bananas have a lower price volatility than most other commodities that enter international trade. In large part, this is due to the wide variation of geographic supply and their year-round growing pattern. There is little if any seasonal variation in banana prices

entering the European Union. In recent years, banana import prices to European Union have fluctuated in the range of $500 to $800 per metric ton, with perhaps half of this price representing the export value earned by the supplier country. For purposes of this study, the average unit value (AUV) for Ghana's exports is assumed to be $300 per metric ton.

A key factor that cannot be assessed in this study is the nature of the contractual arrangement between the domestic Ghanaian banana producer/investor and the multinational banana company that is responsible for marketing and distribution. The pricing element of such contracts can be complex — in part, to ensure that domestic production maintains a sustainable profit despite international price volatility — and thus the actual price (and thus revenue and profit) received by Ghanaian interests depends on the nature of that contractual relationship.

F. Ghanaian Value-Added

After estimating the associated expenditures for production and investment based on the cost data, it was necessary to determine the share of the expenditure that is on labor (and thus entirely a direct economic benefit, as explained in the previous section) and, of the remaining expenditure amount, what is the portion that is Ghana's value-added (and thus also counted as a direct economic benefit). These variables were derived in item-by-item discussions with executives of horticulture producers in January 2007, and further reviewed during a roundtable discussion of knowledgeable industry executives, government officials, and other researchers on January 25, 2007 in Accra.

G. Ghanaians Benefited

It is possible to estimate the employment that would be generated by an expanded banana-export sector. The implied direct employment in banana production can be calculated for the range of hypothetical banana exports up to 300,000 MT per year, at which point direct employment would reach 12,000 people. Because of the indirect economic benefits, however, another 8,000 jobs (or their full-time equivalent or a higher number of part-time jobs) could be generated, resulting in more than 20,000 total new jobs.[18]

[18]Chiquita provided its own estimates of employment effects at the May 22, 2007 Ghana Investors Conference in Accra. Chiquita's direct employment numbers were slightly lower but the total employment numbers were slightly higher, although direct comparisons are difficult because of possible differing assumptions regarding labor productivity rates.

Based on interviews with executives of Ghana's two operating banana producers in January 2007 and a follow-up roundtable discussion, it is estimated that each worker employed in the formal sector in the rural banana-producing regions supports six dependents, not including the worker. This level of dependents may be reached quickly if it includes a spouse, two parents, and three children, before considering any grandparents, additional children, adult siblings and cousins, or other family members or social dependents.

IV. Mangos

Ghana has only recently been encouraging the development of its existing mango trees for the production of export-grade mangos, mostly to the European market. Unlike banana production, mango production can be undertaken on a relatively small scale with fewer workers and less investment. Production is seasonal, with harvests in the spring and fall.

Two mango crop budgets were used as a basis for this analysis. Both crop budgets envision a commercial-scale mango farm operation, one at 40 trees per acre and one at 60 trees per acre.[19] Because these two crop budgets differed somewhat in their cost and output assumptions, it was necessary to synthesize[20] the information into a uniform set of cost items, and then assign costs to these synthesized items based on the two companies' cost and output data.

A. Benefit Estimate

Each acre of Ghanaian mango production is estimated to generate around 1,075 cedis of annual direct economic benefit after the initial start-up investment is completed and the trees reach maturity after year four. Indirect benefits add another 793 cedis per acre, for a total of 1,868 cedis.

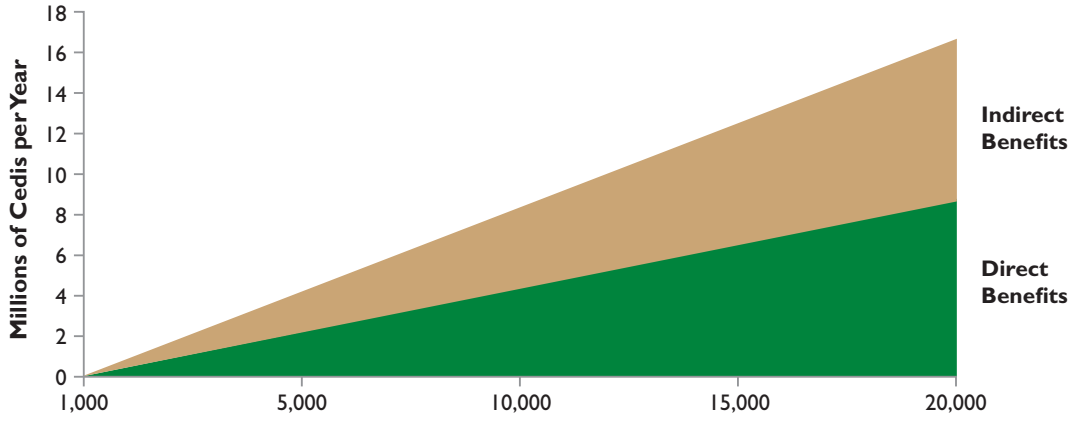
Given an average yield of 4.0 metric tons per acre, and assuming Ghana had 10,000 of acres under mango cultivation and one-half of those are export-grade (see discussion

[19]For ease of identification, these two crop budgets are referred to in subsequent footnotes as "Alpha-40" and "Beta-60," respectively. See Appendix Table A-2 for an example of a mango crop budget.

[20]This synthesis was not always simply an average of the two budgets' reported values; in some cases greater weight was given to one budget due to the overall context in which the value of the line-item was reported. For example, crop budget Alpha-40 assumed the soil enjoyed no nitrogen deficiency, and therefore no NPK fertilizer was used in the crop budget. The economic- benefit calculation throughout this report assumes NPK fertilizer is used uniformly.

below), the annual average economic benefit in the dozen years (after planting) from year 5 through year 16 would be 18.68 million cedis. This is shown for a range of potential output levels by the Ghanaian mango sector in Figure IV-1. The likelihood of reaching these volume levels is discussed in the next section on Ghana's mango competitiveness and in section IV-D on potential volume levels.

Figure IV-1. Mangos: Potential Economic Benefit



B. Competitiveness

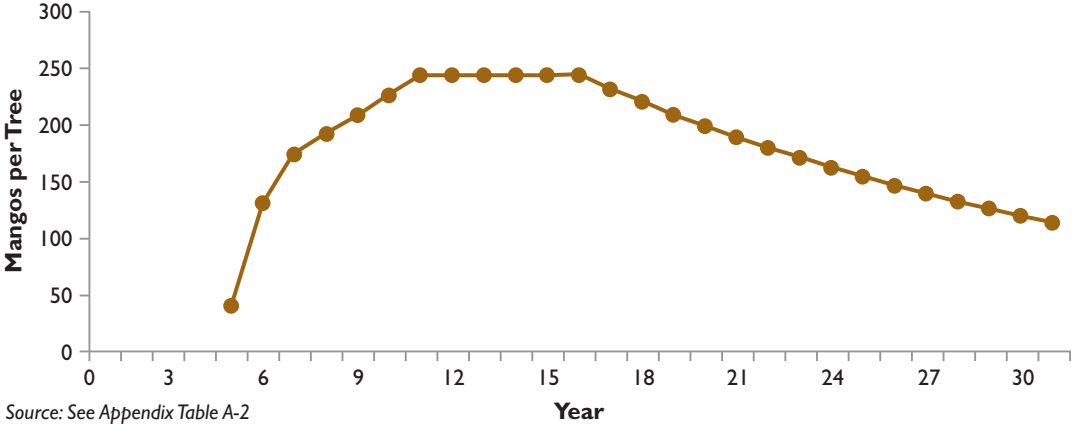
Ghana has proven itself to be competitive in the international mango market, particularly in the European Union. The EU mango imports have reached more than 200,000 metric tons annually, after growing at double-digit annual percent rates in recent years. Ghana's contribution to this total has grown from near zero to more than 1,000 metric tons, with the likelihood of further growth, perhaps to 10,000 MT in the coming years. Like bananas, mango production for export is best placed near the ports in the south. The Integrated Tamale Fruit Company in Northern Ghana produces export-grade mangos, however, and further development is possible as transportation networks improve.

C. Timing of benefits

The *timing* of cost outlays and production yield is an important feature for estimating the economic benefit from mango production. The elements of a mango's crop budget are

shown in Table A-2 of the Appendix. As shown in Figure IV-2, mangos begin producing fruit four years after tree planting, and then yields rise markedly before peaking. Some well-maintained mango trees can continue to increase their yields without exhibiting the yield decline shown in Figure IV-2, but other trees may succumb to old-age, disease, or accident, thus pulling down the average as time goes on.

Figure IV-2. Mangos: Yield per Tree



Source: See Appendix Table A-2

This yield-curve profile is important for the timing of both cost-expenditures and income-earnings (the profit portion of economic benefits). As shown in Figure IV-3, in the first few years expenditures are lower because the plant needs to be maintained, but there is no harvesting. Moreover, also seen in Figure IV-3, there is an uneven pattern to expenditures on tools and consumables because these have an average useful life of multiple years (depending on the type of product). This uneven pattern of sectoral expenditures leads to a similarly uneven pattern of economic benefits, as shown in Figure IV-4 with respect to direct benefits.

