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Increasing Income of Ghanaian Cocoa Farmers: Is Introduction of Fine Flavour Cocoa a Viable Alternative

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Abstract

Consumers' taste and preference for differentiated cocoa based on darkness and flavour quality has been rising over the years. Added value of such specialty cocoa is expressed by consumers' willingness to pay more than the standard commodity price for the attributes and associations such as augmented health benefits that differentiate the product. Conventional cocoa production systems often planted with local landraces and to some extent hybrids often have low yields that cannot match farmers' investment decisions. An ex ante analysis of fine flavour cocoa was investigated for Ghana vis-à-vis existing farming conditions, using economic decision criteria. Fine flavour cocoa is differentiated on the basis of clonal planting material as opposed to regular pods and by its superior flavour qualities at during post-harvest handling. Results of hypothetical fine flavour systems are compared with business-as-usual systems with high input fine flavour system emerging as clear winner in terms of profitability. Sensitivity analysis shows that increasing percentage of producer price with fertiliser subsidies dramatically improves farmers' income.

Keywords: fine flavour cocoa, ex-ante cost-benefit analysis, speciality cocoa production, smallholder livelihood
JEL: D1, Q12, Q15, Q17, Q18

1 Introduction

Ghana, the world's second largest producer of cocoa, is well endowed with premium bulk cocoa and is strategically positioned to capture significant market shares for the growing demand in specialty cocoa products on the world market. Consumers' taste and preference for differentiated or 'specialty' cocoa and chocolate products based on unique characteristics such as flavour, sugar content and perceived health benefits has been rising over the years (ICCO, 2007a).

Cocoa production in Ghana is the major economic activity for over 700,000 households, with around 6.3 million Ghanaians (representing around 30 per cent of the total population) depending on cocoa for their livelihood. At the national level, Ghana has set an ambitious target of raising its current cocoa output from 700,000 tonnes in 2009 (FAOSTAT, 2009) to 1 million tonnes by 2012.

As forest lands for new cocoa plantings have all but disappeared, achieving this growth target will require a concerted effort to introduce innovations to cocoa farmers. Productivity growth has stagnated over the last twenty years with average yields for most regions being lower as production is based on extensively low input systems most often planted to local landraces. The lack of significant structural change within the Ghanaian cocoa sector over the past couple of decades stems from the fact that production is characterised by small scale farming with an average productive cocoa area per household of approximately 2 hectares (BARRIENTOS et al*.,* 2008). The average yield per hectare is 450 kg (MMYE, 2008), which is low compared to on-station research trials.

Hybrid cocoa varieties developed by the Cocoa Research Institute of Ghana (CRIG) have been adopted by approximately one-third of Ghanaian farmers who appreciate their high yielding nature (PADI and OWUSU, 1998). However, these systems, when not accompanied with fertiliser, can rapidly deplete soil nutrients and tend to have shorter production cycles because of the physiological stresses of higher yields as can be observed in the Western region of Ghana. For example, the rapid expansion of extensive low shade systems has been found to be a major cause of deforestation in West Africa (Obiri et al., 2007; GOCKOWSKI and SONWA, 2008).

To address the lack of innovation, low returns and take advantage of premium earnings of differentiated niche cocoa products on the world market, a new production system, namely, fine flavour (FF) is examined for Ghanaian smallholders. The FF production systems are distinguished from bulk cocoa production systems in Ghana by the proposed use of FF Criollo clonal and side grafted varieties rather than the seeds of Amelonado landraces and Amazonian hybrids used in the production of bulk grade Ghanaian cocoa. There are also knowledge gaps in the farming population concerning FF clonal cultivation practices that would likely require some investment in farmer training and extension to build their capacity in cultivation, pest and disease control and postharvest. The returns to such institutional investments will depend on the added value to the economy from the adoption and spread of the FF production systems. If farmers do not earn positive returns with these systems there is no reason to further invest in the new planting distribution systems or farmer training.

The Ghana Cocoa Board (COCOBOD) provides phyto-sanitary support to farmers and regulates the marketing of bulk Ghanaian cocoa on international markets. This has helped to maintain the quality of Ghanaian bulk cocoa, which earns an international price premium of between 7 to 10 per cent above the price paid for other West African bulk origins. Ghana's high quality cocoa and the good reputation of the COCOBOD allow it to sell up to 70 of its cocoa on forward markets which allows it to hedge the price for the season. On the basis of this price, the COCOBOD's Producer Price Review Committee sets the producer price for a reference year. Under pressure to liberalise cocoa marketing, the COCOBOD agreed with the World Bank and IMF to fix producer prices at 70 per cent of "net" FOB price. In the 2008/2009 main crop season, the producer price fell short of this price target.

This study forms part of a larger research agenda on new business models for sustainable trading relationships being currently tested by the Rainforest Alliance through the Agro-Eco Louis Bolk within the cocoa sector of Ghana to evaluate the profitability or otherwise of selected differentiated cocoa products on the world market. This component of the new business models study evaluates the potential economic returns of introducing FF cocoa production systems and compares them with those generated by typical smallholder production systems as well as intensified systems promoted by the Ghanaian cocoa authorities. Thus, the potential benefits and costs of FF cocoa are examined using the theoretical construct of product differentiation. FF cocoa is differentiated from bulk cocoa on the basis of value addition through a combination of production of identified inherent clonal genetic planting material followed by carefully managing postharvest drying and fermentation techniques to yield superior flavour qualities that attracts a premium price on global markets. As well as developing a differentiated product, introducing FF cocoa as a new business model can be scaled up and sustained. Production and marketing of this niche product requires changes in the value chain that allow an increased percentage of value to reach smallholder farmers within the cocoa belt of Ghana. The model is based on the concept that differentiation is an innovative approach that compliments other efforts to increase productivity and crop diversity on West African farms (SUSTAINABLE FOOD LAB, 2009).

Ghana has a proven comparative advantage for the production and supply of good quality bulk cocoa. Whether or not it could also be competitive in the production of FF cocoa is the main focus of this study. In this setting, the specific objectives of the study are to determine the economic returns per ha under best management practices of two hypothetical production scenarios namely; Low Input Fine Flavour Cocoa (LIFFC) production and High Input Fine Flavour Cocoa (HIFFC) production vis-à-vis two existing on-farm scenarios; Low Input Landrace Cocoa (LILC) typical in the cocoa belt of Ghana and High Input no Shade Cocoa (HINSC) production that is popular in the Western region of Ghana.

2 The Niche Market for Fine Flavour Cocoa

The notion of value addition through differentiation is a foundation of product development and marketing and is widely accepted both in business practice and theory (PETCHERS, 2003). The author further noted that a differentiated product is one that has unique characteristics – real or perceived – that can be used to position it in such a way that it holds added value for a particular group of buyers. That added value translates into consumers' willingness to pay a premium above the commodity price for the product. PORTER (1980) identifies product differentiation as an effective means for creating competitive advantage (i.e., earning above average profits). He states that competitive advantage creates a defensible position for coping with five competitive market forces – industry competition, supplier power, buyer power, potential market entrants, and substitute products. Building on the premise that competitive advantage yields sustained profits, GRANT (1998) also asserts that differentiation is a key to creating sustainable competitive advantage. Moreover, value is added to products through the process of matching consumer needs and interests with product attributes and associations (GRANT, 1998).

