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Assessing the resilience of the cocoa value chain in Ghana

Case study report

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Authors:

Elena Monastyrnaya[1]

Jonas Joerin[1]

Evans Dawoe[2]

Johan Six[1]

[1] Sustainable Agroecosystems Group, Swiss Federal Institute of Technology Zurich, Switzerland

[2] Department of Agroforestry, Faculty of Renewable Natural Resources, Kwame Nkrumah University of Science & Technology, Kumasi, Ghana

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Department of Environmental Systems Science

Sustainable Agroecosystems Group

www.resilientfoodsystems.ethz.ch, www.sae.ethz.ch

Address:

Sustainable Agroecosystems Group

TAN F4, Tannenstrasse 1

8092 Zürich

Switzerland

Executive Summary

Food systems are constantly challenged by changing environments. Multiple factors, related to economic instabilities, social insecurities and climate change can affect the functioning of food systems. The Sustainable Agroecosystems Group at ETH Zurich conceptualized food systems resilience in the context of various shocks (natural, economic, social and political).

In this study, the concept of food systems resilience is applied to assess the resilience of activities (input supply, production, processing, retailing and consumption) of the cocoa value chain in Ghana. The cocoa value chain is susceptible to various types of shocks (price fluctuations, natural hazards, biological shocks, changes in governmental policies, etc.) which can have detrimental impacts on the provision of sufficient and safe supply of cocoa. The data for this study was gathered from November 2015 to February 2016 through literature analysis, interviews with actors and experts of the cocoa value chain in Ghana as well as through a stakeholder workshop.

The resilience assessment shows that the activities of the cocoa value chain were found to have different levels of resilience. While there are some actors showing relatively high resilience performance, others are less resilient to shocks. For example, governmental input supply, internal marketing (responsible for purchases of cocoa from the villages) and processing overall achieve higher than average resilience scores due to improved management and planning, good access to information, sufficient financial capital and the use of insurance to cover potential losses. Private input supply, transportation and food retail show a heterogeneous resilience picture. On the positive side, all three of them rely on a dense network of flexible small businesses scattered throughout the country. Activities of these businesses are highly diversified and do not rely solely on cocoa. Input dealers sell a variety of agro-chemicals, seeds and tools for various farming activities while hauliers transport different commodities and often run repair garages and other small ventures. For food retailers, cocoa products make up only a small proportion of the products they sell. The production of cocoa (farming) shows the lowest resilience performance within the value chain because of high dependency on income from cocoa, lack of planning and organizational skills as well as limited knowledge of efficient farming practices.

Furthermore, the resilience assessment shows that low diversification is a major issue throughout the value chain. First, many actors are characterized by an over-dependency on cocoa as their main source of income. Second, the regulated organization of the cocoa value chain decreases the diversity of supply channels between actors and reduces logistical flexibility. Finally, many key activities such as quality control, internal marketing, research and governmental input and extension provision rely on a single governmental body – Ghana Cocoa Board (COCOBOD). As COCOBOD embraces key activities of the cocoa value chain and performs various supporting functions, actors of the cocoa industry are essentially encouraged to rely on its support during a shock. This leads to disincentives for developing alternative resilience strategies.

Following the collection of the data for the resilience assessment, a stakeholder workshop was held in Kumasi in January 2016 to identify interventions for building resilience in the cocoa value chain in Ghana. The participants were representatives from different activities (input supply, production, processing, retail and governmental experts) of the cocoa value chain. They discussed ways and interventions on how to improve the resilience of the cocoa value chain against specific shocks and risks, such as droughts and world cocoa price fluctuations. The participants were split into two groups. Input suppliers, farmers, NGO representatives as well as some governmental experts focused on the ability of the cocoa production to withstand droughts. Stakeholders that are involved in processing, trade, retailing and consumption looked at how to make the post-production of the value chain more resilient against price fluctuations.

Overall, early warning systems for droughts were found to be important to ensure the production of cocoa is upheld at all times. For the risk of world price fluctuation of cocoa, alternative income sources were identified to be important for all stakeholders representing the post-production activities of the cocoa value chain in Ghana. Furthermore, savings, insurance protection and self-organization were other interventions seen by a large number of stakeholders to be beneficial for building resilience against droughts and world price fluctuations of cocoa.

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Abbreviations

CHED	Cocoa Health And Extension Division
CMC	Cocoa Marketing Company of COCOBOD
COCOBOD	Ghana Cocoa Board
CRIG	Cocoa Research Institute of Ghana
FAO	Food and Agriculture Organization of the United Nations
FOB	Free on Board
GHC	Ghanaian cedi
GNFS	Ghana National Fire Service
GoG	Government of Ghana
ISSER	Institute of Statistical, Social and Economic Research
KNUST	Kwame Nkrumah University of Science and Technology
LBC	Licensed Buying Company
MFA	Material Flow Analysis
MoFA	Ministry of Food and Agriculture
MOFEP	Ministry of Finance and Economic Planning
NADMO	National Disaster Management Organization
NGO	Non-governmental organization
NHIS	National Health Insurance Scheme
PPCR	Producers Price Review Committee
QCC	Quality Control Company of COCOBOD
RCB	Rural and Community Banks
SDP	Seed Production Division of COCOBOD
SSNIT	Social Security and National Insurance Trust

1. Introduction

1.1. Background

Today, around 800 million people around the globe are undernourished (FAO, 2015). Food insecurity is especially prevalent in Sub-Saharan Africa, where one person out of four does not have adequate access to food (FAO, 2015). Well-functioning food systems are vitally important for tackling food insecurity because they ensure food is available, accessible and affordable at all times (Tendall et al., 2015). Food systems are increasingly exposed to various shocks related to climate change, economic instabilities and political conflicts (Ericksen, 2008). Shocks may disrupt the functioning of food systems and contribute to insecurity of food supply both at local and global levels.

This study focuses on the resilience of the cocoa value chain in Ghana. Cocoa is the most important agricultural export crop for Ghana as it delivers 30% of the country's total export earnings (Asante-Poku and Angelucci, 2013). Being primarily a cash crop, cocoa does not contribute much to the nutritional aspects of food security. However, cocoa remains an important indirect contributor to food security in Ghana due to its function to support the livelihoods of people engaged in the cocoa sector. As of 2011, more than six million Ghanaians, around 25% of the population, were involved in the cocoa sector as farmers, distributors, processors and retailers (Gockowski et al., 2011). Being an important source of rural employment, cocoa production supports more than 800,000 of smallholder farmers and delivers 70% - 100% of their income (Anim-Kwapong and Frimpong, 2005).

The cocoa value chain is exposed to multiple types of shocks. Crop pests and diseases (e.g. cocoa swollen shoot virus, black pod, mirids) are frequently occurring and are a key challenge for the sustained production of cocoa. Other shocks include impacts of climate change, such as heavy rainfalls, floods, droughts and bushfires, which lead to yields losses, destruction of roads and infrastructure and community facilities, and, consequently threaten food security, through decrease of income of people engaged in the cocoa sector.

Besides natural shocks, the cocoa value chain in Ghana is prone to sudden economic disturbances. Around 80% of cocoa is directly exported in raw form, therefore, fluctuations of world prices of cocoa have significant impacts on the functioning of the cocoa value chain in Ghana. Inflation is another common economic risk, to which the cocoa value chain is exposed: for example, many activities of the cocoa value chain rely on imports of materials and goods, such as agro-input products (fertilizers, pesticides, etc.), transportation (vehicles and spare parts) and processing (processing equipment, sugar, milk, etc.).

This study examines the resilience of different activities of the cocoa value chain, including input supply, production, marketing, transportation, processing and retail. The cocoa value chain in Ghana, has an hourglass structure (Laven & Boomsma, 2012). At the production level, there are millions of farmers who raise cocoa on small plots of land. In the middle of the chain, there is a limited number of buyers, followed by COCOBOD (Ghana Cocoa Board) who sells

Ghanaian cocoa to a large number of international merchants as well as to numerous foreign and domestic processors. The earnings from cocoa are distributed throughout the value chain in a top-down manner, descending from COCOBOD all the way down to farmers with fixed rates for each player in between. The structure of the cocoa value chain, which combines elements of privatization with a strong government presence, is a particularly interesting case for the resilience assessment.

1.2. Objectives

The objectives of this research project are:

1. to identify the structure, functions, stakeholders and outputs of the cocoa value chain in Ghana.
2. to determine the most relevant shocks that affect or could potentially affect the value chain.
3. to assess the resilience of the value chain using a set of resilience attributes and questions.
4. to deliver solutions for enhancing the resilience of the cocoa value chain

1.3. Research questions

Overall: Is the current cocoa value chain resilient to provide its functions during times of shocks?

More specifically, this research seeks to answer the following questions:

- What is the level of resilience of the cocoa value chain?
- Which interventions can increase the resilience of the cocoa value chain?

1.4. Methods

1.4.1. Main steps and data collection

In order to address and answer the research objectives and questions, the "guidelines to assess and design interventions for food system resilience", developed by the Sustainable Agroecosystems Group, are applied.

The guidelines structure research into several stages:

1. Problem identification and framing
2. Definition of the system: identification of key stakeholders, mapping of the value chains (material, financial and information flows), identification of major drivers to shocks.
3. Resilience assessment: semi-quantitative assessment of resilience attributes for every process of the value chain using an extensive questionnaire.
4. Interventions for building resilience: development of interventions to increase the resilience of the cocoa value chain.

Data was collected through literature review, interviews and a workshop with stakeholders of the cocoa value chain. In collaboration with the Kwame Nkrumah University of Science and Technology (KNUST), fieldwork was conducted between November and December 2015. During this period, key stakeholders of the cocoa value chain were identified and interviewed to gain information about their resilience to potential shocks, such as droughts, world price fluctuations, inflation, disease and pests infestations, etc. Key stakeholders included main actors (input suppliers, farmers, LBCs, hauliers, processors and food retailers) of the cocoa value chain and supporting actors (researchers, banks, insurance companies, NGOs etc.) as well as representatives from governmental institutions (COCOBOD, Ministry of Food and Agriculture, Ghana National Fire Service and National Disaster Management Organization). In total, 55 interviews were conducted using a tailored questionnaire for each value chain activity (input supply, production, marketing, transportation, processing and food retail).

At the end of the fieldwork, a stakeholder workshop was held, which brought together actors and experts of the cocoa value chain. The purpose of this workshop was to develop potential interventions for enhancing the resilience of the cocoa value chain. In total, 24 stakeholders representing different activities of the cocoa value chain participated at this meeting at KNUST in Kumasi (figure 1).

Figure 1: Participants of the stakeholder meeting at KNUST, Ghana

The outcomes of the workshop were used to validate the key shocks affecting the value chain, to collect more information for the resilience assessment and to identify interventions to enhance the resilience of the cocoa value chain. In addition, the workshop was well received

by the participating stakeholders as an opportunity to gather and discuss challenges relevant for building interventions, which strengthen their resilience.

1.4.2. Resilience assessment

The resilience assessment is based on a set of questions that embraces different aspects of the functioning of each activity of the cocoa value chain. Each question is assigned to a resilience attribute (see table 1). Based on three different data sources mentioned above, namely literature, stakeholder interviews and the workshop, each question was given a rating based on a five-tier scale (figure 2).

More details about the food system resilience concept and its methodological aspects can be found in Tendall et al. (2015). The detailed overview on the resilience assessment is provided in the report on case study research of the tef value chain resilience in Ethiopia (Hauenstein, 2015).

