Information Efficiency and the Cocoa Supply Chain in Ghana

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Abstract

The challenges of the cocoa supply chain in Ghana have received enormous attention from researchers over the years. This research particularly focused on how efficiency of information from the standpoint of the cocoa farmer contributes to eliminating or ameliorating some of these challenges and thereby impacting on farmers' productivity. Certain risks or challenges have therefore been highlighted time and time again. Among these consist predominantly of issues relating to seedling procurement, fertilizer application, pests and diseases control, and credit and loans facilities. The research therefore explored how information efficiency in these areas impacted on farmers' productivity. Data were collected from three cocoa farming communities in the Eastern Region of Ghana with sample size of 300 and through the use of multiple regression and descriptive statistics tools, established and tested four hypotheses that were produced from the review of literature. The research outcome indicated a strong impact of the lone as well as the combined impacts of the predictor variables; information efficiency levels in seedling procurement, fertilizer application, pests and diseases control and credit and loans facilities on the dependent variable; farmers' productivity. The research also established the relation between gender and income levels of farmers and the information efficiency levels and the resultant effects on farmers' productivity. In respect of these findings, recommendations are offered to improve information dissemination among cocoa farmers in the areas in issue in particular, and Ghana as a whole.

Background of the study

Agricultural sector in developing countries in general remains undeveloped. Nonetheless, in almost all of these countries, agricultural sector is at the heart of their economies. The sector contributes a humongous share of GDP, employs a large proportion of the labor force, represents a major source of foreign exchange earnings, supplies the bulk of basic food required by the population and provides subsistence and other income for large rural populations (FAO, 1997; FAO 2013; and Baffoe-Asare *et al.*, 2013). In Ghana, a developing country on the west coast of Africa, the forgoing paragraph paints a vivid picture of the country's economy. Most literatures attempt an explanation of forces that militate against the agricultural sector in developing economies.

However, in the view of FAO, two factors are preeminent; the past policy bias against agriculture in these countries and the major distortions on world agricultural markets due to the protection and subsidization of this sector in many developed countries (FAO, 1997).Cocoa is a household name in Ghana. The role played by the Cocoa subsector of the agricultural sector as well as the overall economy of Ghana is enormous. Cocoa is Ghana's single greatest export commodity, (COCOBOD, 2014).It formed 45% of export earnings in the 1960s and until 1990, its annual contributions averaged (35%) of the total export earnings of the country, forming 3.5% of the country's Gross Domestic Product (GDP).

However, these figures have plummeted to about 25% (still very significant figure), a quarter of all export earnings in recent times, (Essegbey and Ofori-Gyamfi, 2012; and Cooper and Cudjoe, 2012). On the score of employment, "Cocoa employs approximately 800,000 farm families spread over six of the ten regions of Ghana", (COCOBOD, 2014).Over the past few decades, the subject of sustainability has gained currency among all actors of the cocoa industry; Governments, Multinational Firms, Research Institutions, Standard-setting organizations, Academics, Farmers, inter alia. In the words of Uijl *et al.,* 2013, "Stakeholders in commodity supply chains demand more transparency regarding sustainability of production, work conditions, product quality, safety and compliance with laws and regulations. Supply chain transparency requires the collection and sharing of production information among several stakeholders, as well as some form of external monitoring and review to establish reliability". In furtherance to the observation of Uijl*et al.,* reliability would be achieved when production information is not the only thing sought after but also, market access, both local and international trade laws, price and information on the gamut of actors and processes that will ultimately ensure the creation of sustainability, Mustapha (2004).

Ghana's cocoa supply chain is a complex one, it involves a lot of actors with different interests, different cultural and educational backgrounds and operate under very different conditions. Nonetheless, they are all a part of a network with shared goals and mutual interdependence that demand coordination and information sharing, Uijl*et al.,* (2013). The cocoa supply chain starts with suppliers of farm inputs, then farmers who produce the cocoa beans, Licensed Buying Companies (both private and public) who purchase the beans at farm gates and bag them, then transporters or haulers that convey the bagged beans to the warehouses for export or/and sales at the local and global market, then processors (both local and global companies), then consumers. Also, government of Ghana through COCOBOD, is a key player on the value chain playing different roles at different times and governments of importing countries.

Also civil societies, financial institutions and inter-governmental organizations are important part of the cocoa sector. System's performance is determined by how an entity strategically trade-off cost (efficiency) and responsiveness at all levels (Annan *et al.*, 2013). Information efficiency will definitely take the center stage of such trade-off in any value chain. Then again, you realize it all starts with information sharing. As succinctly captured by Lee *et al.,* (1998), Information Sharing is the basic enabler of tight coordination in the SCM, and averred this is facilitated by advances in Information System Technology. In spite of cocoa's pivotal role in Ghana's economy, the blessings of supply chain integration and implementation have not been adequately realized, a consequence of supply chain underestimation. The outcome as we all know too well has been very devastating on the cocoa industry first of all, and the total economy of Ghana as a whole (Otchere *et al.*, 2013). Generally, the term Supply Chain Management (SCM) seems to have little consensus with respect to its definition (New, 1997; Lummu *et al*., 2001; Mentzer *et al*., 2001; Kauffman, 2002. In: Burgess *et al*., 2006, p.704). Nonetheless, for the purpose of this research the following definition will be used to provide scope, direction and a bit of context:

Supply Chain Management is defined as the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole (Mentzer et al., p. 18. In: Burgess et al., 2006, p. 704).

Interestingly, information system as found out by Burgess *et al*., 2006, is the second most researched of all four "hard constructs" and third of all the seven soft and hard constructs of SCM. According to Wikipedia, "*An information system (IS) is a system composed of people and computers that processes or interprets information*". This brings to fore the significance of information and information efficiency in a supply chain of any kind, with the cocoa industry in Ghana not accepted. Hence, the assessment of information efficiency in the cocoa supply chain of Ghana solely from the context of the Ghanaian farmers.