D. Volume Potential

The actual economic benefits to Ghana will depend on the scale of the mango-export sector created. For context, Ghana exported 1,071 MT of mangos in 2007, nearly all to the European Union, and the Ghanaian mango industry has identified 6,000 MT as its near-term target for export. The European Union imported more than 211,000 MT of

Figure IV-3. Mangos: Cash Outlays per Year

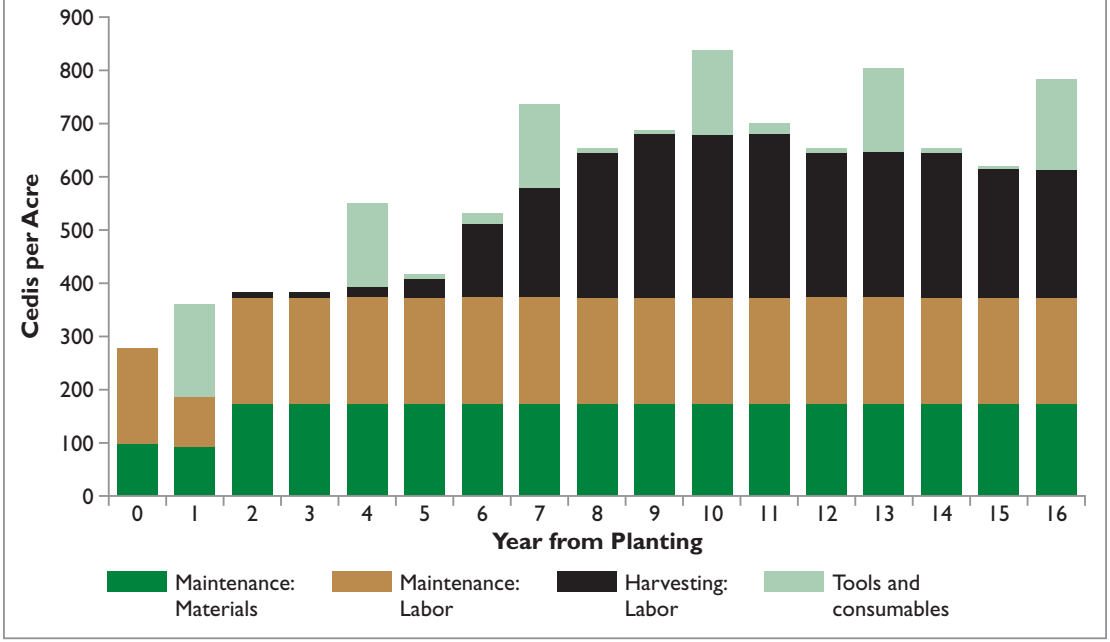
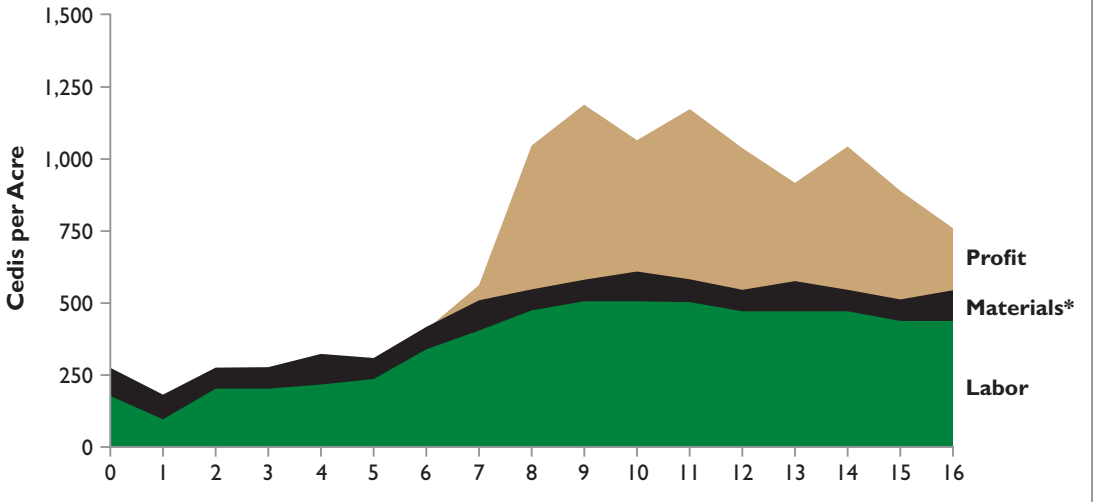


Figure IV-4. Mangos: Direct Economic Benefits Over Time



*Includes tools and consumables.

mangos from all sources in 2007,[21] implying a Ghanaian market share of less than 0.5 percent, although because of the seasonality of mango production, Ghana's effective share of the EU market is higher in those months in which Ghana's mangos are harvested. In 2007, the EU imported 14,706 MT from the Cote d'Ivoire, 4,317 from Mali, and 3,191 from Burkina Faso.[22]

Other reference points exist for what is possible for Ghana's mango export levels in the near term. Ongoing crop mapping by USAID's TIPCEE program estimates that there are more than 10,400[23] acres under mango cultivation, much of which has been created in recent years and has yet to reach full yield levels (see discussion of yield timing, below). The amount of fruit that such acreage would produce depends on the yields that can be obtained, particularly for fruit of export quality. The FAO puts Ghana's yield for 2006 at 4.5 MT/acre for all mangos (domestic plus export),[24] and the crop budgets used for this report imply yields in the 3.0 to 5.0 MT/acre range.[25] Thus, a reasonable 4.0 MT/acre yield would imply production of more than 40,000 MT. Much of this would not be export-grade quality, however.

Assuming one-half of this production can reach export quality, however, 20,000 MT could be available for export, which would put Ghana above the Cote d'Ivoire's 14,700 MT and below Peru's 36,700 MT for exports to the EU for 2007.[26] This 20,000 MT figure is thus used as the high end on which to base the estimates, as shown above.

E. Price

Another component of direct economic benefit is the residual profit the farm owner earns, assuming such owner is Ghanaian. Unlike the two cost components (labor and materials) of direct benefits, this profit component depends on the price of the mangos sold, which in turn depends on the destination market: exported mangos earn far more then mangos sold domestically, either as fresh fruit or for processing.

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[21] Eurostat Extra-EU27 trade for mangos, mangosteens, and guavas.

[22] Eurostat Extra-EU27 trade for mangos, mangosteens, and guavas.

[23] More than 6,400 acres have been mapped affirmatively as under mango cultivation. Prior to this mapping exercise, FAO listed Ghana in 2006 as having 1,572 acres (reported as 636 hectares) of land under cultivation for mangos, mangosteens, and guavas.

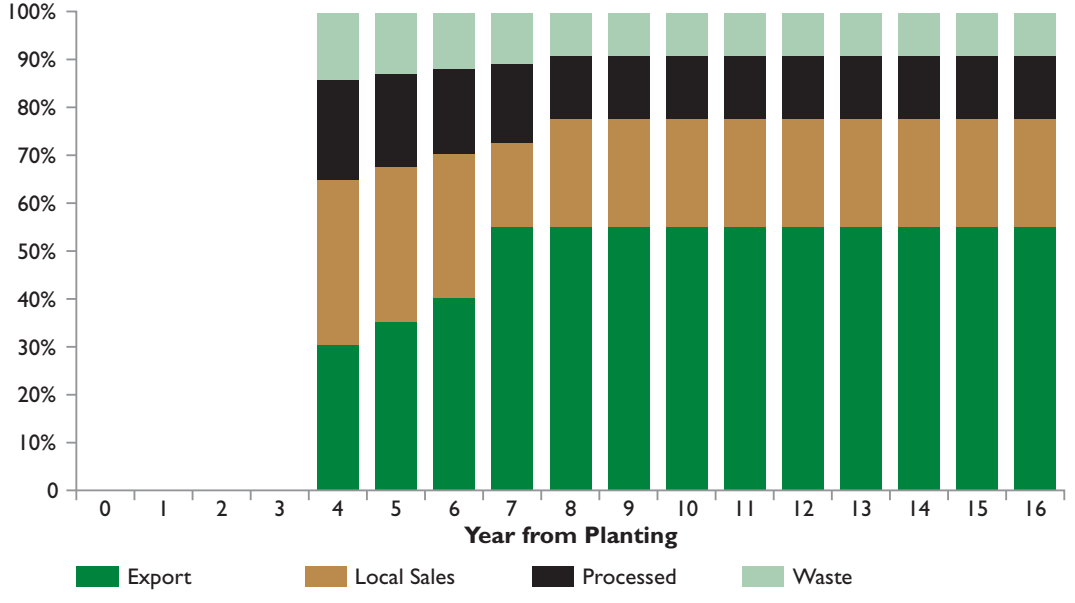
[24] FAO stat for mangos, mangosteens, and guavas.

[25] Average for years 4 through 13, after planting, of the yield cycle.

[26] Eurostat Extra-EU27 trade for mangos, mangosteens, and guavas.

Figure IV-5 presents the assumptions from the crop budgets on the share of the mangos that achieve export quality in each of the acre's post-planting years, and what shares go to local sales, processing, and waste. Exported mangos are assumed to earn 0.30 cedis per fruit, locally sold fruits earn 0.10 cedis, and processed fruit earns 0.15 cedis. Note that the profit declines somewhat as the declining-yield assumption from the crop budget takes hold. As noted above, mango trees can retain and even continue to increase their yields with proper maintenance thus perhaps mitigating this eventual profit decline.

Figure IV-5. Mangos: Assumed Share by Destination in Profit Calculation



F. Ghana Value-Added

After estimating the associated expenditures for each of these items based on the two crop budgets, it was necessary to determine the share of the expenditure that is on labor (and thus entirely a direct economic benefit, as explained in the previous section) and, of the remaining expenditure amount, what is the portion that is Ghana's value-added (and thus also counted as a direct economic benefit). These variables were derived in item-by-item discussions with experts and other officials in Accra in April 2008.[27]

[27]See Technical Note B.

