ALLANBLACKIA: STANDARD SETTING AND SUSTAINABLE SUPPLY CHAIN MANAGEMEN -PRICE SETTING AND MARGINAL COST STUDY



Collectors separating nuts from *sonkyi* pods

FINAL DRAFT REPORT

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EXECUTIVE SUMMARY

Allanblackia spp is a tree species widely distributed in the forest regions of Sub Saharan Africa. The supply chain for AB has been established and is functional. Recent studies have recorded that trends in a number of collectors, quantity collected and price per unit have all shown positive growth. This study sought to describe the price setting process by examining income generating activities and the opportunity cost of labour for the target population in Ghana at the time of year when Allanblackia is harvested. It also sought to estimate the likely farm-level investment and operating cost, cash flow and net returns over a period of 20 (tbc) years; compare the net returns to Allanblackia ($/ha, $/person, internal rate of return) with alternative tree crops including cocoa and evaluate potential synergies between AB and other crops, e.g. AB + cola; cocoa + AB, etc.

A three step approach was employed in developing the methodology for the study. First, the conceptual framework was described; here the thinking was based on basic theories of economics and expert opinion. Then, simple descriptive statistics and project appraisal indices (NPV and IRR) were computed for selected variables. Mainly primary survey data from focus group discussions and a sample of 103 respondents from three communities (Pataho, Mmerewa and Kroboase) in the Western Region of Ghana was employed. The findings of the study show that:

i. Allanblackia Collectors in the western Region of Ghana are cocoa and food crop farmers who have well established calendar of input acquisition, production and marketing activities. Income generated from these activities is key; yet they seek other sources of income generation during their leisure. Allanblackia is one such source of income for about 44 percent of the sample.
ii. In general trees have a role to play in the communities visited. There are wide varieties of tree species known. However, their products are not easily accessible to all households for income generation. Some are in season, when there is less to do on cocoa and food crop farms. Others peak with the cocoa crop. However, where the return on labour is perceived to be high, leisure hours are spent on processing these non-timber forest products (NTFP) for sale. Indeed, collectors of NTFPs believe that the time and physical effort invested need to be rewarded adequately in order for interest to be sustained.
iii. Currently, Allanblackia is a collection activity carried out during the lean season (light crop) for cocoa and its opportunity cost is nil in financial terms. Data from the survey of three selected communities suggest that there are other collection activities that yield higher in terms of value per hour; we compare ¢4,000/hr for AB to ¢6,600 - ¢14,300/hr for cola, "Atooto" and "Abesebuo". Although there are virtually no costs incurred in the collection and processing before sale of AB, the laborious nature of the processes and the ***perceived*** low price per unit makes its sustainability questionable.
iv. AB domestication in Ghana is at the research stage led by the Forest Research Institute of Ghana (FORIG). However, it appears that, AB domestication would be embraced by majority of the farming population if its net returns are positive and contract farming as suggested by Unilever R&D Netherlands is

possible (with assurances of no capital investment by farmers). Then there will be no working capital needs, no seedling costs; there will be free unused arable land, permanent produce buyers in the community and some fringe benefits on occasion. Further analysis suggest that, even those who do not want to opt for the contract farm system can benefit from AB domestication; assuming a discount rate of 19 percent and a life span of 20 years, the one hectare NPV was positive (for all eight scenarios of subsidized and non-subsidised Allanblackia plantation).

v. Currently, collecting AB in addition to cocoa production does not produce as much impact as when other NTFPs such as "Abesebuo" and "Atooto" are added. However, If AB is domesticated, and then concentrating on AB during the light crop cocoa season would be most beneficial.

We note that without the contract described by Unilever R&D Netherlands, the current purchasing price of AB (¢1,500/Kg) may not be incentive enough to collectors of wild AB trees because large quantities of nuts may not be collected and processed (recall the mean revenue of ¢35,000.00 for 2007). The perceived high price (¢9,200.00) per kilo of cocoa induces some farmers to maintain farms (using hired labour) and work extra hours 'when the season is here'. In the same way a higher than ¢1500/kg would induce the AB collector to plan for and invest time and labour (including hired) in collection or establishing and maintaining AB farms. The innovation needed in hiring of labour and transportation services in AB collection or establishment would come when perceived higher prices are given. The implication is that buyers of AB ought to continue the sensitization process, explain the contract package, form an AB Collectors and Producers Association that would be organized so effectively (linking with the local institutions) that non-members would seek membership, and together push forward the agenda of AB in the communities.

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LIST OF ABBREVIATIONS

GPRS II	Growth and Poverty Reduction Strategy
FOB	Free On Board
IUNC	World Conservation Union
AB	Allanblackia species
FORIG	Forestry Research Institute of Ghana
NGO	Non-Governmental Organizations
SECO	Swiss State Secretariat for Economic Affairs
IRR	Internal Rate of Return
NPV	Net Present Value
NTFP	Non -Timber Forest Products
OC	Opportunity Cost
MoFA	Ministry of Food and Agriculture
MLGRE	Ministry of Local Government, Rural Development and Environment
MLFM	Ministry of Lands, Forestry and Mines
MESS	Ministry of Education, Science and Sports
PSI	Presidential Special Initiative
FC	Forestry Commission
CSIR	Center for Scientific and Industrial Research
FAO	Food and Agricultural Organization
ADRA	Adventist Relief Agency
UN	United Nations

1. INTRODUCTION

"The rainforests of West, Central and Eastern Africa are the source of a new commodity hoped to bring economic growth and biodiversity benefits to the people in this region. For the first time, edible oil from the seeds of the indigenous 'Allanblackia tree' will be extracted to produce commercial products sold throughout the world. A unique public-private partnership has been formed to manage this process including local communities, non-governmental organisations, donor agencies and a private company. Together they will ensure that product development, from harvesting to market, takes place in an equitable and sustainable manner".

Ghana is a sub-Saharan African country located along the coast of West Africa. It is bounded in the North by Burkina Faso, West by La Cote d'Ivoire and East by Republic of Togo and South by Gulf of Guinea. Like most developing countries, Ghana is on the growth path. Its growth strategy has been planned with respect to poverty reduction through agricultural and rural development (Ghana, 2006). In the Growth and Poverty Reduction Strategy (GPRS II) document, it has been recognized that if agricultural development would be sustained, then it ought to be modernized. This means that all primary activities of hunting, collection and traditional ways of tilling the land need some form of transformation. There are three major agro-ecological zones in Ghana: northern savanna, forest and coastal savanna. Each of these areas has several valuable resources which has served the livelihoods of the people. In the Savannah area, the Shea tree has been the most important; in the forest zone recent discovery has shown the importance of *Allanblackia parviflora (*AB), known in local parlance as "Sonkyi".

Allanblackia spp is a tree species widely distributed in the forest regions of Sub Saharan Africa. Species such as *A. parviflora* is known in Ghana and Upper Guinean Forest; *A. floribunda* is known in Nigeria, Democratic Republic of Congo and Angola; *A. stuhlmannii* and *A. ulugurensis* are known and endemic in the Eastern arch mountains of Tanzania. In Ghana "Sonkyi" has been identified in the forests and adjoining areas in the Western, Central and some parts of the Eastern regions. Traditionally some local people collect its seeds. They basically use it in making cooking oil and soap for domestic use. Recently Unilever, a private company, discovered its use in the production of spreads (margarine) amongst others and also realised its potential for poverty reduction among the farmer/collectors in the AB producing areas. Thus, in 2002 a partnership was established between Unilever, SNV, World Conservation Union (IUCN), Forestry Research Institute of Ghana (FORIG), ITSC and some non-governmental organizations (NGOs) for the establishment and development of a sustainable supply chain for AB seeds. It meant that issues of environmental management, community development, equity and gender mainstreaming would be the focus.

The supply chain for AB has been established and is functional. Recent studies have recorded that trends in the number of collectors, quantity collected and price per unit have all shown positive growth (IUNC, 2007). Between year 2002 and 2007 the price a collector obtained per kilogram of AB seeds has seen a more than three fold increase in nominal terms; it was ¢400.00 in 2002, ¢1000.00 in 2005 and ¢1500.00 in 2006/2007. It is believed that "Unilever sets the price in a transparent "backward calculation" based on

the free on board (FOB) price of extracted oil in Rotterdam. Transaction costs along the supply chain are deducted from the FOB price to derive the price paid to the farmer collecting the seed at sources in Western Ghana" (IUNC, 2007). There is also the recognition that without domesticating the plant the amount of seeds collected currently from the wild by individual farmers would never be substantial enough to make significant contribution to their income levels. Volumes collected and supplied to Unilever would also not be commercially meaningful. Domestication of AB is the strategy that is being explored by Unilever and its partners.

However for a significant scale on AB production to unfold through domestication, concrete information on economically attractive price level for farmers, comparative analysis of AB cultivation in relation to other farming and economic activities, and methods for gaining and sustaining farmer interest in planting AB on a longer term scale are required. In deed, the current price setting approach has been questioned; "whereas the method is transparent and justifiable for current situation where no market for the Allanblackia seeds exist, it does mean that existing inefficiencies along the supply chain are simply passed along to the price paid to the farmer". Yet, there is still the common perception among many collectors that the price is too low (refer IUCN TOR, 2007).

Therefore questions such as the following need answers:
1. Why is the current price not an incentive enough?
2. To what extent does price induce collectors to invest labour and time for increased collection?
3. To what extent does price induce farmers to innovate in ways that would lead to cultivation?
4. What non-price incentives are necessary to induce integration of Allanblackia permanently in the farming system?
5. What is the opportunity cost of integrating Allanblackia into current farming systems of communities?

In order to understand and establish a pricing mechanism from the perspective of the farmers' opportunity cost of capital (natural, human, financial, physical and social), this study was initiated. The study falls under a broader Novella Africa initiative, which is a Public-Private-Partnership aiming at ensuring sustainable supply chain for Allanblackia. IUCN and its members (Institute of Cultural Affairs, the Forestry Research Institute of Ghana) and partner (Technoserve) in Ghana are implementing the study under a project named "Allanblackia: standard setting and sustainable supply chain management". The Swiss State Secretariat for Economic Affairs (SECO) is financing the project.

Objectives of study
This study is divided into two: price setting and marginal cost exercise. The price setting study has the following objectives: To

i. provide information on income generating activities,
ii. better understand the opportunity cost of labour for the target population at the time of year when Allanblackia is harvested.

This study is not for a price negotiation exercise. The intent is to provide Unilever and other stakeholders with comparative information on alternative income generating activities.

The marginal cost study has the following objectives: To

i. estimate the farm-level investment and operating cost, cash flow and net returns over a period of 20 (tbc) years. This is to develop a small-scale agro-forestry system based on Allanblackia.
ii. compare the net returns to Allanblackia ($/ha, $/person, internal rate of return) with alternative tree crops including cocoa and cola.
iii. Evaluate potential synergies between AB and other crops, e.g. Timber + AB + cola; timber + AB + cola; cocoa + AB.

The results of the study would provide information that would help stakeholders to understand the constraints and opportunities that are involved in the Allanblackia seed collection in relation to income.

It was expected from the TOR scope of work that, the overall report would capture among others:

- The role of trees in the household livelihood strategy
- Management characteristics of agroforestry systems
- Rates of economic return relative to the farmer's alternatives, for farmers with access to different resource mixes
- Sensitivity of returns to variation in key economic values
- Environmental and off-site impacts.

2. METHODOLOGY

A three-step approach was employed in developing the methodology for the study. First, the conceptual framework is described; here the thinking concerning basic terminologies, based on basic theories of Economics and expert opinion, are explained. Secondly, the variable selection and methods of data analysis is discussed. Finally, the method of data collection is examined.

2.1 Conceptual Framework: Standard setting and Sustainable Supply Chain Management

Standard setting

Standard setting involves identification of basic product features that are acceptable by a large group of stakeholders in both the supply and demand side. Standards are commonly agreed upon yardsticks of measurement. They ensure a language that can simplify the marketing processes and reduce marketing cost (Kohls and Uhl, 2002). Producers of high quality grades can obtain premiums over lower quality grades. With standards, marketing firms can better communicate their specifications and offerings to farmers and consumers respectively. The suggested criteria of adequate standards are:

- Standards selection must be built on users characteristics of importance and opinion of value,
- Standards selection must be built on factors that can be measured accurately; and those that can be uniformly measured and interpreted,
- Use terminologies and factors that are meaningful to many users in the supply chain,
- The grade classification during standardisation should include enough of average production,
- The cost of operating standards must be reasonable.

There are problems that arise during the development and implementation of quality standards. Kohls and Uhl (2002) has identified the following:

- Determining quality standards is subject to food properties and consumer preference
- Designing food grades: measures are based on physical, chemical and sensory properties; accuracy, number and limits become an issue.
- Implementation: some products may not be graded, others may change grade during marketing; where in the chain should grading be done, especially for highly perishable products becomes an issue.