Table 1: Resilience attributes

Attribute	Description
Buffering capacity	- Availability and spare capacities of input resources - Existence of stocks of inputs and products - Financial buffers in case of a failure (insurance) - Sufficiency, suitability and efficiency of tools
Capital (social)	- Access to social security - Measures to protect health of labourers if needed - Access to health insurance - Access to healthcare organizations
Capital (environmental)	- Impacts of different activities on environment - Existing of measures to protect environment against impacts from the activities
Capital (financial)	- Access to external financing (loans, credits) - Possibility to generate funds for investments
Profitability	- Reliance of an activity on subsidies - Profitability of an activity - Permanence of financial flow
Connectivity	- Stability of demand for product or service - Availability of support services (logistics, communication) to enable connectivity - Engagement of an actor in the information flow
Diversity	- Diversity of income sources, supply channels, varieties etc. - Spatial distribution of actors, activities or input resources

	- Dependency of activity on single inputs/ processes/ actors with no alternatives
Information & learning	- Knowledge base and education level of actors - Investment in knowledge generation (e.g. through extension services) - Level of trust among actors
Self-organization	- Autonomy and control of the actors over the activity and its resources - Ability of actors for self-organization and networking
Equitability	- Existence and fairness of rights, regulations, entitlements, land tenure policies, dispute resolution mechanisms, etc. affecting the different activities. - Equitability (generational, gender, ethnical, etc.) of access to inputs, land, food, etc.

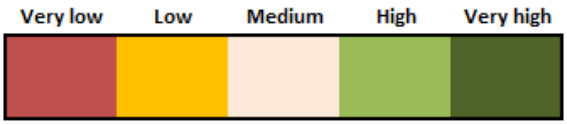

Figure 2: Rating scale for the resilience assessment

2. Cocoa value chain in Ghana and its context

2.1. Background

Cocoa is a key crop in the agricultural sector in Ghana. It accounts for 30% of the total export earnings and provides income for about six million people (Anthonio and Aikins, 2009; Gockowski et al., 2011; USDA, 2012). Ghana also plays an important role on the international cocoa market being the second largest producer of cocoa beans in the world after Ivory Coast and representing about 20% of global production (ICCO annual reports) (figure 3).

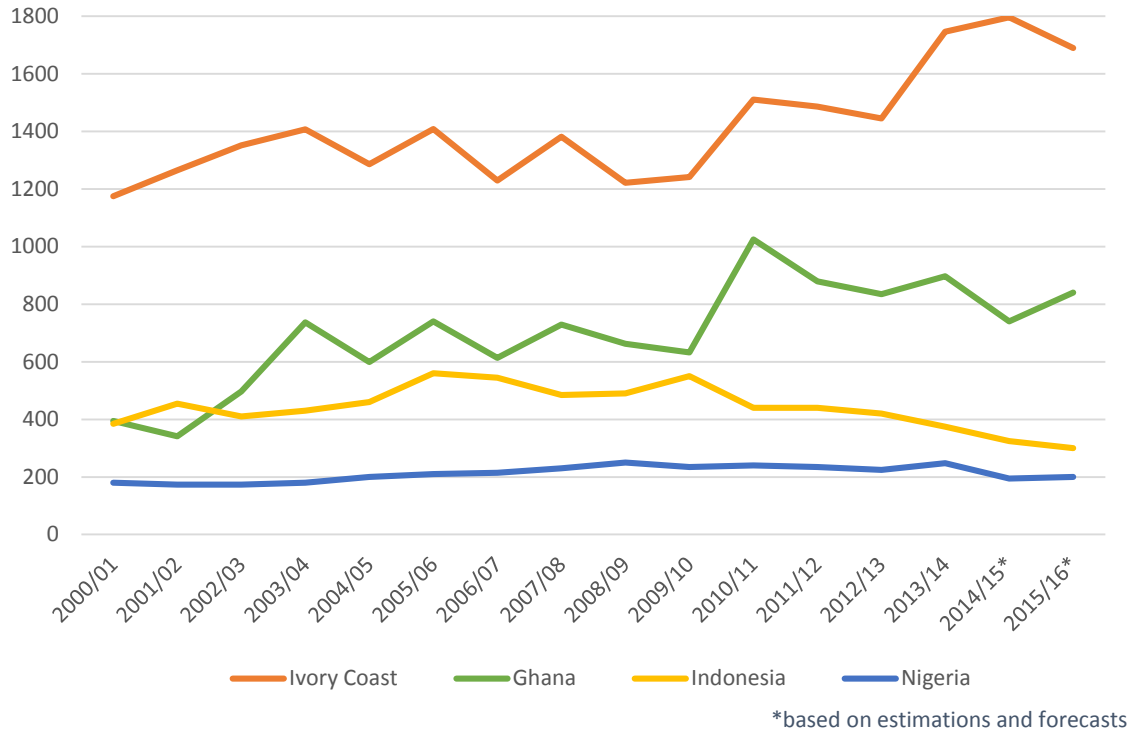

Figure 3: Top four cocoa producing countries in 2012/13, thousand tonnes

Source: ICCO annual reports, 2004, 2007, 2010, 2011, 2013, 2016

Ghanaian cocoa is known for its high quality due to the slightly low levels of debris and defective beans, higher-than average fat content as well as mild and rounded flavor (Kolavalli and Vigneri, 2011; USDA, 2012). The consistent superior quality allows Ghana to receive a 4-6% price premium on the international market (Mulangu et al., 2015). Ghanaian beans are mostly exported to the European Union, Asia and North America (figure 4).

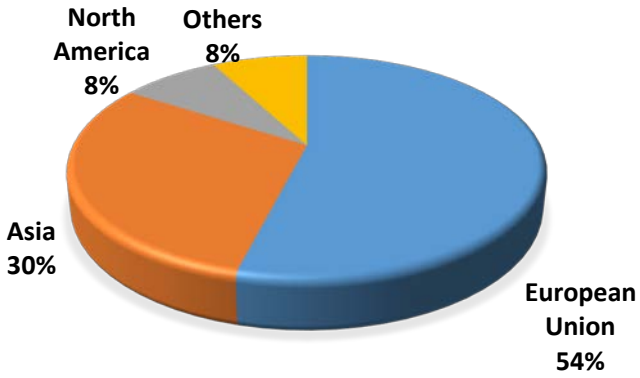

Figure 4: The share of exports of cocoa by region, 2013/2014

Source: COCOBOD Annual Report (2014)

Cocoa was first introduced to Ghana around 1876, by Tetteh Quarshie, who brought it from Fernando Pó (now Bioko in Equatorial Guinea) (Essegbey and Ofori-Gyamfi, 2012). The first trees were planted in the southeast and, since then, gradually shifted to the west (World Bank, 2013). Nowadays cocoa is grown in six out of ten regions in Ghana namely Western, Ashanti, Brong-Ahafo, Central, Eastern and Volta regions (figure 5). Currently, the Western region alone produces over 50% of the Ghanaian cocoa (Abubakar, RM&E (COCOBOD), pers. communic., 2016).

The cocoa growing season begins in October and is split into two harvesting seasons: the main season (October – May) and the light season (June – September) (USDA, 2012). Although the light crop beans are smaller in volume compared to the main crop beans, they are the same quality beans (USDA, 2012).

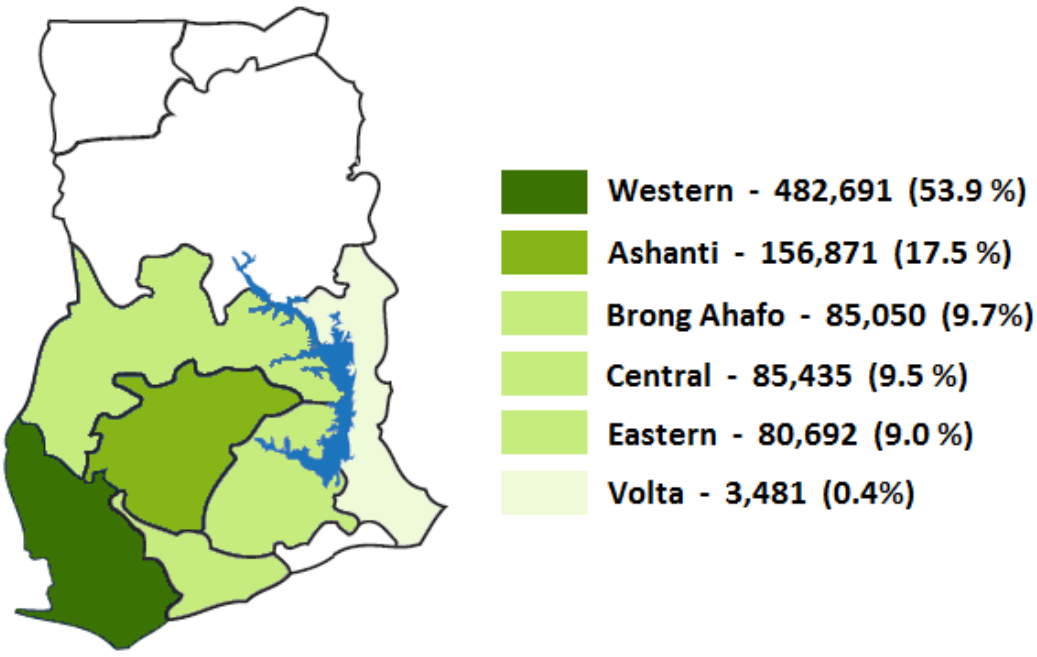

Figure 5: Cocoa production by region in 2013/14, tonnes

Source: Abubakar, RM&E (COCOBOD), pers. communic., 2016

Ghana's cocoa value chain has a so-called partially liberalized marketing structure, which combines elements of privatization with a strong government presence (World Bank, 2013). Prior to the introduction of the partial liberalization, Ghana Cocoa Board (COCOBOD) held a total monopoly on cocoa marketing in Ghana and controlled both domestic purchases and international exports. The structural reforms in the cocoa sector started in the early 1990s, led to the privatization of the internal marketing: number of private companies have been licensed to purchase cocoa beans from farmers and deliver it to COCOBOD (Vigneri and Santos, 2009). However, COCOBOD still plays a major role in the regulation of the cocoa value chain, which includes exports of cocoa and quality control.

The price determination within the value chain is also subject to government regulation. In 1983/84, the Government of Ghana (GoG) established the Producer Price Review Committee (PPRC), which is chaired by the Ministry of Finance and Economic Planning and includes COCOBOD, Bank of Ghana, representatives of farmers, licensed buying companies (LBCs) and hauliers (Kolavalli et al., 2012; Abubakar, RM&E (COCOBOD), pers. communic., 2016). The process of price determination consists of two steps: forecasting of the revenues and costs and deliberations of the PPRC (Kolavalli et al., 2012). First, COCOBOD projects total revenue and industry costs for the season (Abubakar, RM&E (COCOBOD), pers. communic., 2016). Based on these provisions, the PPRC decides on the producer prices for farmers and shares of other stakeholders (LBCs, hauliers, COCOBOD and GoG) for a coming year. A fraction of the price retained by COCOBOD is used to cover its administrative and operating expenses and to reinvest in the cocoa value chain in the form of research, extension provision, input supply subsidies, etc. (World Bank, 2013). The approved producer price is subsequently announced by the Minister of Finance to commence the opening of the new crop season (Abubakar, RM&E (COCOBOD), pers. communic., 2016).

