



Incentives for cocoa bean production in Ghana: Does quality matter?

W. Quarmine^{a,b,*}, R. Haagsma^a, O. Sakyi-Dawson^b, F. Asante^c, A. van Huis^d, D. Obeng-Ofori^b

^a Development Economics Group, Wageningen University, P.O. Box 8130, NL-6700 EW Wageningen, The Netherlands

^b College of Agriculture and Consumer Sciences, University of Ghana, Legon, Ghana

^c Institute of Statistical Social and Economic Research, University of Ghana, Legon, Ghana

^d Laboratory of Entomology, Wageningen University, The Netherlands

ARTICLE INFO

Article history:

Received 21 September 2011

Accepted 1 June 2012

Available online 16 September 2012

Keywords:

Value chain

Information asymmetry

Institutional experiments

ABSTRACT

This paper investigates the institutional factors that constrain farmers' incentives to enhance the quality of cocoa beans in Ghana. Data were collected at three levels of aggregation in the cocoa bean value chain: village, district, and national level. Multi-stage cluster sampling was employed to sample 120 farmers and 12 purchasing agents of licensed buying companies from 12 villages in Assin Foso, Suhum, Dormaa and Wasa Akropong cocoa districts. Convenience sampling was used to sample key informants from relevant organizations and service providers at district and national levels. The study revealed that, even though quality is important to all categories of actors in the cocoa sector, interactions among them are hampered by problems of information asymmetry that result especially in farmers evading recommended practices. While cocoa sector policies ensure the export of premium quality cocoa, policies have not sufficiently alleviated the information problem especially in the relation between farmers and cocoa purchasing agents. It explains why Ghanaian farms have not been able to reach their full potential to produce more than 1,000,000 metric tons of premium quality cocoa annually. Amongst other options, self-selection policies, such as quality testing with price premiums, are recommended for testing as potential incentive mechanisms that address information asymmetry.

© 2012 Royal Netherlands Society for Agricultural Sciences. Published by Elsevier B.V.
All rights reserved.

1. Introduction

Cocoa beans exported from Ghana attract a substantial quality premium compared with cocoa from other countries [1,2]. These quality premiums partly explain the high revenue Ghana earns from cocoa, amounting to about 30% of Ghana's total export revenue and about 4% of GDP.¹ Ghana's status as a supplier of premium quality cocoa is a result of strict post-production quality control measures [3]. The volume of high-quality cocoa beans could be increased if farmers could be motivated to enhance the quality of harvested cocoa beans [4–7].

The question is why cocoa farms in Ghana do not reach their full yield and quality potential. It is thought that institutional factors restrain farmers' incentives to enhance the

quality of the cocoa beans they produce [8]. The Convergence of Sciences – Strengthening Innovation Systems (CoS-SIS) research programme (see Introduction to this issue), of which this study forms part, proposes to tackle the quality concern in Ghana's cocoa sector through experimenting with institutional change [9–13]. The CoS-SIS approach involves identification and facilitation of institutional changes that might provide incentives for Ghanaian cocoa farmers to enhance the quality of the cocoa beans they produce. Quality cocoa here refers to cocoa that is well fermented, dried, and free from disease, contamination and other physical defects.

Because the kinds of change that might achieve this quality objective cannot be known in advance, industry stakeholders acting together in a Concertation and Innovation Group (CIG) have been convened to identify, develop and implement institutional experiments to discover which options work best. In the cocoa domain, the success or otherwise of the CoS-SIS approach will depend on how thoroughly the issue of farmers' incentives to enhance cocoa bean quality is understood. This paper is based on a diagnostic study of the institutional factors that have been identified as constraining farmers' practices to enhance cocoa bean quality. Other studies that analyse the cocoa sector of Ghana from an institutional point of view do not pay much attention to the incentives to sustain quality by cocoa farmers [14–18].

Abbreviations: COCOBOD, Ghana Cocoa Board; CoS-SIS, Convergence of Sciences – Strengthening Innovation Systems; GDP, gross domestic product; LBC, licensed buying company; PPRC, Producer Price Review Committee.

* Corresponding author at: Development Economics Group, Wageningen University, P.O. Box 8130, NL-6700 EW Wageningen, The Netherlands.
Tel.: +31 233 20 2749200.

E-mail address: qandq2002@hotmail.com (W. Quarmine).

¹ Bank of Ghana Annual Report, 2009.

The objective of this paper is to identify the institutional factors that act as a disincentive to farmers to enhance the quality of their cocoa beans. Specifically, the paper addresses four questions: (1) How do the key actors in Ghana's cocoa sector define quality? (2) What is the state of cocoa bean quality in Ghana? (3) What are the institutional and socio-technical reasons underlying the cocoa bean quality problem? (4) What institutional or policy options are likely to address the quality problem in Ghana's cocoa?

The study was based on two assumptions: (1) the quality of cocoa beans produced and exported depends on the actions and interactions of all the actors in the cocoa sector and (2) institutions shape the incentives for these actions and interactions [19]. Institutions are "...the set of common habits, routines, established practices, rules or laws that regulate the relations and interactions between individuals and groups" [20,21]. Actors in this study refer mainly to those individuals or organizations involved with the physical handling of cocoa beans from production to export. They include farmers, licensed buying companies (LBCs), which buy cocoa beans from farmers on behalf of the third-party actor, the Cocoa Board (COCOBOD). The latter is a parastatal entity that governs the industry and also handles all cocoa bean exports.

2. Methodology

2.1. Study context

CoS-SIS selected the cocoa sector as one of its research domains because of this sector's importance to the national economy. Problem identification was carried out in three phases. First, a scoping study was conducted that identified the main concerns in the cocoa sector [8]. Second, stakeholder workshops were held throughout the cocoa belt to identify and prioritize the possibly inadequate incentives for farmers to enhance quality. This paper relates to the third phase, and reports the findings of a follow-up diagnostic study of the prioritized problem. The analysis is conducted mainly from the perspective of the cocoa farmer. Such a perspective is appropriate since it is the farmers' response to any institutional improvement that is likely to enhance the quantity and quality performance of the sector.