As a result of cocoa product differentiation, there are essentially two broad categories of cocoa beans available on the world market. One is "high quality" cocoa, a differentiated product known among chocolate specialists as "fine cocoa" or flavour (fine flavour) cocoa. The second is a "commodity" cocoa or bulk cocoa, a standardised but not quality differentiated product that tends to come from modern varieties developed for high yield, low cost, and other attributes at the expense of the unique quality attributes, which are in demand among differentiated cocoa consumers (ICCO, 2006).

FF cocoa beans are generally produced from Criollo or Trinitario cocoa-tree varieties, while bulk cocoa beans come from Forastero trees. There are, however, exceptions to this rule. Ecuadorian *Nacional or Arriba* Forastero trees, produce fine flavour cocoa. Indeed, *Arriba or Nacional* is a genetically distinctive fine cocoa with a unique floral aroma given by a combination of farming practices, genetics, climate, soil and luminosity that occurs exclusively in the shaded cocoa farms of Ecuador's coastal lowlands (LERCETEAU et al., 1997; DEHEUVELS et al., 2004). On the other hand, Cameroon cocoa beans, produced by Trinitario-type trees are classified as bulk cocoa beans (FOWLER, 1997). There is no single criterion which could be adopted as a basis for determining whether or not cocoa of a given origin is to be classified as FF cocoa.

Besides the genetics of the planting material, plant morphology and agronomic factors also can affect FF quality, as can the methods of fermentation and drying (FOWLER, 1997).

The global dark chocolate market which is the specific market that consumes fine or flavour cocoa is estimated to represent between 5 per cent and 10 per cent of the total market, with a higher share in Continental Europe than in the United States and the United Kingdom (ICCO, 2007a). According to ROSERO (2002), the major consuming countries of fine or flavour cocoa are concentrated in Western Europe including Belgium, Luxemburg, France, Germany, Italy, Switzerland and the United Kingdom. Japan and the United States also consume this type of cocoa. The pace of introduction of new premium chocolate products across the mature markets (Europe, the United States, and Japan) shows that this niche market has expanded very dynamically during the last ten years. A consumer survey conducted in November 2006 in five European countries showed that between 35 per cent and 57 per cent of the respondents in each country consume dark chocolate (ICCO, 2007b). The growth in the consumption of premium chocolate products is mainly driven by a taste for higher quality flavours as well as increased consumer concern over health and nutrition (ICCO, 2007b).

The ICCO in its 2006/07 annual report noted that research conducted on the health and nutritional attributes of cocoa and chocolate have confirmed that flavonoids may decrease low density lipoprotein (LDL or "bad" cholesterol), helping to prevent cardiovascular diseases (ICCO, 2008). The high content of antioxidants found in cocoa surpasses those found in wine and tea. Subsequently, the demand for dark and high cocoa content chocolate has surged in response to these positive findings. Chocolate manufacturers have noticed the changing tastes and even companies traditionally known for milk chocolate products have been introducing new high cocoa content chocolate products (JANO, 2007). According to Datamonitor's ProductScan Online database, 33 per cent of all chocolate candies launched in 2006 were dark chocolate products. In the United States, sales of dark chocolate increased by 9 per cent per annum on average between 2001 and 2005 and sales of high cocoa content dark chocolate increased by 24 per cent according to data published by ACNielsen (ICCO, 2007b).

Ecuador produces more than 50 per cent of FF cocoa beans in the world although the total contribution of Ecuadorian cocoa to the world production is only about 5 per cent (ROSERO, 2002; WORLD COCOA FOUNDATION, 2006, and FAOSTAT, 2009). There is, however, scanty information in the public domain regarding world production of fine flavour/single source cocoa. Based on different information sources complied by PETCHERS (2003), the total volume of FF cocoa was estimated at 90,000 MT in 1998/99. The majority (nearly 60 per cent) originates from South America, mostly

Ecuador and some from Venezuela. Other smaller sources of supply include Asia and the Pacific (Papua New Guinea, Indonesia, and Sri Lanka), Africa (Madagascar and Sao Tome), and Central America (Dominica, Trinidad and Tobago, Jamaica, Grenada, Costa Rica and Panama).

3 Research Methods and Data

3.1 The Study Area

The costs and return calculations for FF cocoa producing certified cocoa are estimated for the medium shade cocoa belt based on parameter estimates obtained from validation surveys conducted at Offinso in the Ashanti region, where the proposed Ghana Fine Flavour Cocoa Project is to be piloted.

The Offinso District is located in the extreme north-west part of the Ashanti Region with about half of its boundary bordered by the Brong-Ahafo Region. The communities selected for primary data collection lie within a radius of approximately 19 km from the regional capital of Kumasi. The district with a population of 140,000 and an area of 1,451 km^2 was strongly affected by the 1983 bush fires that accompanied a severe drought. After the bushfires, most of the cocoa growing farms were abandoned. These farms have either re-generated vegetation or are used for low intensity food crop production (e.g. plantains, cassava, and cocoyam). Many growers have expressed strong desire to return to cocoa production. The district is being targeted for a Fine Flavour Cocoa Pilot Project to be supported by the Bill and Melinda Gates Foundation. The advantages of the study area for FF production include the long fallow period since cocoa was last cultivated that has restored a high fertility level. Another advantage to the site is the close proximity to Kumasi which will allow for better linkages to both input and output markets and effective project monitoring.

3.2 Data Sources

Secondary data from various sources was augmented with primary data on input and output prices and labour estimates from purposive and expert interviews conducted in several communities in the Offinso district in March of 2009. The data collected was used in building the representative counterfactuals and hypothetical FF production systems. Production (yield) data, specifically the effects of shade and age on the yield of cocoa were obtained from CRIG as reported in various issues of the institute's annual report. A list of desirable timber trees to be included in cocoa agroforestry systems especially species native to the Ashanti Region of Ghana were also obtained from various issues of CRIG's annual report. Productivity growth of timber species over time and estimated volume of timber obtained from Forestry Research Institute of Ghana (FORIG) and Forestry Commission of Ghana were used to calculate the timber value in the FF systems at the end of its assumed twenty year production cycle. From the Ghana COCOBOD, time series production figures and farmgate producer price data and relevant produce marketing information were obtained. COCOBOD buys all the cocoa produced in Ghana and then sells it overseas to mainly European buyers. The small quantities of FF cocoa available relative to bulk cocoa and the need to segregate the flavoured (speciality) produce from bulk cocoa will entail additional marketing costs. The Sustainable Tree Crops Program (STCP) also provided a secondary data set from its baseline survey of over 4,500 cocoa producers from across West Africa in 2001 and 2002. Farmers from both the two major cocoa producing regions in Ghana (Western and Ashanti regions) were included in this survey. In addition, an STCP impact assessment survey data of graduated Farmer Field School (FFS) trainees was conducted in 2005 and compared to a control group of non-FFS trained farmers. Data from these secondary sources were combined with primary data from farmers in the cocoa belt to develop the representative farms.