We therefore note that standard setting in AB could be complex. To make the process simpler, standards for AB supply chain have been set "based on what pertains for the universal oil producing community" (Hendrickx, 2007).

Sustainable supply chain management

Sustainability means that we (current generation) do not prosper at the expense of future generations and that we treat the current generation fair. That does not necessarily mean that future generations should be more prosperous. Sustainable supply chain management require the institution of a system that makes the organisation of logistics and services required for the production, processing and market supply of product most efficient. However, some believe that the latter (efficiency) situation may be desirable, but it is not required for sustainable development (Hendrickx, 2007).

In Ghana, a National Agroforestry Programme was implemented in 1988 to incorporate alternatives to land management in all agro-ecological zones. The pilot projects developed two types of tree species for plantation forestry and alley cropping. One specie was purposely for soil fertility improvement, (biomass) and the other specie, economic trees, such as would bear fruits for sale. Mangoes and cashew seedlings were the main tree specie introduced for their fruit. That for soil fertility improvement could also be used for fuel wood, poles to stake yams, etc. The potential of *Allanblackia spp* was not known then. However, Allanblackia is being researched today and its advantages in oil making for margarine and soaps have been demonstrated (Tissari and Danso (2007). There is the belief that those who would take advantage of this newly opened window would benefit immensely. Yet, we note that, for the people who are being called to participate in the system, it is technical change.

Ruttan and Hayami (1995) contend that technical change is guided along an efficient path by *price* signals in the market. The argument is that, if the demand for a product (say Allanblackia) increases, due to growth in user firms (or increased quantity demanded by one firm-here Unilever), prices for its inputs (including labour) may be raised relative to prices of other inputs (McConnel and Brue, 2000). This situation could be avoided if the supply of inputs is also controlled by output demand firms. Consequently, technical innovations that save factors (inputs) characterised by an inelastic supply, or by slower shifts in supply, become relatively more profitable for growers/collectors.

Land tenure security in Ghana

Domestication of Allanblackia as a strategy for sustainable supply chain is dependent on land tenure security. Generally, security of tenure is linked to higher productivity and better land management (Panayotov, 1993). Secure tenure reduces farmers' risk, and raise expected profitability by providing the proper incentive for farmers to make investment in the long-term productivity of their land. However, it is not clear whether many farmers in Ghana do long term investments or have the capability to calculate the benefits of long term investments. Long term investments in tree crop farming such as cocoa, coffee, oil palm and cocoanut stop short of the trees themselves. Some large scale farmers of non-traditional export crops (pineapple, papaya and mango) have invested in irrigation, tractor and other equipments. So, long term AB investment would require external support.

Again, the issue of land and gender need to be analysed. In general, the world over, women farmers have been found to be less productive than men because they farm

smaller amounts of lower quality land and have more restricted access to complementary resources, new technology and adult labour (Mehra, 1997). In Ghana, land has both a mystic and market value. Land is held by the present generation for ancestors and generations yet unborn. Thus most land parcels are communal property and distributed mainly through an inheritance system. There are two major types of inheritance systems in Ghana: patrilineal and matrilineal. The matrilineal system permits women to inherit (property) land. The patrilineal system does not permit women to inherit and own land. Where land markets exist, leases rather than outright purchases are adopted. Therefore, Ghanaian women may gain access to small parcels of land with usufructory rights, only if it is family land. A recent study in Sota in the Greater Accra Region indicated that, the yield levels of female farmers were lower than that of their male counterparts because the women continuously cropped the same land while clearing fields with slash and burn methods and practicing less crop rotation (Fleischer, 2002).

The tenure system in Ghana suggests that for sustainable Allanblackia management, issues of restriction of access to communal land or allocation of marginal lands to the vulnerable (women, young adults and disabled) would need critical attention (see Box 1). It is claimed that AB thrives on marginal lands; the issue is would women still be allocated such lands when they are seen to be benefiting from AB proceeds?

Box 1: Observations in Allanblackia collection areas in Ghana by Amanor (2006)

A large proportion of the farmers moving into this area purchased land from chiefs. Much of this has subsequently been parceled out to family members who helped the original land purchaser in establishing cocoa plantations in the area. A significant number of farmers also acquired land on a sharecrop basis or hire land. Sharecropping usually arises in three contexts:

1. *The farmers have insufficient capital to purchase land and seeks to access land on a share basis for establishing cocoa plantations;*
2. *The farmers have placed all their land under cocoa and negotiate with land surplus farmers to gain access to land for food cropping on a short term basis;*
3. *The farmers have placed all their land under cocoa and cannot purchase new land from the chiefs, since the majority of stool land has been sold. Farmers with surplus land are also unwilling to sell it because of its scarcity value or its future value to their descendants. They are, however, willing to transact the land on a share cropping basis.*

Tenure of land held by men and women

	Male (%)	*Female (%)*	*Total*
Own farm	*27*	*18*	*23*
Family land	*35*	*23*	*29*
Spouse /in laws land	*4*	*46*	*26*
Sharecropping	*30*	*10*	*20*
Hiring	*1*		
Other	*3*	*3*	*2*
No of respondents	*370*	*418*	*788*

Labour use

Labour is the energy and talent needed to transform economic and social conditions of a society. It is a service, specialized or general, and would require high skills or not. Thus the important factors of labour become time, mental and physical effort. The time allocated is an investment (albeit short-term) with expected return (the wages) (MCConnel and Brue, 1999). In the same vein, the mental effort in planning and controlling factors of production need to be adequately rewarded. The physical effort in moving or changing the nature of products must be adequately rewarded too. Otherwise, choice makers who are rational would opt for better alternatives including **leisure**. The latter does not yield income but need not be trivialized by any analyst. People live in social setting that make demands on their labour time. In Ghana, family and friends gatherings for funerals, naming ceremonies, weddings and just conversation are forms of activities that are planned. Thus any new venture would be sorted as a complement or substitute or both. Due to seasonality, introduced ventures may be perceived as complements, requiring that free time (or leave period) during lean season be put to action. It may also mean that even when it is the peak season for certain ventures, rest hours within a day be used for complementary ventures.

To substitute one venture for another means the requirements in terms of land, labour and capital are similar for the two. This is where economic opportunity cost analysis becomes necessary. The clear economic advantages in terms of higher returns (based on current and future considerations of money value) would then be considered. The ease or complexity of the activities involved as well as the shortness of period to observe the returns are also important (Rogers, 1995).

Opportunity cost

Cost benefit analysis alone is not enough. A look at the cost of the next-best investment is also important. This is the opportunity cost analysis. The benefits of investment in a choice (Allanblackia) need to be compared to the opportunities to be lost, opportunities to invest in other tree crops (say cocoa, cola and other NTFP). Thus a choice will be worth forgoing the other alternatives. A related concept to opportunity cost is trade off. A trade off is a decision to spend ones limited resources on one thing instead of another (Marioti *et al* 2001). Most farm households have extra land for future use. Farmers may be confronted with choosing the trade-offs that will be most profitable.

Measures of project worth (profitability)

There are several methods that have been developed to assess the worthiness of projects or profitability of a venture. Many are quick calculations of single indices that do not consider the time value of money. These include calculations of net gains from partial budgeting, gross margin/marginal costing, marginal rate of return or pay back period. Other more sophisticated methods include considerations of the future value of money. Here the present value of the costs and benefits are calculated. Indices such as the benefit-cost ratio (B/C), financial or economic internal rate of return (IRR) and net present value (NPV) are well known (see Gittinger, 1991 and Marioti *et al*, 2001).

2.2 Method of Data Analysis

The method for analysising the raw data collected for this study are described below:

1. Income generating activities:

Income generating activities are those economic activities that allow individuals and groups to employ input labour, land and capital for positive returns. In this study, communities as well as individual perceptions were assessed. Qualitative data based on most significant stories was gathered from groups and key informants. The perceptions of individual respondents were analysed quantitatively based on percentage frequencies of collection, farm and off-farm activities. The general socio-demographic profile of respondents that could influence the participation in income generating activities was also measured. Characteristics such as age, gender, ethnicity, marital status, educational level among others were measured.

2. Measuring opportunity cost of labour

The opportunity cost of labour (OC_L) for the target population at the time of year when Allanblackia is harvested is measured as the residual income for labour from all alternative income generating activities. It is given as:

$$OC_L = \frac{\text{total value of product - Cost of all factors (except labour)}}{\text{Labour hours}} \qquad 2.1$$

The unit value per hour calculated was ranked. The opportunity cost of Allanblackia collection is the next best alternative activity in terms of returns to labour.

3. Estimation of farm-level investment

In general the issue of whether a new product or process (innovation) such as AB domestication would receive the needed attention by cocoa farmers would be closely linked to producer and factor prices as well as the potential of land use. In this study, first, the following assumptions were made based on the cocoa farming system in sample communities:

- there is a land market although free land may exist as well
- there is a labour market although un paid for labour may exist as well
- there is a capital market (input dealers in seedlings, agrochemicals, equipments and protective clothing); these may also be supplied freely by interest groups such as Unilever.
- Returns are sensitive to increases in product prices

- Returns are sensitive to increases in land rent, seedling cost and wages.

The estimation of the Allanblackia was compared with that of cocoa only. Cola and "Abesebuo" are another well-known tree crops in the Western Region. However, their domestication has not been integrated in the farming systems of the communities visited. All factor costs were imputed with **cocoa** input prices. A 10 percent inflation rate (average for Ghana in recent times) was also assumed. The estimation procedure considered a 20-year return on operating cost per hectare (suggested by IUCN); cash flows (established from focus group discussion), net present value (NPV) and financial internal rate of return were calculated. Secondly, a contract type farming system for AB was assumed. Here no variable costs were considered for farmers since as explained (by Harrie Hendrickx – Unilever, Netherlands), the Buyer of nuts would bear all working capital challenges[1].

Finally, an attempt was made to model the factors affecting the willingness to participate in Allanblackia domestication (investment). Based on the assumption of rationality and considering the general microeconomic thinking that, apart from personal characteristics, peoples' choices are dependent on some unique characteristics of the commodity in question (Gujarati, 1992); logit estimation[2] was carried out using the E-views soft ware. However, since a large proportion of the sample were prepared to invest, the regression produced results that suggested that the variables were almost full rank and variation among willing and unwilling respondents was statistically insignificant. Hence, the simple descriptive statistics (cross-tabulations) of willing and unwilling respondents were compared.

4. Evaluation of potential synergies between crops

The analysis of synergies considered crop mixes such as follows: Collection of Allanblackia + cocoa; Allanblackia + cocoa + cola; Allanblakia + cocoa + "Atooto"; Allanblakia + cocoa + "Abesebuo" and Allanblakia + cocoa + "Abesebuo" + "Atooto". The gross margin per annum (2006) was calculated for each combination. These mixes were selected based on initial evaluations of the role of trees in the household livelihood strategy of communities and sample data analysis. Then a seasonal calendar for the community and households operating multiple enterprises were drawn to understand the planning and operation of activities (See Box 2).
In the analysis of synergies the whole farm profit was calculated. Hence,

$$WFP = \sum GM_i - CC \qquad 2.2$$

$$\sum GM_i = (R_1 - VC_{1)} + (R_2 - VC_1) +) \text{ R3-}VC_3) \ldots\ldots + (R_n - VC_n) \qquad 2.3$$

[1] See Annex 2.1 for full explanation of assumptions made based on perceptions during focus group discussions in survey area and on suggestions by Harrie Hendrickx (of Unilever Holland).

[2] See Annex 2.2 for variables included in the logit model.

Where:
WFP = Whole farm profit
GM = Gross Margin
R = revenue, given as sales
VC = variable costs, recurrent costs due to specific activities
CC = common cost, fixed costs and others incurred for all activities

The marginal rate of return (MRR) is another simple measure for making conclusions concerning the viability of adding one enterprise (say AB) onto an initial enterprise. It is given as:

$$MRR = Y/C \qquad 2.4$$

Where:
Y = net return
C = additional cost

The initial enterprise here refers to cocoa. The formula suggests that, if there are no new costs due to the new enterprise (as pertains with NTFP collection and processes), then this method cannot be employed. Indeed, the sample data and focus group discussions for the current study suggested that most materials and labourers employed during NTFP processing are already attributed to cocoa. Thus there were no additional costs due to NTFP collection and processing. MRR could not be evaluated. Costs of farm household activities were treated as common to cocoa and NTFP and the gross margin analysis carried out as the only measure.
The direct and indirect impacts of the synergies on the immediate and surrounding environment were also assessed. Indicators for assessing the physical environment included perception of bio diversity, rain cycle and vegetative cover. Indicators for assessing the rural economic environment included perception of employment generation, changes in food crop prices, availability of input markets, transfer payments (remittances, etc.) and taxation.