Most of cocoa in Ghana is produced by smallholder farmers whose farms sizes usually do not exceed four hectares (Anim-Kwapong and Frimpong, 2005). Being an important source of rural employment, the cocoa production supports more than 800,000 of farmer households (Ghana Statistical Service, 2014) and delivers 70-100% of their income (Anim-Kwapong and Frimpong, 2005). Farmers sell cocoa beans to Licensed Buying Companies (LBCs), which transport it from villages to the marketing subsidiary of COCOBOD - Cocoa Marketing Company (CMC). CMC exports cocoa and sells it to domestic processors. During the 2013/14 season, Ghana exported 80.5% of its cocoa in form of raw beans and sold the rest to the domestic processors (COCOBOD, 2014). Cocoa beans are processed into semi-finished products such as liquor, butter and powder, of which 95% is exported. The remaining 5% is used for cocoa beverages, toffees and chocolate destined for the local markets (Abubakar, RM&E (COCOBOD), pers. communic., 2016). There is also a limited number of domestic efforts to process cocoa by-products (husks, shells, cocoa pulp) as well as inferior quality beans into various finished products not traditionally associated with cocoa such as shampoos, soaps, alcohol, etc.

2.2. Actors of the cocoa value chain

2.2.1. Main actors of the cocoa value chain

The analysis of the literature identified actors who contribute directly to the production, processing, transportation and marketing of cocoa and cocoa products (table 2). The actors of the cocoa value chain belong to public, formal, informal and agribusiness sectors of economy. The public sector within the chain is represented by COCOBOD's input supply and export activities. LBCs, processors and a part of bigger food retailers operate under the formal sector of Ghana's economy, which is subject to government regulations and existence of contractual agreements between employers and employees. The informal sector is widely present in trading (private input dealers and food retailers) and transportation (hauliers) activities, and mostly consists of small businesses or self-employment ventures. In contrast to the formal sector, the informal sector in Ghana is characterized *inter alia* by the non-coverage by official legislation (minimum wage, social security, state-recognition, etc.) and by the absence of the contractual agreements between employers and employees (Osei-Boateng and Ampratwum, 2011). Farming activities belong to a separate sector of economy – "agribusiness", according to "Ghana Living Standard Survey Round 6" of Ghana Statistical Service (2014).

Table 2: Main actors of the cocoa value chain in Ghana

Activity	Actor	Outputs	Type of sector
Input supply	Private input dealers	Seeds, fertilizers, pesticides, fungicides	Mainly informal
	CHED[1], SPD[2] (COCOBOD)		Public
Production	Farmers	Cocoa beans	Agribusiness
Internal marketing	LBCs	Purchases of cocoa beans from farmers and delivery it to COCOBOD	Formal
Transportation	LBCs	Transportation of cocoa beans	Formal
	Hauliers	Transportation of cocoa beans	Mainly informal
Exports	CMC (COCOBOD)	Exporting of cocoa beans	Public
Processing	Processors	Cocoa powder, cocoa butter, liquor, cakes, beverages, chocolate	Formal

[1] CHED – Cocoa Health and Extension Division of COCOBOD

[2] SPD – Seed Production Unit of COCOBOD

Cocoa waste marketing	Cocoa waste companies	Exporting of inferior cocoa and cocoa waste	Formal
Retail	Big supermarkets	Delivering products to consumers	Mainly formal
	Small retailers		Mainly informal
	Table-tops		Informal

Input supply

Main inputs for cocoa production are cocoa seedlings, fertilizers, pesticides, fungicides as well as farming equipment such as harvesting hooks locally known as "*go-to-hell*", cutlasses (large knives to break pods), pruners and spraying machines (farmers interviews). Pesticides and fungicides are widely used against common threats for the production of cocoa, such as the black pod disease, swollen shoot virus and capsids (mirids), whereas fertilizers help to revive soils and increase yields (World Bank, 2013). COCOBOD retains an active role in the distribution of improved planting material and agro-inputs. Seed Production Division (SPD) of COCOBOD multiplies and distributes the seedlings for the cocoa farmers. Cocoa Health and Extension Division (CHED) supports the distribution of seedlings, delivers fertilizers and conducts spraying on cocoa farms.

The private input market is, with few exceptions, represented by a large number of small-scale input dealers (World Bank, 2013). The presence of private input dealers in different regions is presented in figure 6. Private input dealers are usually located in urban and peri-urban areas and sell their products mostly on a cash-and-carry basis (Word Bank, 2013). Input dealers re-sell inputs sourced from wholesalers, which are located in major urban areas such as Accra or Kumasi (Krausova and Banful, 2010). So far, most of the fertilizer products, fungicides and pesticides have been imported (Krausova and Banful, 2010; IFDC, 2012; World Bank, 2012).

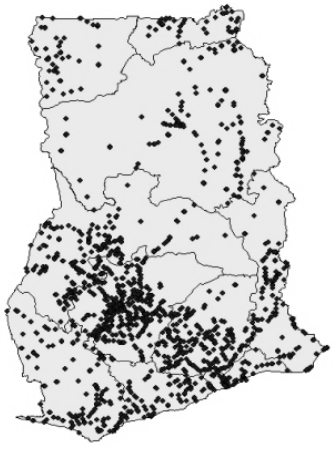

Figure 6: Locations of private agro-input dealers in Ghana

Adapted from Krausova and Banful, 2010

Source: IFPRI/IFDC (2009)

Production

There are around 800,000 households (Ghana Statistical Service, 2014) cultivating cocoa on small plots of land. While the majority of farmers (around 80%) own the land that they cultivate, others are sharecroppers – they manage the fields on a share basis (World Bank, 2013). There are two sharecropping systems in Ghana locally known as *abunu* and *abusa*. In *abunu*, sharecroppers establish cocoa farms themselves and are responsible for the main activities on the farm such as managing the farm, training, hiring labor and applying inputs (Laven, 2010). In return, *abunu* sharecroppers receive 50% of the harvest (Laven, 2010; UNDP, 2011). In *abusa*, owners hire caretakers to manage farms for one-third of the crop, while inputs are usually provided by the land owner, also the quantity may be inadequate (UNDP, 2011).

Cocoa farmers are responsible for the growing, harvesting, fermenting and drying of cocoa. After the harvest, farmers break cocoa pods with a cutlass and keep the beans with its natural pulp in boxes to ferment. Fermentation is a critical step, which determines the flavor of chocolate. Then, farmers leave the beans to dry under the sun for several days (World Cocoa Foundation, 2014; farmers interviews).

Cocoa farming is a labor intensive activity, therefore many farmers organize into informal groups, locally known as *nnoboa*, in order to help each other with harvest and postharvest practices (Laven, 2010). Creation of informal groups also helps farmers to facilitate access to credit as banks are more likely to offer loans to organized groups of farmers than to individuals (Kadri et al., 2013; farmers interviews). Another example of cooperation between farmers is their participation in cocoa certification schemes such as Fairtrade, Rainforest Alliance certified cocoa and UTZ Certified (KPMG, 2012). To comply with requirements of the cocoa certification programs, farmers' groups need to follow specific standards on cultivation of cocoa as well as on social aspects of farming (e.g. no use of child labor).

Internal marketing and transportation

There are around three dozen private national and international Licensed Buying Companies – LBCs (LBCs interviews). At the beginning of every cocoa season, COCOBOD provides LBCs with loans with interests lower than market rates, locally known as a "seed fund", to purchase cocoa from farmers. LBCs receive a fixed amount of revenue per quantity of cocoa and, therefore, try to increase their profits by maximizing the beans purchases and seek to turn over cocoa quantities as quick as possible (Williams, 2009; World Bank, 2013). LBCs employ district managers and purchasing clerks from the local communities to organize purchases and evacuation of cocoa from the villages. Purchasing clerks deliver cocoa to the LBCs' warehouses. LBCs hire hauliers (private transport service companies) to transport sealed bags of cocoa to the Cocoa Marketing Company (CMC). An increasing number of LBCs do not outsource the transportation activity anymore and deliver cocoa to CMC themselves (LBCs and hauliers interviews). There are also non-recognized individuals who buy cocoa directly from farms and then sell it either to LBCs, or elsewhere illegally for higher returns (Mohammed et al., 2012).

Exports

All cocoa is delivered to a subsidiary of COCOBOD – the Cocoa Marketing Company, which stores cocoa in three take-over centers (Tema, Takoradi and Kaase) prior to shipment (World Bank, 2013). CMC has exclusive rights to the marketing and exports of cocoa beans to local and foreign buyers. In addition, CMC manages pre-harvest forward sales and contracts a fixed price with international merchants and cocoa processors to hedge against price volatility. Around 60% - 80% of cocoa is pre-sold (World Bank, 2013). The forward contracts are then provided as collateral to borrow the funds from an international syndicate (World Bank, 2013). These funds are used as the seed fund for LBCs (Kolavalli et al., 2012).

Processing

Around 80% of Ghanaian cocoa is directly exported in form of raw beans and the rest is domestically processed into semi-finished or consumer products (Abubakar, RM&E (COCOBOD), pers. communic., 2016). The majority (over 95%) of the total processed cocoa is used for semi-finished products (liquor, butter, powder and cake), most of which is exported, and the rest is processed into confectioneries and other cocoa-based products destined for domestic market (Abubakar, RM&E (COCOBOD), pers. communic., 2016).

To attract foreign direct investments into the domestic cocoa processing sector, Ghanaian government offers to investors a competitive package of economic incentives. It includes price discounts, tax free zones and extended payment credit (World Bank, 2013). These efforts resulted in an increase in domestic grinding capacities from 110,000 MT in the early 2000s to approximately 431,500 MT in 2013 (World Bank, 2013; Abubakar, RM&E (COCOBOD), pers. communic., 2016). For the medium term, the government aims to process at least 60% of the total cocoa output domestically before exporting it (Abubakar, RM&E (COCOBOD), pers. communic., 2016).

COCOBOD offers domestic processors a discount of 20% on beans produced during the light crop season. (Ecobank, 2014; Mulangu et al., 2015). The growth of processing capacities in Ghana has increased the competition for discounted beans thus reducing their availability. Although domestic processors can also purchase main crop without a discount or import beans from abroad with 20% duty (Asante-Poku and Angelucci, 2013), this is often not economically efficient as processors in general face high operational costs (processors interviews). As the result, processors are unable to procure sufficient quantities of beans and cannot operate at full capacity. In 2013/14, only around 60% of capacities of domestic processors in Ghana were used (Abubakar, RM&E (COCOBOD), pers. communic., 2016).

Cocoa waste marketing

Currently, there are about five cocoa waste companies, licensed by COCOBOD, that purchase cocoa waste from farmers and processors in Ghana (Resigha interview, 2015). Agents of these companies travel around cocoa growing areas and purchase inferior quality cocoa from farmers. In addition, they purchase cocoa shells, husks and cocoa skin from domestic cocoa processors. Before being shipped abroad, cocoa waste is gathered at the companies'

warehouses to be checked by COCOBOD in order to make sure that no cocoa of acceptable quality is exported through this channel.

Retail

Ghana's food retail environment mostly belongs to the informal sector and consists primarily of traditional open-air markets and small groceries. Supermarkets account only for 5% of the retail food market (MoFA and World Bank, 2008). Retailers offer local and imported cocoa-based products such as cocoa powder for beverages, chocolate, spreads, candies, cookies, pomades and creams. However, retailers are merely tangentially connected to the cocoa value chain as these products constitute only a small fraction of their offerings.

Consumers

Although a very little fraction of cocoa is destined for the local market, Ghanaians still have a soft spot for cocoa-based products. Powdered beverages are the most affordable and, thus, the most popular cocoa product among local consumers. Many people, regardless of their income, prepare cocoa drinks for themselves and their families every day. In contrast, chocolate is commonly perceived as a luxury product because it is rather expensive for the majority of consumers. Visited food retailers mentioned the popularity of chocolate around holidays and for special occasions. This pattern was even noticed by the government, who in 2006 re-branded the Valentine's Day into the National Chocolate Day to further encourage domestic consumption of chocolate.