3.3 Estimation of Farmer Costs-Benefits

An ex ante feasibility analysis of FF certified cocoa production systems was conducted for the Offinso area of the Ashanti region of Ghana. The counterfactuals are based on net present value (NPV) analysis of the typical cocoa production systems in the cocoa belt of Ghana. The NPV analysis for all cocoa cropping systems was conducted over a 20-year production cycle with resource endowments typical for a representative cocoa farm of the study area.

The concept of NPV and the Benefit Cost Ratio (BCR) were used to evaluate the economic returns to FF cocoa in Ghana. Benefits and costs are linked to the age of the cocoa trees (NKANG et al., 2007). At the early stages of cocoa, there are high establishment costs which are then followed by annual benefits that are non linear over the life of the trees (NKANG et al., 2007). The benefit components included income from food crops (cassava, plantain and cocoyam) and timber. Perennial crops like cocoa generate a stream of costs and benefits over a given time period. Due to the time value of money, future cost and benefit values were discounted to enable comparison with present values. An ex ante analysis involves projections of costs and benefits associated with the production per ha throughout the assumed 20-year life span (t=20 years) of the farm. The costs and benefits were be discounted using the appropriate interest rate and the Net Present Value calculated on a per ha basis.

$$NPV = \sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+i)^t}$$

Where B_t = benefit per ha in each year;
C_t = cost of production per ha in each year
t = 1, 2, 3, . . .n;
n = number of years;
i = interest rate

The study also estimated the Benefit Cost Ratio (BCR):

$$BCR = \frac{\sum_{t=1}^{t=n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{t=n} \frac{C_t}{(1+i)^t}}$$

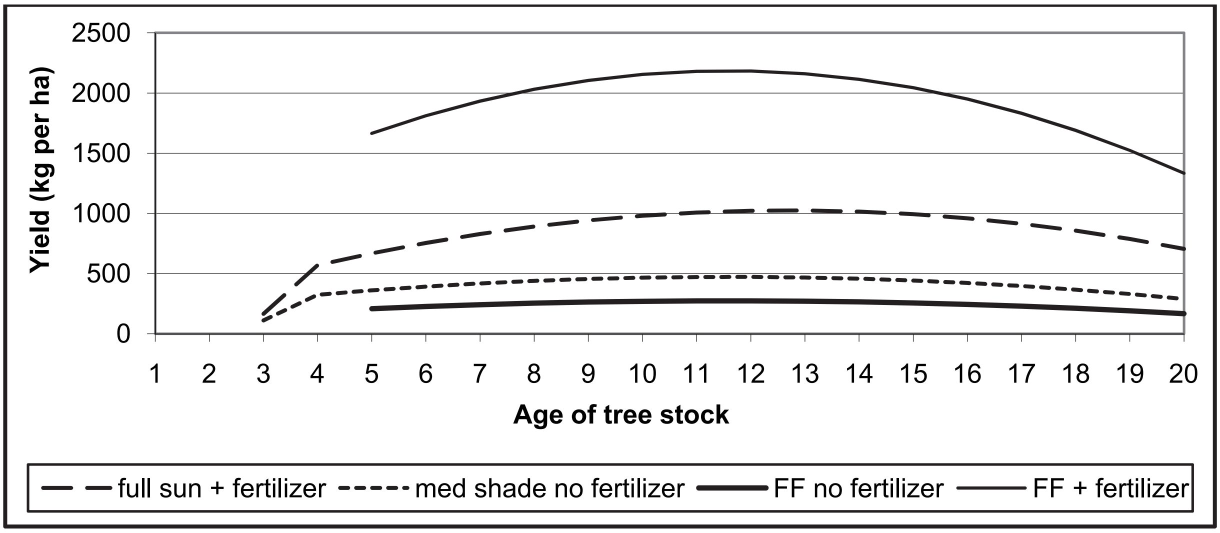
We use the Labour Internal Rate of Return (LIRR) as opposed to the standard Internal Rate of Return (IRR) for our analysis. The IRR determines the discount rate that makes the net present worth of the incremental net benefit stream or incremental cash flow equal zero. It represents the maximum interest that a project could pay for the resources used if the project is to recover its investment and operating costs and still break even (GITTINGER, 1982). As labour is often the smallholder's most scarce and most productive resource of the smallholder, high returns to labour are often critical in the adoption process. The LIRR is the level of wage which makes BCR unity and NPV equal to zero and is found by doing a grid search over different wage rates. It represents the maximum wage rate that a project could pay, if the enterprise is to breakeven. For households where all the labour is supplied by the family, it represents the value of a day's labour.

The formal selection criterion for the net present value is to accept investments with NPV greater than zero. However, if the net present value works out to be negative, then at the chosen discount rate, the present worth of the revenue or benefit stream is less than the present value of the cost stream. Hence, the revenues are insufficient to allow for recovery of the investment. An investment is technically and economically feasible if the NPV is positive. The decision rule for BCR is that for any project to be economically viable, the ratio must be greater than unity. The discount rate used in calculating a project's worth is very crucial. The discount rate determines the value today of an amount received or paid out in the future. OBIRI et al. (2007) for example used the NPV, BCR and IRR for an ex ante financial analysis of shaded cocoa in Ghana. A 10 per cent discount rate was assumed and the findings revealed that, in general, cocoa production in Ghana is profitable. The results further show that a change from the traditional system to hybrid cocoa production raised the IRR from 31 per cent to 57 per cent with planted shade and 67 per cent under the full sun production system, although additional costs incurred for agrochemical usage would tend to reduce profitability of unshaded hybrid cocoa in particular. NKANG et al. (2007) also used the NPV and BCR to analyze the investment in cocoa production in Nigeria. The study examined costs and returns in cocoa production in Cross River State in the context of three identified management systems of cocoa production in the area, namely owner-managed, lease-managed and sharecrop managed systems. The results show that cocoa production is a profitable business irrespective of the management system employed, since all of them had positive NPVs at a 10 per cent discount rate. However, GITTINGER (1982) stated that no one knows what the opportunity cost of capital really is. Therefore, in most developing countries, it is assumed to be somewhere between 8 per cent and 18 per cent in real terms. For this study, a discount rate of 20 per cent is assumed as the upper limit that currently best reflects the time value of money in Ghana.

3.4 Age-Yield Profile Assumptions

The age yield profiles for production systems considered in the study were obtained from the relationship between different shade densities, age and yield from various CRIG trials (figure 1). The medium shade density considered has a tree population of 70 trees per hectare. The average yield of FF cocoa in Ecuador is 181-227 kg/ha/year (MELO, 2008). Yield data for Criollo systems in West Africa do not really exist but yields under typical smallholder management usually ranges from 50 kg to 200 kg per ha (CROSSON, CIRAD, personal communication). At the same time, highly intensified systems of fine flavour Criollo cocoa can easily yield in excess of 2,000 kg per ha under good management (SCHARFFENBERGER, personal communication).