The bulk of the benefit emerges from expenditures on labor because nearly all of the expenditures for materials (including tools and consumables) are on imported goods, Ghana's value-added portion of which is the mark-up from the import price. Such a mark-up represents the value-added from internal transportation, marketing, and retail packaging, as well as profit. Moreover, mango production is more labor-intensive than material-intensive, as can be seen in Figure IV-3 above.

G. Ghanaians Benefited

Mango production differs from banana production in that the employment created is not as structured, and therefore comparing numbers of "jobs" between the two sectors would be misleading. Moreover, the level of labor activity differs over time as the mango orchard matures, as illustrated in Figure IV-3, above (note in particular the variance over time of the two labor-cost components in the middle of the graph). Taking year four as an example, however, crop budgets suggest that there are 52 person-days of employment per acre. As noted above, TIPCEE estimates that there are more than 10,400 acres under mango cultivation, thus suggesting 540,000 person-days of employment created per year. At a 250-day work year, this would be more than 2,100 direct full-time jobs.

Assuming the number of dependents supported is the same ratio to full-time employment as determined for the banana sector (see discussion in section III-G, above), this would imply nearly 13,000 dependents would benefit and perhaps another 1,400 jobs created indirectly as a result of the direct mango employment.

V. Rice

For Ghana, rice differs significantly from bananas and mangos because it is largely a domestically consumed crop, and the country's output has been stable relative to that of the two export fruits. International trade does play a role, however: an expanded rice sector could substitute for rice imports.

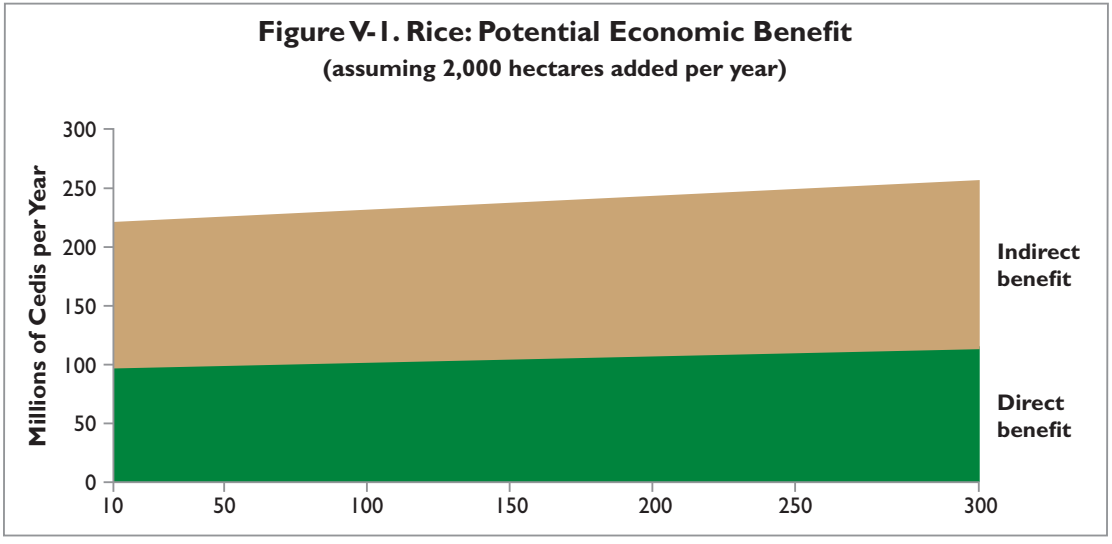
For purposes of this study nine rice crop budgets from several areas of Ghana were obtained from the Ministry of Food and Agriculture.[28] The expenditures in money and manpower, and the resulting yield and price differ significantly by rice-farm location within Ghana, and by type of crop technology used.

[28]See Appendix Table A-3 for an example of a rice crop budget.

A. Benefit Estimate

Figure V-1 presents the estimated direct and indirect economic benefit from rice production in these nine regions as a whole, assuming the total area under rice cultivation expands by 2,000 hectares per year, proportional to where it is currently located. Much depends on the location and nature of technology used, as will be discussed below. Per-acre total economic benefits range from under 300 cedis to more than 1,300 cedis across the nine crop budgets. In all cases, the per-acre benefits are significantly lower than those of bananas or mangos.

Figure V-1. Rice: Potential Economic Benefit
(assuming 2,000 hectares added per year)



For a more accurate sense of the potential for expanded economic benefits from rice production, further data need to be developed regarding the availability and suitability of land for rice crops vis-à-vis other crops, taking into account the use of various technologies (*e.g.,* machinery vs. labor-intensive) by location. Until such an accounting is undertaken in Ghana, these results remain suggestive at best.

B. Competitiveness

Ghana's competitiveness among international suppliers of rice must be viewed from a different perspective from those used to consider Ghana's competitiveness in bananas or mangos. There are several reasons for this.

First, Ghana is a net rice importer, rather than an exporter as in the case of bananas and mangos. The point of competition to assess Ghana's rice-supply competitiveness is therefore *within* Ghana where imported rice is sold in competition with domestically produced rice. (By contrast, the point of competition to be assessed for bananas and mangos is the European market.) The point of competition between foreign and Ghanaian rice is not at Ghana's border, but in the many local markets where foreign and domestic rice is sold or could be sold in competition. In practice, looking at local-market competitiveness rather than border-competitiveness is important because the further north (away from the port) the rice market is, the more that transportation costs favor domestic rice. Similarly, the more quality-conscience urban rice markets are closer to the ports, and therefore domestic rice — which is, on average, of lower quality than imported rice — faces stiffer competition closer to the southern urban centers.

As the Ghana Rice Inter-Professional Body summarized the issue:

> The Northern Region possess[es] the greatest potential for the development of the rice farming in Ghana….
>
> Unfortunately, the parboiled rice is not consumed in the big urban centres of the southern part of the country where households feed on imported rice. In the present state of things, any significant increase of the rice production in the North would lead to marketing problems as past experiences [demonstrate].[29]

Second, Ghana's rice production comes from a much wider range of production technologies and input costs than does banana or mango production for international markets. Key factors differentiating rice-production technologies include the degree irrigation, the application of capital vs. labor, highland vs. lowland locales, and north vs. south. By contrast, banana and mango production for the international market is an increasingly standardized procedure, in large part driven by the fruits' exposure to the demands and technological opportunities of the international marketplace.

As shown in Figures V-2 through V-5, the expenditures in money and manpower, and the resulting yield and price, differ significantly by rice-farm location within Ghana, and by type of crop technology used. Figures V-2 and V-3 are based on the nine crop budgets used in this report to estimate economic benefits. As for location, the limited data suggest that rice farms in the north are less productive, but it is not at all clear that this outcome is an unavoidable

[29]Olivier Maes (Project Coordinator) "Ghana Rice Inter-Professional Body" (October 2005) p. 2.

Figure V-2. Rice: Reported Cost Elements per Region

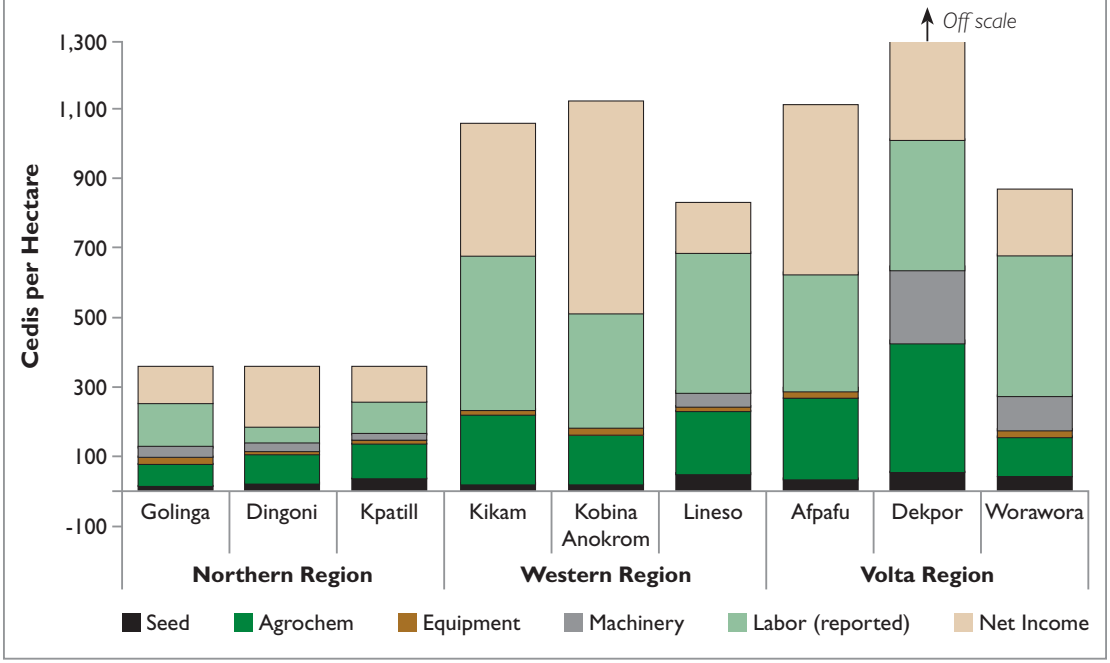
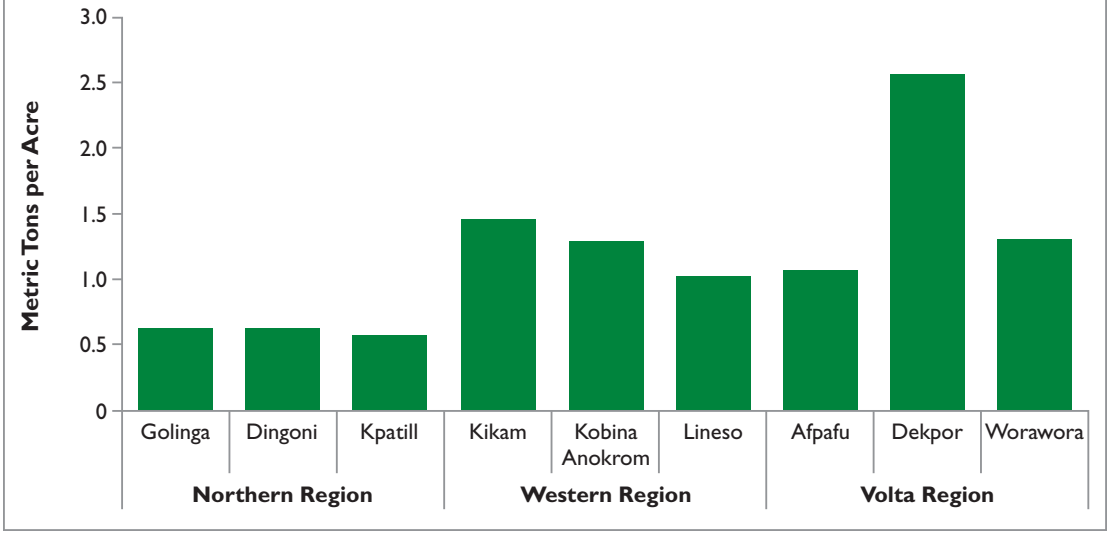