Problem Statement

Previous researches have heavily concentrated on the challenges or risks in the cocoa supply chain of Ghana. There are a number of risks or challenges that the supply chain of Ghana's cocoa is saddled with; from labor intensive nature of production and harvest, poor health and safety measures, the low incomes of the cocoa farmers, lack of access to credit, uncertain property rights, the forest cultivation methods and the use of pesticides and fertilizers (and the effects of these on public health and the environment), (Oxfam International Research Report, January 2009; Borg *et al.,* 2012; Dorman *et al*., 2012; and Otchere *et al.,* 2013).Additionally, there are the risks of low productivity as an outcome of pests and diseases' incidents, and the reduction in hectares cultivated, (Dorman *et al*., 2004; Borg *et al*., 2012). Furthermore, inadequate information sharing stands prominent due the absence of technological innovations and poor integrated database, impropriety in transport modes and use as well as deplorable conditions of these modes, (Mustapha, 2004; Otchere *et al*., 2013).It is in the light of these findings that this study takes a critical look at information efficiency and the possible ways to attain it in the hope to reduce or eliminate altogether uncertainties from the Ghana's cocoa supply chain in the farmers' context in order to rid the supply chain of some of the challenges above.

1.4 Research Questions

The crux of this research basically is an attempt to reduce or eliminate uncertainties in the cocoa supply chain in Ghana, by creating efficiency in information distribution. This is because; information efficiency is recognized as being a hugely positive impact on supply chain performance.
Now, the research questions to guide the study are:

I. How does information efficiency contribute to the attainment of sustainability in the cocoa industry in Ghana?
II. What is the current efficiency level of information in the cocoa supply chain in Ghana?
III. What is the effect of the current information efficiency level on productivity?
IV. What is the best way to attain information efficiency?

Objective of the study

The principal objective of this academic piece is to reduce or eliminate altogether uncertainties from the cocoa supply chain of Ghana through the assessment of information efficiency and the possible ways to improve it. The following are the specific objectives:

I. To examine the level of information efficiency in cocoa supply chain in Ghana from farmers' viewpoint.
II. To estimate the impact of the current information efficiency level on productivity.
III. To identify how best to disseminate these information to the intended receivers taking into account their total background information, e.g., education, economic status among others.

Literature Review and Research Hypotheses formulation

Researches over the years have greatly captured the various challenges militating against the sustainability of the cocoa supply chain in Ghana. Certain factors stand preeminent and recurrent in most if not all of these studies and are linked one way or the other. It is the hope of this research that efficient information contributes greatly towards the alleviation or elimination of these challenges; hence the assessment of the information efficiency levels from farmers' perspective and possible ways to attain it.

Cocoa Supply Chain in Ghana

The Cocoa Supply Chain in Ghana like most others the world over starts with small holder farmers who are directly involved in the cocoa beans production, (COCOBOD, 2014). The beans are then collected and bagged by Licensed Buying Companies (LBC). Presently, there are 36 active LBCs at the up-country directly engaged in cocoa purchases from the farm gates due to partial liberalization of cocoa marketing in Ghana, (COCOBOD, 2012).From this point, private haulers now are contracted to transport the graded and sealed cocoa after inspection by the Quality Control Company (QCC) of COCOBOD to Cocoa Marketing Company's (CMC), also a subsidiary of COCOBOD and other private warehouses or take-over centers in Tema, Takoradi and Kumasi (Kaase inland port). Quality and weight inspections are carried out again by the QCC of COCOBOD before they are tagged ready for sale or exports. The CMC is the sole agency responsible for the sale and exports of cocoa beans in Ghana.

Though there is been a partial cocoa market liberalization, the Government of Ghana (GoG), through COCOBOD yet exercises heavy control ; issues licenses, finances and regulates activities of LBCs, sets the producer prices and margins, finances researches of the Cocoa Research Institute of Ghana (CRIG), and sells and exports to manufacturing and processing companies home and abroad, (Asante, 2014). Ghana COCOBOD, additionally, supplies farm inputs including fertilizers, farm gears, chemicals at a subsidized prices as well as the offer of scholarships to brilliant children of cocoa farmers, (Van and Nord, 2003).

2.2 Information in Productivity

Most often, low productivity rears its ugly head at any point in time that the subject of efficiency or sustainability is brought up from discussions on footpaths to farms to restaurants through to radio and television talk shows to political platforms, inter alia. Scholastically, certain factors are outstanding in view of low productivity of cocoa beans. Prominent among these are the inaccessibility of credit and loans facilities and improved seedlings by farmers, low producer price, continuous depletion of the forest environment, deplorable socioeconomic conditions of rural farmsteads and farm communities as well as the generality of poor maintenance culture with respect to pests and diseases' control and fertilizer application, specially, in the area of pests and diseases' control (Idachaba & Olayide, 1976; MASDAR, 1998; Asante, Aneani, Asamoah & Baah, 2002; Appiah, 2004; Dormon *et al*., 2004; Anim-Kwapong and Frimpong, 2005; Olujide and Adeogun, 2006; Aneani et al., 2007; Dormon *et al.,* 2007; Borg *et al.,* 2012; Baffoe-Asare *et al.,* 2013; and Otchere *et al.,* 2013).

Information in Seedling Procurement

The research results of Aneani & Ofori-Frimpong (2013), clearly pointed out that, crop productivity to a very large extend depends cardinally on the crop area and the crop yield. And as was identified by Aneani and Ofori-Frimpong's study, improved cocoa seeds is a key factor for increasing crop yield and hence, cocoa productivity. In statistical terms, the research outcome of Edwin and Masters (2005), puts the potential increase in yields as a result of improved seeds around 45 percent at least. Additionally, Tijani (2005), asserts that, the main effect of improved variety on cocoa yield is hugely in how these seeds are resistant to pests and diseases. According to Richard et al., (2010), farmers with improved seeds recorded 50 percent growth in productivity. Nonetheless, access to such improved seeds is poor or non-existent. Consequently, yields per ha compares unfavorably with other regions of the world such as Malaysia and Indonesia and neighboring La Cote d'Ivoire even. Poor access to improved planting materials was factored as one of the main determinants of low yields (ibid).

Aneani & Ofori-Frimpong (2013), findings buttress the claim by (MASDAR, (1998); Aneani *et al.,* (2007): and Richard et al., (2010)), that low productivity contributing to yield gap is as a result of depressingly poor access to productivity resources/ materials such as cash/ credit, labour, spraying machines, fertilizers and importantly improved seedlings. Moreover, Aneani & Ofori-Frimpong adds that aside the poor access, there is also the problem of poor adoption of Cocoa Research Institute of Ghana's productivity-increasing technologies. The need for seeds with high genetic qualities calls for well-grounded seed gardens, Richard et al., (2013). Seed Garden according to Aikpokpdion (2007), cited in Richard *et al.,* "is a specialized tree orchard planted with known selected clones as parents to generate hybrid of genetic qualities of known yield, disease and pest resistance potentials." These improved yields enable farmers to increase yield, output, and income.