2.2. Sampling procedures

The study was carried out in the cocoa districts of the southern part of Ghana from June to September 2010. Data were collected at three levels of aggregation: village, district, and national level. Multi-stage cluster sampling was employed to select respondents at the village and cocoa district levels. At the village level, data were collected from farmers and the purchasing clerks of the LBCs. At the district level, data were obtained from the staff of the Quality Control Company, the Cocoa Extension Co-ordinators of COCOBOD, and the District Officers of the LBCs. Convenience sampling was used to select one key informant from each relevant organization at the national level, including COCOBOD, cocoa processors, and input companies.

In order to select respondents from village and district levels, the 38 districts were clustered into four cocoa agro-ecological zones, based on the assumption that climatic factors affect cocoa bean quality [22]. One cocoa district was selected randomly from each zone: Assin Foso from the coastal savannah zone, Suhum from the deciduous rain forest zone, Wassa Akropong from the rain forest zone, and Dormaa Ahenkro from the transitional zone. Next, simple random sampling techniques were used to select three cocoa-growing villages from a list of villages in each of the four districts. Nkrankwanta, Ayitey, and Wura Kesse were selected from the Assin Foso district; Anum Asuogya, Duodukrom, and Kuano from

Table 1
Districts and villages sampled in this study.

Ecological zone	District	Villages
Coastal savannah	Assin Foso	Nkrankwanta Ayitey Wurakesse
Deciduous rain forest	Suhum	Asuogya Duodukrom Kuano
Rain forest	Wassa Akropong	Oppong Valley Bogoso Donkor Krom
Transitional zone	Dormaa Ahenkro	Esikese Diabaa Nkrankwanta

Source: Field data 2010–2011.

the Suhum District; Nkrankwanta, Esikese, and Diabaa from the Dormaa Ahenkro District; and Bogoso, Donkor Krom, and Oppong Valley from the Wassa Akropong District (Table 1).

A two-stage sampling procedure was used to select farmers in each village. In the first round, five cocoa farmers were purposively selected in each village and invited to participate in focus group discussions. They were selected on the basis of their general knowledge of the sampled communities, and helped us to draw up a tentative list of cocoa farmers in the village. In the second round of sampling, 10 cocoa farmers were randomly selected from each village using the tentative list as sampling frame, making a total sample of 120 farmers. In addition, in each village further information was obtained from two purchasing clerks of the LBCs and two members of the government's mass cocoa spraying gangs.

2.3. Data collection and analytical procedures

A semi-structured questionnaire was used to collect data from the 120 farmers. A checklist was used to guide the focus group discussions and key informant interviews with the institutional actors. Further information was obtained from a desk review of official documents supplied by COCOBOD. Descriptive statistics involving frequencies and percentages and content-analyses were used to analyse the quantitative and qualitative data, respectively. The quantitative data were analysed using SPSS (version 17, SPSS Inc.). The socio-technical root system tool [23] was used to analyse the technical and institutional causes of poor cocoa bean quality. This tool helped us first to identify the central problem and then to provide biological or technical explanations for the problem, before going on to unravel the institutional cause of the technical reasons identified [23].

The findings from the diagnostic study were further validated during meetings of the cocoa Concertation and Innovation Group (CIG). Key findings were presented also at a meeting of the CIG [October 2010] where participants were invited to make their input into the study, attended by representatives from the Quality Control Company, Ghana Standards Board, Cocoa Inputs Company, Kuapa Kokoo (LBC), Cocoa Research Institute of Ghana (CRIG), University of Ghana, and the Ministry of Finance.

3. Results and analysis

3.1. Definition and perceptions of cocoa bean quality

The international cocoa market defines quality in four main ways, as applied and certified in exporter–buyer contracts: (1) physical quality; (2) bio-chemical quality; (3) process quality; and (4) origin quality [24,25].

3.1.1. Physical quality

Physical quality relates to moisture content, disease infestation, defectiveness of beans, mouldiness, and the presence of foreign matter [26,27]. Both the domestic and the international

Table 2

Percentages of farmers who agree with the statement: “Bean quality is important for Ghana's cocoa sector”.

	Suhum (n = 30)	Dormaa (n = 30)	Assin Foso (n = 30)	Wassa Akropong (n = 30)	Total (n = 120)
Strongly disagree	10.0	3.3	10.0	0.0	5.8
Disagree	20.0	13.3	20.0	33.3	21.7
Neutral	0.0	3.3	0.0	0.0	0.0
Agree	10.0	46.7	10.0	26.7	23.3
Strongly agree	60.0	33.3	60.0	40.0	48.3

Source: Field data 2010–2011.

market enforce physical quality standards because they are easier to assess prior to export. COCOBOD sets and enforces minimum physical quality standards that are higher than the international market standards. These higher standards are imposed because of the likelihood that the cocoa beans will deteriorate in transit between farms and the final market destination. By Ghanaian standards, a bag of cocoa beans is classified Grade I cocoa if the beans are well fermented, have a moisture content not higher than 7.5% and do not contain more than 3% beans with defects. Grade II cocoa is comparable to international premium quality standards that accept 4–8% beans with any of the other defects, in addition to good fermentation, and not more than 8.5% moisture content. Moreover, all cocoa bags must contain cocoa beans of uniform size. While all other actors in Ghana's cocoa sector have accepted the physical quality standards of the COCOBOD, the farmers interviewed were generally unaware of these specific requirements.

3.1.2. Bio-chemical quality

Bio-chemical quality focuses on butter content, flavour chemicals, heavy metals, toxic compounds, and the level of chemical residues left on the beans [28]. Ghana is known for the production of cocoa beans of a high chemical quality. Recently, however, concerns have been raised about chemical residues on its beans. On two occasions cocoa beans from Ghana have been rejected by Japanese and American markets because they exceeded maximum chemical residue requirements. With the exception of COCOBOD, the parameters of the chemical quality standards appear to be unknown to most cocoa actors. Nevertheless, the key informant interviews revealed that COCOBOD itself acknowledges the importance of chemical quality and has taken steps to control chemical usage in the cocoa sector. COCOBOD is also in the process of setting up laboratories to test for the presence of chemical residues on cocoa beans prior to export.