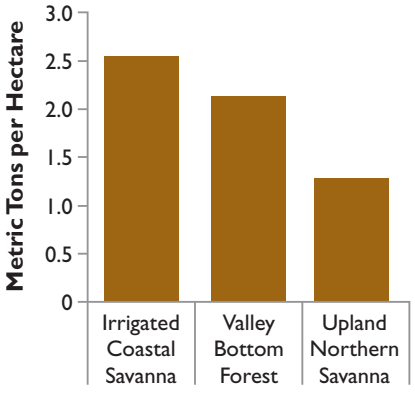
Figure V-3. Rice: Yield per Hectare



result of location. Rather, the widespread lack of irrigation technology in the drier areas reduces both outputs (low yields) and inputs (farmers will rationally refrain from applying labor or material inputs when insufficient rainfall would make such applications futile. Figure V-4 illuminates the role of technology by comparing productivity under different methods.[30]

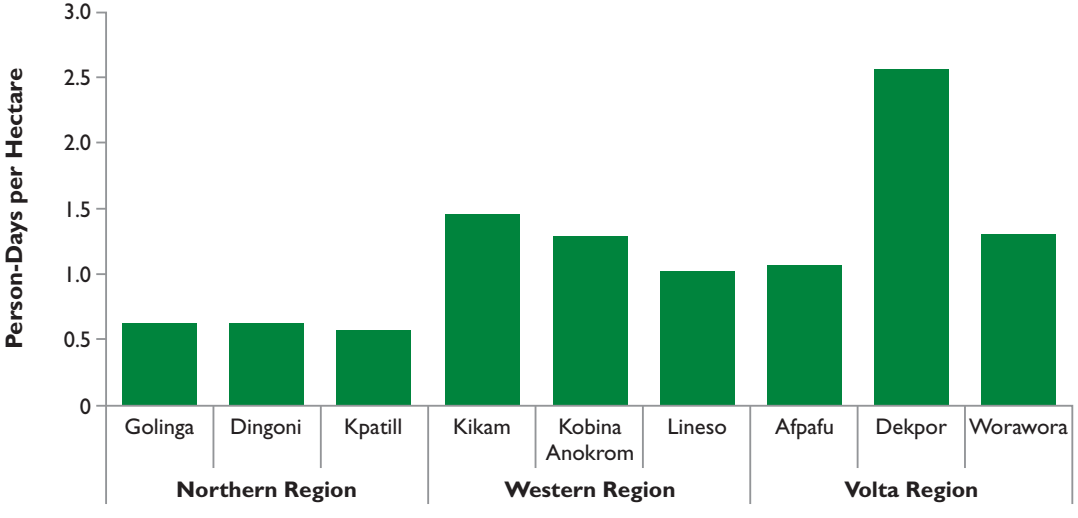
Figure V-5 presents the differences in the person-days that are associated with the same hectare of production in the nine locations examined. Such differences drive the differences in productivity outcomes, yet they also create differences in the number of Ghanaians who enjoy economic benefits from rice production, as discussed below.

Figure V-4. Rice: Yield Differences Among Three Crop Techniques and Locations



Source: Ministry of Food and Agriculture

Figure V-5. Person-Days by Region



[30]The three crop budgets obtained for this comparison did not allow for a sufficient comparison of economic benefits by region, so the nine crop budgets discussed above were used.

Third, a higher proportion of the costs of Ghanaian rice production is priced in cedis than is the case for bananas and mangos, which have higher costs for imported agrochemicals, packaging, and capital equipment. Thus, other things remaining equal, the exchange rate between the cedi and foreign currencies plays a larger role than it does for bananas and mangos. If the cedi weakens against key foreign currencies, those products that depend on imported inputs (here, bananas and mangos) face relatively higher costs. On the other hand, those products that depend more on export markets than domestic sales (here, banana and mangos) or compete with priced imports whose prices are raised by the falling cedi (here, rice, particularly in the south) enjoy higher cedi-denominated revenues. On balance, therefore, mangos and bananas would likely to face relatively higher input costs (relative to the change faced by rice) by a falling cedi, yet all three products would benefit from rising sales prices and competitiveness.

Once these analytical differences between rice on the one hand and bananas/mangos on the other are recognized, the question is whether rice is indeed competitive with imported rice[31] at higher volume levels.

C. Volume Potential

The rice production has been fairly constant over the past decade, with the acreage under cultivation and the yield varying somewhat from year to year depending upon the weather, but neither rising significantly. According to FAO data, Ghana devoted 125,000 of its 11 million arabable hectares to rice in 2006, down from more than 135,000 hectares in 2001, while average yields tend to be in the 2.0 MT per hectare range, depending largely upon annual rainfall, particularly in the north. As shown in Figure V-3, above, yields differ greatly depending upon location.

The potential for Ghana to significantly increase its rice output depends heavily on two factors. First, substantial yield and cultivation increases depend to a great extent on the level of future policy resources devoted to the Ghana's rice sector. Perhaps to a lesser extent, significant increases in farm gate prices (discussed below) would likely attract greater efforts from Ghanaian farmers to boost yields and cultivation. Such farm gate price increases could come as a result of rising international prices or improvements in Ghanaian rice's ability to compete on quality terms with imported rice, as discussed above.

[31] A more detailed study of rice competitiveness would consider Ghanaian rice's competitiveness with other foodstuffs, such as wheat grain, as well as with foreign rice.

D. Timing of Benefit

Rice production and harvest has a much "flatter" timing profile than do bananas and mangos. Typically, rice production can begin in the first season and continue at a fairly constant level in subsequent years. Thus timing is not a significant issue for rice.

E. Price

The important point at which to measure the price of rice for purposes of measuring economic benefit is the farm gate. These prices vary widely in Ghana: the crop budgets provided in 2007 indicate 0.24 cedis per kilogram in Golinga in the Northern Region to 0.43 cedis in Afpafu in the Volta Region — a figure more than 80 percent higher in the Volta Region. Two key factors appear to drive this difference. First, there is location: rice prices in the north are uniformly lower than those in the south, most likely driven by differences in income levels (demand-competitiveness) in the two areas. Second, there is likely to be a significant quality difference among the rice products in the various locations, with northern rice being of lower quality whereas rice in the south is seeking to compete with imports.

Yet another price consideration that might be crucial for estimating the benefits from expanding Ghana's rice industry is the product's long-term international product price, which influences the price of Ghana's domestic rice through competition with imports. Although the international rice prices peaked in May 2008 at multiples of their longer-term historical levels and have declined substantially since that time, they remain well above historical levels (more than 40 percent higher in early 2009 compared to the beginning of 2008), and the International Rice Research Institute projects that price volatility will continue for the years to come.[32]

F. Ghana Value-Added

After estimating the associated expenditures for each of rice's inputs based on the nine regional crop budgets, it was necessary to determine the share of the expenditure that is on labor (and thus entirely a direct economic benefit) and, of the remaining expenditure amount, what is the portion that is Ghana's value-added (and thus also counted as a direct economic benefit). These variables were derived in item-by-item discussions with experts and other officials in Accra in April 2008 as well as from averages derived from the nine crop budgets themselves.

[32]International Rice Research Institute, *Rice Today,* January-March 2009, pp 11-12.

It is important to recognize that rice can be grown under a much wider variety of crop techniques than can bananas or mangos and therefore the capital-labor mix for any given level of output also may vary considerably depending on the crop technique, which in turn is often dependent on location and environmental factors such as rainfall.

Note, too, that the crop technique appears to be the most mechanized in the Dekpor area, resulting in the highest revenue per acre (the total height of the bar, which equals yield times price). This translates into the highest economic benefit among the nine crop budgets because of the high yields achieved. Such mechanization in Dekpor results in low labor utilization per hectare. Although this implies a higher level of economic efficiency (in theory, allowing the unused labor to be applied to other, higher-valued uses), it also means that the direct economic benefit as measured by employment is low relative to other regions.