Improved seeds are pertinent because of ageing cocoa farms, and poor average yield of cocoa trees (ibid). Opeke, (2003) makes a strong case that, La Cote d'ivoire is the world leading producer of cocoa mainly due to the introduction of improved Amazon hybrid seed to the country in 1965 to replace the less productive and pests and diseases resistant Amelonado that were originally grown there (Opeke, 2003; cited in Taphee, Musa and Vosanka, 2015). The blessings of improved seeds have led the Government of Ghana (GoG) to establish 26 Seed Gardens (ibid).McNamara (2009) pointed out, again, that improving smallholder agriculture is an information- and communication-intensive process throughout the value chain from farm to market. Thus, they require information to make an informed decision at each stage of the production cycle, from crop selection, to planning, to harvesting, to selling. Crop quality and yield also depend heavily on producers' access to information and networks in the face of the growing national and global diverse markets. In the words of McNamara, "The smallholder agricultural economy is in crucial ways an Information and Service Economy". This forceful assertion of McNamara in view of other challenges associated to seed procurement brings to the fore the urgent need for the assessment of information efficiency and the proposition that:

H1 = Efficient Seedling Procurement Information has a significant Impact on Cocoa Farmers' Productivity.

Information in Pests and Diseases' Control

The research findings of Dormon *et al.* (2004), found out that aside the decrease in area under cultivation being a major determinant of low productivity because of low producer price leading to low income and shifting interests, low yield per hectare; consequence of pests and diseases' incidences and non-adaptation of research recommendations significantly have impacted on productivity. Dormon *et al.*, (2004), intimated that low productivity is the main problem of the farmer and identified and categorized contributing factors as being biological and socio-economic. To Dormon *et al.* (2004), biological factors were pests and diseases' incidences amongst others whiles socio-economic causes were implicit and consist of low producer price and absence of social amenities and infrastructures like electricity, resulting in migration with its resultant effect of shortage of labor and therefore, high cost of labor.

High productivity according McNamara (2009), is a necessary condition for both household food security and agriculture-based growth and the reduction of poverty. McNamara further indicated that smallholder productivity is critically hindered by lack of information about market prices, available crop varieties, production techniques, and importantly, methods of pests and diseases management. He intimated, that timely and accurate information that pertains to specifically local conditions including the weather, pests and diseases outbreaks, and other seasonal risks, and services that could help address them will tremendously boost smallholders' farms productivity, (ibid). Black pod disease has been identified to have a devastating effect on cocoa productivity and as having the potential as great as harming about 50 percent of cocoa farm crops in the wet and humid weather (Idachaba & Olayide, 1976; and MASDAR, 1998). According to research findings of Richard et al. 2010, farmers still raise seedlings from seeds harvested from their farms or neighbor's farms for planting, and the resultant cocoa tree plants are more susceptible to pests and diseases infestations. Furthermore, pests and diseases have been pointed out as having disastrous consequences on cocoa productivity and therefore, pests and diseases' control can increase cocoa yield (Entwistle, 1985; and MASDAR, 1998). Nevertheless, insufficient and improper chemical application greatly affects productivity, (Asante, Aneani, Asamoah and Baah, 2002). For instance, it has been pointed out that, with sprays to cocoa Mirid Bugs, a negligible estimation amount of 0.02% of the chemical's active ingredients gets to the biological target, with the rest as waste with even far more damaging effect on the environment and the people (Vos *et al.*, 2003).

On a world scale, roughly 500 insect have been identified in connection with cocoa trees, however, only an infinitesimal fraction of these insects are classified as economically baneful, (Vos *et al.*, 2003). Among cocoa pests and diseases, insect pests including shield bugs, capsids, and diseases such as the Swollen Shoot and Black Pod have been recognized to have received extensive research coverage and that farmers are very well familiar with them and receive information on control techniques from extension officers both private and government, (Thorold, 1975; Wood and Laas, 1985; Anon, 1997; Acquaah, 1999; Wilson, 1999; In Dormon *et al.*, 2004). The research findings of Olujide and Adeogun, (2006) recommend that, with respect to the downsides of the over reliance on chemical application on cocoa beans and production costs, a complementary use of best crop growing practices must be adopted to control pests and diseases. These scientific research findings have led to the following proposition for further investigation by this study.

H2 = Efficient Information on Pests and Diseases' Control Contributes to Farmers' Optimal Decisions that Impact on Productivity.

Information in Fertilizing

Borge el al., reechoed the research findings of Dorman *et al.*, (2004), by their research outcome that states that productivity challenges of the cocoa farmer are typically socio-economic and environmental, (Borg *et al.*, 2012). These challenges range from inadequate living conditions, low incomes, child labor, lack of knowledge and education being socio-economic to deforestation, loss of biodiversity, and critically, inappropriate chemical usage and climate change as environmental (ibid). Additionally, it was observed that, the drivers of cocoa industry sustainability are cardinally that of productivity and improved farmers' livelihood and strongly recommended that extra support platforms to empower farmers and sustain or increase productivity are eminent as a result of the inadequacies of current interventionist schemes (ibid). The improved cocoa yield in the main year of 2010/2011 was attributed to key factors such as pests and diseases' control, rehabilitation and replanting of old cocoa farms with fertilizer application not exempted (Ashitey, 2012).

The adoption of improved technologies (seeds, fertilizers, etc.) including organic fertilizers and appropriate management techniques, are critical for holistic agricultural development, harnessing the complementarities among various inputs (Ghana Fertilizer Assessment, 2012). Fertilizer use in Ghana is 8kg per hectare (ha), placing the country as the lowest consumer of fertilizer in the world (MOFA, 2007; In Banful A. B., 2009).Inasmuch as non-chemical usage in the cocoa industry are recommended for health and other important factors, chemical application in the form of insecticides and fungicides and especially fertilizers is inevitable to augment productivity and manage pests and diseases in the face of limited production space (Moy and Wessel, 2000; Opoku et al., 2007; Adjinah and Opoku, 2010; In Afrane and Ntiamoah, 2011). However, information on fertilizer subsidy by the government distorts fertilizer application so much so that farmers are willing to wait on the subsidized fertilizer even when it gets out at such a time that its application becomes ineffective. Given the discussions above, the researcher proposes the following.