3.1.3. Process quality

Biochemical quality refers to the production process of cocoa i.e., whether organic or inorganic methods are employed; whether child labour is used; and whether the production process and subsequent rewards benefit the farmer and his community (fair trade) [29]. The farmers and the LBCs interviewed did not consider process quality an important component of cocoa bean quality. However, COCOBOD is interested in maintaining Ghana's good quality image on the international market and has taken steps to include process-quality control into its policies. For instance, child labour on cocoa farms in Ghana has been minimized. Some cocoa districts have been marked as organic cocoa zones, while Kuapa Kokoo Ltd. has been certified as a fair trade LBC.

In general, the results from the interviews with farmers revealed that the majority of the respondents (71%) acknowledged the importance of cocoa bean quality to the development of the sector (Table 2) and all of the LBC staff interviewed regarded cocoa bean quality as being important to the sector. The perspective of farmers and LBCs is in line with COCOBOD's vision to “Encourage

and facilitate the production and processing of premium quality cocoa.”²

3.2. State of cocoa bean quality in Ghana

Given the current area under production, cocoa farms have the potential of producing up to 1,000,000 metric tons (MT) of premium quality cocoa annually, yet actual production has not exceeded 750,000 MT [30]. One explanation for this is that a great proportion of the cocoa output suffers from diseases and poor handling prior to purchasing by the LBCs, and are thus regarded as cocoa waste [7]. National data on cocoa waste are available, but do not provide accurate information on the total volume of cocoa going waste on farms. This is because they capture only official cocoa waste purchased by licensed buyers who do not extend their buying activities to all cocoa-growing communities in Ghana. Yet, information gathered from various editions of COCOBOD's annual reports suggests that cocoa waste as a percentage of annual production has increased from about 1.5% in the 1999–2000 season to about 7% in the 2008–2009 season. Although these figures represent official records of cocoa waste purchased in just a few communities, there is no reason to expect that the figures will be very different in other communities and they can be taken as a clear indication that farmers could do more to increase the volume of quality cocoa beans they sell.

The study found, based on key informant interviews with COCOBOD officials and LBCs, that even the cocoa beans bought by the LBCs sometimes fail COCOBOD's strict quality control procedures at district depots. Sometimes bags of cocoa beans fail quality tests because the beans are not well dried, not of uniform size, or simply defective. If the beans are not well dried, then LBCs are asked to dry the beans to the appropriate moisture content. Defective, small, or infested beans should either be thrown away or, if possible, sold to licensed cocoa waste buyers.

It is reported for instance that in the 2004–2005 season, after six weeks of purchases, only 15% of all cocoa purchased by the Produce Buying Company (an LBC subsidiary of COCOBOD) met minimum quality standards [5]. In the 2005–2006 and 2006–2007 seasons, less than 10% of the cocoa purchased by LBCs could meet international premium quality standards because the percentage of cocoa beans with a purple instead of chocolate colour was too high [31]. In Table 3, data from COCOBOD for the different categories of cocoa beans purchased are given. *Main crop* cocoa beans are bigger in size, whereas *light crop* and *small beans* are too small for export. The table shows that over the last 10 years at least 10% of the total volume of cocoa beans purchased from farmers annually was too small to be exported. The rejected beans are sold at a discount to domestic manufacturers. The proportion of light crop and small beans was higher between 2002–2003 and 2007–2008, averaging 25% per annum. It is unclear what explains the very low percentage of light crop and small beans for 2008–2009.

² Source: The mission statement of COCOBOD.

Table 3

Proportion of light crop and small beans purchased in Ghana, 1999–2009.

Season	Main crop	Light crop	Small beans
1999–2000	87.92	10.50	1.58
2000–2001	84.27	10.86	4.87
2001–2002	88.67	10.28	1.05
2002–2003	76.71	18.83	4.46
2003–2004	71.15	26.59	2.26
2004–2005	68.68	28.41	2.90
2005–2006	70.13	28.25	1.62
2006–2007	81.07	11.44	7.49
2007–2008	82.45	9.91	7.64
2008–2009	98.25	1.58	0.16

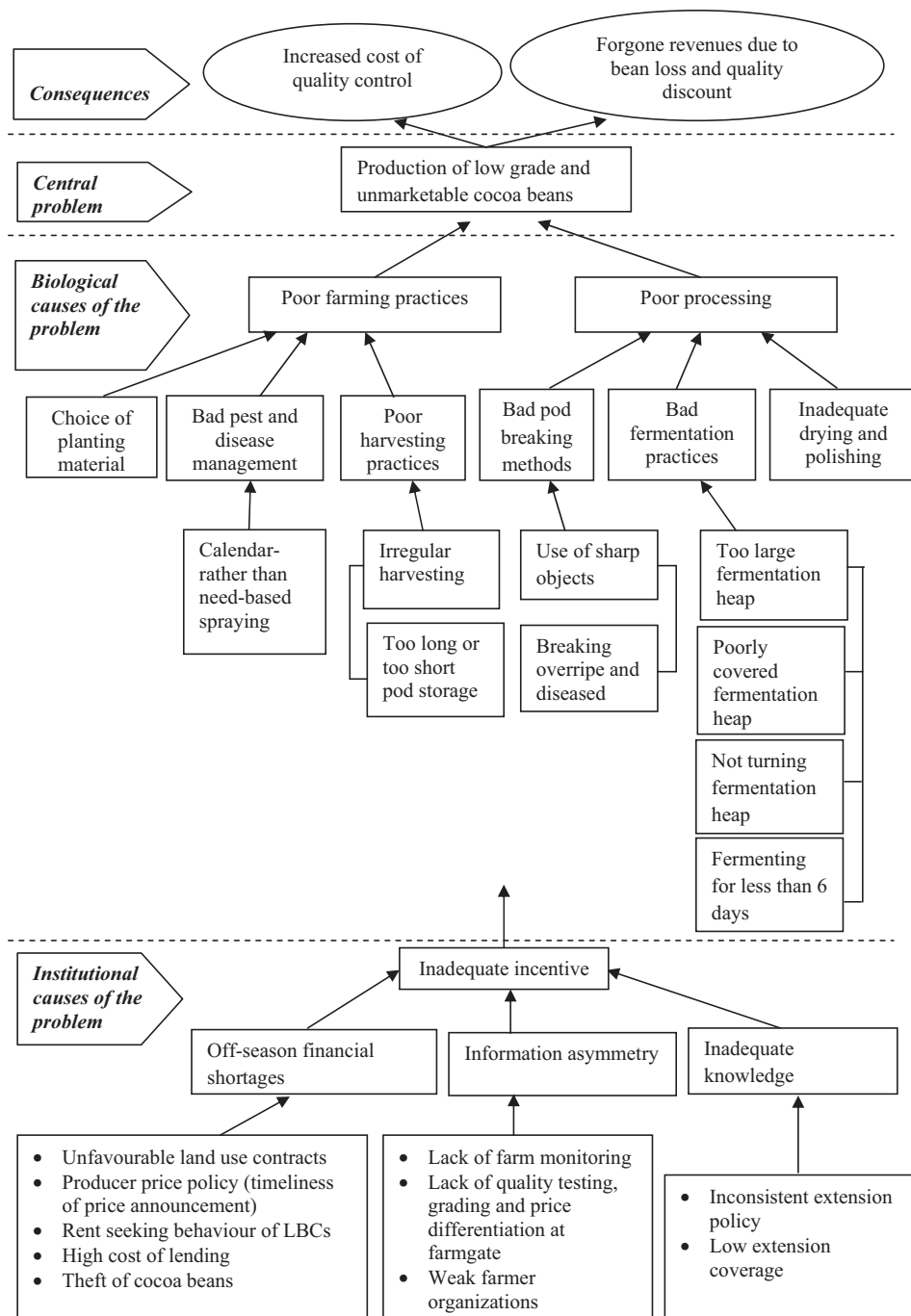
Source: COCOBOD, unpublished data.