G. Ghanaians Benefited

Like mangos, rice in Ghana is not produced through the creation of full-time, structured employment. Complicating estimates of potential economic benefits in terms of Ghana is the fact that per-hectare person-days for the nine crop budgets (as shown in Figure V-5) vary from 21 to 140. Thus, any estimate of the number of persons benefiting from rice production in Ghana would require more detailed information regarding the relative rice output of the regions represented by these crop budgets, as well as differences in the number of dependents by region. Nonetheless, it is notable that mango production's 52 person-day of annual activity is roughly in the middle of the spread of the annual person-day estimates for rice.

VI. Three-Product Comparisons

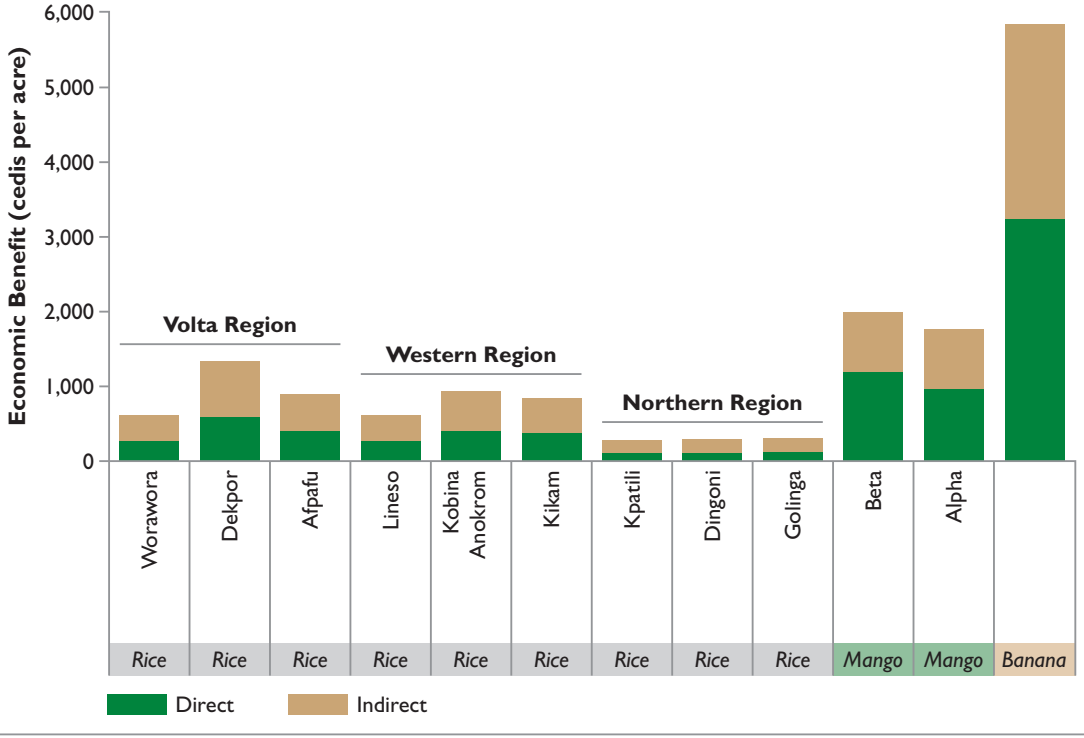
For each of these three Ghanaian products — bananas, mangos, and rice — there is the potential to generate significant, additional economic benefits for Ghana. Given limited public-policy resources to support the development of these sectors, it is useful to compare the results among the three products. This begins with a per-acre comparison, as done in section VI-A below, but must also include other important considerations, as discussed briefly in section VI-B.

A. Economic Benefits per Acre

It is useful for policy purposes to compare the economic benefit generated for each of the three products on a per-acre basis, particularly in the Ghanaian context in which land

is the crucial scarce resource. Figure VI-1 summarizes the per-acre[33] direct and indirect economic benefits arising from each of the three products, based on the crop budgets available for each. For each product, the benefits are calculated after that product's initial investment period.

Figure VI-1. Economic Benefit by Crop Budget: Banana, Mango, Rice



Assume these are only three industries. In the simplest terms, the economic-benefit analysis shows that on acreage where all three products can be grown competitively, the crop that will produce the greatest economic benefit for Ghana is bananas. Where either mangos or rice can be grown competitively, mangos will produce greater economic benefits than rice.

[33]As the product-specific discussions above make clear, data are often reported on a per-hectare (rather than per-acre) basis. For comparison purposes, this section (as well as Table A-1 in the Appendix) presents the economic benefit outcomes on a per-acre basis.

As discussed above, however, this conclusion is *not* the same as saying "Ghana should produce bananas to the exclusion of mangos or rice." The economic-benefit analysis described in Section II is very location-specific. In the extreme, it would be applied on an acre-by-acre basis within Ghana, with any one of the three products potentially showing the most economic benefit for that piece of land.

In particular, the analysis suggests the following process for optimizing Ghana's economic benefit from these three products. First, find places where bananas can be produced on a commercially competitive basis. Generally speaking, these locations will be larger, contiguous tracts of suitable land in the south. Investment in banana production in these areas can grow a great deal before reaching the point where the international market would be saturated by Ghana's output.

Second, land not suitable for commercially viable banana production but suitable for viable for mango production would generate economic benefits from such production, more so than rice. Largely because of transportation costs to and from Ghana's ports, these locations are more likely to be in the south. (Reinforcing this conclusion is the fact that the south is also where rice production would find greater competition from imported rice, reducing rice's commercial viability and economic benefits arising from profits.) Note, however, that limits on European mango demand imply limits on the number of acres in Ghana that can produce commercially viable mangos — after a certain point, additional mango production will depress prices on all mangos from all acres.

Third, land that is not suitable for commercially viable banana or mango production, but is suitable for commercially viable rice production, can best generate economic benefits through rice cultivation. Such land is likely to be in the north, where banana and mango production is not viable in most cases, or in parts of the south on land that is not suitable for banana or mango production. In the case of bananas, a key factor will be the ability to plant large, contiguous tracts, whereas in mango production a key factor will be the limits imposed by international market saturation.

B. Other Considerations in Assessing Benefits

When making these per-acre economic-benefit comparisons for policy purposes, it is important to not lose sight of the other considerations that bear on these product comparisons.

Competitiveness. Each of these three products has demonstrated its commercial competitiveness to different degrees and in different ways. Ghana has shown its ability to serve the European banana market with one mass-market producer and one fair trade producer, but has not yet broken through to the scale necessary to be a top tier banana supplier. Relative to the volume potentials envisioned by this paper, mangos have most fully demonstrated their commercial potential. Rice remains problematic: on the one hand, there is no geographical or environmental obstacle to Ghana increasing rice production significantly (albeit water is an issue), yet despite public policy support, the country's rice yields and output have remained well below their theoretical potential, and there is the question of quality competitiveness with imports.

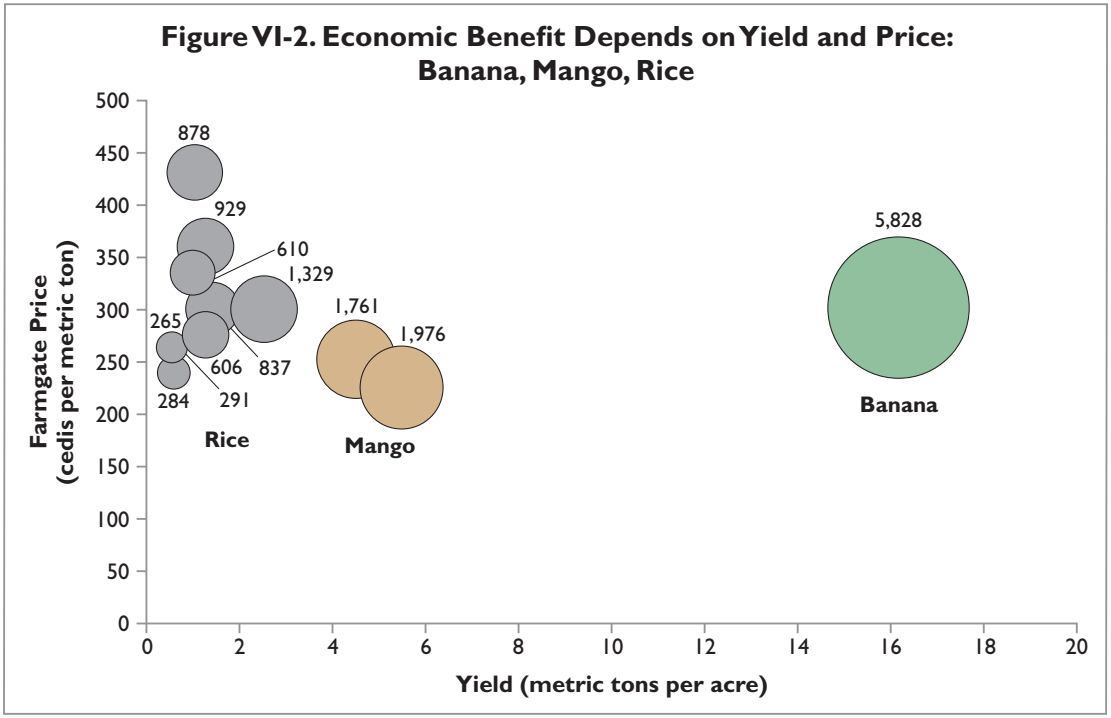
Timing of Benefits. Unlike bananas and rice, mangos require several years for trees to reach their full yield potential, and thus generate the economic benefits arising from profits. Bananas, meanwhile, require a larger up-front, one-time investment relative to those required for mangos or rice.

