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Authors:
Stephanie Daniels, Peter Läderach and Melissa Paschall

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Reaching High-Value Markets: fine flavor cocoa in Ghana

This paper is part of a publication series generated by the New Business Models for Sustainable Trading Relationships project. The partners in the four-year project – the Sustainable Food Laboratory, Rainforest Alliance, the International Institute for Environment and Development, the International Center for Tropical Agriculture, and Catholic Relief Services – are working together to develop, pilot, and learn from new business models of trading relationships between small-scale producers and formal markets. By working in partnership with business and looking across a diversity of crop types and market requirements – fresh horticulture, processed vegetables, pulses, certified coffee and cocoa – the collaboration aims to synthesize learning about how to increase access, benefits, and stability for small-scale producers while generating consistent and reliable supplies for buyers.

For further information see:
www.sustainablefoodlab.org/projects/ag-and-development and
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Please contact Stephanie Daniels stephanie@sustainablefood.org if you have any questions or comments.

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Stephanie Daniels works with the Sustainable Food Lab to lead collaborations between large scale companies, development NGOs and farmer organizations towards development of sustainable global value chains.
stephanie@sustainablefood.org

Peter Läderach works with the International Center for Tropical Agriculture (CIAT). He works on spatial analyses and supply chain tools for coffee and cocoa.
peter.laderach@gmail.com

Melissa Paschall is a doctoral student with Institute for Economy and the Environment at the University of St. Gallen, Switzerland.
melissa.paschall@unisg.ch

Reaching High-Value Markets: fine flavor cocoa in Ghana

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Acronyms and abbreviations

AE-LBI	Agro Eco-Louis Bolk Institute
CIAT	International Center for Tropical Agriculture
CMC	Ghana's Cocoa Marketing Committee
CODAPEC	Cocoa Disease and Pest Control
COCOBOD	Ghana Cocoa Board
CRIG	Cocoa Research Institute of Ghana
CRU	Cocoa Research Unit, University of the West Indies
FFC	Fine flavor cocoa
FOB	Freight-on-board
GHc	Ghanaian Cedi
Ha	Hectare
ICCO	International Cocoa Organization
IITA	International Institute of Tropical Agriculture
LBC	Licensed buying company
NBM	New Business Models
OFFCFA	Offinso Fine Flavor Cocoa Farmers Association
QCD	Quality Control Division
SFL	Sustainable Food Laboratory
STCP	Sustainable Tree Crops Program

Executive summary

Ghana Fine Flavor Cocoa is a collaborative project involving chocolate manufacturers, international agricultural research institutes, small-scale farmers, and international non-governmental organizations. Its aim is to design and implement a fine flavor cocoa value chain in Ghana, to help small-scale cocoa farmers gain access to high-value markets. The project involves a range of activities at all levels of the cocoa value chain from farmers through intermediaries to end buyers:

- Identifying and cultivating the right cocoa varieties.
- Adapting high-yield growing techniques from vineyards and fruit orchards to increase productivity despite the switch to lower-yielding varieties.
- Getting farmers and key government agencies excited and educated about quality and flavor.
- Cultivating direct relationships with specialty buyers in the US, European and Japanese markets to ensure market demand for the new varieties.
- Training farmers in appropriate cultivation and processing methods.

Despite the project getting off to a slower start than hoped, it has notched up a number of successes. Promising varieties have been identified, and it is clear that with sufficient volume, proper post-harvest processing, and rigorous quality control and traceability, these beans could deliver significant value for farmers in the Offinso region and be an attractive product for specialty cocoa buyers. There has been some increase in social capital, for instance the formation of a farmer association. Also, farmers have increased their knowledge of agronomic practices for fine flavor cocoa, and have been introduced to international industry contacts.

Lessons have also been learned:

- Research takes time, and isn't always predictable. Flexibility must be built into the timeline and expectations must be realistic.
- Regular and targeted communication, management of industry expectations, and the cultivation of a sense of ownership among all players allow key stakeholders to stay energized and interested despite delays.
- Balancing farmers' existing skills with development goals is essential, as is providing enough targeted market and field knowledge to build farmer capacity to fulfil the market requirements, and being willing to take the necessary risks to gain success.
- Government agency involvement is essential; however, such agencies are not naturally suited to fast-paced innovation. Realistic timelines, regular communication and strong relationships based on trust are critical for government support over the long term.
- Finding the right agronomic and social conditions in which a project can flourish is essential.

"Balancing farmers' existing skills with development goals is essential, as is providing enough targeted market and field knowledge to build farmer capacity to fulfil the market requirements, and being willing to take the necessary risks to gain success."

1
Introduction

John Scharffenberger founded Scharffen Berger Chocolate Maker with Robert Steinberg in 1996. He brought his expertise from winemaking into the chocolate business, seeking out high-quality beans with unique flavors and aromas, and helping to launch a new American fascination with high-quality dark chocolate.

When the company was bought by The Hershey Company in 2005, Scharffenberger stayed engaged in marketing the brand, participating in chocolate tastings and visiting farmers in places famous for producing fine flavor beans. He remained passionate about sourcing high-end cocoa beans in ways that brought social and environmental benefits to these communities.

One day, a friend from the development world came to him with a question about how to alleviate poverty in cocoa-growing regions of Africa. Growers in fine flavor origins of Latin America were getting three to four times the market price; would it be possible to spread that opportunity to West Africa, where the bulk of the world's cocoa is grown, and where many farmers struggle under conditions of extreme poverty? Scharffenberger outlined the necessary steps for accomplishing this goal:

- Identify and cultivate the right genetics, such as heritage Criollo and Trinitario varieties.
- Adapt high-yield growing techniques from vineyards and fruit orchards, in order to increase productivity despite the switch to lower-yielding varieties.
- Get farmers and key government agencies excited and educated about quality and flavor, in order to motivate the creation of a segregated trading chain.
- Promote ongoing industry engagement to ensure market demand for the new varieties.

Around the same time, a collaborative project to create 'New Business Models' (NBM) linking small-scale African farmers to formal markets was being launched and was seeking private sector partners (Box 1). Scharffenberger was

Box 1: The New Business Models project

This case study is part of a publication series generated by the New Business Models for Sustainable Trading Relationships project. The partners in this four-year collaboration (2008–2012) – the Sustainable Food Laboratory, Rainforest Alliance, the International Institute for Environment and Development, the International Center for Tropical Agriculture, and Catholic Relief Services – worked together to develop, pilot and learn from new business models to facilitate trade between small-scale producers and formal markets. The collaboration has involved private sector partners in four value chains: (1) fine flavor cocoa in Ghana, (2) certified cocoa in Ghana and Côte d'Ivoire, (3) outdoor smallholder flowers in Kenya, and (4) dried beans in Ethiopia. By working in partnership with business and across a diversity of crop types and market requirements, the collaboration aims to synthesize knowledge about how to increase access, benefits and stability for small-scale producers while generating consistent and reliable supplies for buyers.