3.3. Main causes of the cocoa bean quality problem

Fig. 1 gives a diagrammatic representation of what we think, after analysing responses from interviews, are important technical and institutional causes of the quality concerns mentioned in the previous section.

3.3.1. Technical explanation of the quality problem

Our findings suggest that inappropriate pre- and post-harvest activities are the main technical causes of the quality problem. Table 4 presents the views of the sampled farmers on the practices that result in cocoa beans that cannot be marketed. Even though the choice of variety of cocoa planted affects the bio-chemical quality

**Fig. 1.** Biological and institutional causes of the sub-optimal quality performance of cocoa farmers.

Source: Diagnostic Study, 2010/2011.

Table 4

Percentages of farmers who agree that the listed practices result in poor bean quality.

Farm practices	Suhum (n = 30)	Dormaa (n = 30)	Assin Foso (n = 30)	W. Akropong (n = 30)	Total (n = 120)
Variety type	6.7	13.3	6.7	0.0	6.7
Poor farm sanitation	96.6	100.0	83.3	100.0	95.0
Type of chemicals used	76.7	76.7	46.7	70.0	67.5
Frequency of harvest	96.6	96.6	76.7	86.7	89.2
Length of pod storage	90.0	93.3	70.0	80.0	83.3
Poor pod breaking	93.3	90.0	76.7	100.0	90.0
Poor fermentation	83.3	90.0	76.7	86.7	84.2
Inadequate drying	60.0	66.7	90.0	70.0	71.7

Source: Field data 2010–2011.

Table 5

Percentages of farmers satisfied with selected components of COCOBOD's price policy.

Price policy component	Suhum (n = 30)	Dormaa (n = 30)	Assin Foso (n = 30)	W. Akropong (n = 30)	Total (n = 120)
The price (amount)	60.0	83.3	13.3	70.0	61.6
General price increase	90.0	90.0	76.7	90.0	86.7
Timing of announcement	13.3	30.0	16.7	10.0	17.5
Cocoa bonus	70.0	70.0	60.0	80.0	62.5

Source: Field data 2010–2011.

[32], only 7% of the farmers thought that the cocoa variety determines the final quality of cocoa beans. Table 4 also shows that most farmers acknowledged the importance of farm maintenance (95%), appropriate harvesting (89%), good pod storage (83%), fermentation (84%), and drying (71%) in enhancing the quality of the cocoa beans they produce. They explained, however, that carrying out all the necessary farm practices requires extra costs in terms of time and inputs. It is not always possible for farmers to meet these costs because they do not have an adequate incentive to do so.

3.3.2. An information problem

The main reason why the incentive is inadequate appears to be that the domestic cocoa market suffers from a number of information asymmetries. Farmers tend to have more knowledge than the LBCs and COCOBOD about the production and post-harvest practices they apply and hence about some aspects of the quality of their cocoa beans prior to sale. At the same time, farmers lack information about other important aspects of bean quality and required standards that is generated and shared at levels far above them in the cocoa chain.

The asymmetries persist partly because the LBCs and COCOBOD do not have effective mechanisms for monitoring the production process of farmers. The high cost of monitoring each farmer's activities could explain the absence of such procedures. The only time farmers' practices are monitored is during the government's mass spraying of cocoa farms, where the supervisors of spraying gangs ensure that farmers have carried out their farm maintenance activities, such as weed removal and pruning the trees, before the cocoa trees are sprayed against insects (capsids) and fungal disease (black pod).

Prior to the 1980s, when cocoa farmers were better organized, the farmer organizations had rules for monitoring members' practices. The collapse of the farmer organizations throughout the cocoa growing communities arose from political interference, poor organization, and growing mistrust among farmers that increased during prolonged periods of political turbulence [35]. Though there is an umbrella cocoa farmer organization, called the Ghana Cocoa Coffee Sheanut Farmers Association, the association is active only at national level.

Another explanation for the observed information asymmetry is that in Ghana's cocoa industry the cocoa beans are not graded prior to purchase by the LBCs. It is only after the purchased cocoa beans are bulked, sorted, and evacuated from the farms to district depots that the strict quality control procedures of COCOBOD take

effect. Meanwhile, because of high competition among the LBCs for farmers' beans, LBCs buy all the cocoa beans offered to them by farmers and recondition them later through drying and sorting. Farmers thus have a high incentive to reduce their production costs by shirking some of the recommended practices.