Volume. Each product's crop yield and acreage planted are changeable as a result of policy efforts. Thus sound decision-making must take into account the possibility that these variables will move over time, and consider the consequences of these movements for the economic benefit of the product.

Price. Unlike volume, price is less affected by policy efforts, and therefore more policy attention must be given to potential movements in the products' output price as a result of external forces. For bananas, for example, the key factor is likely to be the course of the EU banana-import regime, its affect on specific supplier export prices, and where Ghana sits among these price differentials. By contrast, for mangos seasonal pricing patterns in Europe are important, and for rice the important question is the longer-term trend in international prices affecting Ghana's imports.

Ghana Value-Added. The share of investment and production costs that are attributable to value-added inputs produced in Ghana is a key factor in determining total economic benefits. Such Ghanaian value-added can be increased with the proper set of public-policy initiatives that provide support to commercially competitive Ghanaian suppliers. Packaging and transport are two areas for consideration for the three products examined here.

To reiterate: prices, acreage, and yield are critical in determining economic benefits. The size of the circles in Figure VI-2 represents the total economic benefit illustrated by the vertical bars in Figure VI-1. Each crop's assumed price per metric ton is represented by



its circle's height on the y-axis, with the metric tons per acre represented by the distance the circle is positioned to the right along the x-axis. As can been seen, crops with better yields tend to produce more economic benefits (a larger circle) despite rough similarity of per-ton pricing among crops.

Moreover, even within a given crop type — particularly for rice — there may be significant differences in production expenditures — and thus the level of economic benefits — between different locations and among various types of production technologies. These differences highlight the importance of careful data collection and dissemination for accurate evidence-based decision-making.

Indeed, comparison of economic benefits as in Figure VI-1 is only a starting point for sound policy decision-making and, unless other key factors are considered, can be misleading. For example, to achieve this benefit-per-acre, the acreage required for banana cultivation must be very large and contiguous relative to the much smaller farms that can achieve high rice and mango yields per acre. Moreover, location is a critical factor when comparing potential economic benefits: for a crop to sustainably produce economic benefits it must be competitive, and some soil types (for example) might strongly favor one

Table VI-3. Summary of Attributes

		Bananas	Mangoes	Rice
	Competitiveness	Ghana meets suitability factors for international production. Has emergent export industry.	Ghana meets suitability factors for international production. Has emergent export industry.	Import competition an issue, mostly in south and urban areas.
	Timing of Benefit	Sizeable initial investments, then continuous benefit flow.	Significant benefits begin around fourth year after crop establishment.	Fairly continuous benefit stream.
Volume Potential	Acreage	Requires large, continuous tracts of land for commerical viability.	Tracts for mango production are available in Ghana. Limits imposed by international demand.	Widespread availability.
Volume Potential	Yield	Once international production standards reached, yield static.	Yield improvement is focus of overall volume increases.	Key area for improvement.
	Price	Typically negotiated in contract with multinational fruit distribution company.	Seasonality of mango consumption in Europe, as well as of production among other exporters, is an issue.	International rice prices are off of 2008 high, but remain above historical levels are expected remain volatile.
	Ghanaian Value Added	Increased domestic production of packing materials best opportunity.	Increased domestic production of packing materials best opportunity.	Little opportunity for increasing Ghana's valued-added share of inputs.

crop over another. Figure VI-3 summarizes these key considerations as discussed in the product-specific sections of this paper.

Thus, it is important to recognize that the kinds of economic-benefit comparisons shown in Figure VI-1 assume crop budgets for locations that are already deemed most suitable to the crop in question. ***Evidence-based decision-making must account for these locational differences when considering competing economic policies that favor one crop over another.***

VII. Other Policy Considerations

Expanded production from these three products would also generate economic benefits that are not covered be the quantification exercise presented in this paper. In particular,

such expansion would strengthen economic *linkages* to surrounding (input) sectors and increase their efficiency through boosted *scale economies;* in the case of bananas and mangos, enhance Ghana's *commercial reputation* abroad; promote parallel development goals, such as economic diversification and rural development; and attract additional foreign direct investment.

Linkages and scale economies. Particularly for expanded bananas and mangos, expanded outputs would generate indirect benefits to sectors supplying inputs. These benefits constitute structure development *linkages* that can attract investment to these upstream sectors. In addition to providing additional demand for upstream products (such as packaging), the additional volume of output from these upstream suppliers translates into enhanced economies of scale as fixed overhead costs are spread across more output, thus lowering costs. Moreover, a broader customer base reduces the commercial risk faced by these suppliers, thus attracting investment. Such longer-run development benefits are not just theoretical. Latin American horticultural exports have grown substantial ancillary industries to their core fruit production, including box making, agrochemical services, horticultural research, and other professional services.

A major 27-country study showed that at levels of development similar to that of Ghana, the multiplier effect of agricultural activity is mainly through expenditures on labor (the top pathway in Figure II-2, above), but as development proceeds, there is a shift as the sector's purchase of upstream goods and services — which have a rising domestic value-added component — begins to overtake the benefits of expenditures by labor households:

> The results of the study confirm agriculture's strong backward links to non-agricultural production activities at low levels of development. Also, at low levels of development the rural household income multiplier (i.e. the effect of increases in rural household income on the demand for non-agricultural consumption goods) is the dominant one, while during the development process, the backward agricultural input output multiplier becomes dominant, i.e. the demand for agricultural inputs, including agricultural services and credit, is expanding. The findings indicate that the rural household multiplier declines with development as one would expect.[34]

The reason one would expect the "rural household multiplier" to decline with development is that as agricultural workers' incomes rise they can purchase a broader array of goods from further afield (namely from outside the country), thus moderating the mul-

[34]Food and Agriculture Organization, "World Agriculture: Towards 2010," 1995, section 7.5 p. 5.

tiplier effect of benefits to the local economy. On the other hand, as it develops, the local economy can provide more agricultural inputs, such as packaging materials and services that heretofore were more likely to have been imported.

In addition, enhanced technical knowledge for horticultural productivity tends to spread to surrounding agricultural sectors, as shown in a study of Kenya's horticulture-export sector:

> …the skills and institutional development stimulated by [Kenya's] horticultural export sector also serve to development [SIC] the domestic horticultural market. Given the fact that 96 percent of fruit and vegetable production is consumed domestically, even small improvements in yield, post-harvest methods, and marketing efficiency in the domestic supply chain could have benefits to the economy that are large relative to the direct benefits of horticultural exports.[35]

A more straightforward economy-of-scale benefit is widely seen in international transportation. For example, non-banana horticultural exports have grown from Central America in part because the pre-existing banana-transport pathways had occasional excess carriage capacity, thus presenting very low marginal transport costs for other products, and lower overall average transport costs for all products. For Ghana, the situation has heretofore been the mirror-image, with established pineapple logistics setting the stage for more efficient banana exports; nonetheless, expanded banana and mango transport will reduce transport costs for all other horticultural products.

In sum, many of the longer-run economic benefits to surrounding industries will arise from, but are often not reflected in, the value of the transactions captured in the economic-benefit calculations in the previous sections.

Ghana's commercial reputation. Evidence from recent decades strongly suggests that national success in one horticulture export will facilitate the growth of other horticultural exports from Ghana. In part, this beneficial effect is an outgrowth of simply economies of scale, as discussed in the previous section. Two other dynamics are at play, however. First, the major transnational horticultural companies will, other things remaining equal (and within the objective of supply diversification), prefer to expand supply relations with established producers that have proven their reliability. An concrete example in the case of Ghana is Golden Exotic's straddle across the pineapple and banana sectors.

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[35]Nicholas Minot and Margaret Ngigi, "Are Horticultural Exports a Replicable Success Story? Evidence from Kenya and Cote d'Ivoire," December 2003. p. 39.

Second, at the level of consumer preference, the "name brand" of the supplying country can become a key factor in national competitiveness. As discussed in detail in a recent study,[36] consumers — particularly in Europe — are increasingly sensitive to the labor and environmental conditions under which their fruit and vegetables are grown. If positive, familiar experience with one product from a supplying country carries over to other products produced by that country. Because increased banana and mango exports from Ghana will likely entail high standards of quality control backed by the correspondent multinational specializing in tropical fruit, Ghana's other exports will likely benefit from a strong Ghanaian-fruit reputation.

Development goals. It is possible that longer-term, less quantifiable benefits to economic development will eventually outweigh the near-term direct and indirect economic benefits quantified in the first part of this paper. In particular, the likely benefits generated by an expanded horticulture sector closely track Ghana's Growth and Poverty Reduction Strategy (GPRS II) goals. A pillar of this strategy is to promote "agriculture as [a] basis for economic growth and structural transformation" (p. 23) and to do so with "expanded diversification of competitive crop exports" (p. 24). In addition, the benefits identified above disproportionately flow to rural areas rather than to Ghana's urban centers, thus boosting rural wealth and relieving urban population pressures. Indeed, for Ghana's large self-sufficient farm population, "off farm" employment has been shown to be an important factor in "on farm" productivity because such "off farm" employment provides capital for "on-farm" improvements. As one study of Ghana's agricultural economy noted:

> Farm households' resource endowment positively and significantly determines irrigation adoption….off-farm participation [has a] positive effect on irrigation decision….That is the positive relationship between irrigation and off-farm participation, in spite of the fact that both are undertaken during the same season, the dry season, implies that they are complimentary activities.[37]

Finally, a growing horticulture-export sector with ties to major multinationals also strengthens the formal economy and resulting tax base.

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[36]Brent Bartlett, "Policies Affecting the Development of Ghana's Banana-Export Sector," December 2006, particularly sections I.D.1 and III.F regarding consumer perceptions of banana quality by country of production.