More on the New Business Models principles and framework can be found in the paper "Think Big, Go Small: adapting business models to incorporate smallholders into supply chains" available at www.linkingworlds.org and http://www.oxfam.org/en/policy/think-big-go-small

enthusiastic about this opportunity, and immediately became a champion of the idea. He pitched it to the NBM project team and to the Ghana Cocoa Board (COCOBOD). Both groups found his arguments and enthusiasm to be persuasive.

Soon, the idea had grown into the Ghana Fine Flavor Cocoa Project, a collaboration among chocolate manufacturers, world class agricultural research institutes, small-scale farmers, and international non-governmental organizations, including:

- The Sustainable Food Laboratory (SFL) – a consortium of business, non-profit and public organizations dedicated to accelerating the shift towards sustainable food systems. SFL facilitated market-based solutions and collaborative learning opportunities.
- The International Center for Tropical Agriculture (CIAT) – a scientific research organization that focused on increasing the eco-efficiency of agriculture in the tropics, in order to improve the livelihoods of the poor.
- The Cocoa Research Institute of Ghana (CRIG) – a government agency tasked with investigating pest and disease problems in order to maintain cocoa production.
- The Hershey Company, the largest chocolate manufacturer in North America, which now owned Scharffen Berger Chocolate.
- Agro Eco-Louis Bolk Institute (AE-LBI) – an international institution advising in the field of organic agriculture and related areas. AE-LBI has its main office in the Netherlands and branch offices in Ghana, Uganda and Tanzania.
- The Offinso Fine Flavor Cocoa Farmers Association (OFFCFA) – a grassroots farmer organization formed by small -scale cocoa farmers after the initial project scoping meetings in the Offinso region of Ghana where the project was focused.

Together, these groups planned to design and implement a fine flavor cocoa value chain in Ghana. If successful, the project would help Ghanaian small-scale cocoa farmers gain access to high-value markets through the provision of improved planting material, targeted training, and direct links to buyers.

Dr. Peter Laderach, CIAT at a GFFC field site © Stephanie Daniels

2
The global industry for fine flavor cocoa

Demand for fine flavor cocoa (FFC) has been growing as dark chocolate has become increasingly popular. Cocoa content can be as little as 12 per cent in a bulk milk chocolate product but as much as 99 per cent in a specialty dark chocolate bar. The higher the cocoa content, the more important the quality of the cocoa becomes to the final product flavor.

The total production of FFC worldwide is estimated at 100,000–170,000 tons, approximately 5 per cent of total cocoa production. Over the last century, the share of FFC in global production fell considerably, down from 40–50 per cent of total production in the early 1900s. In the mature chocolate markets of Europe, North America and Japan, however, recent trends are seeing darker chocolate and higher-quality confections becoming a growing sector of the market. In part, this is due to research on the health and nutritional attributes of cocoa. The high concentrations of flavonoids found in cocoa are thought to decrease low-density lipoprotein (LDL or 'bad' cholesterol), helping to prevent cardiovascular diseases. The high levels of antioxidants found in cocoa surpass those found in wine and tea.

Tom Hernquist, Hershey Senior Vice President and Global Growth Officer, estimates that households' consumption of dark chocolate rose to 24 per cent in 2006 from 8 per cent in 2004 and asserts that 'cocoa and dark chocolate will drive the chocolate category for the next hundred years, replacing milk chocolate, which was the driver for the last hundred years' (Chocolate Marketing Association, 2007).

While demand for fine flavor cocoa is soaring, its production has steadily declined in recent years due to a research focus on high-productivity varieties that are resistant to pests and diseases. The Trinitario and Criollo varieties, while known for their fine flavor notes, are typically less vigorous and lower-yielding than the Forestero varieties used in bulk cocoa – and in some cases have higher susceptibility to pests and diseases. Manufacturers pay double or triple the bulk price for fine flavor beans, but these premiums often fail to reach farmers and thus provide little incentive for farmers to maintain the less-productive varieties.

Ghanaian farmer drying his cocoa beans © Stephanie Daniels

How is fine flavor cocoa priced?

As with wine or coffee, many characteristics determine quality; personal preferences mean there is no particular characteristic that can be considered best. It is individual preferences, however, that create opportunities to carve out markets for quality-differentiated products.

Fine flavor cocoa beans produced from the Criollo or Trinitario varieties are typically characterized by fruity notes and aromas, while bulk cocoa beans of the Forastero variety are known for steady, chocolaty notes more suitable as the base of chocolate recipes. But there are exceptions to these rules – and there is no single criterion that determines whether or not cocoa will be classified as fine flavor either by the ICCO or cocoa buyers. Genetics, agronomic conditions and post-harvest processing all influence the final quality.

The market for fine flavor cocoa is governed by direct relationships and stringent quality requirements. Although demand trends and price fluctuations are certainly affected by the world cocoa market, they are not tied to it. Prices are set for each FFC origin, and occasionally for particular suppliers or sub-regions within each origin, based on negotiations between supplier, trader and manufacturer. Contract prices are largely dependent upon the following factors:

- an origin's historical reputation for a certain flavor characteristic
- seasonal availability
- 'organoleptic' quality (aroma, flavor notes, uniqueness)
- 'hysical' quality (standard parameters of fermentation, moisture content, bean size and color; also the absence of slatiness, mould, or insect damage)
- consistency in volumes and quality produced
- reliability as a trading partner
- reputation for quality.

Prices are not generally negotiated as a premium over world market prices, but rather at a set price related to the uniqueness and scarcity of the particular FFC origin. If the quality is exceptional and is accompanied by a concerted marketing effort, premiums can reach as high as US$ 1,000–2,000/t above the world price for bulk cocoa.

"Demand for fine flavor cocoa (FFC) has been growing as dark chocolate has become increasingly popular."

3
The Ghana context

Ghana relies on cocoa as its dominant cash crop and single most important export product. In total, around 6.3 million Ghanaians depend on cocoa for their living, representing around 30 per cent of the population. Production is characterized by small-scale farming with an average productive cocoa area per household of approximately two hectares (Barrientos *et al.*, 2008). In 2008, the year in which the pilot project started, it was estimated that cocoa-producing households had a mean daily income per head from cocoa of US$ 0.42 (out of a total income of US$ 0.63; *ibid.*).

In the past, the dominant strategy for increasing cocoa volume and revenues had been to introduce varieties that were more productive and resistant to pests and diseases. The Cocoa Research Institute of Ghana (CRIG) had embarked on the High Technology Cocoa Production Program several years earlier, introducing new hybrid varieties to tens of thousands of cocoa farmers. The 'high-tech' cocoa trees matured in just 18 months (compared to six to seven years for traditional varieties) and produced an average of four bags of cocoa per acre *versus* only one (*Daily Graphic*, 2004). The cocoa itself was similar in quality to traditional varieties, and the beans were intermingled.

The Fine Flavor Cocoa project team was proposing a completely different approach to poverty alleviation: opening up higher-value markets to Ghanaian farms in order to reward them for increased effort. Fine flavor varieties would not be as robust as the high-tech ones; it was possible they would be lower yielding and might prove to be more susceptible to pests and diseases. But fine flavor beans were selling for prices well above those of bulk cocoa, making it a very lucrative market.