3.3.3. A knowledge problem

From the analyses of the focus group discussions with farmers it was observed that, apart from the information asymmetries between farmers and the LBCs, farmers find the linkage between COCOBOD policies and cocoa bean quality hard to read. Farmers have not received training and feedback on many aspects of quality control standards. The merger of the Cocoa Service Division of COCOBOD, which formerly was in charge of the dissemination of information, with the Agricultural Extension Department of the Ministry of Food and Agriculture (that became known as the unified extension system) marked the beginning of the collapse of specialized advisory services for cocoa farmers. Extension officers under the unified extension system are not sufficiently resourced to carry out their information task with respect to this crop [36].

COCOBOD has recently partnered with private sector organizations like Cadbury Plc. to provide extension services to farmers. It is too early to assess the impact on information asymmetries and especially on farmers' knowledge. However, there is a concern that under this arrangement, the farmer: extension worker ratio remains high. For example, at the time of this study, none of the Cocoa Offices in the districts studied had more than seven extension agents. This is woefully inadequate, considering that each of these districts had no less than 90 cocoa growing villages.

Most farmers interviewed were generally satisfied with COCOBOD's price policy (Table 5). Apart from the amount paid per bag of cocoa, the expectation of annual price increments gives the farmers the assurance that their demands are being recognized even though they were mostly not comfortable with the timing of price announcements. Under their price policy, COCOBOD insures farmers against world price volatility by selling cocoa in forward markets. Windfalls are paid to farmers as bonuses. Farmers do not perceive the current bonuses paid to them as in any way related to the quality of their beans.

3.3.4. An income problem

Notwithstanding the seemingly favourable price policy environment, farmers are faced with an income problem that sometimes makes them reluctant to invest into quality-related activities. It

is instructive to illustrate farmers' income problems by way of a numerical example. In line with the data from our survey and other national estimates, suppose an annual output of 250 kg beans per hectare and an annual labour requirement of 80 working days per hectare [14,33,34]. Also suppose that, again in agreement with what we found, about 40% of the labour requirement is hired at the cost of US\$ 3.57 per day, 10% comes from non-paid sources like family and reciprocal labour; and the remaining 50% is the farmer's own labour. In the 2010–2011 season the price per kg of cocoa beans stood at US\$ 2.23. Since the government provides chemical spraying for crop protection throughout the cocoa belt, the farmer pays only for the cost of hired labour.

Suppose a farmer crops one hectare of cocoa. There are three types of farmers: those who own the land (owner–farmer), tenant–farmer, and caretakers. Each of them earns the same revenue: $250 \times \text{US\$ } 2.23 = \text{US\$ } 557.50$.

The accounting profits – revenue minus explicit out-of-pocket costs – depend on the type of farmer.

Owner–farmer. Since 40% of his labour requirement is hired (i.e., 32 days), we find for his accounting profit (AP) $AP(\text{owner}) = \text{US\$ } 557.50 - 32 \times \text{US\$ } 3.57 = \text{US\$ } 443.26$.

Tenant–farmer. He is always tied to an *Abunu* land use contract. *Abunu* is a land use system in which a piece of land is given to a farmer and crops are shared on a fifty–fifty basis between farmer and landowner. The farmer's explicit costs include payment for hiring of labour and, under the *Abunu* land use contract, half of his output as rent. Therefore, $AP(\text{tenant}) = \text{US\$ } 557.50 - 32 \times \text{US\$ } 3.57 - 1/2 \times \text{US\$ } 557.50 = \text{US\$ } 164.51$.

Caretaker. He is always contracted under the *Abusa* land use contract where he earns one third of the output. His explicit costs are even larger, since under the *Abusa* land use contract two-thirds of the output is paid as rent, so $AP(\text{caretaker}) = \text{US\$ } 557.50 - 32 \times \text{US\$ } 3.57 - 2/3 \times \text{US\$ } 557.50 = \text{US\$ } 71.59$.

However, the relevant income yardstick is not accounting profit but economic profit, which also takes account of implicit costs. Implicit costs are captured by the wage income a farmer could have earned by working on someone else's farm or in another form of employment. Since 50% of the farm labour requirement consists of farmers' own labour, each type of farmer has an implicit cost of $40 \times \text{US\$ } 3.57 = \text{US\$ } 142.80$. Moreover, an owner could also lease his land, so he has an additional implicit cost of $1/2 \times \text{US\$ } 557.50 = \text{US\$ } 278.57$ if he rented his land under the *Abunu* system, and $2/3 \times \text{US\$ } 557.50 = \text{US\$ } 371.67$ under the *Abusa* system.

In sum, if we assume that farmers always have the opportunity to hire themselves out or to lease their land, then an owner–farmer earns an economic profit of US\$ 21.71 ($443.26 - 142.80 - 278.75$) if he leases his land under the *Abunu* system or, in the case of the *Abusa* system, an economic loss of US\$ 71.21 ($443.26 - 142.80 - 371.67$). A tenant–farmer earns an economic profit of US\$ 21.71 ($164.51 - 142.80$); whereas a caretaker always makes an economic loss of US\$ 71.21 ($71.59 - 142.80$).

The example illustrates the fragile basis of farmers' economic position and helps explain why making quality-related investments would require stronger incentives to be provided to them. Although the assumptions in the example may be oversimplified, the example illustrates the fact that without adequate price and non-price incentives most farmers, that is, tenants and caretakers, are unable to carry out the recommended practices, even if they would know what these are.

This constraint arises from the financial losses farmers appear to be making because of the relatively low revenue compared with other uses of their labour and the high cost of renting land. Poor financial services for cocoa farmers, because of the perceived high risks associated with lending to farmers, and because of lack of alternative sources of income during off-season periods affect farmers' financial position, contribute to the income problem.

Two other key issues can be mentioned that affect the financial position of farmers. First, during the interviews and focus group discussions it emerged that the timing of the announcement of producer prices varied from season to season and often were announced too late to inform farmers' production and marketing decisions. The general schedule of events is as follows. Cocoa purchases are halted in June each year. A Producer Price Review Committee (PPRC) announces the new prices that will be paid at the commencement of cocoa bean purchases between September and October each year. Farmers begin harvesting by the end of July and sometimes have to sell their cocoa beans at the prices of the previous year between July and October because of delays in the announcement of new prices. This seems on the face of it to confirm that timing is an issue that may lead to a considerable loss of income for farmers, particularly since up to this year the new prices have always been higher than in the previous years.