[37]Tsegaye Yilma, Ernst Berg and Thomas Berger, "Prospects and Challenges of Agricultural Technology-Market Linkage under Liberalisation in Ghana: Evidence from a Micro-data" (2004) p. 25.

Foreign direct investment. An increase in foreign direct investment (FDI) is an important element in Ghana's development objectives. The economic-development literature, some of which is specific to Ghana, is nearly unanimous in the conclusion that FDI is valuable as a capital inflow to the economy and, perhaps more importantly, as a source of foreign technical and commercial expertise.[38] As explained below, researchers who have questioned the magnitude of FDI-related expertise-inflow into developing countries typically cite unfavorable circumstances that are unlikely to prevail in the case of the Ghanaian bananas and mangos.

The mechanism by which resources would be generated for banana investment in Ghana is likely to be a combination of (a) FDI by horticulture multinationals or third-country investors and (b) domestic investment by Ghanaians in Ghana, based on the prospective inflow of revenue from fruit exports. Indeed the banana multinationals are likely to pursue a "division of rewards and responsibilities"[39] with domestic-investment partners in Ghana, rather than undertaking large FDI projects themselves.

VIII. Conclusions

Aside from the particular benefit estimates for each of the three products covered in this paper, there are seven conclusions that can be drawn from the economic-benefit methodology discussed here:

- Calculating economic benefits is an element in evidence-based policy formation.
- Evidence-based policy depends on good data.
- Total economic benefits can exceed direct benefits.
- Sectors must be commercially competitive to generate sustained benefits.

[38]Lawrence Arbenser, "A General Equilibrium Analysis of the Impact of Inward FDI on Ghana: The Role of Complementary Policies." Arbenser notes that "The need for external capital inflow to finance the current account deficit of developing countries cannot be over-emphasized." (p. 1). "This paper revealed that a policy that ensures [an] increase in FDI inflow and which reduce tariff levels are complementary policies that enhance household welfare in Ghana. It also established that [the] positive welfare impact is induced by the income effect [i.e., increased incomes rather than simply the decreased consumer prices which one would expect from tariff reductions]." (p. 21, emphasis added).

[39]See research report, Brent Bartlett, "Policies Affecting the Development of Ghana's Banana-Export Sector," December 2006, section III.F regarding the "division of responsibility" strategy being pursued by the banana multinationals.

- Comparisons between products begin with the scarce, competing resource (here, land, and thus the per-acre comparisons).
- Scenarios for changes in variables (yield, acreage, prices) should be considered.
- Policies can increase economic benefits (*e.g.,* increase Ghanaian value-added for inputs).
- Many of the economic benefits of expanded production of these products, particularly export products, would support Ghana's longer-term development objectives.

APPENDIX
TECHNICAL NOTES

Note A. Type of economic benefit model employed.

Further information on building economic benefit models for agricultural exports can be found at U.S. Department of Agriculture, Economic Research Service (ERS), "Agricultural Trade Multipliers: ERS Estimates -- Methodology." (www.ers.usda.gov/ Data/ TradeMultiplier/ ERSestimates.aspx.)

Of the models discussed in the ERS materials, the benefit model used here is of the "partially closed" variety, as opposed to being "open." So-called "open" model multipliers calculate the value of the exported product plus the value of the activity in supporting sectors (indirect effects), such as inputs, processing, distribution, and other services. "Partially closed" models assess the direct and indirect effects of exports, as well as the labor-cost induced personal income and spending associated with new and sustained activities arising from the application of new resources.

Multipliers using these methodologies assume that the only limit on the output of an economy is a lack of markets for its production. As explained in Note C, "Economic benefits arising from land acquisition" and Note E, "Elasticity of supply for labor and input goods and services," the fact pattern for expanded agricultural production in Ghana is consistent with this assumption; that is, product production would bring to bear underutilized national resources. In the case of rice, perhaps much of the potential increase in production would come from boosting yields rather than from increased acreage.

When comparing the ERS methodology with that employed here, two particulars regarding Ghana were taken into account. First, a higher proportion of direct inputs were imported by Ghana's horticulture sector relative to the U.S. agriculture sector, thus reducing the economic-benefit multiplier in the case of Ghana. Second, such multipliers can be

measured, as the ERS documents explain, "either at the producer level (which includes just the activity embodied in the commodity as it leaves the farm gate or manufacturer's door) or at the port level (which includes shipping, handling, and storage charges in addition to the farm or manufacturing sector's value)." Because of the availability of good in-country transportation data in the case of Ghanaian exports, the results here are port-level benefits for bananas and mangos, and at the farm gate for rice, which is not generally exported.

Note B. Estimating variables outside of available cost data and verifying cost data.

To develop a more accurate set of input variables for the benefit model used in this report roundtable discussions were held at the TIPCEE offices in January 2007, and in April and August 2008. In attendance were representatives from Ghanaian producers for the three products, suppliers to Ghana's producers, other horticultural exporters, as well as experts on the Ghanaian economy from the Ministry of Trade and Industry, The Ministry of Food and Agriculture (Horticulture Export Industry Initiative), the Ghana Export Promotion Council, the World Bank, USAID, and TIPCEE. During these sessions, the values of the variables used in the models were presented for comment. For certain data less available from documentary evidence, particularly the expenditure patterns and support of employee dependents in various regions in Ghana, the participants were asked for estimates based on their personal expertise and experience. There was a close consensus among the participants on these variables, and they were incorporated into the models.

Note C. Economic benefits arising from land acquisition.

Estimating the economic benefits arising from land-acquisition expenditures is difficult and potentially misleading. First, proceeds from land transfers and leases are typically considered to be "economic rents" and not truly representing "value-added" to the economy. This is because, unlike a workers' labor or an agrochemical used on a farm, the land existed prior to cost-expenditure, in this case the purchase or lease. Second, for potential Ghanaian farms where the investor has always owned the land, it is difficult to distinguish what the investor might consider to be "profits" from for example, banana production and the "shadow rent" that the investor is earning from the land's use in the banana-production operation (although such an accounting would need be undertaken for a clear understanding of the actual returns to investment). In any case, the amount of the land cost to each sector depends on the opportunity cost (*i.e.,* potential valuable alternative uses) of the land in question. If there is a higher value alternative use, then the purchase or lease payments from a horticulture sector would be high but simply be

replacing payments by other sectors, thus not representing additional value-added. If there is little alternative use, then the payments would be minimal but still not represent additional value-added.

Note D. Marginal propensity to consume.

This assumes the marginal propensity to consume is 1.0 and thus that the marginal propensity to save is 0.0. In the local Ghanaian economy "savings" appears to be largely in the form of investment in physical assets, such as simple irrigation structures, and thus can be treated as the functional equivalent of "expenditures" for purposes of calculating indirect benefits.

Note E. Elasticity of supply for labor and input goods and services.

The cost structure approach assumes that a specific sector has access to labor and input goods and services that will not increase in price as a result of the entry of each sector's own demand for the product. In technical terms, this means that these resources are currently unemployed (or largely under-employed), the supply elasticity is extremely high, and that the use of these resources in the sector is not simply the result of the sector "bidding away" the workers and other inputs from other sectors. During the interviews and roundtable discussions undertaken as part of the research for this report (See Note B), this assumption was supported by the factual situation described. In particular, employees are either not being attracted from other non-household employment or whatever productive activity was being undertaken by the employee is being fulfilled by others who were previously under-employed. In the rice sector, additional rice output is likely to come from expanded activity from current growers. Similarly, there does not appear to be a long-term supply constraint on other inputs.

Note F. Occurrence of value-added and the level of trade.

Where this "value-added" occurs within the Ghanaian economy is not relevant; that is, it need not occur at the "level of trade" of the turnover level being considered. For example, the use of domestically produced fuels by an agrochemical supplier would count the value of processing occurring in Ghana as "Ghanaian value-added," but would not count the eventual import of the petroleum, despite the fact that both components may be associated with production activity that is several transactions, or "levels of trade" away from the activities of the agrochemical processor itself. Among the reasons that this use of "value-added" is important to recognize is that the calculations here differ from those that

are used to calculate liabilities under a value-added tax (VAT). In a VAT, only the value-added associated with the taxpayers' own activity (level of trade) is considered.

The economic benefit estimates in this report were based on crop budgets provided for each of the three products. Table A-1 of this Appendix summarizes the key data from these crop budgets and the estimated direct and indirect economic benefits for each. Table A-2 is a sample crop budget for Ghanaian mango production and Table A-3 is one of the nine crop budgets provided for Ghana's rice sector. Figure III-2 in the main text of this report presents the elements of a banana crop budget. Note that these crop budgets were collected and reported at different times and on somewhat different measurement bases (*e.g.,* hectares vs. acres) and therefore some adjustments to the date were necessary for meaningful comparisons across product types. For example, note that the crop budget for rice is reported in cedis prior to the redenomination of the currency.

SAMPLE CROP BUDGETS

Three sample tables are on the following pages.