Box 2: Impression of seasonal calendar of survey areas for the AB study

Activity	*J*	*F*	*M*	*A*	*M*	*J*	*JU*	*AU*	*S*	*O*	*N*	*D*
Land preparation	*X*	*X*	*X*									
Planting -food crops and cocoa				*X*	*X*	*X*	*X*					
Weed management				*X*	*X*	*X*	*X*	*X*	*X*			
Disease and insect management				*X*	*X*	*X*	*X*	*X*	*X*			
NTFP Collection	*X*	*X*								*X*	*X*	*X*
Harvesting of food crops							*X*	*X*	*X*	*X*	*X*	
Harvesting of cocoa					*X*	*X*	*X*		*X*	*X*	*X*	*X*
Post harvest cocoa processing activities				*X*	*X*	*X*			*X*	*X*	*X*	*X*
Post – harvest food processing activities	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*

2.3 Method of Data Collection

There are six regions with forest cover in Ghana. There was thus the possibility of studying all of them; in that way any differences that call for special attention would be identified. However, a case study approach was adopted due to logistical and time constraints. One region, the Western region, in the forest zone of Ghana was selected. Mainly primary data were collected. Other information reviewed from literature was on role of local government agencies in rural livelihoods development (Mensah, 2007), and previous works on Allanblackia in Ghana (Tissare *et al*, 2007; Amanor, 2006 and Opoku, 2006). The primary data was collected from key informants and sample surveys.

The key informant interview

The key informants in this study were categorized into two: Governmental and non-governmental organisations. The functions of these organizations included activities that ensured that livelihoods in rural economies were sustained. The governmental ones were identified as: Ministry of Local Government, Rural Development and Environment (MLGRE), Ministry of Food and Agriculture (MoFA), Ministry of Lands, Forestry and Mines (MLFM), Ministry of Education, Science and Sports (MESS)). These ministries have decentralized departments at the district level. Representatives of MoFA (Agricultural Development Unit) and MLFM (Forestry Commission) were consulted at

the district level. Information on MLGRE was obtained from literature and validated at the national level. The officer-in-charge of the Allanblackia research at the Forestry Research Institute of Ghana was also interviewed.

The non-governmental organizations and individuals included Chiefs and Elders, District Assembly representatives (known as Assembly man), Chief farmers, women's groups, youth groups and representatives of the AB buyers and cocoa Licensed Buying Companies (LBCs).

The sample survey

Selection of communities and respondents:

The sample selected for this study was based on the rural rapid appraisal approach. Five communities in the Western Region were sampled based on previous works done in the area by the Forestry Research Institute of Ghana and World Conservation Union (IUCN). Two of the communities Pataho in the Wassa West District and Sefwi Mmerewa in the Bibiani-Ahwiaso-Bekwai District were purposively selected with the help of Technoserve and IUCN, Ghana. Apart from the Kroboase community, the rest of the communities selected were just neighbouring communities (Nkronua and Maase) that were visited for key informant interviews. Kroboase was selected due to its closeness to Pataho; it also has a buying agent (Banabas Obeng) for Allanblackia purchases. A total sample of 52 male and 51 female respondents were selected in all three communities (see table 2.1). Selection was based on simple random sampling of those who were available at the time of visit and were willing to participate in the interview.

*Interview procedure***:**

The key informant interviews were organised as individual as well as focused group discussions. The governmental representatives were interviewed one-on-one. The community key informants were interviewed as groups. Each focus group consisted of an average of 10 people – males and females. An interview guide aided questioning. The individuals selected for the sample survey were also interviewed face-to-face; the interview was aided by a semi-structured questionnaire. Both instruments included questions that profiled the people and their livelihood strategies in terms of agriculture systems, tree crop cultivation, forest products collection and willingness to domesticate Allanblackia (see Annex 2.2 and 2.3 for samples of interview guide and structured questionnaire).

Table 2.1: Allanblackia study survey area and number of respondents

District	Community	Number of respondents			Nature of survey
		Male	Female	Total	
Wassa West	Pataho	13	13	26	Sample survey Focus group discussion
	Kroboase	13	12	25	Sample survey
Bebiani-Anwhiaso-Bekwai	Sefwi-Mmerewa	26	26	52	Sample survey
	Maase				Key informant interview
	Nkronua				Focus group discussion
Total sample		52	51	103	

Source: Survey data, July, 2007

3. RESULTS AND DISCUSSION

3.1. Socio-economic Background of Respondents

The socio-economic factors that were likely to affect the entrepreneurial abilities or income generating capacities of respondents include gender, age, origin (ethnicity), marital status, family size, availability of income generating activity (occupation) and wealth status.

Gender and Age

The results of the study show that there were as many male (52) as female (51) respondents with ages ranging between 20 years and 60 years. It appears that there were older males than females although the only child respondent was a male (Table 3.1).

Table 3.1: Age distribution of respondents

Characteristics	**Male**		**Female**		**All**	
Age range	Frequency	percent	Frequency	percent	Frequency	percent
At most 20 years	3	5.8	3	5.9	6	5.8
21-30 years	12	23.1	15	29.4	27	26.2
31-40 years	10	19.2	13	25.5	23	22.3
41-50 years	14	26.9	9	17.6	23	22.3
51-60 years	7	13.5	10	19.6	17	16.5
Above 61 years	6	11.5	1	2.0	7	6.8
Total	52	100	51	100	103	100.0
Age statistics			Male		Female	
Mean age			40.9038		37.5294	
Maximum age			73.00		65.00	
Minimum age			15.00		17.00	
Mode			32.00		35.00	

Origin, marital status and size of household

Most of the respondents were not indigenes; many have migrated from all parts of the country to engage in cocoa production. However, there appear to be more Akans and Southners than non-Akans and Northerners[3]. The inhabitants of Mmerewa who claim to be indigenes are originally from a village close by in the Ashanti region. From the group

[3] See Annex 3.1 for list of respondents' origins specified

discussions it became obvious that they migrated to the area about four generations ago. Thus whiles some call themselves Asantes, others just refer to themselves as "Mmerewafour". However, since

> "*we all obtained ownership of our land from the Government Forestry people, there is no discrimination by origin… if you were in this community when the forest was opened in the 1980's you would be given some land once you were an adult, male or female*".

Most of the respondents were married (Table 3.2) and had a family size of 5 or more although many of the family members have migrated to other cities to pursue further education or other occupation. The range was between 3 and 8. Some were adults who worked with their parents or had their own farms.

Table 3.2: Marital status of respondents

Community	**Marital status**	**Sex**		**Percent**
		Female	**Male**	
Pataho	married	13	13	100
Kroboase	married	10	9	76
	single	1	4	20
	widow/widower	1	0	4
	Total	12	13	100
Sefwi Mmerewa	married	18	17	67.3
	single	5	8	25
	divorced	2	0	3.85
	widow/widower	1	1	3.85
	Total	26	26	100

Wealth status

The wealth status of the respondents was not unexpected. Most households were above the poverty line in that all heads of households, spouses and working family members earned more than 5 million per annum from sale of cocoa; food crop and the occasional artisan works (see Table 3.3). We may say that family income is on average US$ 1000 per family. This means about US$ 330 per adult, assuming a family contains man, wife and one grown-up kid that helps on the farm.

Income generating activities

The major occupation of the respondents was farming. Those who specified other occupation were either teachers or self-employed artisans or temporary workers with

government institutions (forestry research assistants and cocoa mass sprayers) (Table 3.4). The indication from focus group discussion was that the level of formal education of the adults was low. Only few people in the communities were holders of secondary and tertiary level certificate. Many (over 50% have up to 10 years of schooling). There is little wonder that farming, dependent on manual effort rather than high level entrepreneurship, is the only option for most people in the communities visited.

Table 3.3: Income of respondents in 2006

Elements	**Amount (¢'000)**
Mean	10,520.00
Maximum	53,175.00
Minimum	0.00
S. Deviation	122.95

Table 3.4: Major occupation of respondents

Community	**Occupation**	**Frequency**	**Percent**
Pataho	farming	21	84.0
	trading	3	12.0
	electrician	1	4.0
	Total	**25**	**100.0**
Kroboase	farming	18	72.0
	trading	1	4.0
	seamstress	1	4.0
	student	2	8.0
	teaching	1	4.0
	hairdresser	1	4.0
	bicycle repairing	1	4.0
	Total	**25**	**100.0**
Sefwi Mmerewa	farming	44	84.6
	trading	1	1.9
	seamstress	1	1.9
	teaching	1	1.9
	hairdresser	2	4.00
	forestry research assistant	1	1.9
	mass spraying	1	1.9
	food seller	1	1.9
	Total	**52**	**100.0**

A few (44%) households make occasional sales from forest products collection. However, most respondents claimed that:

> "*the expenditure centers are a lot so we end up not being able to accumulate capital and build assets…we cannot contribute much to community development…look at this village, what is there to show…yes we have a clinic and primary school but we cannot maintain our road and we are struggling to make electricity a phenomenon…" (Collaborated by Chief, Sefwhi Mmerewa).*

The communities visited perceived that poor households were those that have small sizes of cocoa farms, no more food cropland, have many children and elderly adults with nobody in urban areas to remit them. However, none of the respondents could show one of such households. The reason was that:

> *"…most of us migrated here because of cocoa farming so one cannot say he or she was landless…the poverty may be seasonal; in some years crop fail and those non-remitting households cannot feed well three times a day as expected. Otherwise, when the cocoa season all households were here sold not less than 10 bags. This means that this year the poorest household obtained about 6 million in terms of gross revenue (Kwesi Mathew, AB Buying Agent, Pataho).*

3.2. Factors of Price Setting

The major factors of price setting are nature of income generating activities and opportunity cost of labour. We have noted that over 80 percent of the sample was engaged mainly with farming as the major source of income. From the focus group discussions it was also established that,

> "*We are here because of cocoa farming, thus every household has a cocoa farm and other cash and food crop farms…even teachers and drivers have something small....*" *(Chief of Mmerewa).*

This suggests that the opportunity cost of labour for Allanblackia would be limited to mainly farming activities and less of non-farm activities.

The farming system

The system of farming in the communities visited was similar. They were based mainly on crop production and agricultural commerce and to a less extent livestock keeping. The crop production system was concentrated on both cash and food crops. The major cash crops included cocoa, vegetables (tomatoes and pepper), oil palm and citrus. The food crops included maize, cassava, cocoyam, yam and plantain. The latter is planned

mainly for the home although a larger proportion of all cocoyam and plantain are sold on the market.

Cropping system

The cropping system is such that new land for cocoa, oil palm and citrus are also intercropped with selected food crops. Crop rotation is hardly practiced. Land rotation is what is common for food crop production. Such solely demarcated food croplands are left fallow for two or three years after five years of cultivation as virgin land. This could mean that the investment costs of developing a small plantation / intercropping system can be reduced to a very low level.

Many households have more than 5 hectares of land available. However due to the low investment in labour saving equipments and the high cost of hired labour, less than one-half the size of land available is put under cultivation each season. Yet some have argued that tree crops are very useful in situations where land is available and working power is scarce (Hendrickx, 2007). Indeed, the mean farm size under cocoa (a tree crop) was larger than all other crops (Table 3.5). This is because 1) Most cocoa farms might have been established by one generation and only maintained by another, 2) some cocoa farms are under sharecropping arrangements; the tenants hire casual and permanent labourers to establish the farms and it is divided into two after the cocoa starts bearing pods. This system is known as "abunu". 3.) There is also "abusa", where cocoa farmers pose as land lords who hire care takers to look after their farms and depending on whether they (land lords) pay for inputs or not they receive two-thirds or one-third of proceeds after sale respectively.

Table 3.5: Land use for cropping (Ha)

Elements	**Mean**	**Minimum**	**Maximum**	**Standard deviation**
Amount available	4	0.2	20	3.5
Amount used	3.2	0.2	16	2.7
Mean : Cocoa[4] Food crops Oil palm Rubber	 3.2 0.4 0.8 0.8			

The land sizes of food crop range between 0.4 ha and 0.8 ha. Those households that cultivate more than 0.4 hectare (one acre) of food crop perceive the crops as cash crops. They hire labour, use weedicides and look for buyers outside of the rural community for quick disposal. They may borrow cash from the rural banks to facilitate marketing. In the focus group discussion a group in Mmerewa known as Food Traders Association had

[4] Mode estimation from Focused group discussion

received a facility from the Sefwiman Rural Bank. Such farmers and traders who have opportunity to receive credit also purchase protective clothing like Wellington boots, long sleeve shirts and hats and equipment such as spraying machines, pesticides and fertilizers. Indeed, there is a government-led mass spraying of cocoa farms; this has led to the adoption of fertilizer and weedicide application by many cocoa farmers in the communities visited. In general, although the land sizes are small they are not adequately managed resulting in lower than expected yields (see Table 3.6).