2.2.2. Supporting actors of the cocoa value chain

The cocoa value chain also includes actors that do not directly participate in the production, processing and retailing of cocoa, but provide various types of support to the value chain. These actors are from now on referred as "supporting actors". There is a wide range of supporting activities: research, extension, quality control, disaster management, etc. Supporting actors of the cocoa value chain and their functions are listed in table 3.

Table 3: Supporting actors of the cocoa value chain in Ghana

Function	Actors		Outputs
Extension services and Research	COCOBOD	Cocoa Health and Extension division	Research and transfer of knowledge
		Cocoa Research Institute of Ghana	
	Research institutions	National	
		International	
	Farmers' groups		
	Processors and LBCs		

	NGOs	
Quality control	COCOBOD Quality Control Company	Stable quality of raw cocoa
Financing	Formal financial organizations	Financial services
	Semi-formal financial organizations	
	Informal financial organizations	
Insurance and Social protection	Insurance companies	Risk mitigation
	Social Security and National Insurance Trust	
	National Health Insurance Scheme	
Disaster management	National Disaster Management Organization	Risk mitigation
	Ghana National Fire Service	
	Local Disaster Volunteer Groups	

Extension services and research

Extension services to farmers are provided by the subsidiary of COCOBOD - Cocoa Health and Extension division (CHED) as well as NGOs (often in collaboration with LBCs and processors) (Laven and Boomsma, 2012). Extension services are aimed at increasing yields and enhancing productivity. They include training of farmers on traditional, chemical and sustainable methods of producing cocoa as well as on weed, pest and disease control, safe pesticides usage, new agronomic and forestry technologies, sustainable practices, etc. (Aneani et al., 2012; World Bank, 2013).

Cocoa Research Institute of Ghana (CRIG), another subsidiary of COCOBOD, is the main center of the study of cocoa. CRIG conducts research on various aspects of the cocoa industry, such as pests and diseases, varieties of cocoa species, cocoa establishment on the field, socio-economic aspects of cocoa cultivation and alternative ways of cocoa processing. Other institutions conducting research on the cocoa industry in Ghana are KNUST, Institute of Statistical, Social and Economic Research (ISSER) at University of Ghana, Soil Research Institute, etc. In addition, the cocoa industry in Ghana is of research interest for numerous international organizations: the World Bank, the Food and Agriculture Organization of the United Nations (FAO), the World Cocoa Foundation, the International Cocoa Organization, the Institute of Development Studies, and many universities as well as other international research institutions.

Quality control

The quality control is performed by a subsidiary of COCOBOD – the Quality Control Company (QCC). The QCC assures the traceability of the cocoa value chain by overseeing the quality from the LBCs warehouses to the ports. QCC is responsible for inspection, sampling, grading and packaging of cocoa (Asante-Poku and Angelucci, 2013; Essegbey and Ofori-Gyamfi, 2012;

Mohammed et al., 2012). Through QCC COCOBOD obtains primary information on the quantity and quality of raw cocoa. By Ghanaian standards, grade I is attributed to the bag if the beans have a moisture content not higher than 7.5% and do not contain more than 3% beans with defects (Quarmine, 2013). Grade II accepts not more than 8.5% moisture and 4–8% beans with any of the other defects. Another quality grading system is based on the bean size and weight (table 4).

Table 4: Bean-size categories and their shares in the total cocoa purchases in 2013/14

Category	Bean count per 100 grams	Share
Super main crop	Up to 90	76.87%
Main crop	91-100	
Super light crop	101-110	21.33%
Light crop	111-120	
Small beans	121-130	1.64%
Type 4	131-150	0.14%
Remnant	151-180	0.02%

Adapted from (COCOBOD, 2014)

In 2013/2014 cocoa season, 76.87% of beans were the big size beans that received a premium price on the world market, 21.33% was the smaller light crop beans most of which was sold with a discount to local processors and the remaining 1.8% were sold to the cocoa waste companies.

Financing

Financial institutions in Ghana, which provide financial services to the cocoa value chain actors, can be divided into three main categories: formal, semi-formal and informal (Steel and Andah, 2003).

Formal financial institutions are licensed by the Bank of Ghana and include banks, which target urban middle and high income clients, as well as Rural and Community Banks (RCBs), which provide financial services in rural areas but cannot conduct foreign exchange operations (Kadri et al., 2013; Steel and Andah, 2003). Formal institutions usually require a collateral (e.g. in the form of real-estate), stable employment guaranteed by the employer and a package of documents from the borrower (Kadri et al., 2013; Owusu-Antwi and Antwi, 2010). Semi-formal financial institutions are represented by credit unions and financial NGOs. Those are formally registered financial bodies that, however, do not have a license of the Bank of Ghana (Steel and Andah, 2003). Finally, the informal financial system can be divided into non-commercial transactions (between relatives and friends) and for-profit credit arrangements conducted by all sorts of local moneylenders (Owusu-Antwi and Antwi, 2010). The costs of borrowing in Ghana are high: interest rates from commercial banks reached 40% per annum in 2015 (www.

tradingeconomics.com, 2016), whereas the interests charged by informal moneylenders can be even greater.

Insurance and social protection

Insurance and social protection schemes serve as the financial protection for the actors of the cocoa value chain against natural catastrophes, business failures, illness, unemployment, etc. A number of commercial organizations offer a range of life and non-life insurance services in Ghana (Giesbert and Steiner, 2011). In addition, there are public insurance schemes open for voluntary enrolment, including the Social Security and National Insurance Trust (SSNIT) and National Health Insurance Scheme (NHIS). SSNIT provides coverage for old age, invalidity or family member loss (SSNIT, 2016). NHIS provides medical care at public hospitals and health centers. As premiums depend on income, particular groups such as elderly, poor people and pregnant women, are exempted from charges for NHIS (Giesbert and Steiner, 2011).

Disaster management

Disaster management organizations play an important supporting role for the cocoa value chain, protecting if from bushfires, floods and other natural cataclysms. There are several disaster management governmental agencies in Ghana including the National Disaster Management Organization (NADMO) and the Ghana National Fire Service (GNFS). NADMO has offices in every district in Ghana and provides first line response in times of disasters, coordinates the activities of various organizations in disaster management, provides rehabilitation services and helps communities to restore their activities following a disaster event (NADMO interview, 2015; NADMO, 2016). GNFS has around 200 fire stations for 234 districts in Ghana (GNFS interview, 2015). The responsibilities of GNFS include education of local communities on safe use of fire, raising awareness of fire risk, and provision of rescue services in emergency situations (GNFS interview, 2015). Both NADMO and GNFS are engaged in training of volunteer groups at the community level and provide them with fire beaters and basic protection equipment (Blay et al., 2011; GNFS interview, 2015). Presence of trained disaster volunteer groups increases the responsiveness of the local communities to hazards (GNFS interview, 2015).

2.3. Resource flow maps

2.3.1. Material flow map

A supply chain consists of actors (suppliers, manufacturers, distributors, retailers and customers) linked by material, financial and information flows (Mentzer et al., 2001; Stadtler, 2005). The same definition applies to a value chain, although the emphasis in the value chain approach is shifted to the value created by each activity of the chain.

Material flow analysis includes activities defined as "transformation, transport or storage of materials". (Brunner and Rechberger, 2004, p. 37). The materials within the Ghana's cocoa value chain include agro-inputs (seeds or seedlings, fertilizers, pesticides and fungicides), farming tools (cutlasses, hoes, spraying machines etc.), cocoa beans, semi-finished cocoa products and finished cocoa confectionary products. Figure 7 shows the material flow map of the Ghanaian cocoa value chain.

The outer red frame represents Ghana's geographic border. Actors are symbolized by rectangular boxes. Farmers and farmers' groups are grouped by the blue dotted line as they conduct the same functions. Blue arrows indicate material flow between actors located entirely in Ghana. Yellow arrows indicate the materials transported beyond the national border.

Private input dealers and COCOBOD's divisions, CHED and SPD, are engaged in the supply of agro-inputs to cocoa farmers. SPD grows cocoa seedlings in several cocoa growing areas and distributes them among farmers. CHED assists SPD in the distribution of cocoa seedlings, and, in addition, delivers free fertilizers and conducts mass spraying on the cocoa farms. COCOBOD distributes only a proportion of inputs needed (table 5), and farmers source the rest from the private input market.

Table 5: COCOBOD input supply

Input	Provided by COCOBOD	Recommended by COCOBOD
Pesticide	2 times per season	6 times per season
Fungicide	3 times per season	7-9 times per season

Source: provided by Frimpong Ayerakwa, (CHED, Kumasi, pers. commun. 2015)

Farmers grow and harvest cocoa, break the pods, ferment beans with pulp and dry cocoa beans to reduce the content of moisture under the sun for several days (Asante-Poku and Angelucci, 2013). Purchasing clerks buy cocoa beans from the villages and deliver them to the warehouses of LBCs. Once there is enough cocoa in the warehouses, LBCs invite QCC for the first quality check. QCC controls the uniformity, moisture content and quality of cocoa, and then grades and seals it. QCD checks cocoa beans three times – at the warehouses of LBCs, before entering

Cocoa Marketing Company (CMC) and prior to export shipment. In addition, QCC inspects cocoa waste at cocoa waste companies' warehouses, to prevent exports of beans of an acceptable quality through this channel.

Once the cocoa is sealed in the bags, LBCs hire hauliers to transport it to Cocoa Marketing Company of COCOBOD. Some LBCs transport cocoa themselves to better manage risks of losing cocoa associated with inadequate driving and high speeding and to avoid contamination of cocoa flavor due to dirty trailers of trucks (LBCs interviews).

CMC has exclusive rights to market and export unprocessed cocoa to local processors and foreign buyers. However, there is evidence of smuggling cocoa across the border with Ivory Coast (Mohammed et al. 2011, World Bank 2013). In 2013/14, around 80.5% of Ghanaian cocoa (mostly the main crop) was exported unprocessed and 19.5% was sold for the domestic processing (Abubakar, RM&E (COCOBOD), pers. communic., 2016). Local processors can also import cocoa beans but this is less economic efficient because of the import duty of 20% (Asante-Poku & Angelucci, 2013). Processing companies sell processed cocoa abroad directly. Most of cocoa is processed into semi-finished products and only 5% into confectionaries, which are destined to the domestic market.