Figure 1. Empirical relationships between age of tree stock and yields from year1 to year 20, for four production systems



Source: stylised data compiled from CRIG-Tafo Shade-Fertiliser trials (AHENKORAH et al., 1974; AHENKORAH et al., 1987)

3.5 Computation of Labour Inputs and Wage Rates

Labour estimates were obtained from field data for 40 cocoa farmers in the cocoa belt of Ghana by the STCP. Farms were measured using GPS handsets which reduced measurement error in the estimates of person-days per ha for the various cultural tasks. Average labour requirements for the various activities per hectare and per tonne of cocoa were estimated in 6 hour person-days for the various tasks involved in cocoa production. Data on tree felling and cutting into logs and insecticide application were lump sum labour activities evaluated on a per ha basis.

For the purposes of international labour regulations and fair trade requirements of good working conditions of farmers, an agricultural wage rate higher than the existing national minimum was proposed for the analysis. A wage rate of GH¢ 3.50 per 6-hour person-day of work was used which is more than the government-approved minimum wage, pegged at GH¢ 2.25 for an eight hour task but similar to the agricultural wage rate, which in some areas are pegged to the cost of a cutlass. In accordance with the above stated production requirements, the daily labour wage rate for FF production systems was assumed to be GH¢ 3.50 for 6-hour person-day.

3.6 Bulk Cocoa Price Estimation

The bulk cocoa price was used in the calculation of all production budgets. FF cocoa premiums were added to the bulk price based on historical experiences. The mean of the International Cocoa Organization (ICCO) reference prices for the period 1997-2006 was adjusted by a 10 per cent premium that Ghana receives for its bulk cocoa on the world market and an estimated shipping cost of $20 per metric tonnes to arrive at an estimate of mean FOB price from the shipping ports in Ghana. In the low input landrace and full sun intensified systems, 70 per cent of this estimated FOB price was calculated to represent the value received by Ghanaian cocoa farmers from the Ghana COCOBOD as agreed to with the World Bank. In the sensitivity analysis, we also consider an alternative price of 85 per cent of FOB, where it is assumed that Ghanaian farmers received a competitive market price as opposed to the monopoly producer price offered by the Ghana COCOBOD. Sensitivity analysis of farmgate price for bulk cocoa considered price levels one standard deviation above and below the mean estimated price.

3.7 Description of Cocoa Production Systems

In order to understand the market potential for FF cocoa, we develop for comparison, estimates of the returns to typical cocoa production systems on the landscape. A total of three counterfactual and one hypothetical production systems were analyzed. Two hypothetical FF cocoa systems differentiated by the use of modern inputs is compared with a low input Amelonado production technology typical of most Ghanaian bulk cocoa farms and a high input (technology) full sun Amazon system that is currently being promoted by COCOBOD. Crops used by farmers as temporary shade at the early stages of cocoa establishment commonly include plantain and cocoyam. In this study, plantain intercropped by cocoa farmers during the first two years of the establishment phase of their farm had an assumed yield of 4,500 and 2,500 kg per ha in year 1 and 2 of the production cycle for all systems analyzed. The production cycle for all systems was 21 years.

3.7.1 Low Input, Landrace Cocoa (LILC)

Costs and returns are estimated for 1 ha of unimproved cocoa planted at 3x3 m spacing (1,100 plants/ha). No nursery costs are incurred as the farm is directly seeded (i.e., planted at stake) with unimproved local landrace cocoa varieties. Plantain and cocoyam are planted one year prior to the cocoa seeding and then intercropped for the first two years of the cocoa production cycle. Typical of most farmers we assume no use of agrochemicals other than those provided by the Government of Ghana’s mass spraying program. Shade levels are assumed to be moderate.

3.7.2 High Input, no Shade Amazon Cocoa (HINSC)

Costs and returns are estimated for 1 ha of mixed Amazon hybrids planted at 3x3 m spacing (1,100 plants/ha) with no permanent shade. Cocoa pods are obtained in November from COCOBOD seed gardens operated by their Seed Production Unit and cultivated by the farmer in a nursery for 5 months. Of the 1,400 seedlings started, 1,100 are planted after rouging out the off types. An 80 per cent seedling survival rate requires an additional nursery effort of 280 seedlings for replacement in the second year. Plantain and cocoyam are planted one year prior to the cocoa planting and then intercropped for the first two years of the cocoa production cycle. In addition to the chemicals provided by the Government of Ghana’s mass spraying program, the farmer applies 1.8 kg/ha of copper oxide plus metalaxyl to control black pod disease and 480 ml per ha of imidacloprid for capsid control and 371 kg per ha of compound fertilisers are applied annually to maintain production.

3.7.3 Low Input, Fine Flavour Cocoa (LIFFC).

Costs and returns are estimated for 1 ha of Criollo clonal material planted at a 3x3 m spacing (1,100 plants/ha) in year 1, intercropped with plantain planted at the same density the previous year. Nursery costs are incurred and 75 per cent of grafted seedling attempts succeed. A survival rate of 80 per cent after planting is assumed following the first dry season and 280 replacement plantings are budgeted for year 2. Production is extensive differing from the low input landrace system only in the inclusion of fungicide treatments (1.8 kg/ha of copper oxide plus metalaxyl) to control black pod disease and insecticidal control of capsids (120 ml per ha of imidacloprid). No fertilisers are assumed to be applied in this production system.

3.7.4 High Input, Fine Flavour Cocoa (HIFFC)

Costs and returns are estimated for 1 ha of Criollo clonal material planted at 2.5x1.5 m spacing (2,667 plants/ha) in year 1, in a relay intercrop with plantain (planted at 2.5x2.5 m the previous year). Nursery costs are incurred and 75 per cent of grafted seedling attempts succeed. A survival rate of 80 per cent after planting is assumed following the first dry season and 672 replacement seedlings are prepared in the nursery for year 2 replacement. Production is highly intensive with 1 tonne of compound fertiliser applied along with fungicide treatments (3.6 kg/ha of copper oxide plus metalaxyl) to control black pod disease and insecticidal control of capsids (480 ml per ha of imidacloprid).

High quality Ecuadorian cocoa receives a premium of 20 per cent to 30 per cent over the New York Stock Exchange (NYSE) cocoa price. More recently, FF premiums of between 100 per cent and 300 per cent above the bulk cocoa price of the New York futures have been reported (SCHARFFENBERGER, personal communication, 2009). For this study, a price premium of $1500/metric tonne above the standard bulk cocoa price was assumed as the premium paid for fine flavour cocoa.

4 Results

4.1 Production and Distribution of Fine Flavour Clonal Planting Material

Fine flavour Criollo or Trinitario planting materials are currently not available for farmers who might wish to enter into this market segment. A cost engineering approach was used to estimate the costs of producing grafted budlings of fine flavour planting material. Interviews conducted with cocoa breeders at CRIG supplied the technical parameters used for the cost estimates. The planting material research and the development of an effective distribution system for these materials by CRIG are assumed to occur over a three year period. Two fulltime CRIG officers are responsible for establishing, managing and maintaining the budwood gardens that will provide the foundation stocks to locally trained grafters. These staff would also coordinate and oversee the annual establishment of grafted budling nurseries in 10 communities of Offinso by a mobile team of technicians. The budling nurseries in each year each produce a total of 24,000 budlings which would be adequate for the planting of 17.5 ha at low density or slightly over 7 ha at high planting density. Farmers expressing an interest in becoming nursery operators would be trained in patch budding techniques by the mobile budding team. These budding entrepreneurs would eventually become the source of fine flavour clones for farmers wishing to enter this market.