We note that cocoa production is fairly inefficient. Farmers only get 25% of the capacity of the land and the trees. Some observers believe that "this is probably due to the work that has to be invested in cocoa, which is considerable, and dependent on manual labour force; others also say that the non-sustainable nature of cocoa farming account for lack of commitment to maintenance of farms. Most farms will have old trees on depleted land. Improved farming methods and more education may make some difference, but it could well be that more drastic measures are required to come to full productivity. The 1,200 kg of cocoa earns a farmer some ¢11,250,000.00.

> *"A farmer may have used 17days (136 hours) to complete this task and spent about ¢8,750,000.00 on variable inputs such as hired labour for weeding, and fertilizer and pesticides" (Kwesi Mathew, AB Buying Agent, Pataho).*

Table 3.6: Output per hectare of selected crops[5]

Crop	Amount estimated during survey (farmers' measure)	Mean amount estimated by Researcher conversion (Kilo)	Expected yield By Experts (Kg)
Cocoa (1 bag = 64 kg)	12.5-24 cocoa bags	1,200	5,000
Maize (1 bag = 100kg)	30 bags	1,500	2,500
Plantain	2500 bunches	2500 bunches	3,750 (bunches)
Cassava	187.5 bags	9,375	17,500
Cocoyam	625 bags	31,250	37,500
Tomatoes	1563 boxes	8,125	15,000

Livestock keeping

Livestock keeping is another production system but it is not well developed. All the households keep local fowls. Fewer households keep sheep and goats. There was no evidence of cattle; the new domesticated animal (known as grasscutter) is a growing phenomenon in Pataho. There were groups in Pataho that raise broilers once in a year; others keep pigs.

[5] The estimates were made during focus group discussions in Mmerewa

The role of trees

Trees are a major source of livelihood in both forest and savanna zones in Ghana. Indeed, many of the respondents in the focus group discussions agreed that forest management involves the harvesting of trees and related plant and animal populations in ways that perpetuate the forest ecosystem. Forest products such as fuel wood, fodder, and building materials (timber and thatch) are important inputs in the agriculture and domestic economies of the communities visited. Majority of the households depended on forest trees to meet some part of their nutritional, health, house construction, and other farming needs. There are those who generate income from selling dead portions of trees (fuel wood) collected from the wild. All cocoa farmers leave trees (known as "desired trees") to serve as shade for cocoa stands. Trees such as cola (c*ola ntida*) are left in farms to serve the nut needs of households who have expertise in processing the nuts for sale. Allanblackia has been left in farms to serve as shade trees for cocoa as well as bait for rodents. The rodents are hunted for their meat. The AB nuts were also processed into oils and mixed with kernel oil for home consumption. Many of the respondents said that,

> "*Our fathers used to be hunters as well, so few 'sonkyi' trees are left on the farm to serve as bait for rodents such as "kusi" (giant rats) and "mpese" (bush-tailed porcupines and squirrels). When many are left they attract too many rodents that tend to destroy our cocoa farms. That is why we now can boast of only about 30 trees in farms belonging to members in this community…. The rest of the trees are all in the larger forest reserve so we need permission to create paths or weed around these trees in order to have daily access to fruits and nuts*".

No wonder the results of the sample survey showed that although about 96 percent of the respondents were aware of the importance of Allanblackia only 45 percent had ever collected and processed AB before. Of the collectors only 56 percent sold nuts in 2006 (Table 3.7).

Majority of the respondents knew of the new uses of AB after year 2003, "*when much education was carried by the "Sonkyi" people from Tarkwa, Takoradi and Accra*". In Pataho about 46 percent of respondents claimed they were aware of "Sonkyi's" oil properties before 2003. In Kroboase only 16 percent were aware and in Mmerewa only 15 percent were aware then. The participation of households in AB collection is low. Indeed, the concept is still at its development stage and many say "the return to labour is low…the average person may spend 8 hours to collect and prepare for drying 10 kilos of "Sonkyi" nuts only to receive ¢15,000 for all the effort.

The actual expenses for most households are zero since no hired labour is employed, containers used are recycled from cocoa activities, drying mats are those for cocoa and there is no transportation (haulage) cost. The opportunity cost of the labour is leisure of farmer, containers may have reduced life and drying mat may deteriorate fast and be replaced at a cost.

There are other plants (shrubs, short trees and climbers) such as "Atooto", "Abesebuo" (*Irvingia gabonensis*), "Abako" (*Tieghemella heckeli*), Mfia (*Eremosphatha sp.*) and "Nsokor" (*Garcinia epunctata* that serve as sources of complementary income for some households. "Atooto" is sold to long distance traders who are known to export the product to Nigeria and other countries in the West African sub-region. Mfia is a cane product that is used to make baskets for sale to both local users and long distance traders. "Nsokor" is sold to long distance traders who in turn sell it to urban processors to be turned (cut) into chewable sticks for sale in the urban centers.

Table 3.7: Role of trees in study area

Elements of role of trees	**Frequency**	**Percent**
Level of awareness of Allanblackia		
Pataho (n=26)	26	100
Koase (n=25)	25	100
Mmerewa (n=52)	48	92
Mean AB trees on farms		
Pataho	4	
Kroboase	6	
Mmerewa	3	
Number of AB collectors in 2006		
Pataho	14	54
Kroboase	15	60
Mmerewa	16	31
Total responses	45	56
Other NTFP (no. of responses)		
Abesebuo	14	13.5
Atooto	17	16.5
Wisa	2	2.0
Cola	1	1.0
Awidiaba	3	3.0
Mushroom	2	2.0
Snail	9	8.5
Other tree crops		
Cocoa	81	77
Oil palm	1	1
Oil palm and cocoa	1	1
Rubber	1	1
Non-tree crops	19	16

Since very large numbers of households generate some of their income from selling forest products the need to adopt strategies such that the forest and her products can be harvested on a sustainable basis become crucial. If forest resources are managed properly, both the quantity and quality of soil and water will also be maintained. The non-tree products such as snails and mushrooms would also be sustained.

The marketing system

Marketing of agricultural produce involves all the business activities that move foodstuffs, livestock, cocoa and NTFP from the farm gate to final consumption centers. This implies that there is a system of organization of human and material resources that facilitate the exchange process. The organization may be formal (institutions) or informal. Both types of Organisation involve governmental and non-governmental institutions. The effective functioning of these institutions is an important determinant of an efficient marketing system. Another important determinant of marketing efficiency is the nature of commodities. Where products are highly perishable and seasonally produced, value addition activities affects their pricing. Both available institutions and nature of produce affect the channel of distribution and final destination of produce.

The marketing of agricultural produce in the study area concerns cocoa, food crops, NTFP, other crops and livestock.

Food crop marketing

Food crop marketing is not institutionalized. Communities and individual households determine the form in which produce would be sold, where to sell, when to sell and at what price. Most food crops are sold in their raw state so they are harvested a few days before the major market day. There is a special day in a week when one major community, termed the market centre, provides space with facilities, for display and exchange of goods. The general indication is that:

> "*Our market day is on Wednesday….so Mondays and Tuesdays are busy days for harvesting of food crops. Crops such as cocoyam, cassava, plantain, maize, yam, cowpeas, vegetables, citrus, taro and anything that will sell on the market is harvested and carted by head loads to the market or nearest spot on the major road for sale…. During the peak season for food crops (August/September), individuals (called customers, well known to us request for harvesting of whole plots of cassava, plantain or tomatoes. Such requests usually mean credit sales; payments are made within a week or two and we oblige because during planting season such customers can also lend cash without interest*".

Due to high perishability of food crops, the market appears to be a buyers' one. There is bargaining; yet farmers claim the buyers always win. Therefore farmers perceive traders

as cheats. However, interaction with traders suggest that the marketing cost is high with more than 70 percent of the margin contributing to covering transportation and labour costs.

> "*…look at this bad road of theirs, which good vehicle would like to ply it…only trucks come here once in a week and they may break down often due to lack of maintenance and poor condition of roads…besides fuel costs is high, the produce is bulky and those loading boys charge high fees…*" (Lamentations of Auntie Mansa, a long distance wholesaler in Pataho)

Farmers in the study area add value to a few of the food crops produced. Many (estimated at 60%) households process palm oil (from oil palm) and gari (from cassava) and occasionally pepper (dried). These are targeted at long-distance wholesalers who visit during market days.

Cocoa marketing

Cocoa marketing is highly institutionalized. Each community has a Buying Agent representing a Licensed Produce Buying Company. The farmers know that,

> *"We have to prepare cocoa beans in a way that allows the agent to pay for the government approved price per kilogram. Since October 2006, the price we receive is about ¢9,000/kg.* ***Although it does not merit the work effort and money spent in maintaining cocoa farms we believe it is okay****. …We pay for transportation (head loading or vehicle hire) to the nearest agent because we dry the bulk of cocoa on the farm. However, payment after sales is also cumbersome at times. One may not be given cash if sales volume exceeds 50 kilogrammes. That is where dealing with the banks becomes uncomfortable. Nevertheless, monies are paid and one can sell cocoa any time, although there is a main crop season and light crop season. The main crop begins in October and the light in June of every year.*

Marketing of non-timber forest products

NTFP marketing is partly institutionalized and partly informal. The Allanblackia market in Pataho and Kroboase is institutionalized. There is no market for the product in Mmerewa. Sensitisation programmes in Mmerewa stopped short of identifying a focal person for the biological/chemical experimentation being carried out by FORIG.

> "*…I was selected to count all "Sonkyi" trees currently in the farms and forest close by. About 110 trees were identified; about 40 were females, 5 unknown and the rest were males. The males would only flower without bearing fruits. We also took data on fruit size and colouration…I was also told to buy the dried nuts from individuals. In 2006 I purchased 100 Kg; the "Sonkyi" people did not pay for the 30 kg purchased in 2007 so I stopped all purchases. Since no payments were made there is no interest now concerning collection of "sonkyi" for sale…."*

In Pataho and Kroboase there are buying agents (Kwesi Mathew and Barabas Obeng); they receive volumes offered by individuals, carry out some promotional activities (largely public relations) and make spot payments on occasion. The general indication was that everybody in these communities was aware of the unit price and changes over time. This is because there is a billboard that displays the current price, period of sale (December-April) and the names of partners of the Novella Project. Almost all the respondents confirmed that in Pataho and Kroboase the sale of "Sonkyi' lasts till April although those who have stocks can still sell after this period.

> *"…this year the price of dried AB nuts was fixed at ¢1,500.00 and I purchased about 600 Kg of the dried nuts and 1500 fresh fruits (at ¢500 each)…the fresh fruits were sent to FORIG for experiment…About 60 people sold to me; the minimum of AB nuts any individual sold was 10 kg and the maximum was 60 kg per period…. The sales appear to be decreasing. In 2005 when I started purchasing I bought 1200 at ¢1,000.00/Kg. At the same unit price, in 2006 purchases dropped to 950 kg….this years' drop in dried nuts purchases is due to purchases of fresh fruits…..Mainly women and children make sales…children from the neighboring villages carry one or two kg to sell each day on their way to school…child collectors are not permitted; they do it on behalf of their parents* (Kwesi Matthew, Buying Agent Pataho)

All other NTFP are sold to buyers who visit during market days. The price per unit is not fixed; it is determined by demand and supply factors.

> *"When collection peaks around November-December, cola could sell at ¢25,000.00 per 34 size bucket [20 kg]; the price could rise to ¢80,000 as number of sellers reduce….The unit prices of "Atooto", "Abesebuo", "Ayiduaba" is even higher".*

Indeed among the NTFPs evaluated income from Allanblackia in 2006 ranked third behind "Atooto" and "Abesebuo" (Table 3.8).