Raising farmer incomes would also help raise the quality of the cocoa. When prices are too low to cover normal variable costs, farmers reduce maintenance and halt planting activities. In extreme cases, they even stop harvesting. Conversely, high prices spur farmers to intensify farm management through more harvesting, frequent weeding and application of fertilizers and other inputs. Sustained revenues from the fine flavor market would, the team hoped, be the critical incentive for continuous improvement and sustained commitment among farmers.

Ghanaian cocoa: a solid foundation for fine flavor

Quality control is essential for success in the FFC market. Specialty manufacturers expect pristine and consistent flavor, aroma and physical quality. The cocoa that fetches the highest prices on the market often originates on larger plantations with the systems and resources to maintain the genetic and physical integrity of the crop. While Ghanaian cocoa is largely grown by small-scale farmers, its competitive advantage lies in the country's best-in-class system of quality control, which graded and tracked cocoa from village level to the point of export. This system could provide the platform for small-scale farmers to effectively enter the demanding FFC market.

Given the market premium for FFC, there is always an incentive to add bulk beans at various points in the chain to increase volume. Each point at which the cocoa is handled therefore involves a risk of quality degradation from improper handling or from co-mingling of bulk beans. For Ghana FFC to succeed, internal control systems would be needed to track the cocoa through the supply chain. Fortunately the

Quality Control Division (QCD) system of the Ghana Cocoa Board (COCOBOD) already supplies this from farm gate to export. The ability to trace the beans all the way back to individual farms would also make it possible to reward specific farmers for successful fine flavor production, and for addressing any quality issues directly. The greatest need was to improve traceability within the farm and from farm to the licensed buying company (LBC) collection centers.

COCOBOD provides phytosanitary support to farmers and regulates the marketing of bulk Ghanaian cocoa on international markets. By helping to maintain the quality of Ghanaian bulk cocoa, its beans earn an international price premium of 7–10 per cent above the price paid for other West African origins. The project team felt that the government system run by the QCD would provide a unique foundation for introducing superior fine flavor genetic material, maintaining transparency of product and financial revenue, and controlling product quality.

There was no guarantee that Ghanaian cocoa would enter the high-end specialty cocoa market, but the limited supply of dependable fine flavor cocoa provided a unique opportunity for Ghanaian farmers – and success seemed likely given the country's reputation for consistent quality.

The need for innovation

Most cocoa farmers in Ghana are not organized into local associations, instead selling through private traders who establish buying centers in the production zones. Only government-licensed buying companies (LBCs) are allowed to buy cocoa, and they are required to sell it to the export division of COCOBOD, which holds an external market monopoly.

Centralized control of the cocoa industry had ensured its stability in Ghana, but has failed to promote innovation or professionalism. Despite impressive research capabilities, CRIG has made only one fertilizer recommendation for the whole country, along with a rigid calendar-based pesticide recommendation that failed to account for variation across farms. A new and more innovative approach would be necessary for instituting a fine flavor program.

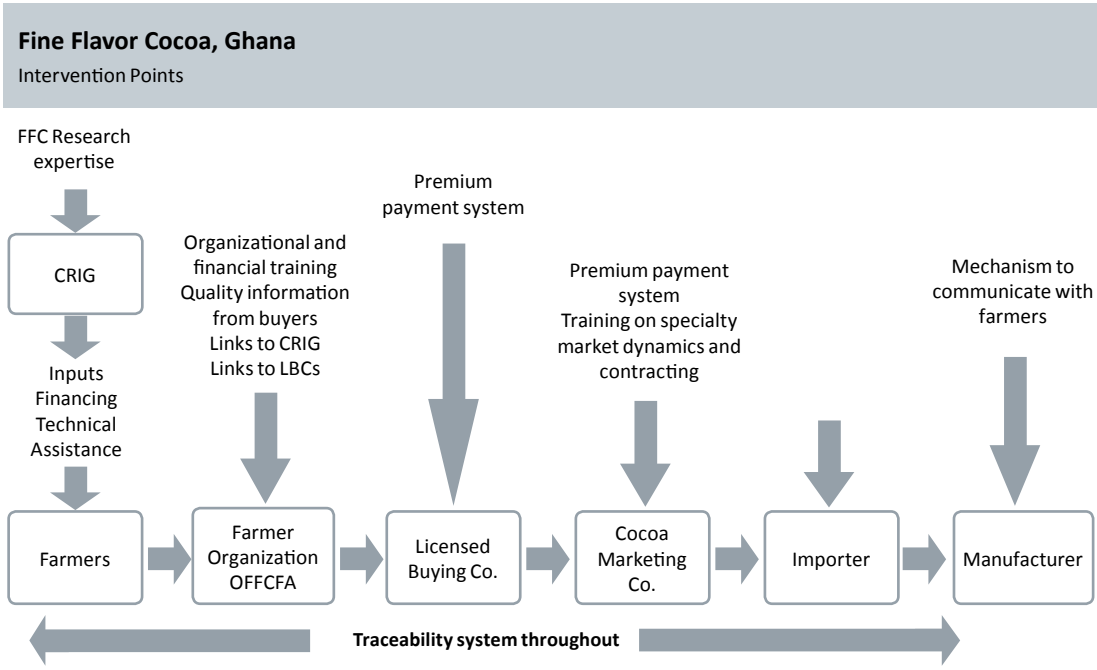
There was inertia at the farm level as well. To maintain or increase cocoa production would require periodic rehabilitation of aging farms and recycling of the land – but with 60 per cent of cocoa farmers aged over 50, the farmers tended to be reluctant to take on additional investment risks. They perceived that investing in yield-improvement strategies would involve high costs from which they were unlikely to benefit. Convincing farmers to try new varieties and learn different farming practices was therefore an enormous challenge. The project team would need to identify and catalyze a new and more innovative way of cocoa farming if Ghana was to become a new fine flavor origin.

Engaging the entire value chain

Promoting exchange between farmers, the government and industry was seen as key to the project's success. The Fine Flavor Cocoa project team included a number of organizations from multiple sectors up and down the value chain. It was led by the US-based Sustainable Food Lab (SFL) and the Columbia-based International Center for Tropical Agriculture (CIAT), and funded by the Bill & Melinda Gates Foundation. The enthusiastic support of John Scharffenberger and of The Hershey Company helped convince COCOBOD to dedicate resources at CRIG and also mobilized interest with Ghana-based traders like Armajaro Ghana Ltd. Initial exchanges between Scharffenberger, COCOBOD and the farmers proved invaluable to early and sustained farmer buy-in.

Early on, the team identified a local partner for the on-the-ground work. Agro Eco-Louis Bolk Institute (AE-LBI) had a deep knowledge of both agricultural development and of the political issues that would be essential to stakeholder engagement – and would be able to facilitate communications between the farmers, the

Figure 1: Value chain map



© Stephanie Daniels

government and the international consultants. Key technical resources were identified for farmer training and cost-benefit analysis with the Sustainable Tree Crops Program (STCP) of the International Institute of Tropical Agriculture (IITA) and the fine cocoa expertise of the Cocoa Research Unit at the University of the West Indies.