The estimated costs of nursery establishment, training farmers on patch budding, and maintaining a budwood garden at CRIG-Tafo are found in table 1. At the end of three years, the approximately 20,000 trees planted at the beginning of the second year should supply sufficient budwood material to allow those trained in budding techniques to begin the low cost production of FF clones for distribution to other farmers. The expected cost of producing a budling was estimated by dividing the sum of items (2) and (3) of table 1 by the total of 72,000 seedlings to estimate the unit cost per seedling from village based nursery operators.

Table 1. Estimated institutional arrangements costs for the production of fine flavour budlings

Cost Item	Units	No. of Units	Unit cost	Total
(1) Budding team[1]	Days	240	185	44,400
(2) Material inputs	Lumpsum			32,643
(3) Capital tools	Lumpsum			91
(4) Transportation	Lumpsum			12,781
(5) Casual labour for establishment and maintenance of budwood gardens over 3 years	Days	468	5	2,340
(6) CRIG Technical officer	Months	36	860	30,960
(7) CRIG Technical assistant	Months	36	600	21,600
			TOTAL	142,475

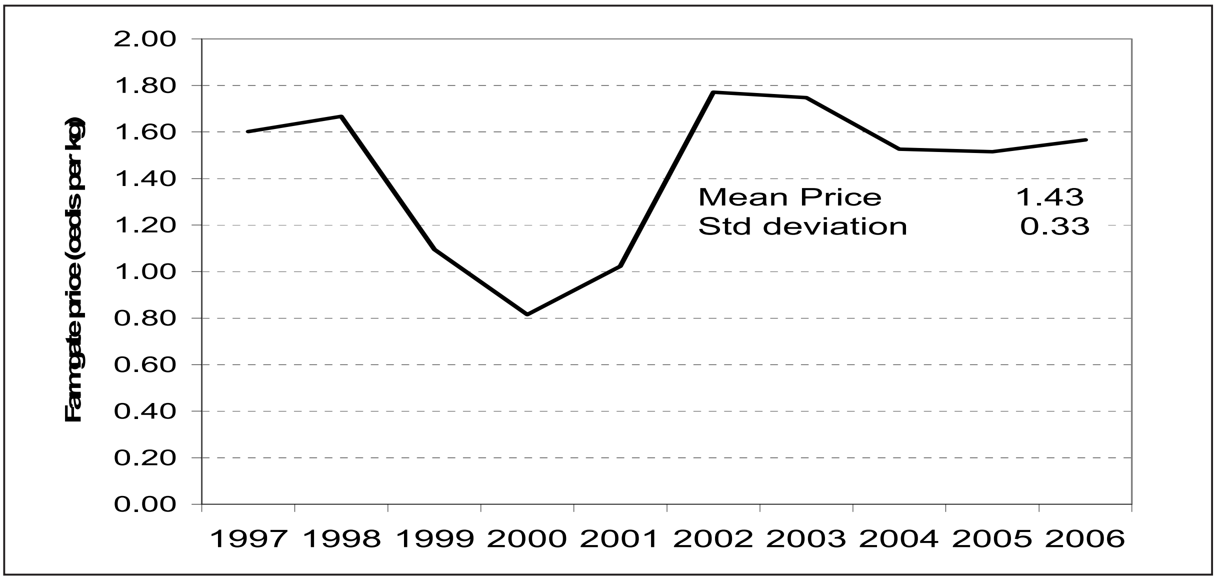
Source: field study by authors (2009)

We assume a 30 per cent profit margin is added to the unit cost resulting in a unit price of GhC 0.585 per budling. This was the price used in the calculation of the costs and returns of fine flavour cocoa.

4.2 Farmer Returns

Budgets for the baseline situation are estimated based on the estimated mean price for bulk Ghanaian cocoa from 1997 to 2006 (figure 2) and 2009 input prices gathered in local markets (appendix 1). The farmgate price of bulk Ghanaian cocoa is assumed to equal 70 per cent of the mean FOB price. The farmgate fine flavour cocoa price is equal to the mean farmgate bulk price plus a fixed premium of 2,100 GHc per tonne. Fertilisers are sold to farmers at a subsidised price of 14.70 GHC per 50 kg bag.

Figure 2. Estimated variation in farmgate price based on an assumed 70 per cent of FOB price policy for Ghanaian bulk cocoa, 1997 to 2006



Source: calculations by authors (2009)

Table 2 presents the financial measures of profitability for the four systems under consideration. The results show that the low input landrace system (LILC) which is widely representative of extant cocoa systems in Ghana had a negative net present value. This result is not surprising as other efforts to estimate farmer returns have also revealed low to negative returns (GOCKOWSKI et al., forthcoming; GOCKOWSKI and SONWA, 2008). The results also suggest that low input fine flavor cocoa production is unlikely to whet farmers' appetites as it too generated a negative NPV and had a BCR less than 1. Of the new systems evaluated, the high input FF system stands out clearly against any comparison with other systems.

It must be said however that there are a lot of uncertainties that must be addressed before this visionary production system can be put in practice. Breeding efforts have mostly neglected Criollo cocoa and clonal evaluations and selections have not been done. Furthermore, the organoleptic qualities of fine flavor cocoa are not solely based on genetics but also depend on many other environmental factors including soil and climate variables. Finally, many of the Criollo and Trinitario accessions are highly susceptible to black pod disease and also exhibit a tendency towards self incompatibility.

Even in an unlikely worst case scenario event that a fine flavor variety appropriate to Ghana conditions can not be identified, there is another possibility to be explored. John Scharffenbarger of Schaffenber Hershey Chocolate Ltd. shared with participants at the 2009 Fine Flavor Summit at the Cocoa Research Institute in Tafo, Ghana a wonderful chocolate bar produced entirely from Ghanaian cocoa beans. He described to participants how 40 different lots of cocoa were sampled by his former company's bean evaluators before arriving at the desired quality. The price they paid for this cocoa was the standard bulk price even though they were retailing the chocolate for the incredible price of 64 GHc per kilogram. If the COCOBOD could identify the bulk beans that meet the quality requirements of the premium markets they could be differentiating and pricing those beans at a premium to the advantage of the Ghanaian producer.

The high input no shade cocoa (HINSC), which has become more widespread in the Western region was the second most profitable system. Unlike other West African cocoa-producing countries, Ghana maintains state control over the determination of prices paid to producers. Historically, producers received between 50 and 60 per cent of the export FOB price with the remaining 40-50 per cent used to cover marketing costs, agrochemical subsidies and as an important source of government revenue. Since 2002, the Ghanaian government has stated it's desired to pay cocoa farmers 70 per cent of FOB price. Although a producer price equivalent to 70 per cent of FOB represents an increase for Ghanaian farmers over previous levels of pricing by the COCOBOD, in the liberalised markets of Nigeria and Cameroon, farmers regularly receive between 80 and 85 per cent of the FOB price. To simulate a competitive price outcome, we assumed that producers received 85 per cent of the FOB price instead of the 70 per cent target. We also simulate a price regime where COCOBOD reverts to a 60 per cent target.