Secondly, rent-seeking activities by competing LBCs also affect farmers' financial position. An example is their adjustment of the weighing scales in order to obtain more cocoa beans from farmers at the going price. Some farmers and LBCs interviewed mentioned that although there is the so-called 'official Accra weight', which is the Producer Price Review Committee's (PPRC's) unit of 64 kg per bag, the prevailing weight is the 'village weight' used by the LBCs, which varies between 65 kg and 70 kg per bag. Farmers have not been able to negotiate their way out of this unfortunate position, probably because they are weakly organized. The LBCs argue that the extra revenue accrued from the adjusted scales covers the risk they have to bear when they purchase cocoa beans of low quality from farmers.

4. Discussion

4.1. Institutions and actor interactions

Problems related to commodity quality are often attributed to information asymmetry [37–39]. The information asymmetry problem is easier to understand when one analyses the interactions among the three main categories of actors in the sector i.e., those who ensure the movement of cocoa beans from the farm to the chocolate manufacturer–farmers, LBCs and COCOBOD. Hueth et al. [39] posit that when incentive problems affect the quality of agricultural commodities, then input control, field visits, quality measurement, and general price increases are the best institutional mechanisms for co-ordinating the interaction between actors in order to ensure quality [40,41]. Two interactions seem to be particularly important here: between COCOBOD and farmers, and between the LBCs and farmers.

The relation between COCOBOD and farmers can be best described as paternalistic. The farmers consider themselves to be the recipients of policies, technologies and inputs from COCOBOD and to have minimal participation in the decision-making processes. Because farmers do not supply cocoa beans directly to COCOBOD, the latter relies solely on reciprocity, that is, by designing a number of beneficial policies in the hope that farmers will respond by supplying quality cocoa beans.

COCOBOD regulates all the chemical inputs imported into the country for use on cocoa farms even though sometimes unapproved chemicals have found their way to the market for farmers' use. Also, COCOBOD uses part of the export revenues from cocoa to carry out mass-spraying of all cocoa farms at least twice per season. The mass-spraying campaign has been expanded since the 2008–2009 season with the introduction of foliar liquid fertilizers in addition to pesticides and fungicides. This helps to reduce the information problem because the majority of cocoa farms are treated with the right chemicals at least once a year. However, it does not effectively

tackle the quality aspects of cocoa pests and diseases because it is calendar-based and not need-based. It was observed during this study that the mass-spraying campaign also faces such challenges as fraudulent diversion of the approved chemicals, the inefficient application techniques used by spraying gangs, application schedules that do not follow COCOBOD recommendations, and political interference.

Price policy is used to co-ordinate the interactions between COCOBOD and farmers. It is effective for the sector as a whole because cocoa supply responds positively to prices. However, the PPRC, which is responsible for setting cocoa producer prices (their recommendation is then forwarded to the Cabinet for approval), finds it difficult to make the voices of the farmers heard even though farmers are represented on the PPRC [42]. The farmer representatives interviewed indicated that they are sometimes not adequately briefed about the methods used to determine prices. Over the years, two modes have been adopted. Prior to the cocoa sector reforms in the 1990s, the policy was to set the price at a level equivalent to the estimated cost of production plus a profit margin. Presently, price-setting is based on a calculated percentage of the free on board (f.o.b) price that Ghana receives from the export of cocoa beans. Even though the PPRC recommended (and the Cabinet accepted) an increase in the price paid to cocoa farmers from 23.3% of the f.o.b price in 1983–1984 to up to 73% in 2008–2009, it is not known which of the two modes provides sufficient motivation to farmers to want to further enhance cocoa bean quality.

Under the current price policy, the information problem in the cocoa sector seems difficult to solve. In principle, a combination of testing and price differentiation could initiate a self-selection process where some farmers would be discouraged from supplying low-quality beans, and others encouraged to produce and sell high-quality beans. From the perspective of COCOBOD, quality already is factored into the pricing formula since its licensed buyers purchase only premium quality cocoa. Furthermore, the two quality grades sold from Ghana are marketable as premium cocoa on the international market. Hence, COCOBOD does not seem to have any incentive to introduce differentiated prices as long as they can be sure of obtaining a sufficient volume of quality beans. On the other hand, the LBCs may have an incentive to differentiate prices in order to increase the volume of quality beans they buy from farmers, yet the cocoa marketing rules do not give much room for the LBCs to implement such a price policy. This is because LBCs do not receive a differentiated price from COCOBOD.

There are other policies introduced by COCOBOD that provide incentives to cocoa farmers to improve their production. These include an input credit programme (the so-called hi-tech scheme), a 45% fertilizer subsidy, annual scholarship grants awarded to about 2600 children of cocoa farmers and the staff of COCOBOD, and flexible house mortgage schemes.

These policies, however, do not help to reduce the information asymmetries in the sector. Also, the majority of farmers are not able to access these benefits because they either are smallholders or they are sharecroppers who do not own the cocoa farms they crop. The house mortgage scheme, for instance, still is too expensive for sharecroppers and, apart from the fact that only 40% of farmers' children benefit from the scholarships, some of the criteria for accessing the cocoa scholarships do not favour smallholders' children. For example, the examination results of children attending village schools i.e., those attended by farmers' children, are often too poor to meet the pass mark required to access cocoa scholarships.

Information asymmetry is more persistent in the interaction between farmers and LBCs than between farmers and COCOBOD since farmers supply their beans straight to LBCs. Prior to the

reforms of the 1990s, only the Produce Buying Company, a subsidiary of COCOBOD, purchased cocoa beans. While this monopoly had some negative socio-economic effects, farmers' cocoa beans were closely inspected at the village-level and a premium was paid for quality. This partly explains the high quality status Ghanaian cocoa beans enjoyed in the years preceding the reforms. The introduction of more LBCs after the reforms brought with it a weakening of the village-level mechanism for bean quality checks and enforcement. This has provided room for rent-seeking activities by LBCs that in turn undermine the grounds for paying quality premiums. Presently LBCs have little or no mechanisms for ensuring that farmers stick to recommended practices. The fundamental concern over the farmer–LBC interaction is that LBCs are becoming merely profit-seeking agents of COCOBOD. Since the rules regarding the marketing of cocoa beans give the LBCs little room to independently tackle the information problem, they themselves have not taken action to remedy the situation.