The project required interventions at each stage of the value chain (Figure 1):

- At the **farm level**, individuals would be trained in appropriate cultivation and processing methods, provided with improved varieties, and would receive loans to cover upfront expenses.
- At the **farmer association** level, there would be organizational development training to help the group create a solid business plan, build capacity to maintain a segregated supply, and recruit new farmers over time.
- To engage **intermediaries**, licensed buying companies were invited to a 'value chain summit' (described below), were visited by the potential buyers, and were included in chain-wide communications.
- For **end buyers**, the team cultivated direct relationships with Hershey and others; team members also interviewed key specialty buyers in the US, European and Japanese markets about their specifications and views on Ghana fine flavor cocoa.

In March 2009, the project team held a Business Model Summit at CRIG, bringing together 28 participants from Ghana's cocoa industry, leading agronomists and researchers, cocoa farmers and the speciality chocolate industry to fine tune the vision for a Ghanaian fine flavor cocoa product. The event was an opportunity to provide updates and discuss any challenges that had been encountered thus far.

Project design meeting of farmers and partners at Cocoa Research Institute of Ghana © Stephanie Daniels

The summit was led by a keynote speech by COCOBOD's Chief Executive, Tony Fofie, and followed by an expression of enthusiastic support from then CRIG Director, Dr Adu-Ampomah. Representatives from COCOBOD's Quality Control Division and the Cocoa Marketing Company also attended and expressed support for the project. They confirmed that Ghana's existing quality control and traceability system would serve the fine flavor cocoa chain well. Additional controls would be necessary, but government representatives offered reassurances that an adequate system was already in place. The National Investment Bank of Ghana presented potential financing models.

Six farmers from the Offinso area of the Ashanti region attended the meeting. Since engagement with the project in 2008, 216 farmers from five communities had, on their own initiative, formed the Offinso Fine Flavor Cocoa Association. They were enthusiastic about the prospect of increasing their incomes and their knowledge of differentiated cocoa production through the Fine Flavor Cocoa project. At the summit, the farmers had an opportunity to taste Scharffen Berger chocolate, and to hear the support expressed by John Scharffenberger himself and by the COCOBOD leadership. This experience convinced them to commit fully to the project by self-selecting 30 farmers who would each commit a one-acre plot to piloting the new FFC system.

The group was encouraged by enthusiastic participation from intermediaries. The national manager of Armajaro Trading Company attended the entire summit. Armajaro had a well-established traceability program and was already delivering traceable cocoa to several clients in Europe and Japan. Also attending was a representative from the Licensed Buying Companies Association of Ghana who planned to remain engaged as the program developed.

4
A strong research component

In 1938, the British colonial government had established a Central Cocoa Research Station in what was then the Gold Coast. Its mandate was to investigate problems with pests and diseases and thereby to increase yields from cocoa farms. With Ghana's independence in 1962, the research station was renamed the Cocoa Research Institute of Ghana (CRIG), and in 1984 it became a division of COCOBOD.

CRIG is now a highly-respected research organization, with well-equipped laboratories and a large land bank where many varieties of cocoa are grown and studied. The FFC Initiative team worked in close collaboration with CRIG on several key research components:

- identifying a suitable region for growing fine flavor cocoa
- selecting potential FFC varieties from among CRIG's genetic collection
- flavor evaluation and confirmation of commercially viable clones
- DNA fingerprinting of all selected materials
- propagation of the chosen clones
- pegging, planting and grafting on farm trial plots
- producing farmer training manuals to explain recommended practices.

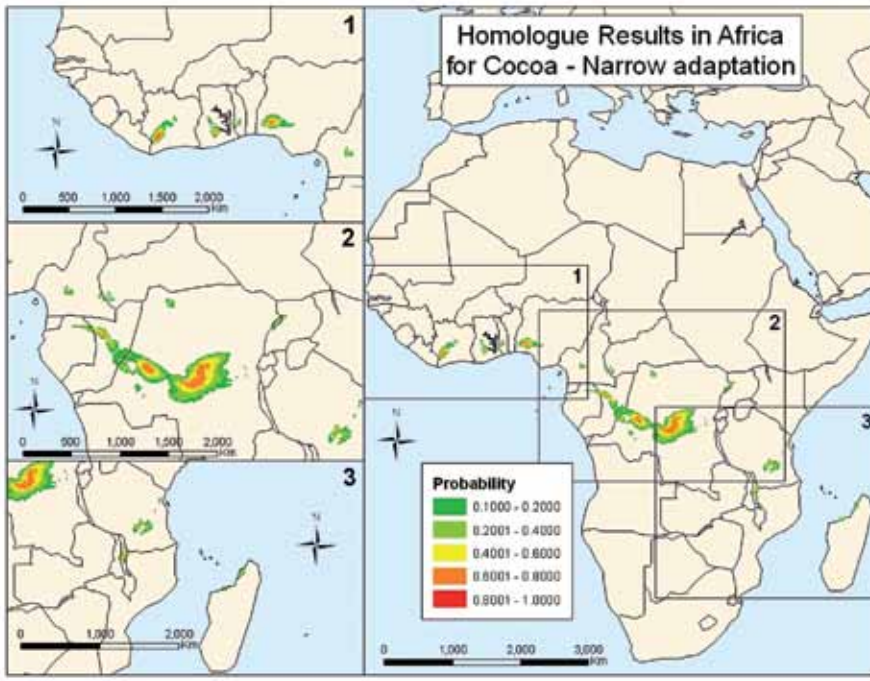
Identifying a growing region

In order to identify a site with climatic conditions similar to fine flavor growing regions in Latin America, CIAT conducted a Homologue analysis. Homologue is a software package that links climatic databases with geographical information systems in order to identify sites with similar conditions for plant growth and development. From just one site a series of similar sites can be identified. With more than one site as the input, a 'cloud' of sites can be identified that covers the range of variation in the input sites. CIAT used a cloud of sites that currently grow fine flavor cocoa in Latin America to identify the potential growing areas in West Africa (Figure 2). This suggested that the area likeliest to yield fine flavor cocoa in Ghana was located north of Kumasi, in the municipality of Offinso (Map 2, Figure 2).

Social and environmental factors also made Offinso a promising project site. Following devastating forest fires in the 1980s, many cocoa farms were producing extremely low yields or had been abandoned, and farmers were making very little money from their remaining cocoa trees. The absence of productive cocoa farms would make it easier to convince farmers to introduce new genetic material, and would offer greater benefits given that current yields were so low. In addition, the nutrients stored in the under-utilized soil would reduce initial expenditures on fertilizer. Due to the low number of existing cocoa trees, cross pollination with bulk varieties would also be less of a concern.

During the scoping process, the team approached farmers in the Offinso area. They were interested in the opportunity to cultivate fine flavor cocoa but apprehensive about the risk that scarce time and money could be wasted if the market potential was not realized.