H3 = Efficient Fertilizing Information Impacts Significantly on Cocoa Farmers Productivity.

Information in Credit & Loans Facilities

In addition to pests and diseases, the cocoa farmer is faced with a volatile global market, labor constraints, and high cost of farm inputs and lack of credit facilities (Vos *et al.*, 2003). According to the research findings of Nkang *et al.*, (2006), access to credit facilities by smallholder cocoa farmers is such a huge challenge as a result of lack of collateral and uncertain nature of the agricultural production. In Nigeria, a study by Akinnagbe *et al.*, (2010), showed that only a very small proportion of 3.3 percent of smallholder cocoa farmers had access to bank loans and the rest of 97 percent had to struggle to finance their farm management from personal savings, friends and/ or families. A number of studies have intimated how farmers' credit constraints affect their investment behavior, productivity and farm expansion in a depressing way (Eswaran and Kotwal, 1990a, b; Rosenzweig and Wolphin, 1993; and Fafchamps and Pender, 1997; In Lawal *et al.*, 2009). Additionally, lack of information on the impact of social capital on credit procurement makes the situation more deplorable, (Lawal *et al*., and 2009). In Nepal, credit has been found to impact positively on soil conservation and farmers' productivity (Debela, 2001). The research findings of Benu (2001), same year, buttressed the claim by Debela with the discoveries from Indonesia that, agricultural credit affect to a large extent of about 60 percent of productivity increase. Bolarinwa and Fakoya of Nigeria, states in no uncertain terms how farm credits impacts positively on agricultural productivity, (Bolarinwa, K. K., and Fakoya, E. O., 2011). This scientific finding leads to the following proposition.

H4 = Efficient Information on Credit and Loans' Facilities has an impact on Cocoa Farmers Productivity.

Methodology

The chapter takes care of how the objectives set out in this research were accomplished. It identifies the data sources, the target population and sample size, sampling techniques and instrument as well as techniques of data processing and analysis.

Sources of Data

The study made use of quantitative method with deductive approach. The primary data of this research were sampled on the current level of information, the impact on productivity and expectation of farmers to optimize productivity through efficient information flow. Given the varying educational backgrounds of farmers, administrators of the questionnaires were oriented to offer guidelines and explanation to the questions. The questionnaires were closed type with five point Likert scale. Administrators had knowledge of the local environment and clearly understood the objectives of the study. Secondary data, comprising statistical data and published library materials such as research reports, journals, dissertations, internet sources and other articles relevant to the study were consulted. Therefore, both primary and secondary data were employed in this research.

Target Population and Sample Size

The cocoa farmers in the Eastern Region of Ghana are the target population of this research. Farmers were sampled from three farm communities, each in different district of the region. The three cocoa farming communities are Begoro (Fanteakwa District), Anyinam (Atiwa District) and Suhum (Suhum-Kraboa-Coalter District). Three hundred (300) cocoa farmers formed the sample size of this research with 100 respondents from each cocoa growing community. Eastern Region is one of the six cocoa growing regions of Ghana and plays such a key role in cocoa production in Ghana.

The three Districts selected in this research are the main cocoa growing districts in the Region and the cocoa farming communities therein are noted for their key roles in the respective Districts in terms of cocoa production of the Region and Ghana as a whole. Therefore, information sampled from these communities is reflective of the population of the study with the use of appropriate sampling methods.

Sampling Instrument and Technique

Questionnaire was the only sampling instrument of this research. It was a structured closed-ended questionnaire with five point Likert scale to permit flexible analysis of the findings that were adduced thereof. A multi-stage sampling technique were employed, with purposive sampling for selecting cocoa farming communities whilst simple random sampling technique was used to select cocoa farmers to avoid bias representation of the population. The questionnaires were administered by the oriented administrators knowledgeable of the local dynamics and therefore all administered questionnaires came out valid for the research.

Data Processing and Analysis

Statistical tools were employed for data processing, analysis and presentation. Statistical Package for Social Sciences (SPSS) version 16.0 and Microsoft Office Excel 2007 were used for the processing of the data. Descriptive statistical techniques such as graph, charts, and frequency distribution tables were used for the display of processed data for analysis and interpretation. Statistical tests such as mean, multiple regression were performed on the sampled data. Preliminary administration was done to check the validity and reliability of the questionnaires to avoid inconsistencies and possible errors.

Results and Data analysis

This chapter analyses, interprets and presents the results obtained from the field data objectively. These set of information is presented in pie charts, bar graphs and frequency tables et cetera, through the use of Statistical Package for Social Science (SPSS), version 16.0 and Microsoft office excel 2007. These charts, graph and tables are then explained.

Background Information of Respondents

The gender, age, educational level, annual income and lastly, the farm size of the sampled population were not factored as a prerequisite for respondents' selection – respondents were sampled randomly. Respondents were selected from three farm communities, each in one district of the Region. These farm communities are Begoro in the Fanteakwa District, Anyinam in the Atiwa District and Suhum in the Suhum-Kraboa-Coalter District. One hundred (100) persons were sampled from each community, making a total of Three Hundred (300) sample size.

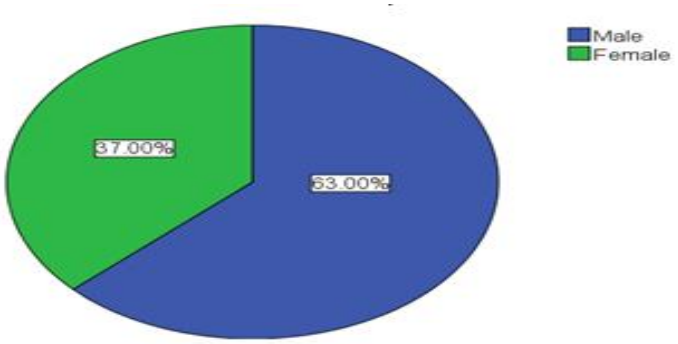

Figure 4.1.1: Pie Chart Showing the Gender Distribution of Respondents

The pie chart above shows the distribution of gender of respondent. Males formed 63% percent of the sampled population whiles 37% constituted females. The obvious preponderance of males is in no way a reflection of prejudiced sample selection but from the fact that farming, especially, cash crop farming has hugely been made the preserve of males with cocoa production not excepted.