Table 2. Profitability estimates of cocoa production systems

System	NPV	BCR	Labour IRR	Annual net return at t=10
Low input landrace cocoa (LILC)	-79	0.97	3.35	128
High input no shade cocoa (HINSC)	179	1.05	3.71	215
Low input fine flavor cocoa (LIFFC)	-129	0.95	3.25	377
High input fine flavor cocoa (HIFFC)	9,351	2.11	10.33	5,676

Source: scenario analysis by authors (2009)

The results of the first of these simulation exercises show a significant improvement in the profitability of all systems (table 3). The income at year 10 of the low input land race system is more than double that achieved under COCOBOD's policy-determined price of 70 per cent. As this is the most typical of the four systems analyzed, we conclude that increasing the producer's share of FOB price would have a major impact on rural poverty. Conversely, under the 60 per cent price regime, all systems generate negative NPVs and had a negative return in year ten by which time the cocoa tree should be mature and high yielding. Given a positive supply price elasticity, the reversion to a 60 per cent price regime would call into question the feasibility of achieving the stated target national output of 1 million tonnes by 2010. Thus, the ability of COCOBOD to sustain national output at its current levels may be difficult.

Table 3. Sensitivity analysis of an increase (decrease) in farmgate price

System	NPV	BCR	Labour IRR	Annual net return at t=10
LILC competitive market (85 per cent FOB)	221	1.09	3.91	271
HINSC competitive market (85 per cent FOB)	469	1.12	4.00	362
LIFFC competitive market (85 per cent FOB)	12	1.00	3.52	459
HIFFC competitive market (85 per cent FOB)	10,714	2.28	11.32	6,345
LILC (COCOBOD price regime 60 per cent FOB)	-280	0.89	2.98	33
HINSC (COCOBOD price regime 60 per cent FOB)	-15	1.00	3.48	117
LIFFC (COCOBOD price regime 60 per cent FOB)	-223	0.92	3.06	321
HIFFC (COCOBOD price regime 60 per cent FOB)	8,443	2.01	9.67	5,230

Source: scenario analysis by authors (2009)

Sensitivity analysis is also performed on the fertiliser price in the two high input models (HINSC and HIFFC). All of the estimations above used the subsidised price of fertiliser. We now consider two fertiliser use scenarios concerning the four production systems using fertilisers. Under the first scenario (SC_1), we assume that the producer maintains fertiliser use at its subsidised level and simply re-estimate using the unsubsidised fertiliser price. However, the theory of profit maximization tells us that when input prices rise their utilization level will decline. To capture such an occurrence, the second scenario (SC_2) assumes that in response to the price increase the farmer reduces fertiliser use by 50 per cent which engenders a 12.5 per cent decrease in yields.

The results suggest that without subsidization under scenario1 (SC_1), fertiliser use in the bulk cocoa sector at the quantities indicated is not profitable (table 4). On the other hand the fine flavour system still generates impressive returns even with the removal of fertiliser subsidies. This can be attributed to the high marginal value of fine flavour output. The low returns to unsubsidised fertiliser explain its low use when subsidies are not available such as in 2000/2001 when only 2 per cent of Ghanaian cocoa producers were reported to have used fertilisers (AGBENYEGA and GOCKOWSKI, 2002). Reducing use of fertiliser under scenario 2 (SC_2), did improve the returns of the bulk cocoa systems but they still had negative NPV and BCR<1. However, if a pseudo-free market price policy of 85 per cent FOB were pursued in conjunction with scenario 2 then the HINSC system does generate a positive NPV and a return to labour of 3.76 GHC per work day is obtained from a joint simulation exercise.

Examples where agrochemical and fertiliser subsidies have in the long term led to the development of the input subsector are hard to find in Africa. Such schemes are plagued by inefficiencies and a lack of performance based incentives. Most importantly, they often stifle competition in the subsector and present entry barriers to new firms wishing to enter the market. Competition in the market drives incentives for innovation and efficiency as firms compete to stay ahead of each other. Competition to make a sale ensures that fertiliser is delivered at the lowest cost when the farmer needs it. The unsubsidised price of fertiliser is estimated at 51 GHC per 50 kg bag. In an efficient fertiliser market such as the Midwest in the US the same formulation is selling for the equivalent of 30 GHC per bag.

Table 4. Profitability measures of cocoa production systems under different fertiliser subsidy and yield scenarios

System	NPV	BCR	Labor IRR	Annual net return at t=10
HINSC scenario 1	-571	0.87	2.83	-55
HIFFC scenario 1	7,330	1.70	8.85	4,950
HINSC scenario 2	-214	0.94	3.23	49
HIFFC scenario 2	7,068	1.81	8.98	4,634

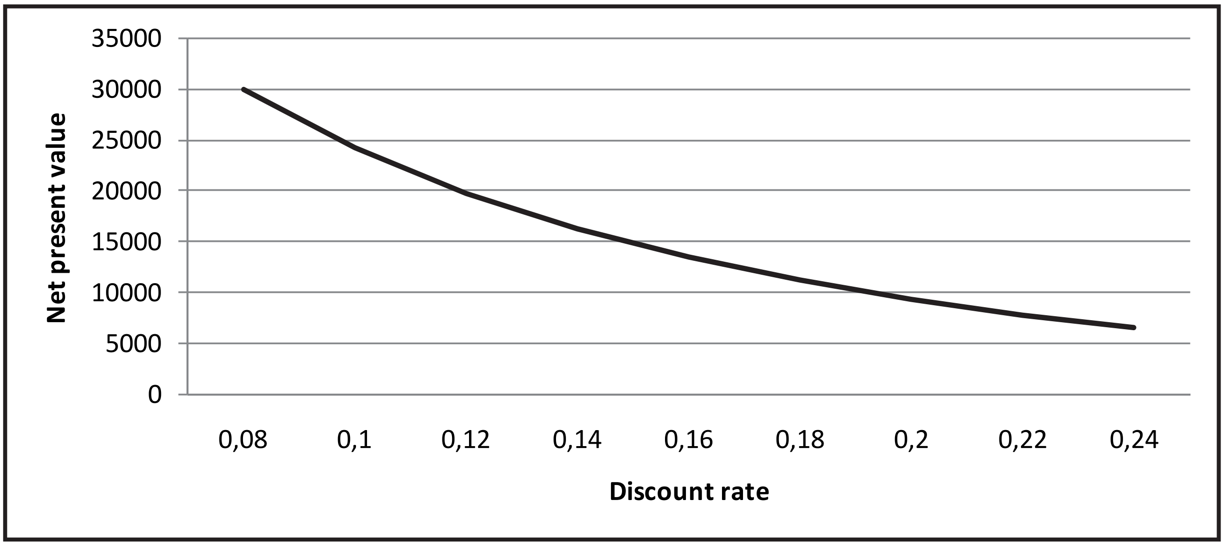
Source: scenario analysis by authors

Another concern is the sensitivity of our results to changes in the discount rate. Figure 3 plots the net present value (NPV) of the high input fine flavor and the low input landrace systems against 2 per cent incremental increases in the discount rate, starting at a value of 8 per cent and continuing to a value of 24 per cent. The sensitivity of NPV to changes in the discount rate was high for HIFF while the LILC showed less than a 7 GHc change per ha from the lowest discount rate to the highest. The high input fine flavor system (panel a) was among the most sensitive with NPV falling from