Table 3.8: Total income from NTFP from all respondents in survey area in 2006 ('000)

Source	Amount	Rank
Allanblackia	1,589.50	3
Abesebuo	12,940.00	2
Atooto	29,360.00	1
Wisa	350.00	6
Cola	400.00	5
Yediaba	1,240.00	4
Whintia	60.00	7
Mushroom	0.00	
Snail	0.00	

Opportunity cost of labour

The opportunity cost of Allanblackia labour (OC_L) for the target population at the time of year when Allanblackia is harvested is measured as the residual income from labour. It is given as

$$OC_L = \frac{\text{total value of product}}{\text{Labour hours}} - \text{Cost of all factors (except labour)}$$

Currently collectors do not pay for labour services. Children, spouses and other family (including caretakers of cocoa farms) may assist in collection, processing, drying and selling (Annex 3.2). However, all those who assist benefit from sale directly or indirectly. Results of FGD suggest that sometime children are made to keep what they sell for lunch or snacks during school break hours. During the period all utensils and drying materials (mats or sheets) used are not purposively purchased for the operation. Mats are usually purchased for cocoa and pans for processing of palm fruits or palm kernel (Figure 3.1). It appears that Collectors use their leisure period for processing. In deed, in Kroboase the buying agent had this to say:

> *"….since the season for "Sonkyi" begins when the main cocoa season is tapering off, Collectors and family use their leisure period to complete operations…during the peak AB season it is possible to collect and process 40 pods in a day. The pods fall off by themselves, so if one has about three trees on the farm the 40 pods would be collected and assembled within one hour. Just like cocoa one need to break the pods, scoop the nuts out, and remove all unwanted materials before placing on the mats for drying. Each pod requires about 10 minutes for processing…unlike cocoa, "sonkyi" does not require fermentation although some people may hold wet nuts in a bowl for a few days before drying. This is done just to accumulate enough for drying. Drying takes between 4 and 7 days and any body can help, children and adults alike…However, without assistance one may spend a maximum of 1 hour a day on drying…AB collection and processing is a very physically demanding operation; thus one may repeat processing every other day or two times a week. Each pod could produce one half of a kilogram; it means that one could process about 40 kg a week, spending about 15 hours…* (Barabas Obeng, Buying Agent, Kroboase)

All the sampled respondents identified with the story. Hence assuming that 40 kg could be processed and sold each week, the residual income would be given as:

$$OC_{LAB} = \frac{(40 \times 1{,}500) - 0}{15 \text{ hours}}$$

$$= 60{,}000/15$$

$$= ¢4{,}000/\text{hr}$$
$$= \text{GH}¢0.40/\text{hr}$$

With "Atooto", the season is said to coincide with the main cocoa season, October to December. Like AB, Collectors and family use their leisure period to complete operations. About 7 hours can be spent on the processing of 2 kg. The plant is a climber with beanlike seeds; one has to remove the plants from its mother trees carefully, dry and crack with a heavy stick before obtaining seeds. Drying takes about 5 days; one may spend a maximum of 1 hour a day on drying. The pods are small and require about 5 minutes for processing. The physically demanding nature of operations allows just 2 kilograms a week to be processed. A kilo could sell for as high as ¢70,000.00 and as low as ¢50,000.00 (as explained by Wofa Baffour Agyemang, Focal Agent Mmerewa). Hence,

$$OC_{LAT} = \frac{(2 \times 50{,}000) - 0}{7 \text{ hours}}$$

$$= 100{,}000/7$$
$$= ¢14{,}285.71$$
$$= GH¢1.43$$

For Abesebuo (*Irvingia gabonensis*), each kilo sold for ¢2000. Agya Baffour Acheampong (Focal Agent, Mmerewa), says one could process[6] 50 kg per week (7 days). One could use 7 hours a day to process about 7 kg. Hence,

$$OC_{LAS} = \frac{(50 \times 2000) - 0}{7}$$

$$= 100{,}000/7$$
$$= ¢14{,}285/hr$$
$$= GH¢1.43$$

Box 3: Processing of Irvingia gabonensis (Abesebuo)

"…Fruit harvesting has to be undertaken at the optimum time to prevent the harvest of immature fruits. The extraction of the kernels entails the fruits being split open using machetes (when the fruits are fresh) or with truncheons or hard stones when they are dry or fermented fruits. The seed shell splits open through the longitudinal line of weakness, exposing the kernels wrapped in a dark brown testa. Extracted kernels are further dried for storage or for direct sale in units of 5, 10 or 25 kg sacks on the wholesale market. Methods of extraction have been reported to differ between countries. The kernels of Irvingia in South West Nigeria are usually extracted in the fresh state, then dried before storage and sale, whereas dry stage extraction, which requires very little additional

[6] see box 3 for description documented by FAO

drying, is the preferred means of extraction practiced in Cameroon.

Drying of kernels is very important. Without this, stored kernels become discoloured and prone to fungal attack and this is a major determinant of quality. Post-harvest attack by insect pests can seriously affect products' market acceptability. Ashiru (1997) has isolated and described the insect pest responsible for the damage to Irvingia kernels in storage. Aside from pest and disease susceptibility there are also many environmental factors which can affect the rate of quality decline in ogbono. High humidity and also high temperature decreases colour quality as whitish cream kernels turn brownish or dark tan…."

Source: FOA Repository, 2007

For cola, the only person who had current data claimed that she received ¢40,000 for an equivalent of 20 kg bag in December, 2006. It took her about 6 hours to process and obtain the quantity for sale. This story on 'hours needed to process 20 kg' was collaborated by others who had tried it in earlier years. Hence:

$$OC_{LC} = \frac{(20 \times 2{,}000) - 0}{6}$$

$$= 40{,}000/6$$

$$= ¢6{,}600/hr$$

$$= GH¢0.66$$

The results of the study shows that the opportunity cost of labour for Allanblackia could be high (Table 3.9). Among the four products, Allanblackia gives the least return per hour. However, the general contention was that these commodities could complement each other. The peak for each of the commodities tends to overlap and there are only a few wild NTFP trees available on individual farms.

Table 3.9: Ranking of residual income of labour for selected NTFP

NTFP	Amount (GH¢/hr)	Rank
"Atooto"	1.43	1
"Abesebuo"	1.43	1
Cola	0.66	3
Allanblackia	0.40	4

The bulk of NTFP is in the forest reserve section of the communities. During focus group discussions in all the communities it was agreed that,

> *" …where the price of NTFP is perceived 'reasonable', one may engage in all, using leisure periods after cocoa work…..in fact we can even hire labour to assist in assembling and processing NTFP as we do for cocoa….then we can share the proceeds with labourers based on abunu (1:1) or abusa (1:2)".*

We note that there is the volume problem. The NTFPs, others than AB may give good revenue per working hour, due to low supply. It means that by increasing the amount of AB on the farm, there is a potential to go from the current level of GH¢0.40 up to a higher level.

3.3. Farm-level AB Investments and Willingness to Invest

Farm level AB investment

The issue of whether Allanblackia domestication would receive the needed attention by the farmers studied appears to be closely linked to producer and factor prices as well as the potential access to land. The results of nine scenarios of financial IRR and NPV evaluation suggested that Allanblackia domestication would be as profitable as cocoa production (Table 3.10). Even the worst case scenario (8) that could occur is viable: the price per unit of Allanblackia remains at ¢1,500 in year 0, increases by 10% (to ¢1,650.00) in the first year (2008), and subsequent years; cost of seedlings and other materials, cost of land, labour and capital (at 19%) are all evaluated at private market prices. Here the net present value (NPV) by year 20 and at 19% discount rate is ¢675 million and the financial IRR is 60 percent. This means that the 19 percent cost of capital profit would be about ¢675 million in real terms. The average net internal income generating capacity of the project is estimated to be 60 percent which implies at a cost of capital of 60% interest rate the project will break even. The contract farming system of Unilever (Scenario 9) is also worthy (at 5% discount rate); the NPV and IRR are estimated as ¢317 million and 103% respectively[7].

[7] See Annex 3.3 and 3.4 for cash flow of scenario 8 and 9 and Excel file for all others.

Table 3.10: Analysis of worthiness of investments in Allanblackia and cocoa

Scenario	Description[8]	NPV (¢'000,000)	IRR (%)	Remark
1	Unit price = 1650; seedling cost =1,500; all costs including land rent	929	74	Viable (subsidy; buyer price)
2	Unit price = 5000; seedling cost= 2,250; all cost except land rent	2,890	150	Viable (no rent + some subsidy; demand side modal price)
3	Unit price = 5000; seedling cost = 2,250; all costs, including land rent	2,904	104	Viable (some subsidy; demand side modal price)
4	Unit price = 5000; seedling cost = 15,000; all cost including land rent	2,892	94	Viable (private cost; demand side modal price)
5	Unit price = 3000; seedling cost =15,000; all cost including land rent	1,712	80	Viable (private cost; demand-side minimum price)
6	Unit price = 5000; seedling cost = 1,500; all cost including land rent	2,905	105	Viable (subsidy; demand side modal price)
7	Unit price = 3000; seedling cost =1,500; all cost including land rent	1,725	89	Viable (subsidy; demand-side minimum price)
8	Unit price =1650; seedling cost = 15,000; all costs including land rent	675	60	Viable (private costs; buyer price)
9	Unit price = 2000; No other costs except land rent	317	103	Viable (Contract farming suggested by Unilever Netherlands)
Cocoa				
1	Unit price = 9,200; seedling cost = 1,500; all cost including land rent	5,931	130	Viable (land rent, seed subsidy; buyer producer price)
2	Unit price = 9,200; seedling cost = 1,500; all cost except land rent	5,951	191	Viable (no land rent, seed subsidy; buyer producer price)

[8] see Table 3.11 for sample statistics on respondents' perception of reasonable AB price/Kg.

Table 3.11: Perception of reasonable price of AB nuts by respondents

Statistic	Amount (GH¢)/kg	Amount (¢)/kg
Mean	0.52	5,200
Mode	0.50	5,000
Std. Deviation	0.15	1,500
Minimum	0.30	3,000
Maximum	1.00	10,000

Indeed, since farmers did not know of the Unilever possibility at the time of survey, the scenario farmers called for was scenario 2. Here, farmers would receive AB price per kilogram of ¢5,000.00, land would be free, seedling would be at most ¢2,250.00 (50% higher than cocoa seedling sold by government seed centers) and farmers would be made to bear the cost of all variable inputs (including Wellington boots, and fertilizers and pesticides and labour for land preparation and farm maintenance).

Investments in cocoa, given all two scenarios, appear to be a worthier alternative. Further observations by research team and analysis of sample data show that farmers' interest in Allanblackia would also be enhanced if protective clothing, credit and other farm inputs (machetes, etc.) are supplied at no or low cost.

However, an assessment of perception of constraints showed that all Collectors (to be farmers) would prefer higher producer prices. The respondents strongly agreed that the low producer price was a deterrent to AB collection (Table 3.12). The other constraints mentioned were (in decreasing order of importance), the laborious nature of collection, the distant location of AB trees and rodent attack on AB fruits. The latter situation requires that one be alert in order to collect as many whole pods as possible.

Some collectors (25%) also asserted that they may lose interest if the price was not reviewed upwards soon.

"*…some of us collect "sonkyi" because it is on our farm and we are morally bound to collect since if we do not rodents would feast on it ….it is Gods blessing and once it is needed else where we should not let it go waste….after all, it gives extra income for food ingredients and school children's chop money*"

Table 3.12: Constraints in Allanblackia collection

Problem	Sum of Ranks	Mean Rank	Ranks
Low price	270.00	2.62	1
Collection is laborious	419.50	4.07	2
Long distance	422.00	4.10	3

Rodents attack	432.00	4.19	4
Biasness in sharing of incentives by Buying Agent	442.50	4.30	5
Delay in payment after sale	446.50	4.33	6
Low material incentives given to collectors	451.50	4.38	7
n (number of respondents)	103		
(Kendall's Concordance test) *chi-square (corrected for ties)* *Degrees of freedom* *p-value* *W* *avg. rank-order correlation*	 *187.820* *6* *7.40E-38* *0.304* *0.297*		

Factors affecting willingness to invest in domesticated Allanblackia

An important element of sustaining Allanblackia supply is willingness of farmers to participate in its domestication. AB is yet to be domesticated in the communities visited. Hence, the respondents were only briefly sensitized about the enterprises and questioned about their willingness to commit investment capital (including land, labour and funds) of their own to establishing and waiting for medium and long term returns. Results of willingness to domesticate suggest that interest of respondents (cocoa farmers and AB collectors) is very high. About 89 percent of the respondents responded in the affirmative when asked "are you willing to fully involve yourself in Allanblackia plantation? In fact, only two people (1 male, 1 female) thought that it was not important to domesticate Allanblackia. Thus the logit analysis that sought to determine which socio-economic, technical and institutional factors would influence a person's willingness to participate could not be estimated. All the variables were not statistically significant. However, descriptive statistics of factors suggest that origin, fear of future of Allanblackia sustainability, and assurances of external support are likely to affect willingness to participate (Table 3.13). It appears that indigenes and those who do not require much information now but want assurances of high prices are more likely to participate fully in domestication. Land tenure appears not to be a critical issue since both willing and non-willing respondents had land; the mean size of land available for those not willing appear to be slightly higher though (by 30%).