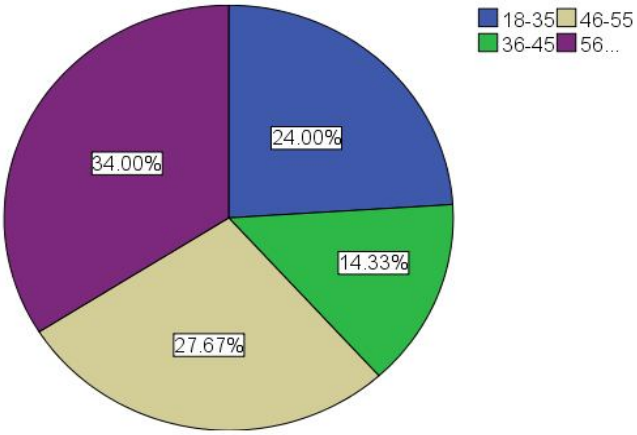

Figure 4.1.2: A Pie Chart Showing the Age Distribution of Respondents

With regards to the ages of the respondents, the chart above indicates 34% being those at the age of 56 and above. And 27.67% of the respondents fell into the range from 46 to 55. Also, 24% of them fell between the ages of 17 and 36 and finally, 14.33% of respondents formed between 35 and 46. Hence, respondents aged 46 and above form 61.67%, indicating an aging cocoa farming population.

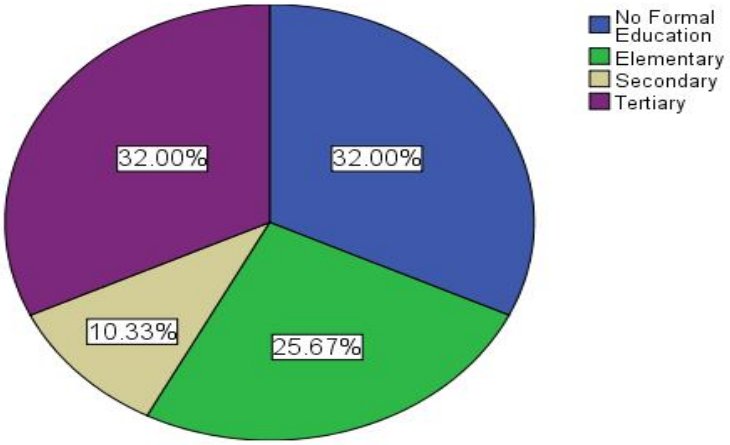

Figure 4.1.3: Pie Chart Showing the Educational Level Distribution of Respondents

On the score of educational level, the pie chart above shows that No Formal Education and Tertiary Education both recorded 32% respectively. Elementary Education formed 25.67% while Secondary constituted 10.33%.

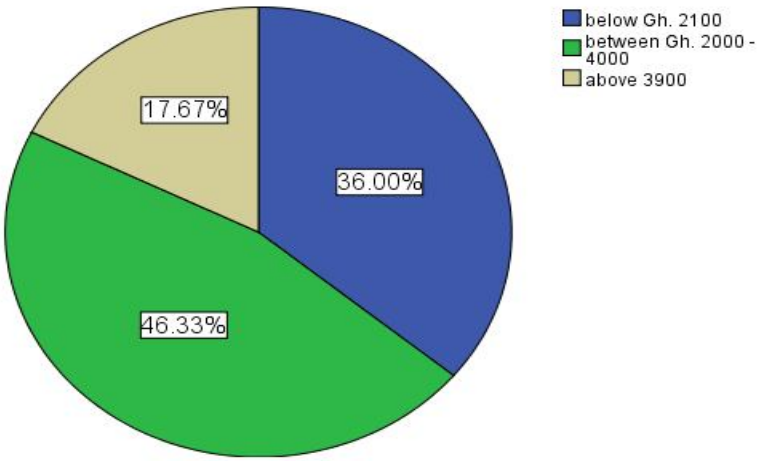

Figure 4.1.4: A Pie Chart Showing the Respondents' Annual Income Distribution

The pie chart above shows the annual income distribution of respondents. 46.33 % of the respondents formed those earnings between Gh.₵ 2,000 and 4,000. Again, 36% of them earned below Gh.₵ 2,100 and 17.67% of the respondents represented those earning above Gh.₵ 3,900. This implies that 82.33% of the cocoa farmers live below Gh.₵ 4,000 annually, which translates into a little over USD 1,000 per year.

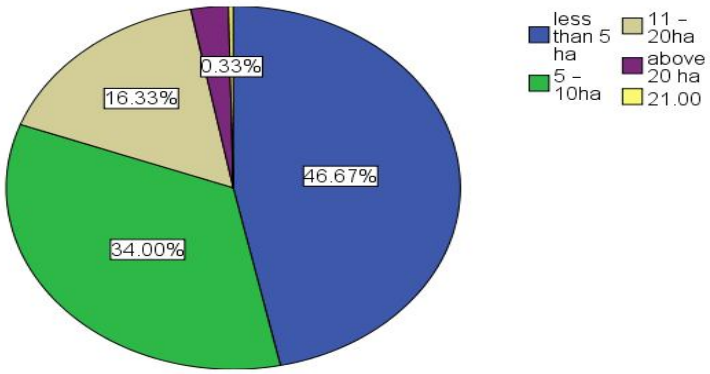

Figure 4.1.5: Pie Chart Showing Respondents' Farm Size Distribution

The size of the farms of the respondents is portrayed in the pie chart above. 46.67% of them have a size of a farm less than 5 ha. 34% of the respondents' farms sizes range from 5 to 10 ha. Farm sizes ranging from 11 to 20 ha represented 16.33%. Finally, those respondents who had a farm size of 20 ha and above formed 0.33%. Clearly, cocoa farmers are undisputedly smallholder farmers with approximately 80.67% of them having a farm size of up to 10 hectares.

Comparative Analysis among Variables and Demographics

The tables below demonstrate respondents' demographic features and their corresponding impacts on the levels of information efficiency. They reveal and compare the mean and the standard deviation coefficients of the respondents found within each group of bio characteristics. In an exploratory manner, the researcher sought to find out if demographic features affect cocoa farmers' levels of information efficiency.From the Table 4.2.1 below, the mean values of farmers derived for each group of educational levels portray that, information efficiency levels does not significantly differ with educational levels of cocoa farmers in that the means were found to be slightly different from each other in the groups with an evenly distributed standard deviation of the mean. In respect of this, farmers' educational level was found to be non-determinant of information efficiency levels.