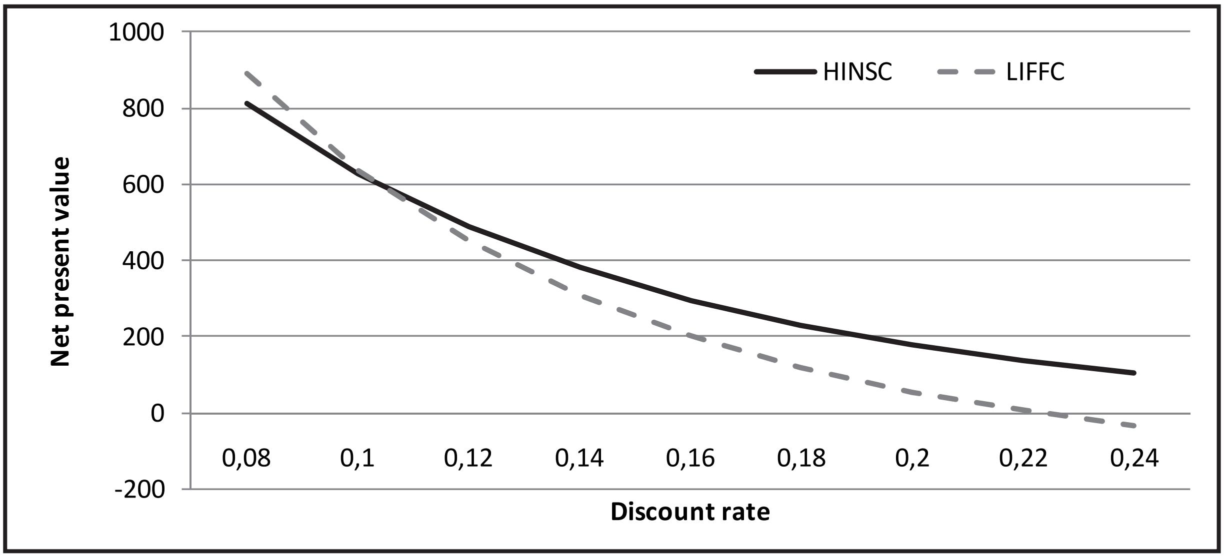
30,000 GHc at a discount rate of 8 per cent to 6,600 GHc at a rate of 24 per cent. The biological lags in production and the shape of the age-yield distribution largely explain this sensitivity. A comparison of HINSC with LIFFC over different discount rates is illustrated in panel b. After an initial higher sensitivity of LIFFC compared to HINSC (up to at 10 per cent discount rate), the HINSC was more sensitive to higher discount rates (above 10 per cent) than the LIFFC.

Figure 3. Sensitivity of NPV profitability to choice of discount rate for HIFF, LILC and HINSC production systems

(a)



(b)



Source: scenario analysis by authors (2009)

4.3 Cash Flow Analysis

As the analysis is focused on the feasibility of developing alternative production systems, the investment costs associated with these enterprises will be required for credit applications. Cash flow projections allow the enterprise to manage the outflow of cash in order to stay solvent.

In order to assess medium and long term credit needs, we project cash flows on an annual basis over the 20 year production cycle for the high input fine flavour system. Outflows are split into labour and physical input (planting material, tools and equipment, agrochemicals etc.) expenditures. We also examine short term credit needs by splitting expenditures into those occurring during the production season and those occurring during the major harvest period.

The intensified fine flavour system generates a small positive cash flow in year 3 as a result of the revenues from plantains and cocoyams (table 5). Cocoa revenues begin to flow in year 5 from which point the system consistently generates a positive cash income. The total expenditures per ha over the first four years are projected at 5,915 GHc per ha against a total income of 3,111 leaving a deficit of 2,804 GHc per ha. The largest expenditure occurs in year 2 and is principally composed of the cost of grafted budlings and labour for planting. The labour requirement per ha rises in a non-linear fashion. This is a reflection of the age yield profile. Approximately two-thirds of the total labour input occurs during the harvest season. Labour innovations in harvesting techniques, pod breaking, and fermentation would significantly add to the profitability of this system and may be required for its widespread promulgation given a generally tight supply of unskilled labour. Short term cash outflows during the production season are approximately 2,000 GHc per ha starting in the fifth year with approximately half of this for agrochemicals and tools and half for labour. Depending on labour availability, herbicides and/or mechanical means of under-brushing might also be cost effective.

Total expenditures per ha over the first five years of production are projected at 3,267 GHc per ha against a total income of 2,868 GHc leaving a deficit of 399 GHc per ha. In the first season a total cost of 643 GHc/ha is incurred with no revenue. More than two-thirds of this sum may be considered “sweat equity” if, rather than hiring labour to establish a new farm, the cocoa farmer chooses to do it herself. In terms of actual physical inputs, an expenditure of 223 GHc/ha would be required. Although this may not seem like a great deal of money, for the chronic poor, it potentially represents a major credit constraint. Short term borrowing needs include fertilisers and agrochemicals with projected average expenditures of roughly 300 GHc/ha. This again may represent a serious credit constraint for the poor.

Table 5. Cash flow projections for high input fine flavour cocoa production system

Year	**Labor quantity (days)**	**Labor costs (GHc/ha)**	**Physical input costs (GHc/ha)**	**Total costs (GHc/ha)**	**Total revenues (GHc/ha)**	**Net annual return (GHc/ha)**	**Expenditures during production season (GHc/ha)**	**Expenditures during harvest season (GHc/ha)**
1	110	384	204	588	98	-490	588	0
2	396	1 385	1 996	3 381	2 025	-1 356	3 249	132
3	159	556	393	949	988	39	883	66
4	128	447	550	997	0	-997	997	0
5	366	1 282	486	1 768	5 882	4 114	1 768	835
6	387	1 355	606	1 961	6 397	4 436	1 961	908
7	405	1 416	486	1 902	6 828	4 925	1 902	969
8	419	1 465	606	2 071	7 173	5 102	2 071	1 018
9	429	1 502	560	2 062	7 435	5 372	2 062	1 055
10	436	1 527	606	2 133	7 611	5 478	2 133	1 080
11	440	1 540	486	2 026	7 702	5 676	2 026	1 093
12	440	1 541	606	2 147	7 709	5 562	2 147	1 094
13	437	1 530	486	2 016	7 631	5 615	2 016	1 083
14	431	1 507	680	2 187	7 468	5 281	2 187	1 060
15	421	1 472	486	1 958	7 220	5 262	1 958	1 025
16	407	1 425	606	2 031	6 888	4 857	2 031	978
17	390	1 365	486	1 851	6 471	4 619	1 851	918
18	370	1 294	606	1 900	5 968	4 068	1 900	847
19	346	1 211	560	1 771	5 382	3 611	1 771	764
20	319	1 115	606	1 722	4 710	2 988	1 722	669
21	288	1 008	486	1 494	3 953	2 459	1 494	561

Source: model results from authors (2009)

Finally we note that there is a large labour cost and a large revenue item in the final year of the system. These charges are for the harvesting of 59 *Terminalia superba* trees which are conservatively assumed to yield 56 cubic meters of timber at a stumpage value of 25 GHc m^{-3}. Both the total volume and the stumpage price of the timber used in our calculations are believed to be conservative estimates for the purpose of this study.