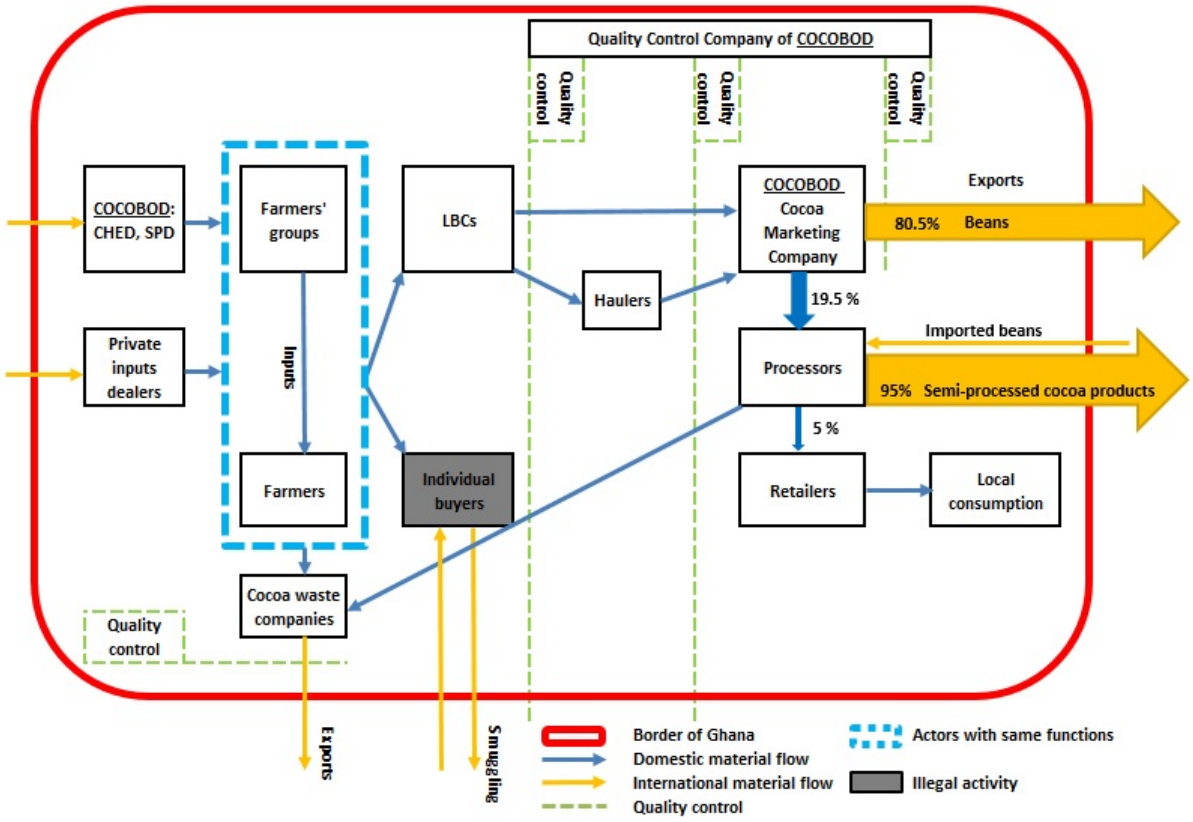

Figure 7: Material flow map of Ghana's cocoa value chain

2.3.2. Financial flow map

Material flows within supply chains induce several financial processes. According to Pfohl and Gomm (2009, p.150), financial processes comprise "inventory management, the handling of

the logistically induced financial flows as well as the supporting activities with an immediate reference to logistics as, for example, the insurance management for stocks." Financial resources and funds provide a basis for the business operations, allows investing in development, paying wages, recovering in case of a damage, etc.

Figure 8 shows the financial flow map of the cocoa value chain in Ghana. Red frame indicates Ghana border, while green frame separates the cocoa sector from supporting activities. This map aims at identifying financial flows between main actors and supporting financial sources for the activities of the value chain. The proportions shown on figure 8 are calculated based on Kolavalli et al. (2012), MOFEP (2011, 2012, 2014), Quartey (2013), GoG, (2015a) and experts interviews.

Financial flows induced by the main activities of the value chain are represented by the solid red and yellow arrows. Solid red arrows represent payments for the goods or services between the main actors. Yellow arrows across the border indicate the main exports income flows and illegal financial flow related to smuggling. The income from exports of cocoa comes through two gates: cocoa processors (semi-finished cocoa products) and COCOBOD (cocoa beans). In addition, a small share of income comes from local consumers.

The income for cocoa beans is equal to Free on Board (FOB)[3] cocoa price, which is distributed by COCOBOD among actors in different proportions. Around 13% of FOB price remains at COCOBOD and is used for taxes, administrative purposes, pre-harvest and post-harvest supporting activities such as quality control, extension services, input supply, research etc. (authors calculations based on (Quartey, 2013, Shashidhara Kolavalli et al., 2012)). COCOBOD gives the remaining 87% of the price to LBCs, which then share it with farmers and hauliers in the proportions established by the PPRC. For the last four years, the producer prices were fixed at around 73-78% of FOB price (MOFEP, 2011, 2012, 2014; Quartey, 2013).

Financial flows related to supporting activities that are placed outside of the green frame are indicated by red dotted arrows across the green frame. These flows are in form of subsidies, loans, insurances and social security payments. The supporting actors engaged in financial flows are insurance companies, financial organizations, social security and health insurance institutions (SSNIT and NHIS). Insurance companies provide means of protection against financial losses for Ghanaian businesses. Ghanaian workers and their employers contribute to SSNIT in order to receive income compensation for the old age or in case of invalidity or loss of life (SSNIT, 2016). NHIS provides financial access to several categories of healthcare facilities such as clinics, hospitals, pharmacies, etc. To subscribe to NHIS, workers pay premiums. Workers contributing to SSNIT, children, the elderly, pregnant women, poor people and some other categories are exempted from paying premiums. Financial organizations offer loans and credits for the value chain actors.

[3] Free on Board Price includes all charges up to placing the goods on board a ship (www.businessdictionary.com)

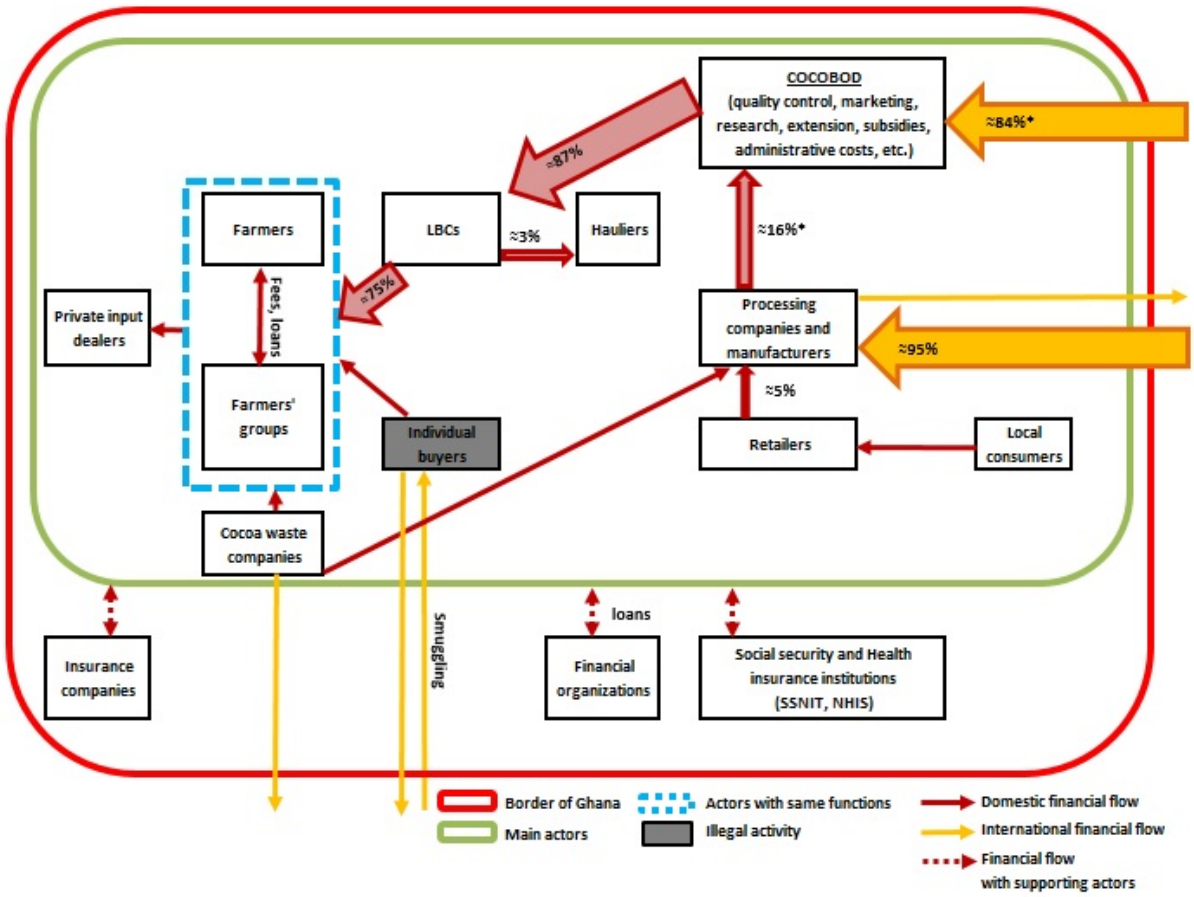

Figure 8: Financial flow map of Ghana's cocoa value chain[4]

2.3.3. Information flow map

Information flows are the mechanism of coordination of supply chain activities (Lee et al., 2004) and comprise information on demand, forecasts and knowledge (Pfohl and Gomm, 2009). Adequate access to information reduces uncertainty, facilitates decision-making for each actor, increases transparency and traceability of a chain, helps to reduce costs, improves awareness of changes and new business opportunities, provides access to knowledge and best practices and facilitates data collection to support institutional decision-making processes (Bailey and Francis, 2008; Prajogo and Olhager, 2012). Information hiding, mistrust or even cheating can bond the information flow within a chain (Stadtler, 2005).

Figure 9 represents the information flow of the cocoa value chain in Ghana. The information flow map includes different types of information exchange between the actors: transfer of knowledge (extension services, trainings, etc.), data collection activities, signals from

[4] * Approximate shares of COCOBOD revenues from cocoa are calculated taking into account discount offered to domestic processors

international markets (demand, prices), identifiable informal relations and research data exchange.

Few studies have been published on the topic of information exchange within the cocoa value chain in Ghana. A study researching about the relationship between cocoa farmers and other value chain actors, conducted by Roldan et al. (2013), shows that small-scale farmers (who are responsible for most of cocoa production) mostly have contact with COCOBOD and relationships with other actors of the value chain are limited. Roldan et al. (2013, p. 131) say that farmers have "little or no access to information on market demands and price fluctuations" and thus, can easily get cheated by LBCs (adjusted scales or payments below the fixed price). Surveys conducted by Baah et al. (2012) also reveal cases of unfair treatment of farmers by purchasing clerks and lack of monitoring activities of cocoa purchases from third-party organizations.

NGOs are another source of information for the cocoa production activity, although they work with a limited number of farmers organized in groups. NGOs play an important role in supporting the information flow within the cocoa value chain, because they create links between international markets, LBCs, processors and farmers. NGOs promote certification schemes, which aim at supporting sustainability of farming activities and assure compliance of agricultural outputs for the international markets. Within certification schemes, NGOs provide extension services and trainings for cocoa farmers and link them with input dealers. Some LBCs and processors also support certification schemes and cooperate with NGOs to improve agricultural and social performances among farmers (actors and experts interviews).

NGOs cooperate with COCOBOD, especially with CHED and SPD, to penetrate the value chain and facilitate the access to cocoa farmers. COCOBOD accumulates most of the information about the cocoa value chain in Ghana. QCC collects statistics on quantity and quality of cocoa beans throughout the value chain. CMC, the only official representative of the Ghanaian cocoa in international markets, interacts with international buyers and markets. In addition, CMC traces export price history and quantities of exported cocoa. On behalf of COCOBOD CRIG conducts scientific research, particularly on aspects of cocoa production, such as diseases, pest resistance, improvement of yield, suitability of inputs for cocoa, as well as socio-economic issues of cocoa farming etc. Based on such research activities, CRIG develops recommendations for improving the production of cocoa. The dissemination of new knowledge to farmers is done through CHED.

The cocoa value chain is of particular research interest for other national research institutions as well. For example, the Institute for Statistical and Social Research (ISSER) at the University of Ghana offers socio-economic research to support the cocoa industry (Essegbey and Ofori-Gyamfi, 2012). The Kwame Nkrumah University of Science and Technology (KNUST) also actively conducts studies on a wide range of aspects of the cocoa production in Ghana. International institutions interact with COCOBOD, national research institutions and NGOs.