Table 4.2.1: Comparison among Respondents' Educational Status and Their Information Efficiency Levels

Educational Level of the Respondents		EFFICEINCY IN SEEDLINGS PROCUREMENT	EFFICEINCY IN PESTS & DISEASES	EFFICIENCY IN FERTILIZING	EFFICIENCY CREDIT & LOANS
No Formal Education	Mean	8.8438	10.4375	9.6875	9.3646
	N	96	96	96	96
	Std. Deviation	2.22109	2.18518	2.55595	2.78764
	Std. Error of Mean	.22669	.22302	.26087	.28451
Elementary	Mean	8.7013	10.2597	9.2857	9.3766
	N	77	77	77	77
	Std. Deviation	2.04595	2.66756	2.35560	2.54455
	Std. Error of Mean	.23316	.30400	.26845	.28998
Secondary	Mean	8.0000	10.1935	9.0323	8.6129
	N	31	31	31	31
	Std. Deviation	1.98326	2.67606	2.53619	2.94027
	Std. Error of Mean	.35620	.48063	.45551	.52809
Tertiary	Mean	8.8646	11.0625	10.5208	10.3646
	N	96	96	96	96
	Std. Deviation	2.06025	2.32521	2.52974	1.98478
	Std. Error of Mean	.21027	.23732	.25819	.20257
Total	Mean	8.7267	10.5667	9.7833	9.6100
	N	300	300	300	300
	Std. Deviation	2.10715	2.42594	2.54256	2.55990
	Std. Error of Mean	.12166	.14006	.14679	.14780

Source: Field data 2015

From Table 4.2.2 below, it is amply evident that there is meaningfully significant relationship between the levels of information efficiency of cocoa farmers and their income status. The mean values of information efficiency levels as related with income levels of farmers show an increasing efficiency with an increasing income of farmers for all the four predictor variables; efficiency levels of information in seedling procurement, fertilizing, pests and diseases and credit and loans facilities. In this regard, it can be scientifically concluded that, there is a relationship between farmers' income and their efficiency levels of information.

Table 4.2.2: Comparison among Respondents' Income Status and Their Information Efficiency Levels

Annual Income of the Respondents		EFFICIENCY IN SEEDLING PROCUREMENT	EFFICEINCY IN PESTS DISEASES	EFFICIENCY IN FERTILIZING	EFFICIENCY IN CREDITS AND LOANS
below Gh. 2100	Mean	8.1944	10.1667	9.2963	9.0648
	N	108	108	108	108
	Std. Deviation	1.90650	2.62803	2.69392	2.90431
	Std. Error of Mean	.18345	.25288	.25922	.27947
between Gh. 2000 – 4000	Mean	8.7914	10.6691	9.8273	9.7482
	N	139	139	139	139
	Std. Deviation	2.07286	2.36333	2.49907	2.24607
	Std. Error of Mean	.17582	.20046	.21197	.19051
above 3900	Mean	9.6415	11.1132	10.6604	10.3585
	N	53	53	53	53
	Std. Deviation	2.27946	2.03489	2.09343	2.38662
	Std. Error of Mean	.31311	.27951	.28755	.32783
Total	Mean	8.7267	10.5667	9.7833	9.6100
	N	300	300	300	300
	Std. Deviation	2.10715	2.42594	2.54256	2.55990
	Std. Error of Mean	.12166	.14006	.14679	.14780

Source: Field data 2015.

From Table 4.2.3 below, it is evidential that, men in cocoa farming record higher information efficiency levels. The results published in the table with respect to information efficiency levels and gender relationship, it is obvious that male cocoa farmers registered higher levels of efficiency across all four predictor variables; efficiency levels of information in seedling procurement, fertilizing, pests and diseases and credit and loans facilities, than their female counterparts. This shows that gender plays a role in the level of farmers' information efficiency.

Table 4.2.3: Comparison among Respondents' Gender Status and Their Information Efficiency Levels

Gender of the Respondents		EFFICIENCY IN SEEDLING PROCUREMENT	EFFICEINCY IN PESTS DISEASES	EFFICIENCY IN FERTILIZING	EFFICIENCY IN CREDITS AND LOANS
Male	Mean	8.8783	10.7725	9.9524	9.8307
	N	189	189	189	189
	Std. Deviation	2.03454	2.41804	2.45878	2.46095
	Std. Error of Mean	.14799	.17589	.17885	.17901
Female	Mean	8.4685	10.2162	9.4955	9.2342
	N	111	111	111	111
	Std. Deviation	2.21080	2.40985	2.66586	2.68990
	Std. Error of Mean	.20984	.22873	.25303	.25531
Total	Mean	8.7267	10.5667	9.7833	9.6100
	N	300	300	300	300
	Std. Deviation	2.10715	2.42594	2.54256	2.55990
	Std. Error of Mean	.12166	.14006	.14679	.14780

Source: Field data 2015

4.3 Testing of Research Hypotheses

H_1 = Efficient Seedling Procurement Information has a significant Impact on Cocoa Farmers Productivity.
H_2 = Efficient Information on Pests and Diseases' Control Contributes to Farmers' Optimal Decisions that Impact on Productivity.
H_3 = Efficient Fertilizing Information Impact Significantly on Cocoa Farmers Productivity.
H_4 = Efficient Information on Credit and Loans' Facilities has an impact on Cocoa Farmers Productivity.

Table 4.3.1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.840[a]	.705	.701	1.72630

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2101.053	4	525.263	176.256	.000[a]
	Residual	879.134	295	2.980		
	Total	2980.187	299			

a. Dependent Variables: Farmers' Productivity

b. Predictor Variables: Information efficiency levels in Seedling Procurement, Fertilizing, Pests and Diseases' Control and Credit and Loans Facilities.

Source: Field Data 2015

The table above clearly shows the results' summary of the regression analysis for the independent variables employed in this research; the efficiency levels of information in Seedling Procurement, Fertilizing, Pests and Diseases' Control and Credit and Loans' Facilities and the dependent variable; Farmers' Productivity. The model empirically arrived at a correlation coefficient of (r=.840), meaning there is a strong positive linear relationship between criterion variable; farmers' productivity and the predictor variables; the efficiency levels of information in Seedling Procurement, Fertilizing, Pests and Diseases' Control and Credit and Loans' Facilities. The coefficient of determination derived (R^2= .705), portrays that, approximately 70% of the total variability in the criterion variable; Farmers' Productivity is scientifically explicable by the predictor variables; the efficiency levels of information in Seedling Procurement, Fertilizing, Pests and Diseases' Control and Credit and Loan Facilities.