5 Conclusions and Recommendations

Achieving Ghana’s national growth target of 1 million tonnes per hectare requires a concerted effort to introduce innovations for producing bulk cocoa as well as introducing speciality cocoa into the country to target niche markets in consuming countries. Average yields for most regions are low and production is still extensively based on low input systems most often planted to local landraces. These are modelled in our analysis by the LILC system and assume no agrochemical application other than those supplied by the government at no producer cost.

Most of the recent growth in national output is attributable to expansion in the western region where forest lands have been converted to full sun production systems which are represented in our analysis by the HINSC system. Yields in the northern producing districts of the Western Region are known to be the highest in Ghana and this is partly attributable to the robustness of their tree stocks composed of recently planted Amazon hybrids developed by CRIG combined with low or no permanent shade, high levels of soil nutrients after forest conversion and higher application rates of purchased fertilisers, insecticides and fungicides.

In this study, fine flavour cocoa is differentiated from standard bulk cocoa from the production side by the use of clonal propagated Criollo varieties as opposed to pods from the Amazonian hybrids or low input Amelonado landraces. Regarding output, fine flavour cocoa is differentiated from bulk cocoa by its superior flavour qualities. In our ex ante analysis, involving different economic decision criteria, we assumed a price premium of 146 per cent is added to the bulk farmgate price of cocoa. We also assumed that the COCOBOD passes 100 per cent of the quality premium through to the farmer. Both of these are strong assumptions about how these new markets might conduct their affairs.

In our base case scenario, we compare results of the high and low input fine flavour production systems (HIFFC and LIFFC) with the LILC and HINSC systems believed to be representative of (i) farmer practice in the first case and (ii) the COCOBOD’s high technology cocoa promotion. Profitability of these systems was evaluated under the assumption that the farmgate bulk cocoa price is set at 70 per cent of the Tema FOB by COCOBOD, the discount rate is 20 per cent and that fertilisers were available in the quantities needed at the subsidised price. Under these conditions we estimate that the LILC, LIFFC and are essentially breakeven propositions with the representative low input LILC system having a negative NPV at the current price target of 70 per cent FOB. The high input no shade system (HINSC) was moderately profitable while the high input fine flavour system was highly profitable. At a bulk price equal to 60 per cent of FOB the LILC, LIFFC and loose money while the high technology full sun system (HINSC) was a breakeven proposition. Only the high input fine flavour system remained profitable.

These results beg the question. Why is everyone not growing fine flavor cocoa in Ghana? First of all, it was initially uncertain whether Ghana can produce a "fine flavour" cocoa from its existing germplasm collection. Flavor testing of a limited number of accessions at Tafo was only successful in late 2009. Assuming appropriate clonal selections are available, the second constraint is the lack of an institutional arrangement for the production and distribution of planting material. To address this second constraint, the institutional costs of developing production and distribution capacity were estimated. The costs of producing 72,000 budlings in 30 village nurseries and training 60 villagers in nursery management and budding technique was estimated at 142,475 GHc over a 3 year period and the per unit cost of producing patch budded seedlings in farmer owned nurseries was 0.45 GHc per budling. We also made an assumption that the yields of the fine flavor system respond to intensified use of fertilisers by producing an average output of 1,900 kg per ha for the bearing years from year 6 to year 21; this is more than double the productivity of the next most productive system. Furthermore, we assume that the high pest and disease susceptibility that many of the fine flavour varieties exhibit can be managed through a rigorous IPM program combining rationale pesticide use and cultural control methods.

Sensitivity analysis shows that a shift of producer price policy from 70 per cent of FOB to an 85 per cent FOB level would have significant poverty reduction impacts. Before concluding with policy suggestions we would like to call attention to the limitations of the study. First of all not all costs associated with introducing fine flavour cocoa in Ghana at the farmer level were estimated. Agent information was not shared on the additional marketing costs incurred to ensure that the value chains for fine flavour remain segregated from bulk cocoa. Finally, it must be pointed out that all our estimates represent just a single moment in time. In these volatile economic times it is difficult to predict how prices might move over time.

Based on our analysis, we proffer the following suggestions to policy makers, donor agencies and relevant authorities in the cocoa sector of Ghana. First, it is suggested that the high input fine flavour technology be validated through demonstrations with farmers. Cocoa marketing authorities should carefully evaluate (taste testing) the quality of the existing bulk bean output on a district by district basis for its suitability in the production of premium chocolate. Districts identified with superior bean quality should be also assisted to differentiate and brand their premium quality cocoa on world markets. Direct interventions and distortions in input markets can impede the development of a competitively structured private sector and should be avoided. Policy reforms are thus needed to foster efficiency and private sector involvement in input markets. It is anticipated that the production of FF cocoa would be an initiative that creates motivation throughout the value chain to produce, segregate and pay appropriately for a higher quality of cocoa that is in growing demand in world markets. Presently, cocoa producers supplying the bulk market are not rewarded for quality: good and bad are mixed together during processing and distribution. The introduction of new FF varieties, the accompanying upgrading of knowledge and skills to produce, harvest and ferment them, and the increase in international demand will enable more collaborative relationships that capture the increased value and distribute it to the benefit of all.

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Appendix 1. Input prices used in the cost and returns analysis

Item	Unit	Unit price
Ridomil (copper oxide plus metalaxyl)	50 g sachet	1.80
Confidor (imidacloprid)	liter	16.80
fertiliser subsidised	50 kg	14.70
fertiliser non subsidised	50 kg	51.00
cutlass	each	5.00
raffia mat for drying	each	30.00
baskets	each	4.00
mistblower	each	125.00
pruning knife	each	5.00
cocoyam corms	each	0.05
plantain suckers	each	0.10
polybag	each	0.10
grafted budling	each	0.59
watering can	each	15.00
mixed hybrid pods	each	0.10
hired labour	6 hr personday	3.50

Source: field study by authors

Appendix 2. Cost and return items included in production systems

Revenue sources	Nursery costs	Establishment costs	Production processes	Tools and equipment	Agro-chemicals	Planting material
cocoa	prepare site	slashing	underbrushing	cutlass	Confidor	cocoyam corms
plantain	shade structure	tree felling	structural pruning	raffia drying mats	Ridomil	plantain suckers
timber	fill polybags	burning	chupon removal	basket	Asaase Wura fertiliser	grafted Criollo budlings
cocoyam	planting	field cleaning	fertiliser application	mistblower		*Terminalia superb* (emeri) seedlings
	watering	lining and pegging	insecticide application	pruners		Mixed Amazonian hybrids
	spray pesticides	plantain planting	fungicide application	watering cans		Amelonado landraces
	polybags	dig cocoa planting holes	pod harvesting and collecting	water barrels		indigenous timber species
		transport seedlings	pod breaking	protective equipment		
		planting	fermentation	wheelbarrow		
		weeding	transport to drying site			
		formation pruning	drying/sorting			
		harvest plantain	transport			
		harvest cocoyam				

Source: field study by authors