Processors interact with CMC to get information on cocoa prices and quantities of discount cocoa available for the domestic production. As mentioned above, some processors cooperate

with NGOs and LBCs to support cocoa farmers certification schemes. However, local cocoa processors have weak ties with scientific institutions (Essegbey and Ofori-Gyamfi, 2012). For example, although the Product Innovation department of CRIG is actively researching new products that can be made out of cocoa, so far, local processors have not been adopting the technologies for mass-producing them. At the moment, such products (e.g. shampoos, pomades, creams etc.), in Ghana, are mostly produced in small quantities by CRIG itself.

As shown on the material and financial flow maps, the amount of cocoa destined for local consumption is negligible. Consequently, retailers and local consumers do not play any significant role in the cocoa value chain in Ghana. According to Consumer Advocacy Center Ghana (2015), no consumer advocacy group has been known to specialize on cocoa products.

The information flow map of the cocoa value chain has a centralized character. COCOBOD has strong relationships with some actors and retains most of the information on the cocoa value chain. However, the actors who do not seem to have strong contacts with COCOBOD are less connected or mostly excluded from the information flow, as autonomous networking is rather limited. According to the interviews with actors and experts, hauliers and retailers do not participate in the information exchange.

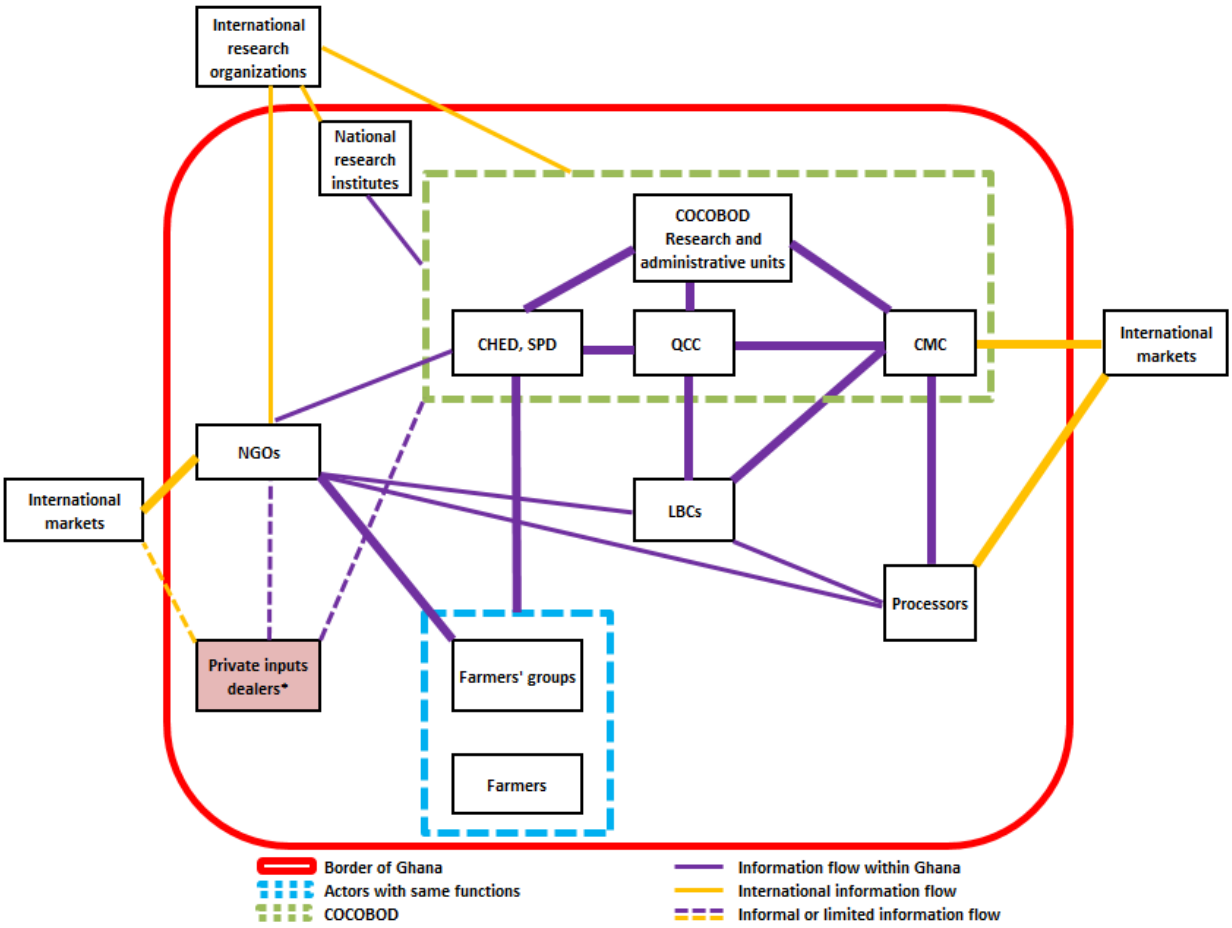

Figure 9: Information flow map of Ghana's cocoa value chain

2.4. Shocks affecting the cocoa value chain in Ghana

2.4.1. Participatory-based identification of shocks affecting the cocoa value chain

The current study focuses on the ability of the cocoa value chain to withstand shocks – *sudden and often unforeseen disturbances that may disrupt the functioning of actors and the whole chain.* Shocks for the cocoa value chain were identified through a participatory-based approach[5]. First, actors and experts were asked during the interviews to list potential shocks, which could affect various activities of the cocoa value chain. Second, during the stakeholder workshop, actors and experts were asked to agree on the five most important shocks for their activities. The results of the interviews and the workshop are presented in Appendix 1 and include various types of disturbances mentioned by the actors, such as inflation, poor road conditions, floods, pests and diseases, bushfires and fire outbreaks at the processing sites, robbery etc. While many of these disturbances clearly represent potential shocks for the cocoa industry, some (e.g. poor road conditions) cannot be considered shocks as they are not sudden or unexpected and the actors are dealing with them on a daily basis.

To distinguish between shocks and other negative but not unexpected issues, a simple process shown in table 6 was applied. The process included two steps. First, all the risks mentioned by the actors and experts were attributed a score of "0" or "1" depending on whether or not the particular inconvenience is associated with a change in the operating environment. For example, "poor roads" was given a score of "0" because it is just an existing albeit unfavorable condition, and "bushfire" was given a score of "1" because it represents an unexpected change in the operating environment.

Second, inconveniences associated with changes were given a "0" if the change is slow or regular, and "1" if the change can occur suddenly and therefore can be considered as a shock. For example, "ageing of farmers", which is of big concern for a cocoa production activity, is a slow change, whereas "bushfire" is a sudden event.

Table 6: Example ratings for the shock-factor of issues

Issue mentioned by actor	Change of environment	Suddenness	Result (Change + Suddenness)
Poor roads	0	0	0
Ageing of farmers	1	0	1
Bushfire	1	1	2
0 – Unfavorable condition 1 – Driver of change 3 – Shock			

[5] Shocks identified through this approach confirmed the conclusions from the literature analysis.

During the interviews, actors and experts themselves interpreted some of the issues as both drivers of change and shocks, depending on the strengths of their impact. One example is a drought that can appear just as a prolonged dry season or as a severe dryness that destroys farming activities. Another example is the fluctuations of cocoa prices, which are always varying, but may suddenly turn into an unexpected change and thus represent a shock.

2.4.2. Main shocks and their effects on the cocoa value chain

Table 7 presents shocks identified through participatory-based approach and their impact on the activities of the cocoa value chain. The impacts of the shocks were identified based on the analysis of literature, interviews with actors and experts as well as on the results of the workshop. Rows in the table represent shocks and are grouped by the type of a shock. Columns are the main activities of the value chain identified earlier (see sections 2.2. and 2.3.).

Table 7: Most important shocks affecting the cocoa value chain

Shock \ Activity		Private input supply	COCOBOD input supply	Production	Internal marketing	Transportation	Processing	Food retail
Weather-related	Drought							
	Bushfire							
	Flood							
Bio-logical	Diseases and pests							
Economic	Price fluctuations on cocoa and cocoa products							
	Inflation							
Political	Changes in governmental policies							
Related to illegal activities	Illegal activities (mining, tree felling)							
	Criminal activities (theft, robbery)							
Industrial	Fire outbreaks							
	Unstable utility supply							
	Machinery breakdown							

Direct negative impact
Indirect negative impact
Positive impact
Not-identified or minor impact

Colors represent various types of impact as described in the legend. Indirect impacts are realized when a shock does not seem to have an immediate effect on the actor while the activity may still get negatively affected through the disruptions of other related activities. For example, most actors of the cocoa value chain will only feel the consequences of a bushfire when it results in a beans shortage, i.e. when the production of cocoa beans is significantly reduced. Therefore, direct and indirect impacts of shocks can be considered. The remainder of this section provides commentary on each shock affecting the cocoa value chain and additional information on how the table 7 was constructed.

Weather related shocks

Climate change present severe challenges for West Africa and for Ghana in particular (Brown and Crawford, 2008). In Ghana, the consequences of climate change include rising temperatures, declining and more variable amounts of rainfall as well as high incidence of weather extremes (UNDP and UNEP, 2012). The cocoa tree is especially vulnerable to changes in weather patterns because it is a rain-fed crop and typically requires certain temperature and rainfall levels. Cocoa primarily grows in deciduous and transitional zones of Ghana (figure 10). According to the Ghana Environmental Protection Agency (GoG, 2015b), the risks induced by climate change are especially high in the transitional zone. These risks include both extremes: torrential rains and droughts, both leading to reduced agricultural production.

Figure 10: Six ecological zones in Ghana

Adapted from GoG (2015b)

The annual mean temperature in Ghana is expected to rise by 1°C between 2011 and 2040 (GOG, 2015b). A temperature change of even such a modest magnitude can lead to reductions in the amount of water available to cocoa plants because of the potential increase in evapotranspiration (Läderach et al., 2013). Figure 11 shows the predicted suitability change for cocoa growing regions caused by climate change for Ivory Coast and Ghana by 2050. The biggest change is expected in the Western region of Ghana where most of cocoa is produced.

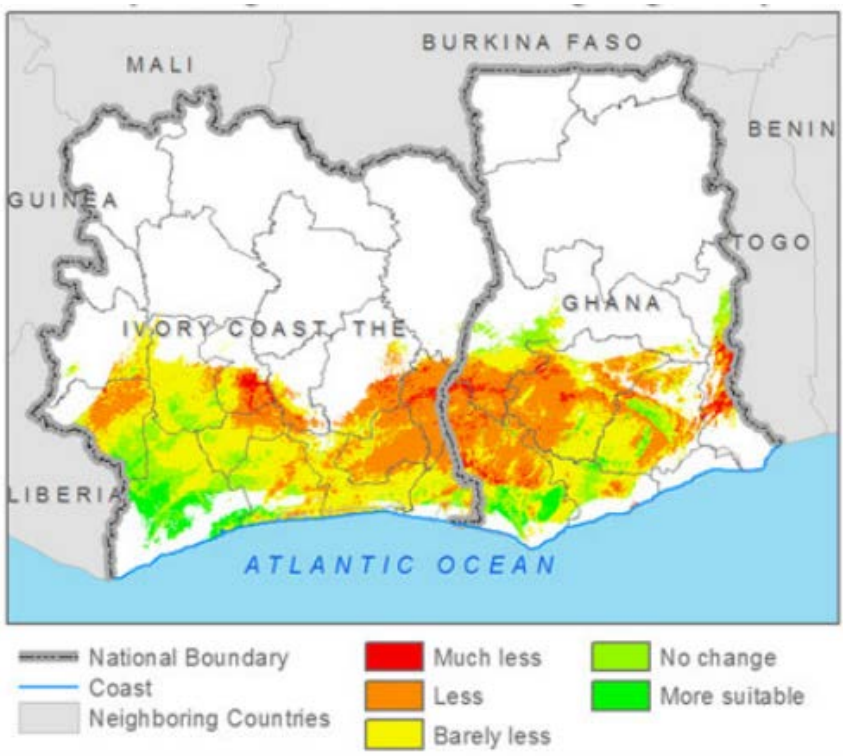

Figure 11: Suitability change for cocoa growing-regions by 2050 in Ghana and Ivory Coast

Adapted from (Läderach et al., 2013)

The effects of weather-related shocks (droughts, bushfires and floods) on the cocoa value chain in Ghana are explained one-by-one below.