Likewise, the farmers' productivity determinants in terms of efficiency levels of information, thus considered in the multiple regression; Seedling Procurement, Fertilizing, Pests and Diseases' Control and Credit and Loan Facilities together explains empirically an approximate of 70% of the degree of variation in Farmers Productivity with regards to matters in issue related to information efficiency. The calculated Adjusted R square of .701 adduced summarizes that, an approximate of 70% of the impacts on Farmers' Productivity is conclusively explainable by the model and near 30% of the impact is attributable to variables exogenous to those the model proffered. Moreover, it's obviously discernible that 30% of the impact on Farmers' Productivity are connected to or attributable to explanation(s) offered by variables external to this model.

Table 4.3.2: Regression Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.387	.474		7.150	.000
	Efficiency (Seedling Procurement)	.339	.073	.226	4.666	.000
	Efficiency (Pests and Diseases' Control)	.249	.069	.192	3.637	.000
	Efficiency (Fertilizing)	.234	.071	.188	3.308	.001
	Efficiency (Credit & Loans facilities)	.420	.064	.340	6.532	.000

a. Dependent Variable: Farmers' Productivity

The efficiency levels of information in Seedling Procurement, Fertilizing, Pests and Diseases' Control and Credit and Loans Facilities were fingered to be significant predictors on Farmers Productivity. The coefficients of the individual predictors dispute the Null hypothesis that states, the slopes of the farmers' productivity determinants are equal to zero (Ho: β=0) on the dependent variable, that the dimensions cannot predict farmers' productivity.

However, the model supports the assumption that efficiency levels of information in Seedling Procurement, Fertilizing, Pests and Diseases' Control and Credit and Loan Facilities are significant predictors of farmers' productivity, (β=.226, t=4.666 for Seedling Procurement; β= .192, t=3.637 for Pests and Diseases' Control; β=.188, t=3.308 for Fertilizing; β=.340, t=6.532 for Credit and Loans' Facilities). In other words, at .05 level of significance, there exists enough evidence to conclude that, the slope of all the Farmers Productivity dimensions (predictor variables) is not zero and that they are useful in predicting Farmers Productivity. Comparison of the beta weights given by the regression coefficients indicates that, the Credit and Loan Facilities variable has greatest effect in explaining Farmers' Productivity than does Seedling Procurement, or Fertilizing, or Pests and Diseases Control. Also, the Seedling Procurement variable explains greater effect on Farmers Productivity compared to the Pests and Diseases Control or Fertilizing. Based on the foregoing analysis, it's laudable to conclude that, the alternative hypotheses for H1, H2, H3 and H4 are all accepted.

Discussion, Summary and Conclusion, and Recommendation

This chapter discussed findings from the preceding chapter and the literature review, summarized and concluded based on findings and presented recommendations appropriately. The discussion brought out analogies between the research findings and other research works reviewed in the study and deductions and conclusions were drawn in the light of the findings in the study that were corroborated by literature from similar studies.

5.1 Findings Summary

There have being some important insights that have been adduced by this particular research. This research actually tested four hypotheses with the use of multiple regression and descriptive statistics. The multiple regression model performed revealed the independent variables; information efficiency levels in Seedlings' procurement, Pests and diseases control, Fertilizing and Credit and Loan facilities as being significant predictors of the dependent variable; Farmers' Productivity. Below are the significant findings of this research in a bulleting:

- That there is no significant relationship between educational levels and the levels of information efficiency of cocoa farmers.
- That there exists a significant relationship between income levels and the information efficiency levels of cocoa farmers.
- That gender of a farmer impacts significantly on the level of information efficiency.
- That information efficiency in seedling procurement, fertilizing, pests and diseases' control and credit and loans facilities impact on the cocoa farmers' productivity. And that the synergistic effect of the four independent variables account for approximately 70% of farmers' productivity.
- That all the alternate hypotheses of this research are accepted.
- That information efficiency levels in credit and loans' facilities impacts the most on farmers' productivity as compared to other independent predictors of the model. That alone contributes 34% to farmers' productivity, perhaps because money is such a significant element in any human undertaking. Clearly, farmers need money to buy the highest quality seedlings, fertilizers and pesticides and insecticides to control the development and spread of pests and diseases as well as weeds management.
- That information efficiency in seedling procurement comes as the second most significant predictor of farmers' productivity. It contributes 22.6% of farmers' productivity. High quality seedlings are high yielding and resistant to weeds and diseases. Therefore efficient information leading up to the procurement of such high quality seedlings came in very significant, second only to information efficiency in credit and loans' facilities, thus, the means to purchase them.
- That information efficiency in pests and diseases control forms 19.2% impact of farmers' productivity and was revealed to be third most important predictor of farmers' productivity.
- That information efficiency in fertilizing was found to constitute 18.8% of farmers' productivity and revealed to be a significant predictor of farmers' productivity also.
- With respect to information efficiency attainment in terms of frequency, farmers indicated they will like to receive information four (4) times per month for seedling procurement, fertilizing, and pests and diseases control but intimated five (5) times per month for credit and loans facilities. This goes to reinforce the perception of the farmers that information efficiency in credit and loans facilities has the most impact on farmers' total investment behavior and ultimately their productivity.

Discussions

The insights from the findings of this research reveal very interesting patterns consistent or otherwise with extant literature in the topic area. The following discussion sheds light on these. The research outcome that information efficiency in seedling procurement impact significantly on farmers' productivity is well in sync and corroborated by other research findings reviewed in this work such as those of Aneani& Frimpong (2013), which posited that farmers' productivity depends hugely on crop yield and that crop yield is determined by the kind of cocoa seed planted. So therefore, an improved seed is a key player of high farmer productivity. This claim of seeds impacting on productivity is buttressed by other research findings, (Opeke, 2003; Tijani, 2005; Aikpokpdion, 2007; and Richard *et al*., 2010). Nevertheless, poor access to improved seeds was quickly highlighted as being the cause of farmers' low productivity magnified by information inefficiency, (MASDAR, 1998; Aneani *et al*., 2007; McNamara, 2009; and Richard *et al*., 2010).Additionally, and information efficiency in pests and diseases which was found to have the third most significant impact on farmers' productivity reechoes the claims of other researches. Several research findings have intimated the devastating consequences of pests and diseases (Idachaba & Olayide, 1976; Entwistle, 1985; and MASDAR, 1998) and that information plays such a significant role in pests and diseases control (Dormon *et al*., 2004; and McNamara, 2009).