4.2. Institutional gaps and opportunities for experimentation

The execution of a diagnostic study on the institutions governing interactions in a public-interest sector like cocoa faces the problem of acquiring adequate data. Moreover, it is difficult to point out any shortcomings while Ghana enjoys a high reputation for the export of quality beans. Notwithstanding these difficulties, the study has shown that COCOBOD's policies have provided some incentives to farmers to enhance quality but also that these policies only partly reduce the information asymmetries among cocoa farmers, LBCs, and COCOBOD. It has been demonstrated that this may be the real reason why some farmers shirk the responsibility of adopting the recommended production and post-harvest management practices.

Farmers who do not stick to the recommended practices remain undetected and unsanctioned: no mechanism nor procedure exists to enforce their adoption. These gaps represent opportunities for institutional change that could help reduce the information problem and at the same time provide cocoa farmers a more remunerative reward for their activities. The original entry point of the CoS-SIS cocoa domain research was to sustain the quality of cocoa bean by means of changes in the structure of incentives. This study suggests that further research is warranted that takes into account the potential influence of farmer organizations and networks on member farmers' production practices. The main suggestion arising from this study is that the appropriate development of self-selection mechanisms, such as quality testing coupled with price premiums paid at farm gate, could overcome the negative impact of the existing information asymmetries in the cocoa sector and hence is an option worth exploring as a policy experiment. Another worthwhile institutional experiment would be to make the cocoa price policy formulation process more transparent and to increase the transparency of the relation between pricing and quality. Exploration of the economic, social and quality impacts of different modes of pricing would also provide useful insight into price policy options for enhancing cocoa bean quality.

The institutional experiments suggested by the analysis in this paper should be of interest to the cocoa Concertation and Innovation Group. However, the higher level institutional changes would require evidence and feedback from the farmer- and village-level experiments. Experiments that provide differentiated incentive prices for farmers (which might become part of our on-going (PhD) research), could provide information about cost-effective strategies for enhancing cocoa bean quality by raising standards right from the beginning of the value chain. Such experiments would provide insight into how farmers might respond, in terms of quality and quantity, to the introduction of alternative pricing mechanisms into the local cocoa market.

5. Conclusions

This paper reports the findings of a diagnostic study on quality in the cocoa sector in Ghana, focusing on the institutional factors that act as a disincentive for farmers to enhance the quality of cocoa beans. The concept of cocoa bean quality is complex, encompassing socio-economic, physical, and bio-chemical aspects as well as the process of cocoa production. Currently, because of the relative ease of observing physical characteristics, both domestic and international markets emphasize physical quality.

The analysis highlights the fact that although Ghana exports only premium quality cocoa beans, the volume of high quality beans could be increased if farmers were motivated to enhance the quality of their harvested cocoa beans. At present, farmers sometimes are unable or unwilling to invest resources into the recommended farm practices because there are little or no incentives to do so.

The key explanation identified for the lack of incentives is that the interaction among farmers, LBCs and COCOBOD is characterized by problems of information asymmetry. The lack of farm monitoring and grading services, and the lack of strong farmer organizations, allow the information problem to persist. Furthermore, our analysis shows that farmers face an income problem off-season that restricts the potential for investment of any kind, and have little knowledge of either the recommended farm practices or COCOBOD policies and standards with respect to quality.

The current policies of COCOBOD do not address adequately the incentive problem. The policy gap presents an opportunity for experimenting at farmer- and higher levels that might lead to institutional improvements through the value chain that would help enhance and sustain cocoa bean quality and increase the reward that farmers receive.

Acknowledgements

This study was funded by the Convergence of Sciences – Strengthening Innovations Systems (CoS-SIS) research programme. We are grateful to Mr. Felix Awu, MIS officer at the Ministry of Agriculture at Suhum Craboar-Coaltar District. We also appreciate the assistance of the staff of COCOBOD, in all the districts we visited, for helping us to complete this study.