Droughts

Droughts have direct impacts on the COCOBOD input supply and cocoa production. COCOBOD input supply is affected because reduced water availability causes stress or even death to cocoa seedlings which are nursed by SPD. Moreover, droughts affect the wellbeing of cocoa trees, which leads to the loss of yields and translates into financial losses for farmers. Consequently, farmers buy fewer inputs and, therefore, private input dealers experience business losses as indirect effects of the droughts.

Drought affects all other actors through the decline in cocoa production. For example, LBCs get their revenues by purchasing cocoa from farmers and unavailability of cocoa may have a dramatic impact on their functioning. Hauliers receive fewer orders to transport the cocoa and need to search for alternative jobs.

Reduced supply of cocoa leads to underutilization of processing capacities of cocoa processors. If revenue losses become significant and a processor is not able to cover his operating costs, it can end up in a factory shutdown. Accordingly, the supply of cocoa products destined for the local market reduces. As a result, retailers bear losses because lesser confectionary is available for consumers in food retail shops.

Bushfires

Most of bushfires in Ghana are anthropogenic in origin, caused by farmers who set fire to forests to clear the land, and by hunters who trap animals with fire (Agyemang et al., 2015; GNFS interview, 2015). Although bushfires are usually not induced by weather per se (except of cases of lightning strikes), they can be considered as weather-related shocks, because drought conditions are a prerequisite for fire propagation. A memorable bushfire occurred during a severe drought in 1982-1983 resulted it the loss of 35% of crops (Arthur and Arthur, 2011) and caused financial losses estimated at more than US$ 36 million (World Bank, 2013).

When bushfires destroy a farm, the cocoa trees need to be replanted. Farmers not only lose this year's yields but also experience further income shortages until new cocoa trees start bearing fruits, which takes at least two years (Padi, 2015). Provision of the material for replanting falls entirely on the shoulders of COCOBOD as it is the only source of cocoa seedlings for Ghanaian farmers.

The decline in production caused by bushfires cascades throughout the value chain in the same way as it does in the case of droughts discussed above.

Floods

Floods result from moderate or severe precipitation coupled with the structure of the landscape and poor physical planning (GoG, 2015b). Rising water damages or destroys farms situated close to rivers, thus creating negative impacts on the rest of the cocoa value chain through reduced cocoa production. Production is not the only activity of the cocoa value chain that is directly affected by floods. Floods also create threats to the actors conducting the transportation activity. Floodwater blocks access to rural areas, washes out unpaved roads and slows down road traffic. In addition, floods are usually assisted by heavy rains, which increase the risks of accidents as paved roads become slippery and visibility is reduced. Moreover, when a truck is stuck on a road in a remote area, road robbery is possible. Cocoa processors are also vulnerable to flood events as they are located in industrial areas next to the seaports. Floods suspend functioning of factories and cause delays in deliveries. Moreover, damage to physical assets of cocoa processors leads to significant financial losses as costs of restorations are very high.

While floods have direct and indirect negative impacts on most activities of the cocoa value chain, surprisingly, private input dealers reported to benefit from them (stakeholders workshop). The reason is that floods provoke outbreaks of biological shocks which boost the demand for chemicals.

Biological shocks

Diseases and pest infestations are the biological shocks commonly mentioned by the interviewed stakeholders. They are all very similar in their effects on the cocoa value chain actors and thus are kept as a single row in table 7.

SPD, which raises cocoa seedlings, and farmers are the two actors exposed to direct effects of biological shocks. Pests and plant diseases affect the growth of the cocoa tree, reduce the number of pods on the tree or even lead to its death. According to (Hainmueller et al., 2011) farmers lose about 34% of their cocoa harvest due to diseases. Other actors of the value chain experience indirect negative impacts of biological shocks when the quality of beans deteriorates and productivity declines. However, as mentioned above, private input suppliers feel positive impacts of diseases and pest infestations because farmers are bound to buy more chemicals to protect their yields.

Black pod disease

Black pod disease is widely present in all the cocoa growing regions in Ghana (World Bank, 2013). It is one of the diseases that can be triggered by excessive precipitation and floods. The reason is that the pathogen causing black pod disease is climate sensitive: it is more active when humidity is high as it propagates through rainfalls and running water. Prolonged and excessive rains provoke serious spikes of the disease. Infected pods turn brown both on the surface and inside and the beans get destroyed (figure 12). It is recommended to control the disease by removing affected pods and/or applying fungicides during the rainy season (Akrofi, et al., 2003; Dormon et al., 2007).

Figure 12: Cocoa pod affected by black pod disease

Cocoa Swollen Shoot Virus Disease

Cocoa Swollen Shoot Virus Disease (CSSVD) is a virus spread by insects, roots and interlocking branches (World Bank 2013). Some of the isolates of the virus are virulent and cause death of cocoa trees (Ollennu, 2001). The epicenter of the CSSVD is Western region, which produces more than a half of cocoa (Domfeh et al., 2011). In 2010, the loss from CSSVD in Ghana was estimated at US$ 21 million (World Bank, 2013). To support the early detection of CSSVD, COCOBOD issues posters to help farmers and control officers recognize its symptoms. Once the infection is noticed, COCOBOD officers remove trees with visible symptoms of CSSVD and their immediate neighbors, because cocoa trees can transmit virus before showing any symptoms of the disease (World Bank, 2013). Even though COCOBOD offers farmers new seedlings for replanting, the eradication measure is not well received by farmers as they lose yields for the next 2-3 years before new trees start bearing cocoa pods.

Pests

In Ghana, the main insect pests of cocoa are capsid bugs (mirids) and shield bugs. They cause damage to the cocoa tree by feeding on it, thus creating lesions on its pods, stems and leafs. Moreover, pests increase the exposure of the tree to other diseases or even transmit them (Dormon et al., 2007). Insects infestations cause estimated loss of cocoa of at least 100,000 tons yearly (World Bank, 2013). The pest management includes tree maintenance (control of shade, removal of chupons etc.) and application of insecticides (Dormon et al., 2007; World Bank, 2013).

Mistletoe

The mistletoe is a parasitic plant, which is a common problem for some forest trees including cocoa. Mistletoe affect yields by extracting water and nutrients from the cocoa plant (Dormon et al., 2007). In addition, mistletoe can serve as a host for CSSVD transmitting insects (World Bank, 2013). Mistletoe is controlled manually by removal of parasitic weeds with cutlasses or pruners.

Economic shocks

Economic shocks affecting the cocoa value chain include cocoa price fluctuations on international markets and inflation in Ghana.

Price fluctuations on cocoa

The high variability of cocoa prices on the world market was mentioned to be a significant shock for the activities of the cocoa value chain. The decline in cocoa prices translates into financial losses for every activity of the cocoa value chain in Ghana. COCOBOD inputs supply, production and internal marketing heavily rely on the export of cocoa and bear financial losses once the prices on cocoa decrease. Input suppliers, hauliers and food retailers also get affected when the prices of cocoa are changing, albeit to a lesser extent, as cocoa-related activities only constitute a share of their incomes.

Gibson (2007) suggests that cocoa price fluctuations result from several supply- and demand-related issues. On the supply side, the major drivers are weather changes, natural disasters

and conflicts in the producing countries, while the demand-driven fluctuations mostly result from changes of demand in key markets and market speculations.

The fluctuations of world cocoa prices since 1960s and their drivers are illustrated in figure 13 (PwC, 2014). Consistently with the suggestions of Gibson (2007), the significant declines in the cocoa price have mainly resulted from increases in the cocoa supply to the world market. For example, the government-led investments in the cocoa industry in Ivory Coast around 1985 have led to a long period of price decline. On the other hand, the increases in the cocoa price were caused by shortages of cocoa beans on the world market. Several events led to these shortages: reduced manpower and constrained supply due the poor road network in Ghana in the late 1960s, cocoa bean shortage in the late 1970s, civil crisis in Ivory Coast in 2002, etc.

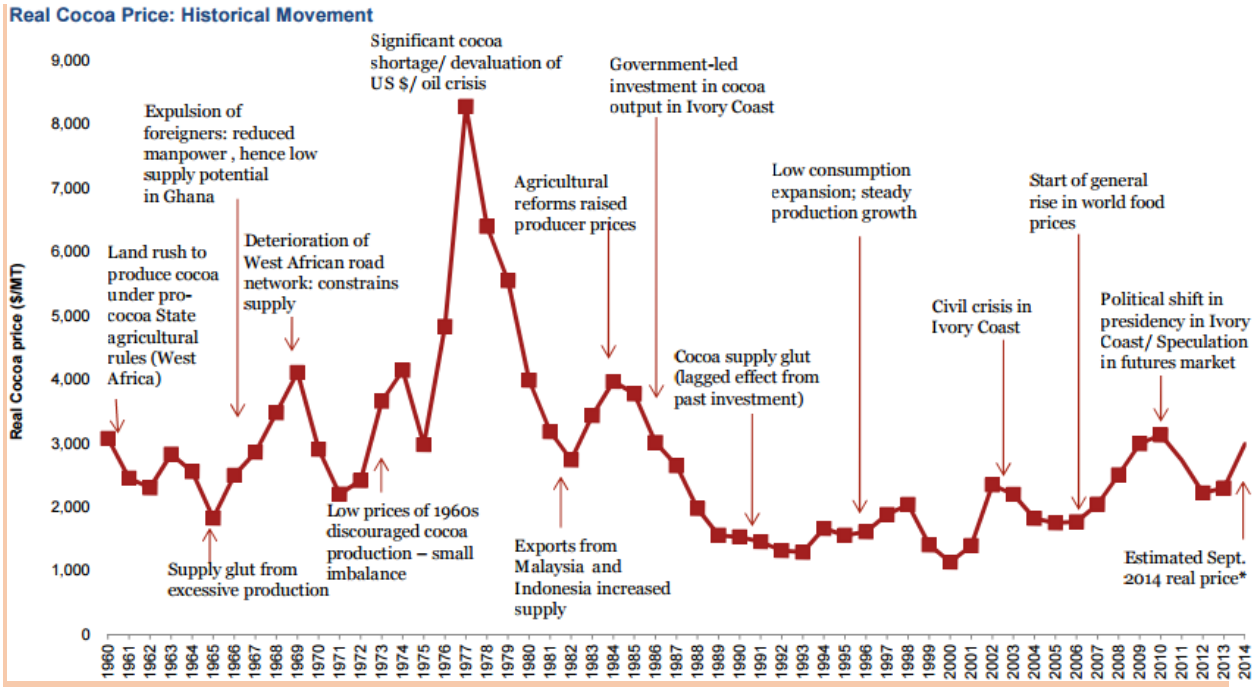

Figure 13: Movement of cocoa prices

Adapted from PwC, 2014

The fluctuations of cocoa prices on the world market enables another risk for the cocoa value chain. In contrast to the neighboring Ivory Coast where the cocoa market is fully liberalized, COCOBOD fixes a domestic producer price, which is different to the global market price of cocoa (see section 2.1.). As the global cocoa market price is volatile due to price fluctuations on international markets, price disparities are likely to occur between the fixed producer price and the global market price of cocoa. Furthermore, producer prices in Ghana and Ivory Coast (figure 14) are interchangeable (World Bank, 2013). Ghanaian farmers get more or less than their counterparts in Ivory Coast depending on the rise or fall of the market. This price disparity is an incentive for illicit cocoa trade between the two countries, which share a 600-km border. Thus, when the producer price in Ghana is higher, compared to the producer price offered to farmers in the Ivory Coast, cocoa is smuggled into Ghana and vice versa, if the producer prices are higher in the Ivory Coast, cocoa is being smuggled to the Ivory Coast.