Other researches that share the view point above include the findings of Thorold, 1975; Wood and Laas, 1985; Anon, 1997; Acquaah, 1999; Wilson, 1999; In Dormon*et al.*, 2004.Furthermore, the research result that information efficiency in fertilizing impact on farmers' productivity agrees with that of Ashitey, 2012. Then again, same is true with the assessment outcome of Ghana Fertilizer Assessment, 2012, which asserts the complementarities among agricultural inputs. This finding again is a reverberation of several findings of other important researches that saw fertilizing to augment productivity, (Moy and Wessel, 2000; Opoku*et al.*, 2007; Adjinah and Opoku, 2010; In Afrane and Ntiamoah, 2011).Similarly, the findings that information efficiency in credit and loans facilities impact the most on farmers' productivity is in tone with other research works reviewed in this research. Some of these researches established the fact that poor access to these facilities is a great challenge for small farm holders (Vos*et al.*, 2003; Nkang*et al.*, 2006; and Akinnagbe*et al.*, 2010). And again how this inaccessibility constrain investment behavior and ultimately impact negatively on farmers' productivity, but sharply reinforced the hope in effect of information efficiency, (Debela, 2001; Benu, 2001 Eswaran and Kotwal, 1990a, b; Rosenzweig and Wolphin, 1993; and Fafchamps and Pender, 1997; In Lawal et al. 2009; and Bolarinwa, K. K., and Fakoya, E. O., 2011).

Summary and Conclusion

This academic study empirically explored the impact of information efficiency in the cocoa supply chain in Ghana from the farmers' perspective. Accordingly, the researcher examined scientifically how information efficiency in key predictor variables of small holder farmers' productivity contributed to high productivity. Literatures reviewed on the subject matter in scope and content satisfactorily generated four hypotheses for further validation or otherwise. The significance of information efficiency was elicited in the process of review readily from global to local contexts and there then became the need and basis for further exploration. In the quest to thoroughly test and satisfy the rudiments of hypothesis testing, the study employed quantitative data collection method and adopted multiple regression and descriptive statistical packages to that purpose. The study was fundamentally approached and undertaken in three phases. The establishment of the current efficiency level, the impact of this on productivity and the best possible way to achieve efficiency in the area of frequency of information.

The study additionally looked at how the bio characteristics of cocoa farmers such as their gender, educational level or income level influence the level of information efficiency attainment. Moreover, it further sought and established the combined impact of all the predictor variables and again, their singular contributions to productivity of cocoa farmers. In the nut shell, this research revealed that the predictor variables; information efficiency levels in seedling procurement, fertilizer application, pests and diseases' control and credits and loans' facilities were found to be significant predictors of farmers' productivity individually and cooperatively. And collectively, they explained approximately 70% of farmers' productivity. It was established strongly that information efficiency levels in credit and loans facilities has the greatest impact on farmers' productivity, then seedling procurement, then pests and diseases' control and finally fertilizer application. Moreover, gender and income levels of cocoa farmers make a difference in their information efficiency levels and the impact on productivity as a whole.

Recommendation and Business Implication

In accordance with the result of this study, it is conclusively clear that information efficiency in the predictor variables have significant effect on farmers' productivity. In the vein of this, the following recommendations have been adduced in reference to the on-the-ground picture of information efficiency levels of the predictor variables. These are offered in the spirit of achieving optimal information efficiency levels in the predictor variables to affect farmers' productivity as well as arm businesses along the chain to do more and optimize their Return on Investment (ROI).

- Firstly, the extension officers of the Cocoa Services Division (CSD) of Ghana COCOBOD should take into consideration the income and gender of the cocoa farmers in the discharge of their responsibilities of informing and empowering the small holder famer as they impact on their level of information efficiency.
- Also, the Cocoa Marketing Company (CMC) of Ghana COCOBOD can undertake the duty of informing the farmers about the credit and loans facilities that exist and ways to acquire loans or access these facilities. The CMC can also take it up upon itself to offer soft loans or any form of financial support to the farmers and have a comprehensive system for such finance accessibility and modes of payments. This will go a very long way to bolster the smallholder farmers to articulate and express fully their investment behaviors for the best possible result as source of finance for them is the foremost predictor of farmers' productivity.
- Furthermore, institutionalization of information communication technology (ICT) enabled centers with trained personnel mandated to carry out the dissemination of information on seedling procurement, fertilizer application, pest and diseases control and credit and loans facilities will go a long a way to improve efficiency levels of information.
- Business owners including suppliers of chemicals and fertilizers as well as credit facilities can partake in the information dissemination to the farmer to maximize their market profitability. This ranges from revision of market strategies to take advantage of the findings of this research.
- Moreover, there should be some mechanism to incentivize the youth in order to undertake farming of cocoa as the farming population is aging.
- Last but not least, the seed gardens in the country should try as much as possible to educate farmers of their undertakings and also make sure they improve production to increase the supply of the improved seedlings that are resistant to pests and diseases and high yielding concomitantly, so as to reach cocoa farmers nationwide.

Limitation of the study

First and foremost, the study will not permit chain-wide assessment of information efficiency due to time constraints. Also with respect to scale, the research focuses on Eastern Region of Ghana. However, data collection can be extended to other regions of Ghana or outside even; in countries where cocoa is important part of their economic life like La Cote d'Ivoire or Brazil or Nigeria or Cameroon etcetera. Additionally, all the respondents to the questionnaire were farmers, most of who could not read and understand to respond to the questionnaires accordingly. It was in this regard, that the questionnaires administrators with knowledge on the local context were carefully selected and oriented to offer guidelines and explanations to the questions for easy completion of the questionnaires. The researcher was not directly involved in the data collection because of prohibitive cost of travel to the study area of study. It is on the wheels of the above limitations that the researcher recommends a further research that will look at a wider scope in terms of the whole supply chain system in Ghana and larger sample size from different cocoa growing regions of the country and even outside.

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