References

- [1] P. Jano, D. Mainville, The cocoa marketing chain in Ecuador: analysis of chain constraints to the development of markets for high-quality cacao, Paper Presented at IAMA Conference, Parma, Italy, 2007.
- [2] T. Wahyudi, The world scenario of cocoa production and consumption, Paper Presented at 2nd International Plantation Industry Conference and Exhibition (IPiCEX), UiTM Shah Alam, Selangor, Malaysia, 2008.
- [3] T. Williams, An African success story: Ghana's cocoa marketing system, Institute of Development Studies Working Paper 318, 2009.
- [4] D.A. Kotey, W.S.K. Gbewonyo, K. Afreh-Nuamah, High chlorpyrifos levels on vegetables in Ghana, *Pesticides News* 80 (2008) 4–6.
- [5] K. Kpodo, Ghana Light Crop Cocoa Purchases Pull Ahead of 06/7, Dow Jones Newswires, New York, 2006.
- [6] A. Laven, Marketing Reforms in Ghana's Cocoa Sector, ODI Background Note, London, 2007.
- [7] I. Osei, Sustainable practices in the global cocoa economy—a producer's perspective, Paper Presented at 4th Indonesia International Cocoa Conference, Indonesia, 2007.
- [8] E.N.A. Dormon, O. Sakyi-Dawson, Exploring opportunities for enhancing the profitability and sustainability of cocoa production in Ghana, in: A. van Huis, A. Youdeowei (Eds.), *Towards Enhancing Innovation Systems Performance in Smallholder African Agriculture*, Elmina, Ghana, 2009, pp. 68–69.
- [9] F.W. Geels, Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, *Research Policy* 21 (2002) 1257–1274.
- [10] F.W. Geels, From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory, *Research Policy* 33 (2004) 897–920.
- [11] D. Hounkonnou, A. van Huis, A. Röling, B. Sterk, The innovation systems approach proposed for CoS-SIS, in: A. van Huis, A. Youdeowei (Eds.), *Towards Enhancing Innovation Systems Performance in Smallholder African Agriculture*, Elmina, Ghana, 2009, pp. 11–14.
- [12] R. Kemp, J. Schot, R. Hoogma, Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management, *Technology Analysis and Strategic Management* 10 (1998) 175–196.
- [13] A. Rip, R. Kemp, Technological change, in: S. Rayner, E.L. Malone (Eds.), *Human Choice and Climate Change*, Battelle Press, Columbus, OH, 1998, pp. 327–399.
- [14] O. Abenyega, J. Gockowski, Labour practices in the cocoa sector of Ghana: with a special focus on the role of children, STCP/IITA Monograph, IITA, Ibadan, Nigeria, 2003.
- [15] W. Asenso-Okyere, The response of farmers to Ghana's adjustment policies, in: *The Long-Term Perspective Study of Sub-Saharan Africa*, The World Bank, Washington, DC, 1990, pp. 74–83.
- [16] F. Baah, Harnessing farmer associations as channels for enhanced management of cocoa holdings in Ghana, *Scientific Research and Essay* 3 (2008) 395–400.
- [17] M.J. Bateman, A. Meeraus, D.M. Newbery, W. Asenso-Okyere, G.T. O'Mara, Ghana's Cocoa Pricing Policy, Agricultural and Rural Development Department, The World Bank, Washington, DC, 1990.
- [18] T. Takane, Incentives embedded in institutions: the case of share contracts in Ghanaian cocoa production, *The Developing Economies* 38 (2000) 374–397.
- [19] J. Woodhill, Institutional change—a framework for analysis, in: *Wageningen International Occasional Paper*, Wageningen International, Wageningen, 2008.
- [20] C. Edquist, B. Johnson, Institutions and organizations in systems of innovation, in: C. Edquist (Ed.), *Systems of Innovation*, Pinter, London, 1997, pp. 41–63.
- [21] A.J. Hall, L.K. Mytelka, B. Oyelaran-Oyeyinka, Concepts and guidelines for diagnostic assessments of agricultural innovation capacity, *UNU-MERIT Working Paper* 2006-017, 2006.
- [22] K.A. Oluyole, The effect of weather on cocoa production in different agro-ecological zones in Nigeria, *World Journal of Agricultural Sciences* 6 (2010) 609–614.
- [23] C. Leeuwis, Innovation as a process of network building, social learning and negotiation—implications for transdisciplinary research collaboration, Paper Presented at Trans-KARST 2004—International Transdisciplinary Conference on Development and Conservation of Karst Regions, Hanoi, 2004.
- [24] S. Asuming-Brempong, D.B. Sarpong, N.A. Anyidoho, R. Kaplinsky, J. Leavy, Mapping sustainable production in Ghanaian cocoa. Report to Cadbury, Accra, 2008, 96 pp.
- [25] C.S. Poulsen, H.J. Juhl, K. Kristensen, A.C. Bech, E. Engelund, Quality guidance and quality formation, *Food Quality and Preferences* 7 (1996) 127–135.
- [26] R. Dand, *The International Cocoa Trade*, Woodhead Publishing Ltd., Cambridge, 1999.
- [27] D.A. Sukha, Potential value added products from Trinidad and Tobago cocoa, in: *Revitalisation of the Trinidad and Tobago cocoa industry—Targets, Problems and Options*, The Association of Professional Agricultural Scientists of Trinidad and Tobago, Trinidad and Tobago, 2003, pp. 69–73.
- [28] M. Gilmour, Quality and food safety in a sustainable cocoa supply chain, in: 16th International Cocoa Research Conference, Bali, 2009.
- [29] S. Ponte, P. Gibbon, Quality standards, conventions and the governance of global value chains, *Economy and Society* 34 (2005) 1–31.
- [30] C. Breisinger, X. Diao, S. Kolavalli, J. Thurlow, The role of cocoa in Ghana's future development, in: *Ghana Strategy Support Program (GSSP)*, International Food Policy Research Institute, Accra, 2008, 24 pp.
- [31] M. Anim-Kwapong, R. Appiah, K. Osei-Bonsu, A review of the factors affecting the quality of processed cocoa beans in Ghana, *Journal of Ghana Science Association* 9 (2007) 103–119.
- [32] L.N. Dongo, E.O. Aigbekaen, C.O. Jayeola, L.A. Emaku, S.B. Orisajo, Influence of farmers practices on cocoa bean quality: Nigeria field experience, in: *African Crop Sciences Conference*, African Crop Sciences Society, Uganda, 2009, pp. 299–302.
- [33] F. Teal, A. Zeitlin, H. Hammah, Ghana Cocoa Farmers Survey, Ghana Cocoa Board, Accra, 2006.
- [34] K. Opoku-Ameyaw, F. Baah, V. Anchirinah, H.K. Dzahini-Obiatey, R.A. Cudjoe, S. Acquaye, Y.S. Opoku, *Cocoa Manual—A Source Book for Sustainable Cocoa Production*, Cocoa Research Institute of Ghana, Tafo, 2010.
- [35] G. Ton, G. Hagelaar, A. Laven, S. Vellema, Chain governance, sector policies and economic sustainability in cocoa: a comparative analysis of Ghana, Côte d'Ivoire, and Ecuador, in: *Markets, Chains and Sustainable Development Strategy & Policy Papers*, Stichting DLO, 2008.
- [36] E.N.A. Dormon, From a technology focus to innovation development: the management of cocoa pests and diseases in Ghana, CERES, Wageningen University, Wageningen, 2006.
- [37] M. Kherallah, J. Kirsten, The new institutional economics: applications for agricultural policy research in developing countries, *MSSD Discussion Papers* 41, 2001.
- [38] G.A. Akerlof, The market for 'lemons': quality uncertainty and the market mechanism, *Quarterly Journal of Economics* 84 (1970) 488–500.
- [39] B. Hueth, E. Ligon, S. Wolf, S. Wu, Incentive instruments in fruit and vegetable contracts: input control, monitoring, measuring, and price risk, *Review of Agricultural Economics* 21 (1999) 374–389.
- [40] J.J. Laffont, D. Martimort, *Theory of Incentives – The Principal – Agent Model*, 12th ed., Princeton University Press, Princeton, NJ, 2002.
- [41] B. Holmström, P. Milgrom, The firm as an incentive system, *American Economic Review* 84 (1994) 972–991.
- [42] M. Vigneri, P. Santos, What Does Liberalization Without Price Competition Achieve: The Case of Cocoa in Ghana, *Ghana Strategy Support Program (GSSP)*, International Food Policy Research Institute (IFPRI), 2008.