Table 3.13: Perception of factors of willingness to participate in Allanblackia domestication

Description	Willing	Not willing	Remarks
Socio-cultural characteristics			
Mean age	39 years	40 years	No effect
Community Pataho Kroboase Mmerewa	 26 22 52	 18 45 36	No effect
Sex • Percentage male • Percentage female	 52 48	 40 60	No effect
Major occupation (percentage farmers)	96	100	No effect
Other occupation	37	36	No effect
Origin • Percentage Foreigners • Percentage indigenes	 60 40	 80 20	Likely effect; indigenes are more likely to participate
Marital status • Percentage married • Percentage unmarried	 76 24	 90 10	No effect
Percent with child labourers (12 years – 18 years) in household	71	73	No effect
Percentage literate	75	90	No effect
Allanblackia collection (percentage) • Collectors • Non-collectors	 43 50	 57 50	No effect
Percent with land available Mean (hectares)	89 3	82 4	No effect
Fears for successes • Fears (long gestation, no seedlings, no land and no market) • No fears	 13 87	 25 75	Likely effect; those who harbor fears are less likely to participate

Table 3.13 cont'd

Assurances of external support as incentive for participation			
Provide information and inputs (Percentage)	19	33	Likely effect; those with high expectations of information and inputs are less likely to participate
Good pricing policy (Percentage)	46	33	Likely effect; those requiring good pricing policy are more likely to participate

A gender analysis of willing participants also shows that, fewer females have extra land available, for AB domestication. Again fewer females claim to have initial cash to invest in seedling and other material requirements. We note also that fewer females are prepared to pay for extension information. Asked whether respondents could wait for the anticipated long gestation period of AB, fewer females (88%) than males (94%) responded in the affirmative (Table 3.14). More intensive education and support (if any) for females may be called for.

Table 3.14: Extent of respondents' preparedness to participate in Allanblackia

Indicators of preparedness	**Respondents**	
	Male	Female
Land availability	94	73
Initial cash investment	50	26
Gestation period	94	88
Extension services	19	7
Initial investment in seedling	50	25
Fears	14	`13

Institutions in Capacity Building for Sustainable Allanblackia Supply

Another determinant of sustainable supply is availability and **effectiveness** of support institutions. To achieve sustainability of Allanblackia domestication all stakeholders in the supply chain (of information and materials) ought to be fully integrated in the process. There are both statutory and non-statutory institutions at the local, national and international levels that ought to function to ensure that the Allanblackia value chain is strong. What is the situation today? Results of rapid appraisal and review of literature show that the statutory institutions include the Ministry of Food and Agriculture, Ministry of Lands and Forestry, Council for Scientific and Industrial Research (CSIR), the Universities, Ministry of Trade, Industry, PSI and Private Sector Development, Ministry of Local Government, Rural Development and Environment, and Ministry of Manpower Development and Employment. The Non-statutory institutions include traditional leaders, private agribusinesses, non-governmental organizations and Farmer Based Organizations (FBOs).

Ministry of Food and Agriculture (MoFA)

The directorate of extension and crops of MoFA are mandated to repackage all new information on crop farming systems for dissemination by extension staff. The district level staffs of MoFA (met at time of survey) did not appear to have much knowledge about developing the Allanblackia supply chain in their districts and in Ghana as a whole.

Ministry of Lands and Forestry

The story appears not to be different with the MLF since staff of Forestry Commission (FC) contacted were neither aware of the collection and sale of the nuts or fruits nor its intended domestication in the districts visited. The mandate of the Forestry Services Division of the FC includes tree conservation and domestication of relevant species. AB was not mentioned as one of such accepted species.

Council for Scientific and Industrial Research

The Forestry Research Institute of CSIR is fully involved with all the exploration processes for domesticating Allanblackia. It is collaborating with international donors and international research institutes such as IUCN and ICRAF. However, the Food Research Institute of the Council is yet to be part of experimentation on uses of the nut.

Universities

Universities in Ghana have Schools and Institutes of Agriculture and Natural Resources (including Botany departments). However, interactions with University of Ghana's Crop Science Department and Agricultural Research Centers suggest that none of the Researchers was aware of Allanblackia and its potential in Ghana. A review of Student dissertations and thesis did not show any indication of awareness by agricultural and life sciences students.

Ministry of Trade, Industry, PSI and Private Sector Development (MTIPSD, PSI)
There are several agro-industrial and export businesses in Ghana being supported (albeit meager) by MTIPPSD. They are small, medium and large. The only company that processes Allanblackia into Margarine is Unilever Holland. None of the other small scale processors of oil palm (into palm oil and kernel oil) interacted with used the product. The Ghana Export Promotion Council of MTIPPSD supports exporters with information on prices and destination for non-traditional export commodities such as sheanuts and oil palm. None of the staff interacted with in Accra was aware of Allanblackia.

The Ministry of Local Government, Rural Development and Environment (MLGRDE)
This Ministry is the mother of all district assemblies in Ghana. It is mandated to play central government at the district level (Mensah, 2007). Thus the District Chief Executives are mandated to be custodians of all government lands and forest reserves. They negotiate for and protect land banks in localities. They would sanction the opening of forest reserves for tree felling and/ or cultivation. Any project that requires new land should not by pass the district administration. Where new forest lands will not be required (as suggested in the sustainability guidelines of Unilever Holland) (Hendrickx, 2007), the Assemblies may not be needed. However, any disputes resolution process in land (boundary conflicts, encroachments, etc.) cannot ignore their involvement. The Allanblackia study is yet to interact with appropriate personnel although a review of useful trees in the two districts visited did not show that Allanblackia had a place in the local economies (Assese, 2000).

Departments of MLGRDE such as Community Development, Cooperatives and Social Welfare are all concerned with interventions for improved rural livelihoods. They organise low-income groups for training in various income-generating activities and could contribute to the promotion of Allanblackia groups in some way. When an FBO concerning AB is formed these could be instrumental in the group dynamics.

Traditional Leaders
In Ghana, the forest and all its resources is held in trust for the people by the government or the traditional Chiefs, Village heads or Family heads. These traditional heads assign the right of use. Traditional land tenure systems usually grant either use rights and/or transfer rights to members of society. In both matrilineal and patrilineal inheritance systems, land tenure arrangements emphasise communal land use rights: the rules are clear on use, exclusion and transfer. Whiles the matrilineal systems theoretically offers women better access to property than the patrilineal system, closer examination reveals that tenure under any of the traditional systems can be quite secure for men and not for women (Cleaver *et* al, 1992; Winter, 1990). For instance in some communities women can only use their land to cultivate food crops, fell old branches for firewood and only hunt for wildlife such as snails and mushroom. Land given them cannot be used for commercial purposes. This is because women's rights derive from their status as wives and wards – that is mothers, daughters, sisters or widows – and their degree of access to

land varies with, and reflects, the social status of the male members of the household. When women's status changes through divorce and widowhood, they are vulnerable to losing their land rights and hence their access to livelihood (FAO, 1985; Mehra, 1997).

This was not the situation in the two districts surveyed. Where traditional leaders are custodians of village land they would be needed to release land to all those who are willing and able to utilize land irrespective of gender.

Agribusinesses

Domesticating tree crops for plantation farming may require that dealers in seedlings, improved fertilizers and agrochemicals, machines and other implements are available at the local level. It appears that all district capitals have a few of such dealers. Some communities may also have one or two agents. In Pataho there were two agro-input dealers. Produce buyers are also needed within a limited radius to sustain interest in the commercial production of any commodity. Currently, only Pataho and it environs have produce buyers for AB. For cocoa, each community (including Mmerewa) perceived large enough has a produce buying agent. This situation would be required when Allanblackia is fully integrated.

Non-governmental Organizations

These are service organizations that assist resource poor communities and individuals to strategies for better livelihood outcomes. With calls for credit (kind and cash) as an assurance for full participation and inability to pay for technical information generation and use, NGO action in Allanblackia supply chain would be needed. The SNV, Technoserve and World Conservation Union (IUCN) are well known for their interest in how Allanblackia would improve the livelihood of those engaged in its farming/collection system. Others such as Adventist Relief Agency (ADRA), Action Aid, World Vision and Care International that have interest in agro-based livelihoods may be encouraged to play a role, particularly if such organizations should have unique experiences or skills or resources that would be needed.

Farmer based organizations

In order to ensure that technical information sharing is continuous and effective farmer-based organizations have been suggested

> *"....when cocoa growing started we were all grouped into societies at the village level and we received constant training in seedling selection, nursing, line and pegging, pest management and soil fertility management…that is what would be needed for Allanblackia so that only active members would receive the incentives that would be supplied and no one person would share it among family and friends only"* (Chief of Mmerewa).

Unfortunately, formal FBO appears not to be a well-developed phenomenon. None of the respondents belonged to a registered organisation that has a constitution, bank accounts meets regularly, has planned programmes and with patrons leading and

directing affairs. The only success story concerns a trader group that has organised to access micro finance from a rural bank near Pataho.

3.4. Potential synergies between AB and other crops

Synergies refer to how intercropping can improve yields and sustainability of revenue. There is currently no intercropping of NTFP being practiced in the communities visited. What came close was, harvesting of wild AB trees that were left unfelled in cocoa farms during establishing. From this study, it appears that household harvesting of AB trees (wild) was restricted to those in farmer's own farms or the open forest. In the survey only 8 percent of collectors harvested from other people's farms. Those who were in this category were relatives of the farm owners. The general assertion was that '*those who can visit other people's farms may not be allowed to continue when fruit collection becomes as beneficial as expected*'.

The evaluation of synergies concerned Allanblackia + cocoa; Allanblackia +cocoa +cola; Allanblakia + cocoa + "Atooto"; Allanblackia + cocoa + "Abesebuo"; Allanblakia + cocoa + "Abesebuo" + "Atooto". Results of gross margin analysis show that each of the combinations is profitable due to low variable costs from non-cocoa activities and low common cost from all activities. It is noted that combining cocoa with Allanblackia alone is not as beneficial as adding other collection activities (Table 3.15). It may thus be argued that several NTFPs can come together to increase the income level. One does not have to limit oneself with only one type of NTFP. Farming NTFPs like Allanblackia (but potentially also others) can be synergistic with other crops, e.g. cocoa. As an example: cocoa may need shade and many nutrients from the soil and that combines well with Allanblackia because it does not need many nutrients and because it may act as a shade provider. Whether the latter works well in practice remains to be seen by field trials (Hendrickx, 2007). In this particular case, the Cocoa Research Institute of Ghana (CRIG) has started a 7 Ha field trial. Results are expected in 7 to 10 years from now (2017).

Results of Focused Group Discussions also indicated that the synergies are perceived to have an impact on the immediate and surrounding environment particularly with respect to conservation of different kinds of trees, allowing vegetative cover that would ensure that the rain cycle is not distorted. It is also believed that such synergies create employment for all members of the family and minimizes idling and earning income during off-cocoa activity periods. Extra non-cocoa income supports child education, Medicare and remittances for parents and other elderly members of the extended family. Indeed, this situation has meant that there is no real hunger period in forest area communities; such communities are above the poverty line.

With an average family size of 4, each earning a dollar a day (UN expectation), households would need to make ¢13,575,000.00 a year. Households would be better off if they adopted the four combination scenario; the AB + cocoa strategy alone yielding is currently not adequate.

Table 3.15: Mean whole farm profit in survey area in 2006 (¢'000)

Source	Mean revenue (A)	Variable cost (B)	Gross margin (B-A) = C	Common cost D
1. Allanblackia 2. Abesebuo 3. Atooto 4. Cola 5. Cocoa	35.32 924.29 1,727.05 350.00 22,800.00	0 0 0 0 10,000.00	35.32 924.29 1,727.05 350.00 12,800.00	Mats (2) = 500 W.boots = 60 Weeding = 200 Others = 280 Total = 1,000.00
Variable cost for cocoa (3 Ha)	Pesticides = 2,400 Fertiliser = 5,000 Processing for drying = 2,600 Total = 10,000			
WFP (1+5) – D WFP (1+4 +5) – D WFP (1+3+5) – D WFP (1+2+5) – D WFP (1+2+3+5)-D	12,835.32 -1,000 = 11,835.32 13,185.32 -1,000 = 12,185.32 14,562.37 -1,000 = 13,562.37 13,859.61 -1,000 = 12,859.61 15,486.67 -1,000 = 15,486,67			

4. CONCLUSIONS AND RECOMMENDATIONS

Allanblackia, is wild tree specie in arable land with potential for domestication in Ghana. In order to sustain the positive trends in the supply chain for AB, seeking information on income generating activities, the opportunity cost of labour, farm-level investment and operating cost, cash flow and net returns over a period of 20 (tbc) years, potential synergies between AB and other crops has become pertinent. Primary data was collected from Pataho, Kroboase and Mmerewa, all cocoa-based communities in the Western region of Ghana.

vi. Allanblackia collectors are cocoa and food crop farmers who have well established calendar of input acquisition, production and marketing activities. Income generated from these activities is key; yet they seek other sources of income generation during their leisure.

vii. Trees have a role to play. There are wide varieties of tree species known. However, they are not easily accessible to all households for income generation. Some are in seasoning when there is less to do on cocoa and food crop farms. Others peak with the cocoa crop. However, where the return on labour is perceived to be high, leisure hours are spent on processing them for sale. They require little physical and financial capital investment. Yet, collectors believe that the time and physical effort invested need to be rewarded adequately in order for interest to be sustained.

viii. Allanblackia is a collection activity carried out during cocoa lean season and its opportunity cost is nil in financial terms. There are other collection activities that yield higher in terms of value per hour; we compare ¢4,000/hr for AB to ¢6,600 - ¢14,300/hr for cola, "Atooto" and "Abesebuo". Although there are virtually no costs incurred in its collection and processing before sale, the laborious nature of the processes and the perceived low price per unit makes its sustainability questionable.

ix. AB domestication would be embraced by majority of the population if its net returns are positive and contract farming as suggested by Unilever R&D Holland is assured (with assurances of no capital investment by farmers). There will be no working capital needs, seedling cost; there will be free unused arable land, permanent produce buyers in the community and some fringe benefits on occasion. Even when farmer estimation of costs and yield were employed, at a discount rate of 19 percent and a life span of 20 years, the NPV was positive for all eight scenarios of subsidized and non-subsidised Allanblackia plantation. Indeed apart from the first five years of establishment, the net cash flows for each year were positive.

x. Currently, collecting AB in addition to cocoa production does not produce as much impact as when other NTFPs such as "Abesebuo" and "Atooto" are added.