Figure 2: Homologue mapping



Notes: Similarity of growing regions in Africa with sites in Latin America where fine flavor cocoa is produced, expressed in the probability of success (0.1 to 1) of growing fine flavor cocoa.

© CIAT

Genetic selection and fingerprinting

There are three varietal types of cocoa within the *Theobroma cacao* species:

1. Forastero varieties, the majority of which are grown in West Africa, are characterized by small, purple beans. Bulk cocoa is generally from Forastero varieties and dominates the global cocoa trade.
2. The Criollo varieties which, on the other hand, are well known for their signature complex flavors – but are risky due to a higher susceptibility to disease.
3. Trinitario varieties, hybrids between Criollo and Forastero varieties, which are known for their higher disease resistance and for having fine flavor distinction.

While genetics alone do not determine fine flavor pedigree, they are an important factor in fine flavor production. For many years, CRIG has maintained a garden of cloned trees representing hundreds of cocoa varieties – including many that were used to produce fine flavor cocoa from Latin American origins.

Through repeated screening of databases, relevant literature, and based on consultations with experts such as John Scharffenberger, Ed Seguine (Mars/ICCO Fine Flavor Committee), Dr Yaw Adu-Ampomah (COCOBOD), and Dr Darin Sukha (Cocoa Research Unit, Trinidad), the project selected 27 clones with the potential to produce FFC.

To be completely certain that the cocoa tree genetics had been correctly identified CRIG researchers conducted genetic fingerprinting on

the final selected clones. Without this step, the team couldn't be sure that the varieties were accurately identified: the tags could have fallen off some trees in the clone garden, there could have been a mix-up before planting or the origin of a certain variety might have been misidentified all along. Before scaling up the project, it was important to know precisely which cocoa varieties were producing fine flavor beans. This fingerprinting was done in partnership with the US Department of Agriculture's Beltsville laboratory.

Flavor evaluation

The team had expected that CRIG would be able to identify promising fine flavor varieties quickly, since the species under consideration were already growing in the CRIG clonal garden.

With only a few trees of each type in the garden, however, the volumes harvested were quite small – sometimes too small to evaluate. Even with varieties that produced a significant sample, there was not enough to ferment each type separately. Fermentation requires a critical mass of beans to create the necessary amount of endogenous heat (Box 2), so each of the 11 samples was placed in a mesh sack and fermented within a larger body of bulk Ghanaian beans.

Small-batch fermentation is uncommon, and turned out to be trickier than anyone anticipated. Prior studies conducted at Cocoa Research Unit (CRU) had indicated that using a mesh bag in a larger fermentation heap would indeed yield cocoa true to type, though this was not the result of the project's trial. When delivered to Hershey for flavor evaluation, all of these initial samples tasted like standard Ghanaian beans due to the co-mingled fermentation. Any unique flavors had been lost.

The team began working out a new small-batch fermentation method for the following year's harvest, but in the meantime the project was stalled – and farmers were left without any planting materials for an additional year. Proper micro-fermentation methodology remains an active area of research for the cocoa sector.

Box 2: How cocoa is processed

Cocoa beans are fermented and dried before processing into chocolate. Fermentation can be carried out in a various ways, but all methods depend on removing the wet beans from the pods and piling them together in heaps, boxes or trays to allow heat to build and micro-organisms to develop and initiate the fermentation of the pulp surrounding the beans. Fermentation continues as the beans are turned and aerated, increasing the bacterial activity. This process allows complex chemical changes to take place in the bean, including enzyme activity, oxidation and the breakdown of proteins into amino acids. These chemical reactions cause flavor and color development. The length of fermentation varies depending on the bean type, with Forastero beans requiring about five days and Criollo beans two to three days. Following fermentation the beans are spread out to dry – either in the sun or in mechanical dryers – until the moisture level is reduced to approximately 7 per cent.

The following year, the team experimented with small-batch fermentation in Styrofoam coolers based on successful experience with this method in other origins. But new complications arose. Because of the small volumes in each batch, the beans took longer than usual to reach the high temperatures necessary for fermentation, with unknown consequences for the final flavor. Also, beans fermented directly in the coolers tasted slightly of Styrofoam. Researchers at CRIG found that lining the coolers with banana leaves helped eliminate some of these unwanted flavors, but the challenge of insufficient heat remained. A decision was made to not rule out clones if their flavor imperfections were clearly attributable to inadequate fermentation; instead, the experienced tasters concentrated on the potential of the clones while ignoring faults due to fermentation.

The next flavor evaluations were conducted on samples from 12 clones processed to chocolate liquor and tasted in December 2009 at Hershey by an internationally recognised team of

Project partners inspect microfermentation boxes with CRIG scientists © Stephanie Daniels

chocolate experts from Mars North America, the Cocoa Research Unit of the University of the West Indies, Chloe Chocolat (France), and Hershey's own artisan brand team. At the first tasting, the team concluded that, despite fermentation problems, six of the clones had strong enough fine flavor notes to recommend them for planting. In the next set of tastings, conducted during the first quarter of 2011 at Hershey and Mars, two additional clones were identified as FFC and added to CRIG's multiplication regime.

Propagation

For the life of the project, the plan was for CRIG to establish a budwood garden and a nursery to multiply and propagate the necessary budlings of the six clones to be distributed to farmers. To produce FFC, participating farmers would have to begin growing the varieties by either planting new orchards with the CRIG budlings or by grafting new budwood onto old cocoa stumps. One challenge was the lack of an institutional arrangement for the production and distribution of planting material.

Ideally, distribution would be managed by the Seed Propagation Unit of COCOBOD, with farmers replacing their Forastero orchards gradually so as to maintain income in the latent period before the first harvest from the new types. The cost of producing 72,000 budlings in 30 village nurseries and training 60 villagers in nursery management and budding technique was estimated at 142,475 Ghanaian Cedi (GHc, approximately US$ 100,000) over a three-year

Members of the Offin Fine Flavor Cocoa Farmers Association, with Dr. Laderach CIAT © Stephanie Daniels

period. The initial start-up period was driven by propagation at CRIG, where there were trained budders and facilities, making the costs somewhat higher.

Training

Two Offinso farmers were trained as master trainers in best agricultural practices in the Sustainable Tree Crops Program's Farmer Field School Training of Trainers program. These farmers returned to the farmer organization to start a field school in Offinso, training farmers in proper weed management, pruning and other agricultural practices.

The lead manager at CRIG travelled to the CRU in Trinidad and Tobago to be trained in dense spacing and post-harvest processing of fine flavor cocoa. In order to scale up the project, the team had planned to publish training materials so that farmers would be able to easily learn how to care for the new and more labor-intensive varieties of cocoa. In particular, the team wanted to use drawings to communicate the instructions, so that farmers who were illiterate or from a smaller language group would be able to follow. CRIG took the lead in developing the training manual, which included several innovations in tree spacing, pruning and post-harvest processing. CRIG staff had technical expertise in these methods, and had published farmer training materials before. Unfortunately, the tedious approval process and rigid departmental roles have caused one delay after another – and several years later the manuals are still unpublished. This has not delayed actual farmer training, because CRIG staff knew the material well and were able to communicate it verbally, but it will delay the expansion of the project beyond the circle of farmers that CRIG was able to train directly.