Table A-1. Economic Benefit Comparison Per Acre: Three Products and Twelve Crop Budgets

			Per Acre												
						Direct Benefit						Indirect Benefit			
			Price	Yield	Revenue	**Labor Benefit**	Materials Cost	Ghana Value-Added Share[1]	**Materials Benefit**	**Profit[3] Benefit**	Total	Labor-Profit Multiplier[2]	Materials Multiplier[2]	Total	**Grand Total**
									40%						
			a	b	c	d	e	f	g=e*f	h=c-d-e	j=d+g+h	k	m	n=f(d,h,g,j,k,m)	**p=j+n**
Banana		Note 4, 6	300	16.2	4,856	Note 7	←		→	Note 7	**3,238**	1.8		2,590	**5,828**
Mango	Alpha	Note 5	250	4.5	1,125						**968**	1.94	1.43	**793**	**1,761**
Mango	Beta	Note 5	224	5.5	1,229						**1,183**	1.94	1.43	**793**	**1,976**
Rice	Golinga	Note 4	238	0.6	146	51	51	33%	17	44	**112**	2.77	1.65	**179**	**291**
Rice	Dingoni	Note 4	238	0.6	146	20	55	36%	20	71	**111**	2.77	1.65	**174**	**284**
Rice	Kpatili	Note 4	262	0.6	147	38	66	37%	24	43	**106**	2.77	1.65	**159**	**265**
Rice	Kikam	Note 4	298	1.4	430	150	94	40%	38	185	**373**	2.31	1.65	**464**	**837**
Rice	Kobina Anokrom	Note 4	357	1.3	455	134	74	40%	30	248	**411**	2.31	1.65	**519**	**929**
Rice	Lineso	Note 4	333	1.0	337	163	98	36%	35	76	**274**	2.31	1.65	**336**	**610**
Rice	Afpafu	Note 4	429	1.1	452	138	95	40%	38	219	**395**	2.31	1.43	**484**	**878**
Rice	Dekpor	Note 4	298	2.5	759	152	226	30%	68	381	**601**	2.31	1.43	**728**	**1,329**
Rice	Worawora	Note 4	274	1.3	354	164	111	29%	32	79	**275**	2.31	1.43	**331**	**606**

1. See discussion in Section II regarding value-added methodology.
2. See discussion in Section II regarding multipliers for indirect benefit.
3. Includes implicit wage among worker-owners, and therefore numbers may not be comparable across samples. Assumes profits are earned by Ghanaians and are expended in Ghana in first instance.
4. Reported on per hectare basis.
5. Reported on per acre basis; see table below for market-destination assumptions for mango price. Standalone report uses 4.0 yield, which is conservative and conforms to FAO statistics; crop budgets are likely to be state of art for growth.
6. Price conforms to 2007 report; depends on nature of responsibility-sharing contract with international trading company; original banana report was not done on per-area basis.
7. Calculations based on company proprietary information on cost structure.
   $30 million of direct benefit based on 150,000 MT of export at yield shown here implies → 9,266.25 acres, or → 3,237.56 per acre

Note: All benefits are taken for year of mature production and exclude one-time investment benefits, depending on time horizon, this creates a bias against bananas and, to a lesser extent, mangos.

Mango market-destination assumptions (cedis per kg).

	Alpha	**Beta**
Export %	60%	55%
Export Price	0.35	0.300
Domestic Price	0.10	0.130
per kg	0.25	0.2235
Per MT	**250**	**223.5**

Note: Beta local price reflects mix of local sales and processing.

Table A-2. Example of a Crop Budget: Mango

8 MANGO MAINTENANCE COSTS PER ACRE PER YEAR AFTER YEAR 4

Data to be filled out per orchard!	
Number of trees per acre	40
Age orchard / year after planting	7
Number of seasons in the year	2

	Activity	Unit	# of Applications	Qty per appl.	Unit Price (¢)	Total cost (¢)
A.	***Weed control***					
	Herbicide - Glyphosate	1 lt	4	3	5	60
	Ring weeding & herbicide appl.	man day	4	5	3	60
	Sub Total					**120**
B.	***Fertilisation***					
	NPK	n/a	0	0	0.0	0
	Foliar ca, boron, P&K fertiliser	1 lt	4	0.10	3.2	1
	Potassium nitrate	25 kg	2	4	24	192
	Fertiliser application	man day	4	0.80	3	10
	Sub Total					**203**
C.	***Disease Control***					
	Contact fungicide Funguran	kg	12	2.00	5.4	130
	System fungicide Mancozeb	kg	12	2.00	4.5	108
	Spraying	man day	12	0.80	3	29
	Sub Total					**266**
D.	***Pest Control***					
	Stone weevil insecticide	lt	2	0.35	10	7
	Spraying weevil insecticide	man day	2	0.8	3	5
	Fruit fly trapping	sensus trap	1	1	5	5
	Sub Total					**17**
E.	***Pruning***					
	Pruning trees	man day	6	1.0	3	18
	Sub Total					**18**
H.	***Harvesting***					
	Harvesting fruits	100 fruits	2	76	0.10	15
	Carrying fruits	100 fruits	2	76	0.15	23
	Sub Total					**38**
I.	***Fixed Inputs***					
	Tools & consumables	8 types	1	1	56	56
	Sub Total					**56**
	TOTAL PER ACRE					**718**

Herbicide	**Herbicide need**	**# of appl. per year**	**Cost per litre**	**Total**
Glyphosate	3 lt per appl.	4	5	20
		4 x 5 man days		

Fertiliser	**Qty. of fertiliser per tree**	**# of appl. per season**	**Cost per unit**
No NPK on assumption that soil has no nitrogen deficiency			
MangoBoost	2,5ml	2	3.2
Potas. nitrate	100g	1 (for flower induction)	24
50 trees per man per day		4	

Fungicide	**Qty. of fungicide per tree**	**# of appl. per season**	**Cost per kg**
Funguran	5g	3 (between flower&fruitset)	5.4
Mancozeb	5g	3 (between flower&fruitset)	4.5
50 trees per man per day		6	

Pesticide	**Qty. of pesticide per tree**	**# of appl. per season**	**Cost per unit**
Hocklicombi	8,75ml	1 (when fruit is golfball size)	10
50 trees per man per day		1	
Fruit fly trap	4 per acre	0.5	5

Pruning		**# of appl. per season**	
40 trees per man per day		3	

Year after est.	**Yield estimate per tree per year**	**Year after est.**	**Yield per tree**	**Year after est.**	**Yield per tree**
4	40	18	209	27	132
5	130	19	198	28	125
6	174	20	188	29	119
7	191	21	179	30	113
8	209	22	170		
9	226	23	162		
10 - 15	243	24	153		
16	231	25	146		
17	220	26	139		

PRODUCTION COSTS/KG		**REVENUE ASSUMPTIONS**			
Total Cost (¢)	718	**Export sale (60%)**		**Local sales (40%)**	
Total Yield/Tree (kg) *	191	Quantity	4,584	Quantity	3,056
Average Weight/Fruit (kg)	0.5	Price/Kg	0.35	Price/Kg	0.100
Total Yield/Acre (kg)	**7,640**	Value (¢)	1,604	Value (¢)	306
Total Cost /Kg (¢)	**0.0940**	**Total Value(¢)**	**1,910**		
* Fill in the yield per tree corresponding with the age of the orchard (see next page)		**Total Cost (¢)**	**718**		
		Profit (¢)	**1,192**		
		Gross Margin	**62%**		

Tools and Consumables	**Cost**	**Qty**	**Wear per year**	**Cost per year**
i. Machete - slashing	5.0	2	50%	5
ii. Boots	7.5	4	50%	15
iii. Nose mask	0.5	6	50%	1.5
iv. Plastic gloves	2	2	50%	2
v. Goggles	5.2	2	50%	5.2
vi. First Aid box	10	1	25%	2.5
vii. Secateur/picking pole	4.0	5	50%	10
viii. Harvesting crates	7.5	10	20%	15
			Total	**56.2**

Assumptions:
1. 6 trees sprayed with 1 knapsack (2,5 lt per tree)
2. 1 man sprays 50 trees in 1 day (6 per hour)
3. 1 man prunes 40 trees in 1 day (5 per hour)

Notes:
Only preventive IPM spraying included
Curative spraying to be included in oper. expenses

Table A-3. Example of a Crop Budget: Rice

2.10 Cost and Benefit of Paddy Cultivation

Region: **Volta**

Site - 1 **Akpafu**

Input	Unit	Unit Cost (¢)	Requirement (m.d)	Family Labour M	Family Labour F	Hired Labour M	Hired Labour F	Unit per ha Total Amount (¢)
Labour								
Nursery preparation/broadcasting								
Land preparation	ha	615,000	2	√				1,230,000
Sowing seed	ha	300,000	1	√	√			300,000
Weeding	ha	100,000	5	√	√			500,000
Application of fertilzier	ha	60,000	1		√			60,000
Pest and disease control								
Cutting/harvesting	ha	180,000	5	√	√			900,000
Threshing and Cleaning	ha	30,000	5	√				150,000
Transport		175,000	1			√		175,000
Carting by head load		90,000	1	√	√			90,000
Total Labour (1)								3,405,000

Input	Unit kg/ha	Unit Cost (¢)	Requirement	Total Amount (¢)
2.Materials				
Seed	kg	5,000	70	350,000
Fertilizers :				
Sulfate of ammonia	kg	3,600	125	450,000
NPK 15-15-15	kg	4,000	250	1,000,000
Herbicides : Caliherb	Lits	65,000	7	455,000
roundup	Lits	55,000	8	440,000
Pesticides :				
Fungicides :				
Tools and equipment Hoe		45,000	2	90,000
Cutlass		35,000	2	70,000
Farm Machinery				
Land Preparation				
Threshing				
Drying				
Transportation				
Miscellaneous	l.s.			
Total for Materials (2)				2,855,000

(1) Production	2,604	kg
(2) Farm Gate Price	4,286	
(3) Gross Income	11,160,744	
(4) Production Cost	6,260,000	
Labour wage	3,405,000	
Materials	2,855,000	
(5) Net Income	¢ 4,900,744	