We note that without the current purchasing price of AB (¢1,500/Kg) may not be incentive enough to collectors of wild AB trees because large quantities of nuts are not being collected and processed (recall the mean revenue of ¢35,000.00 for 2007). The perceived high price (¢9,200.00) per kilo of cocoa induces farmers to maintain farms

(using hired labour) and work extra hours 'when the season is here'. In the same way a higher than ¢1500/kg would induce the AB collector to plan for and invest time and labour (including hired) in collection or establishing and maintaining AB farms. The innovation needed in hiring of labour and transportation services in AB collection or establishment would come when perceived higher prices are given. Respondents of this study believe that, like it is done for cocoa, non-price incentives such as credit facilities and other fringe benefits (occasional distribution of T-shirts, Wellington boots, etc.) are necessary to keep farmers thinking AB. Currently, the opportunity cost of integrating AB into the farming system would be framers' leisure. No income generating activity is perceived worse than AB collection. The contract farming proposed by Unilever R&D Netherlands Holland would be welcome. The implication is that buyers of AB ought to continue the sensitization process, form an AB Collectors and Producers Association that would be organized so effectively (linking with the local institutions) that non-members would seek membership, and together push forward the agenda of AB in the communities.

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ANNEXES

Annex 2.1a:

Scenario 1-8: Establishing an acre[9] of Allanblackia private farm (seed subsidy)

Activity	Cost	Remarks
One acre of land	¢10 million	Paid once
Cost of seedlings per acre	450 seedlings per acre * ¢1500 (Govt subsidy)	
Land preparation	¢ 800,000 +104,000=904000	For Domar Machine
Total Fixed Cost	¢11,579,000.00	
Wellington boots	¢ 60,000*	A maximum of 2 years
Drying cocoa mat	¢250000.00**	A maximum of 5years
Weeding, fertilizer, chemical and maintenance cost	¢ 800,000***	Done every year
Planting	¢ 240,000.00	30,000 per day for two days (4 labourers needed)
Total Variable Cost	¢750,000.00	
Total cost/acre Total cost/ha	¢12,929,000.00 ¢32,322,500.00	

Assumptions

- *= W. boots lasts 2 years hence cost of replacement is computed at the end of every other 2 years at 10%.
- **=Drying mat last 5 years hence cost of replacement is computed at the end of every other 5 years at 10%.
- ***=Weeding, fertilizer, chemical and maintenance cost are incurred once a year hence labour cost was computed every year using 10% increment.

It was assumed that for the first five years of domesticating Allanblackia, there would not be any fruits to harvest until the sixth year.
It was also assumed that after the first five fruitless years, there would be a gradual increment in the fruiting of Allanblackia trees to a peak after which there would be gradual decrease in the quantity of AB fruiting.

It was assumed that: At the beginning of fruiting, collectors would harvest 1 fruit per tree through to 2 fruits to 3 fruits (peak) per day for about 60 days (which may represents the harvesting days/season of Allanblackia) This would be multiplied by the number of trees per acre to get the total quantities of Allanblackia, assuming a pure stand.

Pricing: Quantities were multiplied by the price which was ¢1500 for the zero year, and increased (to different levels in year one) and projected to the 20th year by 10% annual increment.

These quantities were multiplied by the price which was ¢1500 for the zero year, and then projected to the 20th year by 10% annual increment.
e.g.1 3 pods/day* 60days = 180pods/tree
180 pods/tree * 450 trees/acre = 81,000pods/acre

e.g. 2 2 pods/day* 60days = 120 pods/tree;
120pods/tree * 450trees/acre=54,000pods/acre; 1 pod gives 1 kg of dried nuts

[9] Farmer estimation was in acres. During cash flow analysis total costs and revenues were converted to hectares (1 ha =2.5 acres)

Annex 2.1b
Scenario 9: Establishing an hectare of Allanblackia farm (Contract farming by Unilever Netherlands)

Activity	Cost	Remarks
One acre of land	¢2,250,000	Paid once
Cost of seedlings per acre	Free	Supplied by Buying Agency
Land preparation	Nil	Done for food crop
Total Fixed Cost	¢2,250,000	
Wellington boots	Free	Supplied by Buying Agency
Drying cocoa mat	Free	
Weeding, fertilizer, chemical and maintenance cost	Nill	Not required by Buying Agent
Planting	0.0	Farmer's own labour required by Buying Agent
Total Variable Cost	¢0.00	
Total cost	¢2,250,000	
Other assumptions: Yield = 6,000 Kg per hectare per year for 16 years Price at establishment (year zero) = ¢2000.00 and projected to the 20th year by 10% annual increment.		

Annex 2.1c:
Scenario 10: Establishing an acre of Cocoa farm: (land rent and Buyer producer price)

Activity	Cost	Remarks
One acre of land	¢10 million	Paid once
Cost of seedlings per acre	450 seedlings per acre * ¢1500 (Govt subsidy)	Paid once
Land preparation	¢ 800,000 +104,000=904000	For Domar Machine
Total Fixed Cost	¢11,579,000.00	
Wellington boots	¢ 60,000*	A maximum of 2 years
Drying cocoa mat	¢250000.00**	A maximum of 5years
Weeding,fertilizer,chemical and maintenance cost	¢ 800,000***	Done every year
Planting	¢ 240,000.00	30,000 per day for two days (4 labourers needed)
Fertiliser	¢0.0	Only after year 10
Total Variable Cost	¢750,000.00	
Total cost	¢12,929,000.00	

Assumptions

- *= W. boots lasts 2 years hence cost of replacement is computed at the end of every other 2 years at 10%.
- **=Drying mat last 5 years hence cost of replacement is computed at the end of every other 5 years at 10%.
- ***=Weeding, chemicals, fertilizer and maintenance cost are incurred every year hence labour cost was computed every year using 10% increment.

It was assumed that for the first two years of cultivating cocoa, there would not be any fruits to harvest until the third year. It was also assumed that after the first few fruitless years, there would be a gradual increment in the fruiting of cocoa trees to a peak after which there would be gradual decrease in the quantity.

It was assumed that: At the beginning of fruiting, less than 5 bags (64 kg/bag) would be collected. The peak yield would be 15 bags (940 kg). These quantities were multiplied by the price which was ¢9,200 for year zero and one, and then projected to the 20th year by 10% annual increment on price.

Annex 2.1d:
Scenario 11: Establishing an acre of Cocoa farm: (No land rent andBuyer producer price)

Activity	Cost	Remarks
Cost of seedlings per acre	450 seedlings per acre * ¢1,500 (Govt subsidy)	Paid once
Land preparation	¢ 800,000 +104,000=904000	For Domar Machine
Total Fixed Cost	¢1,579,000.00	
Wellington boots	¢ 60,000*	A maximum of 2 years
Drying cocoa mat	¢250,000.00**	A maximum of 5years
Weeding, fertilizer, chemical and maintenance cost	¢ 800,000***	Done every year
Planting	¢ 240,000.00	30,000 per day for two days (4 labourers needed)
Total Variable Cost	¢750,000.00	
Total cost	¢2,929,000.00	
Other assumptions same as scenario 10		

See Excel file for cash flow analysis

Annex 2.2: Identifying factors affecting willingness to participate in Allanblackia Domestication: the logit model

Prob (AB) = f (SD, TE, IN)

Where:

Prob (AB) = willingness to grow Allanblackia (dummy variable, 1= willing, 0 = Otherwise)
SD = socio-demographic factors including sex, age, educational level (edu), Residential status (res), ownership of land (ow), other occupation (occ), Household income and level and household labour (lab).

Sex = gender of respondent (1=male, 0=female) (+)
Age = age of respondent (±)
Edu = number of years of formal education (+)
Res = residential status (dummy variable, 1=indigene, 0=otherwise) (+)
ow = own land (dummy variable, 1=owner of land, 0=otherwise) (+)
occ = other occupation (1= regular employment, 0=otherwise) (±)
inc = level of household income per annum (+)
lab = availability of household labour (dummy variable (1=yes, 0=otherwise) (+)

TE = technical factors including own price of Allanblackia (pab), perception of Gestation period (ges), availability of investment capital (cap), ease of Processing allanblackia (eas)

pab = perceived % increase in price level (+)
ges = perception of gestation period (dummy, 1= not long, 0=otherwise)
cap = availability investment capital (dummy, 1= available, 0=otherwise) (+)
eas = labour intensity of processing nuts (dummy variable, 1= high 0=otherwise)

IN = institutional factors including availability of buyers (bu), credit facilities (ct), Extension contacts (ext) and availability of social incentives (so)

bu = availability of buyer (dummy variable, 1=in community, 0=otherwise)
ct = availability of credit facilities in community (1=always, 0=otherwise)
ext = willingness to pay extension services (dummy variable, 1= willing, 0=otherwise)
so = perception of availability of social incentives (1= periodic, 0= never/once)

Annex 2.3: ALLANBLACKIA: STANDARD SETTING AND SUSTAINABLE SUPPLY CHAIN MANAGEMENT

KEY INFORMANT INTERVIEW CHECKLIST

Name of Chief/Focal person/group: _____
Date and time: __/__/____ ___:___
Community: _____
District: _____

Identification of collectors (all key informants to respond)

1. Gender
2. Age group
3. Origin (%):
4. Role in the family:
5. Family size
6. Range of annual income per household
7. Major income generating activities
8. Availability of skilled and unskilled labour
9. Location of jobs

Farming activities (focus groups)
10. Major crops cultivated
11. Ratio of current yield to expected yield
12. Percent sold of harvest
13. Major livestock kept
14. Range of annual sales
15. Major agro-processing activities of farm households
16. Time series of major prices

Allanblackia and NTFP trading (AB focal agents)

17. Main season and light season for collection
18. Kilograms of product traded in 2006
    + main season?
    + light season?
19. Number of collectors trading in 2006
20. Average amount of product brought by each collector in a normal year
    + The one who brings more/year?
    + The one who brings less/years?
21. Average total collection in a normal year
    + A good year?
    + A bad year?

22. Price paid for a Kg of product?
    + Is it changing depending on the quality?
    + Is it changing depending on the season?
23. Social groups in collection
    + Man/Woman + Children/Adults+ Rich/Poor
    + Farmers/Others + Skilled/Unskilled
24. Mode of planning for collection (specifically/mixed)
25. Daily stocks?
    Main season? _____ Light season

Labour opportunities in the area (for focused group)

Main jobs and occupations of the habitants of the community

Job or occupation	Target social group	Skilled/Unskilled	People working in this job	Location of the job	Availability	Labour requirements (time)	Net Returns

Land tenure system (Chiefs to respond)
Proportion of land belonging to:

- Government (including forest reserves)
- Village
- Stool
- Clan
- Families
- Households
- Individuals

Determination of ownership of NTFP
Domestication of NTFP (all key informants)
Willingness to establish plantations
Presence of cultivators
Cost of establishment of I hectare
Elements of Cash outflow

- unit service charges/input cost
- amount of service/inputs
- expectation of yield

Elements of Cash inflow

- unit price per season
- quantity sold per season
- revenue from bye-products

Life expectancy of trees
Discount rate determination
Use of income of NTFP
Job creation capability
Availability of extension services

Problems and Incentives (All key informants)
Motive for collection and purchasing of NTFP
Main problems of collectors and purchasers
Non-price incentives for increased collection

Physical infrastructure
-Road network – surface conditions, frequency of commercial vehicles, cost of use
-Water
-Electricity
-Health center
-Financial institutions

Mechanisms for conflict resolution
-Decentralised system of political governance
-Chieftancy and clan system
-Other leadership systems: Community Based Organisations, NGOs
Any other information of interest

Annex 2.4: ALLANBLACKIA: STANDARD SETTING AND SUSTAINABLE SUPPLY CHAIN MANAGEMENT

COLLECTOR QUESTIONNAIRE

Name of respondent: _____ Name of interviewer_____

Date and time: __/__/____ ___:___

Community: _____

District_____

A. Socio-demographic background of Collector

1. Age: _____
2. Sex: _____
3. Origin: _____
4. Role in the family: _____
5. Marital status: _____
6. years of formal schooling: _____
7. Major Occupation: _____
8. Other Occupation:_____

B. Family and farm revenue information

- Members in the family

Member	Sex / Age	If schooling…		If working…			
		Course	Place	Job (s)	Place	Labour requirements	Revenue in 2006

Most significant story

- Collector's farm revenue analysis

- Farm analysis: Major season 2006

Plots	Crop	Area	Year of plantation	Production	Self consumption	Selling price	Inputs	Time requirements

- Other sources of revenue in major season
Which other sources of revenue do you have?