5
Improved agronomic management

By reviewing current agronomic management practices in Ghanaian cocoa production, the project team identified a range of potential strategies to improve farmer's livelihoods and farm sustainability. Strategies, described below, included specialized input application, denser planting systems, income diversification, and added value through quality control in post-harvest processing.

Field technician grafting a coppiced cocoa tree with fine flavor budwood © Stephanie Daniels

Fertilizers

Approximately one-third of Ghanaian farmers had adopted the high-yielding hybrid cocoa varieties developed by CRIG, but were not applying the recommended amounts of fertilizer. Without supplemental nutrients, the hybrids rapidly deplete the soil. Moreover, the trees tend to age quickly due to the physiological stress of producing higher yields.
Even for farmers following the fertilizer recommendations, improvements were possible. There was just one blanket fertilizer recommendation for the entire country, despite variations in climate, soil, and cocoa variety. A more nuanced set of fertiliser recommendations was needed for cultivating fine flavor cocoa.

Controlling pests and diseases

West African cocoa losses are mainly caused by black pod disease (*Phytophthora*), swollen shoot virus (CSSV), and by insect pests such as mirids and the cocoa pod borer. Despite these losses, most farmers in Ghana do not control for pests and diseases using research-based recommendations.

The government of Ghana introduced the cocoa disease and pest control (CODAPEC) program in 2001; this included free mass-spraying of all cocoa farms against black pod disease and capsids using synthetic insecticides and fungicides. CRIG formulated a spraying calendar to control capsids and black pod as well as a regimen to control weeds and remove mistletoe.

These recommendations for controlling cocoa pests and diseases had two main constraints: (1) they relied heavily on synthetic pesticides, which have negative environmental impacts and may not be sustainable; and (2) the program was not cost effective since it was calendar based rather than need based. The Ghana Fine Flavor Cocoa project organized training in best agronomic practices, including pruning and

cultural control, along with rational input use, to ensure pest and disease control.

Planting density

The two most common production systems in Ghana use a spacing of 3 by 3 metres (1,100 plants per hectare). Growers who use a traditional low-input system would sow plantain and cocoyam, then under-sow with cocoa one year later so that the cocoa seedlings would have moderate shade over the following two years; farmers were discouraged from growing cassava due to its competitive nutrient uptake. Growers relying on the high-input full-sun system promoted by COCOBOD did not plant any shade species.

The FFC varieties were expected to thrive with denser planting, thus making up for lower yields. Recommended spacing in the farm test plots was 1.5 by 2.5 m and 2.5 by 2.5m. Long-term shade species were spaced at 12 by 12m, to be thinned later for an ultimate spacing of 20–24 by 20–24m. The team believed that planting valuable hardwoods as shade trees would provide another income source for farmers in the long term; they helped farmers register their trees with the local forest service office in order to have the timber rights assigned to them.

Post-harvest management

Carefully controlled fermentation and drying protocols are essential to reaping the benefits of fine flavor cultivation; no matter how high quality the beans are at harvest, poor control of post-harvest processing can ruin their flavor (Box 2). The fermentation stage is the key to aroma and flavor formation. It initiates the development of various flavor precursors in the beans. Enzymes and microbes are active during fermentation, allowing the beans to reach temperatures of 50–55oC and achieve their distinctive brown color. Ambient environmental factors can produce distinct microbial compositions in each cocoa batch, which leave different flavor signatures after fermentation.

Immediately after fermentation, the beans are dried: it is crucial to remove the excess water content from them so as not to risk over-fermentation or early spoilage. Recently fermented beans have a moisture content of around 60 per cent; the drying stage reduces this to between 6 and 8 per cent. Too much remaining moisture runs the risk of fungal growth; too little can make the bean shells brittle.

The proper regime for the Ghanaian FFC was still under development, with trials being run comparing the traditional box fermentation with the use of Rohan trays (recently adopted in several regions of Ghana and elsewhere); purported to deliver unique and often superior flavor quality. The 2011 main crop of Ghana FFC only yielded an experimental volume of beans for these trials; the first commercial crop is expected in late 2012.

Ghanaian cocoa bean crop being sorted © Stephanie Daniels

6
The business case

The STCP was commissioned to develop a cost-benefit analysis of FFC for Ghana. They projected cash flows on an annual basis over the 20-year production cycle for various planting systems. Expenditures were split into labor and other physical inputs such as planting materials, tools and equipment, and agrochemicals. After comparing several different planting systems from low-shade, landrace to high-input FFC, the analysis showed that a high-input, low-shade FFC system would be the most profitable.

For the high-input scenario, costs and returns were estimated for one hectare of fine flavor clonal material planted at 2.5 by 1.5m spacing in the first year, with plantain planted at 2.5 by 2.5m the previous year. Nursery costs were charged and grafts were assumed to be 75 per cent successful. A survival rate of 80 per cent was assumed following the first dry season after planting, indicating a need for 672 replacement seedlings in the second year. Production was assumed to be highly intensive with one ton / hectare of compound fertiliser applied, along with fungicide treatments to control black pod disease and capsids.

While market premiums were impossible to predict, several benchmarks were available. Over the past decade, FFC premiums of between 100 per cent and 300 per cent above the bulk cacao price of the New York futures market had been reported. The project team conducted extensive interviews with industry professionals to gauge their interest in a Ghanaian origin FFC, and to assess what buyers might be willing to pay. These discussions indicated that the cachet of high-priced FFCs was part quality, part scarcity and part salesmanship. In order to drive demand, Ghana's Cocoa Marketing Committee (CMC) would need to create a marketing campaign that would generate a buzz among fine chocolatiers. With good quality and the right marketing, premiums could be up to US$ 1,500 per tonne above bulk prices. With good quality and no marketing, the beans were still likely to fetch a moderate premium of $300/t.

The base scenario assumed an optimistic assumption of both yield and premium (Figure 3). According to the analysis, the intensified FFC system would generate a small positive cash flow in year three as a result of the revenues from plantains and cocoyams. Cocoa revenues would begin to flow in year five, from which point the system would consistently generate a positive cash flow. The total expenditures per hectare over the first four years were projected at 5,920 GHc/ha (approximately US$ 4,155) against a total income of 3,110 GHc/ha ($2,177), leaving a deficit of 2,800 GHc/ha ($1,960). The largest expenditure would occur in year two – principally the cost of grafted budlings and labor for planting. The labor requirement per hectare would rise in a non-linear fashion, reflecting the expected age/yield profile. Approximately two-thirds of the total labor input was assumed to occur during the harvest season. Starting in year five, the profit for farmers would be substantial – about an order of magnitude higher than before.