_____

Job or occupation	Skilled Unskilled	Location of the job	Labour requirements (Season)(time)	Net Returns

- Farm analysis: Minor season 2006

Plots	Crop	Area	Year of plantation	Production	Self consumption	Selling price	Inputs	Time requirements

- Other sources of revenue in minor season
Which other sources of revenue do you have?

_____

Job or occupation	Skilled Unskilled	Location of the job	Labour requirements (Season)(time)	Net Returns

Most significant stories

C. Information on Allanblackia and other Non-Timber Forest Products

Collection operation

1. How many years ago did you start collecting NTFP?

2. Which is the season for NTFP collection?

3. Average harvest for 2006:

4. How many trees did you harvest?

5. Where were these trees? 1=Own Farm: %_____ Distance: _____
2=Other's Farm: %: _____ Distance: _____
3=Forest: %: ____ Distance: _____
4=Community land:%: ____ Distance: _____
5=Other: %:_____ Distance: _____

6. Unitary production of a tree?

7. Evolution of the amount you have harvested in 2006:

- minimum quantity collected per period
- maximum quantity collected per period

NTFP	Year collection begun	Season for collection	Average harvest in 2006	Number of tree harvested	Location of trees		Range of quantity	
					%	Km	Min.	Max.
Allanblackia								

Human resource (Labour)

8. Who is collecting the NTFP in the family?

9. How much did you pay family labour per period?

10. Do you hire non-family labour for collection?

11. How much do you pay hired labour per period?

12. Who is the person in charge of drying the nuts?

13. How many days are used to dry?

NTFP	Who in family	Cost of family labour per period	Hired labour	Cost of hired labour	Labour for drying	Number of days for drying
Allanblackia						

14. When are you more occupied with your farm or other non-collection activities?

_____

15. In that time (busy time), do you collect NTFP?

_____

16. How do you plan your collection: Do you spend an entire morning or day in collecting NTFP or do you collect them when going to the bush for other tasks? (in busy and non busy time)

_____

17. How many Kilograms of NTFP can you harvest in one entire morning?
18. How many kilograms of NTFP can you harvest in an entire day?
19. How many days do you need to harvest all the trees you usually harvest?

_____

20. How much time (weeks) do you have to wait to come back to harvest the same tree?

NTFP	Kilos per morning	kilos per day	Number of day for all trees	waiting time of re-entry
Allanblackia				

Location and Materials for drying

21. Where do you dry the NTFP?
22. What materials and cost are required for drying?
23. What percentage is lost during drying?
24. What is the cause of loss?

NTFP	Location of drying	Materials required	Cost of materials		% loss	Causes of loss
			Main season	Light season		
Allanblackia						

Marketing of NTFP (sales, processing and storage)

25. Do you use NTFP yourself or you sell all of it? Amount consumed by self (%).
26. In a bad year for NTFP production, do you prefer to use your collected products or you prefer to sell them?
27. Uses of NTFP when consumed by self (main and secondary)
28. Do you sell any processed products of NTFP?
29. Specify the processed products and amount sold.

NTFP	Use of NTFP	Amount consumed (%)	Bad year usage	Main use of NTFP	Secondary use of NTFP	Processed products	Amount sold (%)
Allanblackia							

30. Who is buying the NTFP?
31. Price (GH¢/Kg) for each buyer.
32. Are these prices changing during the year?
33. Are the prices changing depending on the quality of the nuts?
34. Are the prices changing depending on the season of sale?
35. What was the revenue from NTFP sold in 2006?
36. Amount sold? Main crop/ Light crop:
37. How many times do you sell per season? Main crop/ Light crop

NTFP	Buyer	Price (GH¢ /Kg)	Price based on quality?	Price based on season of sale?	Main Revenue	Light revenue	No of time sold during main	No of time sold during Light
Allanblackia								

38. How much did you spend on transportation each season?

39. How much did you spend on other marketing activities?

NTFP	Transportation cost	Taxation	Interest on credit	
Allanblackia				

D. Problems of Allanblackia collection

1. Which problems do you encounter during the management of Allanblackia collection (Rank)

[ ] low price offered by buyer

[ ] poor quality product offered for sale

[ ] inadequate family labour

[ ] inadequate hired labour

[ ] long distances between residence and location of nuts

[ ] collection is laborious

[ ] poor human relations of focal agent

[ ] others

2. Which of the problems stops you from collecting more Allanblackia?

3. Why do you collect AB if there are other NTFP with better economic performances?

_____

4. Which price would be reasonable for you for the dry AB nuts? _____

Most significant stories

E. Non-collectors

1. Why are you not interested in NTFP collection?
2. What percentage price increase will encourage you to collect?
3. What other non-price incentives will encourage you to collect?

NTFP	Reason for disinterest	% price increase required	Other incentives required
Allanblackia			

F. Domestication of Allanblackia

1. Do you think it is important to domesticate AB? Yes _____ No _____
2. If yes, in your opinion what will be the expected benefits from AB domestication?

   Economic_____

   Social_____

   Ecological_____
3. If no, give reasons.

   _____
4. Are you prepared to fully involve yourself in AB domestication? Yes ____ No _

   If yes, how prepared are you to undertake AB farming?

   Availability of land_____

   Initial cash investment_____

   Gestation period _____

   Payment for extension service _____

   Investment in seedlings_____

   Etc

   _____
5. Do you harbor any fears so far as future AB domestication is concerned? Yes _No__
6. If yes, what are they (economic, social, ecological, and political)?

   _____
7. What assurances do you require before opting for AB domestication? _____

   ___

   _

What do you think should be done to prevent poor men and women from being excluded in AB business in future after domestication? ————

_____

8. What support do you expect or require ensuring full involvement in AB domestication and business?
   - Technical support in production and processing

     _____
   - Funding

     _____
   - Information and inputs provision

     _____
   - Political and policy

     _____
   - Access to land

     _____
   - Business development services

     _____
9. Do you believe that AB will help the overall development of your community?

   Yes/No

   Describe the direction

_____

Annex 3.1: Distribution of place of origin of respondents

Place of origin of inhabitants (Pataho)

Origin	**Frequency**	**Percentage**
Akans		
Obuase	1	3.8
Pataho	1	3.8
Abrotenya	1	3.8
Abuakwa	1	3.8
Aburi	1	3.8
Ashanti	1	3.8
Ashanti region	1	3.8
Breman Fosu Ansa	1	3.8
Donpim	1	3.8
Fante	1	3.8
Gomoa	1	3.8
Gomoa Kwahu	3	11.5
Kumasi	2	7.7
Mankessim	1	3.8
Takoride	1	3.8
Winneba	1	3.8
Non-Akan		
Northeners	4	15.4
Ningo	2	7.6
Dodowa	1	3.8
Total	26	100.0
Place of origin of inhabitants (Koase)		
Akan		
Abuakwa	1	4.0
Gomoa	1	4.0
Ahanti-Mampong	1	4.0
Ajumako	1	4.0
Akwapim Adukrom	1	4.0
Appiahkrom	1	4.0
Gomoa Affanse	1	4.0
Mampong	2	8.0
Mampong Nsuta	1	4.0
Techiman	8	32.0
Wenchi	1	4.0
Non-Akan		
Volta Region	2	8.0
Wa	1	4.0
Total	25	100

Place of origin of inhabitants (Sewhi-Mmerewa)		
Place of origin	Frequency	Percentage
Indigenes		
Mmerewa	34	65.4
Sefwi	4	7.7
Akans		
Ashanti	8	15.4
Fante	1	1.9
Techiman	1	1.9
Burkina Faso	1	1.9
Eburim	1	1.9
Manso Asuade	1	1.9
Tano Odumase	1	1.9
Total	52	100.0

Annex 3.2: Labour use situation of Allanblackia collectors

Labourer	**Frequency**	**Percentage**
Alone	22	48.9
My spouse and children	4	8.9
My spouse	4	8.9
My children	12	26.7
Brother	1	2.2
My parents	2	4.4
Total	45	100

Annex 3.3: Cash flow analysis: Scenario 8 of AB domestication

years	Fixed Cost-	Variable cost	Other Costs	Total Cost/acre	Total cost/ha	price	quantity /acre	revenue
0	17,654,000.00	800,000.00	550,000.00	19,004,000.00	47,510,000.00	1500	0	
1	-	880,000.00		880,000.00	2,200,000.00	1650	0	
2	-	968,000.00	66,000.00	1,034,000.00	2,585,000.00	1815	0	
3	-	1,064,800.00		1,064,800.00	2,662,000.00	1996.5	0	
4	-	1,171,280.00	72,600.00	1,243,880.00	3,109,700.00	2196.15	0	
5	-	1,288,408.00		1,288,408.00	3,221,020.00	2415.77	27000	490
6	-	1,417,248.80	79,860.00	1,497,108.80	3,742,772.00	2657.34	27000	539
7	-	1,558,973.68		1,558,973.68	3,897,434.20	2923.08	27000	592
8	-	1,714,871.05	87,846.00	1,802,717.05	4,506,792.62	3215.38	40500	978
9	-	1,886,358.15	275,000.00	2,161,358.15	5,403,395.38	3536.92	54000	1434
10	-	2,074,993.97	96,630.00	2,171,623.97	5,429,059.92	3890.61	81000	2367
11	-	2,282,493.36		2,282,493.36	5,706,233.41	4279.68	81000	2604
12	-	2,510,742.70	106,293.60	2,617,036.30	6,542,590.75	4707.64	81000	2864
13	-	2,761,816.97		2,761,816.97	6,904,542.43	5178.41	81000	3151
14	-	3,037,998.67	419,422.00	3,457,420.67	8,643,551.67	5696.25	81000	3466
15	-	3,341,798.54		3,341,798.54	8,354,496.34	6265.87	54000	2542
16	-	3,675,978.39	128,615.26	3,804,593.65	9,511,484.12	6892.46	40500	2097
17	-	4,043,576.23		4,043,576.23	10,108,940.57	7581.71	40500	2306
18	-	4,447,933.85	141,476.78	4,589,410.63	11,473,526.58	8339.88	27000	1691
19	-	4,892,727.24	332,750.00	5,225,477.24	13,063,693.09	9173.86	27000	1860
NPV	¢674,621,356.71							
IRR	60 %							

Annex 3.4: Cash flow analysis: Scenario 9 of AB domestication

years	Fixed Cost minus cost of land preparation	Variable cost	Total Cost	price	quantity/acre	revenue/acre	rev
0	2,250,000.00	0	2,250,000.00	2000	0	0	
1	-	0		2200	0	0	
2	-	0		2420	0	0	
3	-	0		2662	0	0	
4	-	0		2928.2	2400	7027680	
5	-	0		3221.02	2400	7730448	
6	-	0		3543.12	2400	8503492.8	
7	-	0		3897.43	2400	9353842.08	2
8	-	0		4287.18	2400	10289226.29	25
9	-	0		4715.9	2400	11318148.92	28
10	-	0		5187.48	2400	12449963.81	31
11	-	0		5706.23	2400	13694960.19	34
12	-	0		6276.86	2400	15064456.21	37
13	-	0		6904.54	2400	16570901.83	41
14	-	0		7595	2400	18227992.01	45
15	-	0		8354.5	2400	20050791.21	50
16	-	0		9189.95	2400	22055870.33	55
17	-	0		10108.9	2400	24261457.37	60
18	-	0		11119.8	2400	26687603.1	66
19	-	0		12231.8	2400	29356363.42	73
NPV	¢317,298,410						
IRR	103%						