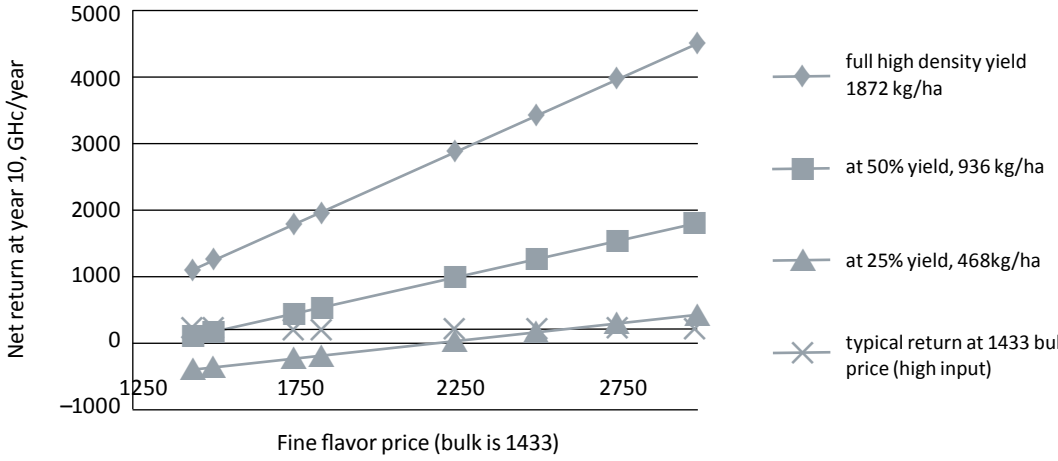
Figure 3: Cash flow projections for high-input fine flavor cocoa production system

Year	Labor quantity	Labor costs	Physical input costs	Total costs	Total revenues	Net annual return	Expenditures during production season	Expenditures during harvest season
	Days	GHc/ha	GHc/ha	GHc/ha	GHc/ha	GHc/ha	GHc/ha	GHc/ha
1	110	384	204	588	98	–490	588	0
2	396	1385	1996	3381	2025	–1356	3249	132
3	159	556	393	949	988	39	883	66
4	128	447	550	997	0	–997	997	0
5	366	1287	486	1768	5882	4114	1768	835
6	387	1355	606	1961	6397	4436	1961	908
7	405	1416	486	1902	6828	4925	1902	969
8	419	1465	606	2071	7173	5102	2071	1018
9	429	1502	560	2062	7435	5372	2067	1055
10	436	1527	606	2133	7611	5478	2133	1080
11	440	1540	486	2026	7702	5676	2026	1093
12	440	1541	606	2147	7709	5562	2147	1094
13	437	1530	486	2016	7631	5615	2016	1083
14	431	1507	680	2187	7468	5281	2187	1060
15	421	1472	486	1958	7220	5262	1958	1025
16	407	1425	606	2031	6888	4857	2031	978
17	390	1365	486	1851	6471	4619	1851	918
18	370	1294	606	1900	5968	4068	1900	847
19	346	1211	560	1771	5382	3611	1771	764
20	319	1115	606	1722	4710	2988	1722	669
21	288	1008	486	1494	3953	2459	1494	561

Running the model for a spread of potential yields and potential premiums, rather than only the most optimistic scenario, showed the boundaries of profitability for the FFC project. For those scenarios, STCP considered yields as low as 25 per cent, which would be close to the current performance of Ghana cocoa growing with modest input (Figure 4). For prices, they looked at premiums ranging from US$ 1,500/t in the optimistic scenario down to no premium at all.

Another key factor was the percentage of the export price that COCOBOD would share with farmers. Historically, farmers had been paid 60 per cent of the freight-on-board (FOB) price. In other cocoa countries where cocoa marketing is fully liberalized, such as Nigeria and Cameroon, farmers receive between 80 and 85 per cent of the FOB price. Recently, under pressure to liberalize cocoa marketing, COCOBOD has agreed with the World Bank and the International Monetary Fund (IMF) to fix the producer price at

Figure 4: Fine flavor cocoa price sensitivity



Notes: Assumptions are: 1) farm gate price is 70% of FOB; 2) discount rate is 20%; 3) includes income from plantain and cocoyam.
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70 per cent of net FOB price – but change has been slow to materialize. For this reason, the cost-benefit analysis assumed that farmers received 70 per cent of FOB prices, but would consider a range of profit-sharing from 60 per cent to 85 per cent. Sensitivity analyses of changes in FOB shares revealed that all systems become profitable if the farm gate price is set to 85 per cent of FOB. However, at a bulk price equal to 60 per cent of FOB, the only profitable production system was high-input FFC, given the higher market price.

7
Challenges and risks

Risks

While the STCP analysis demonstrated that the FFC project could bring substantially higher incomes to Ghanaian cocoa farmers, the plan was not without risk.

FFC is often produced in relatively small volumes and purchased at high prices, meaning there is a heightened need for reliability and consistent quality from suppliers. Manufacturers of premium chocolate, especially those marketing a single origin or high cocoa-content product, are extremely sensitive to quality. They demand a consistent supply, every season, of high-quality beans with a similar flavor profile. This would be challenging for small farmers accustomed to simply selling whatever they grew on the spot market each season.

The novel FFC varieties could also become pest and disease vectors if farmers did not follow the recommended cultivation and management practices. These varieties have historically exhibited higher susceptibility to pests and diseases and had not yet been grown at scale in West Africa. This risk was being mitigated through rigorous study and control at the CRIG clonal garden to monitor pest and disease damage and by the fact that Offinso is not a major cocoa-producing region, rendering the risk of contamination to other cocoa farmers low. Regardless, this risk needs to be monitored continuously by CRIG and COCOBOD to ensure it is contained should any outbreak occur. In a sense, the best mitigation measure would be market success: if farmers received a significant premium for their product, they would protect that value through careful management.

There is also the risk that bulk beans would find their way into the FFC supply; COCOBOD's Quality Control Division needs to maintain strict quality standards for the supply chain of FFC, particularly in the initial transition years when buying relationships are being developed.

While profitability would create pressure to expand the FFC program, Ghana would have to expand cautiously to avoid swamping the market and driving down the price premium. Analysis showed that the ceiling volume might be 2,000–10,000 tonnes per year. Since farms are small, however, this still represents significant social impact, with up to 10,000 farmers benefiting.

Fine flavor nursery at CRIG © Stephanie Daniels

Challenges

Research challenges

As the project entered its third year in 2010, the genetic trials at CRIG had still failed to identify the necessary flavors and there were persistent delays in reaching project goals. Altogether, the unexpected delays in identifying fine flavor varieties due to lack of reliable micro-fermentation process have put the project two years behind schedule.

Institutional challenges

As with the delay in producing the farmer training manuals, CRIG's approach to the propagation process has been too slow and methodical. The organization found it hard to deliver with the urgency of an industry development project in which livelihoods depend on timeliness. The institutional delay was compounded by lack of budwood from the clonal garden, without which the budders couldn't graft the FFC material on to the rootstock. By July 2011, CRIG had produced 29,350 FFC budlings – 50 per cent of the planned quantity. In retrospect, this seemed an inevitable clash of government and industry cultures coupled with unrealistic targets for budwood production – but understanding that made the delays no less frustrating.

The delay in seedling propagation also seemed to be a symptom of a wider issue: that CRIG was slow to take ownership of the project. With only three years of grant funding, it was essential that Ghana's own ministries be prepared to take over beyond 2011 for the project to succeed. Representatives of the Food Lab, Hershey, CIAT and Agro-Eco spent time visiting the CRIG facilities to understand what had been accomplished so far, and to offer collaborative solutions. They began to worry about whether the project would continue to be a high priority at CRIG once foundation funding ran out. By the end of the project in mid 2012, a solution had been found. A nursery near to the test farms in Offinso had been established where farmers are being trained to care for their budlings with CRIG's support on propagation.

Farmer costs

While each source of delay had been unavoidable and understandable, the farmers who had risked their time and labor, and who were counting on the projected revenue, were becoming increasingly nervous about the project.

At a farmer association meeting attended by several of the international consultants in 2010, it became clear that weeding was more costly than anyone had predicted – but was absolutely necessary to protecting the fragile seedlings until they became established. Farmers found it necessary to hire seasonal labor for this purpose, and could neither afford the cost nor borrow the funds. Traditional microfinance lenders were not interested in such small-scale loans, especially given the lack of any collateral. In the end, the project team was able to put together a small revolving fund to help farmers with any unexpected expenses that would be necessary until the project became profitable.

Brand development

While an exciting marketing campaign would be essential to success of the new FFC brand, nothing along these lines has been developed yet. In many ways, it was premature to advertise a product that hadn't yet been proven – but the project had been ongoing for several years and many key players were already heavily invested.

Given the delay in delivering commercial volumes to the market, the project team decided to build interest among key industry players. This was an extension of the recruiting done for the flavor evaluation panel and consisted of the core partner, The Hershey Company, along with Mars, Guittard Chocolate, Tcho Chocolate, Armajaro and a representative of the World Cocoa Foundation. Several meetings were held with

members of this group at industry conferences, and they continued to be engaged and interested in the results of the project. The group agreed to provide insight and guidance to COCOBOD once there was commercial-quality product to share with the trade. An industry meeting has been planned with executive leaders of COCOBOD for mid-2012.

Price fluctuations

World prices for bulk cocoa have risen sharply since the beginning of the project, and are now approximately double what they were in 2007. This is good news for cocoa farmers in general, and for the poverty alleviation that everyone hoped would happen. On the other hand, the rise in bulk prices mean that FFC beans are no longer commanding as significant a premium as they had – and the extra work and lower yields are no longer as strongly justified as they had been.

Prices continue to fluctuate, and everyone knows they might fall again at any time. The team felt that by investing in a high-quality product, with strong and secure demand, farmers would be at a long-term advantage. Over the short term, however, all the extra time and expense might not make as big a difference as expected.

Project teams from OFFCA, CIAT and AE LBI © Stephanie Daniels

8
Encouraging results

'I entered this project fairly skeptical – with reservations let's say – and actually became a believer. Principally because of the way the project was managed. It was managed well; it's a small project but has delivered measurable, tangible results – hard results as opposed to soft results. It's a very good project to be associated with and I appreciate the opportunity to use this project to help in Ghana and further develop the origin expertise in our company.' Ray Major, Specialty Buyer for The Hershey Company, Pers. Communication 2011.

Despite the project getting off to a slower start than hoped, a number of successes were achieved quite quickly, and the future looks promising.

The final tasting was done in the spring of 2012. The 2011–2012 main crop yielded enough beans from the grafted trees on farmers' plots to reach acceptable fermentation levels – indeed all the samples were rated by The Hershey Company as within the acceptable fermentation range. This was a significant improvement over prior years. The team worked with the farmers to blend the beans from the mixed plots to deliver samples that would be representative of the beans that could eventually be sold to the traders. Samples were sent to Hershey, Mars, Guittard and Tcho for cut tests and flavor evaluation.

The preliminary results were quite promising with the experts at Hershey's artisan brands laboratory stating that they were likely to be able to make a single origin chocolate from 8 out of the 10 samples. One of the samples was particularly well rated by the entire eight-person tasting panel, describing it as having unusual fruity notes such as apricot, citrus and apple, as well as floral notes. Based on these positive results, it is clear that with sufficient volume, proper post-harvest processing and rigorous quality control and traceability, these beans could deliver significant value for the Offinso farmers and be an attractive product for speciality cocoa buyers.

Given the delays in the project, it is impossible to measure income or livelihood impacts from the sale of fine flavor cocoa, though the anticipated economic returns are high. There has been some increase in social capital, for instance the formation of the farmer association. Also, farmers have increased their knowledge of agronomic practices for fine flavor cocoa, and have been introduced to international industry contacts. Natural capital had been transferred to them in the form of shade trees and fine flavor cocoa budlings, and financial capital has been established through the revolving loan fund.

Other stakeholders have benefited as well. CRIG has now improved its capabilities for establishing and maintaining fine flavor cocoa; they have exchanged valuable expertise with experienced researchers in Latin America, and they have gained visibility at an international level. And Ghanaian cocoa has already enjoyed an image boost on the international stage; the lead CRIG scientist from the project has been invited to join the International Cocoa Organization's prestigious Fine Flavor Panel. The global cocoa industry is set to profit from the new FFC origin as soon as it becomes available; buyers have been engaged and primed for the commercial phase of the project.

In conclusion, while the project has not yet 'proven' its success, all indications are that it will do so within a few short years.

9
Lessons learned

In late 2011 the team got together to consider what lessons had been learned from the project thus far. They distilled the following, which may be of some value to other, similar initiatives:

- Regular and targeted communication, management of industry expectations, and the cultivation of a sense of ownership among all players allowed key stakeholders to stay energized and interested despite the delays.
- Research takes time, and isn't always predictable. When embarking on a project that will embrace new technology and new processes, it is important to incorporate some flexibility into the timeline and have realistic expectations, particularly with farming communities.
- The most lucrative markets demand the most professional farmers; reaching for these opportunities is especially challenging for the rural and unorganized farmers who are most in need of an income boost. Balancing the existing farmer skill set with development goals is essential, as is providing enough targeted market and field knowledge to build farmer capacity to fulfil the market requirements, and being willing to take the necessary risks to gain success.
- The participation of governmental agencies is essential to achieving development goals in certain highly regulated industries; however, such agencies are not naturally suited to fast-paced innovation. Realistic timelines, regular communication and strong relationships based on trust are critical for government support over the long term.
- Homologue screening identified the right agronomic conditions for FFC, but further research is necessary to identify the social conditions in which a project can flourish. No screening for a farmer organization had been made, and the team was lucky that Offinso's enthusiastic farmers took co-operative formation into their own hands.

Mr. Bonsu showing visitors grafted fine flavor trees
© Stephanie Daniels

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Contact:
Stephanie Daniels
stephanie@sustainablefood.org

Cover image: Mariama Zachary, 44, and Akua Azaiz, 20, tend to cocoa beans on a drying table on January 21, 2011 in Sawuah, Ghana. Cocoa beans are an important cash crop for the farmers in Sawuah, many of whom use the profits to send their children to school.

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