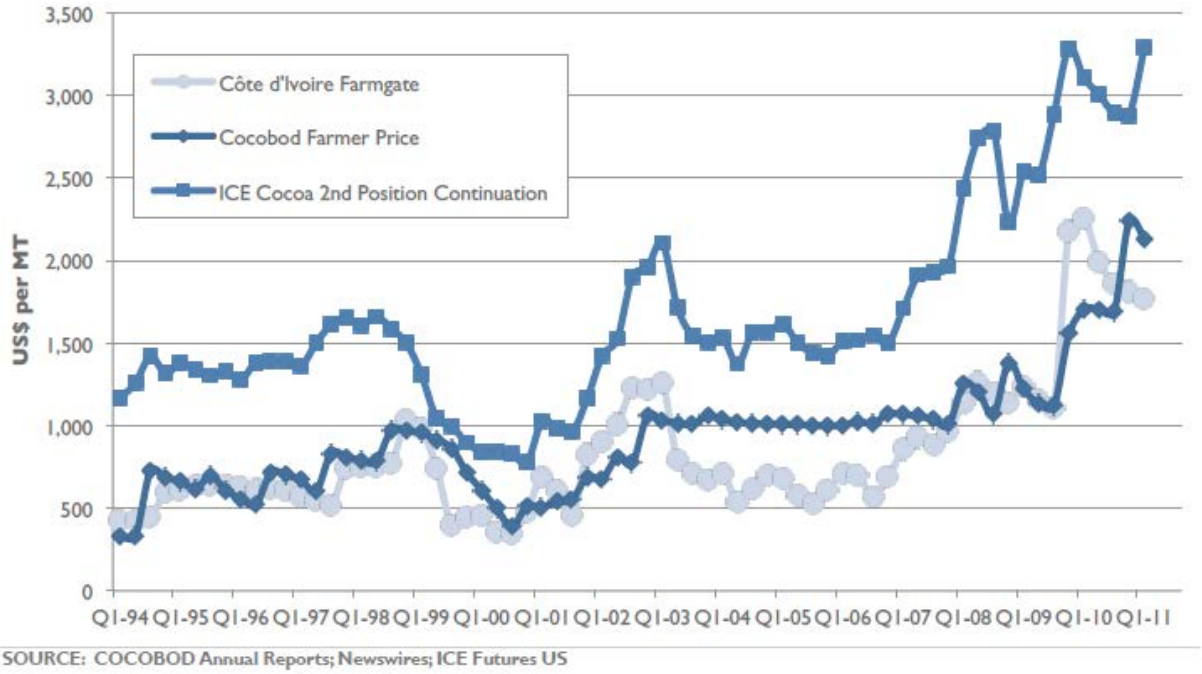

Figure 14: Cocoa producer price in Ivory Coast and Ghana, 1994-2011

Adapted from World Bank, 2013

Inflation

Another financial shock mentioned by every actor of the cocoa value chain is inflation. Figure 15 demonstrates that inflation in Ghana has shown significant variations over past 15 years and currently is at a rather high rate of almost 20%.

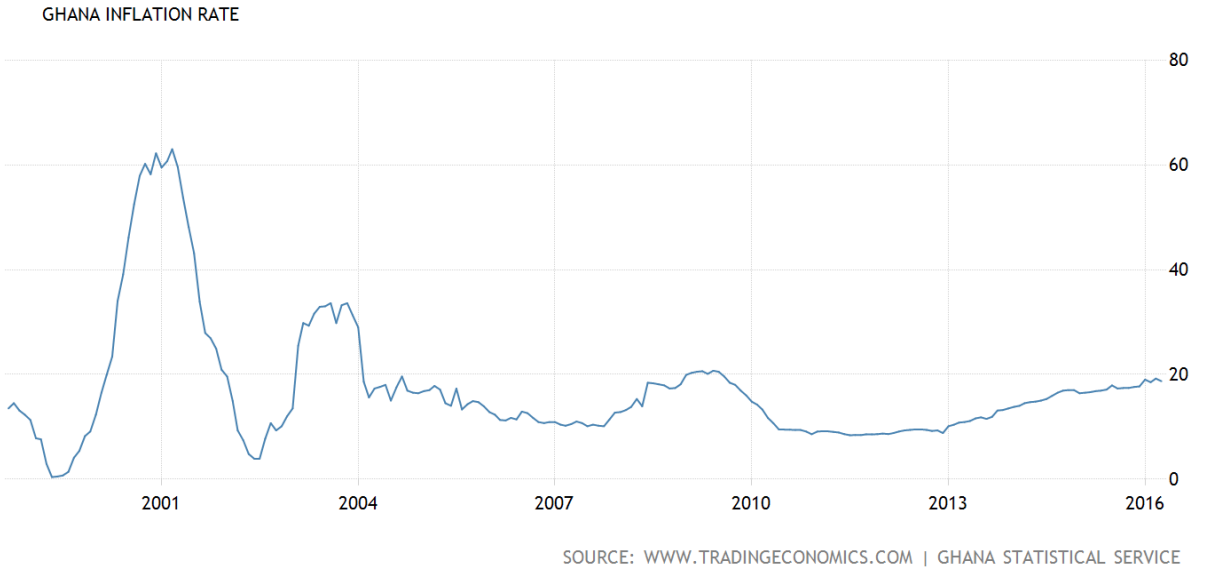

Figure 15: Inflation in Ghana, 2001-2016

Source: www.tradingeconomics.com, 2016

High rates of inflation in Ghana lead to the depreciation of cedi against currencies of international trade partners, thus directly affecting activities that rely on imports: input supply, transportation, processing and, to some extent, food retail (interviews with input suppliers, LBCs, hauliers, processors and food retailers; stakeholders workshop). Input suppliers import agro-inputs, LBCs and transporters import trucks and spare parts, processors use imported machinery and retailers sell foreign-made food products among other goods. Figure 16 shows that cedi has lost three quarters of its value against US dollar since 2008.

Secondary effects of inflation cascade through the value chain in the following manner. Domestic prices on imported agro-inputs increase to the point that many cocoa farmers are not able to afford them anymore. Cocoa production without the necessary inputs is less effective and thus results in lower yields, leading to even more financial losses for the farmers as well as to overall decline in cocoa production in Ghana. The latter means that export earnings, the lifeblood of the cocoa value chain, decrease thus causing even worse financial shortages for all players.

Figure 16: Depreciation of cedi against US dollar (GHS per USD), 2008-2016

Source: www.tradingeconomics.com, 2016

Political shocks

As the cocoa sector in Ghana is characterized by the strong presence of a government-controlled institution (COCOBOD), changes in governmental policies may become shocks for the other actors of the cocoa value chain.

Governmental involvement in cocoa production includes the establishment of fixed producer prices as well as delivery of agro-inputs and extension services to farmers (see sections 2.2.

and 2.3.). This means that changes in governmental policies would affect both input and output conditions for cocoa farmers. LBCs, who purchase cocoa from farmers, would undoubtedly feel the consequences of political changes because COCOBOD is fully regulating their activities by granting licenses and lending money (seed fund) for internal marketing. Processors would be also affected, because they could lose the agreements on the supply of beans with COCOBOD or experience changes in taxation.

During the workshop, the group that consisted of COCOBOD's representatives also mentioned that political instability would have multiple negative effects on the cocoa value chain, such as production declines, compromised quality of cocoa and decreases in producer prices.

Shocks related to illegal activities

Illegal mining, illegal tree felling

Cocoa farmers are affected by illegal tree felling and illegal small scale gold mining (World Bank, 2013; Boateng, et al., 2014; farmers interviews, stakeholder workshop). Illegal miners, locally referred to as *Galamsey*, offer money to farmers to conduct mining on their farms. Some farmers expect to get new land as compensation, which sometime never materializes (Boateng, Nana, Codjoe, & Ofori, 2014). On the global scale, illegal mining leads to the environmental degradation: destruction of eco-systems and contamination of water bodies. For the cocoa industry, repurposing of cocoa lands for mining leads to reductions in cocoa production, which translate into loss of income for farmers and threatens their livelihoods. Illegal tree felling was listed as one of the reasons why farmers do not plant shade and economic trees on their farms (farmers interviews).

Armed robbery

LBCs and transporters reported the threat of armed robberies on the roads, especially in the remote unfrequented areas. Armed robberies may result in the loss of cocoa and vehicles and cause delivery disruptions, threatening the supply of cocoa to the end buyers.

Industrial shocks

Shocks such as fire outbreaks, unstable utility supply (gas, water, electricity etc.) and machinery breakdown are specific to the processing activities. An increase in operational costs results in a price increase of final products destined for the local market thus impacting retailers with the indirect effects of industrial shocks. Other actors of the cocoa value chain do not feel the consequences of the shocks related to processing because this sector is in its infancy and even dramatic variations in its demand would not affect the value chain upstream in a significant way. Moreover, excess cocoa beans can always be exported as the demand for Ghanaian cocoa is always high.

3. Resilience assessment: results

3.1. Input Supply

3.1.1 Private input supply

This study focuses on the assessment of the resilience of small-scale dealers who operate at the local level on an informal or semi-formal basis (World Bank, 2013). Thus, the performance of wholesalers is not taken into account.

Buffering capacity (low)

So far, most inputs for cocoa farming (except of improved planning material locally grown by SPD) have been imported (IFDC, 2002; Krausova and Banful, 2010). That is why devaluation of the national currency (see section 2.4.2.) significantly increases the prices of imported inputs and creates bottlenecks in the private input supply. Moreover, high costs of loans limit the ability of local dealers to tackle inflation risks. The survey conducted by Krausova and Banful (2010) shows that in 2008 and 2009 around 30% of input dealers were not selling fertilizers because they could not obtain them. The same survey reports that 18% of input dealers were not selling fertilizers because they could not afford to stock them. This finding is consistent with a survey of the World Bank (2013) that states that among interviewed suppliers few reported to keep a regular stock of agricultural supplies. As a result, agro-inputs inputs are not always available in local markets (World Bank, 2013, farmers interviews).

Capital (social) (medium)

Most of input dealers operate in urban and peri-urban areas (IFDC, 2002), where the access to healthcare facilities is not a constraint. In addition, Ghana has a national insurance scheme that facilitates the access to healthcare services for more than 70% of the population (Ghana Statistical Service, 2014). However, for people who are working in the informal sector social security and protection is not ensured. For example, in traditional open-air markets, input vendors may sell chemical products without wearing protective clothes and masks to avoid inhaling chemical gases. Osei Boateng and Ampratwum (2011) suggest that many informal sectors workers are unaware about hazardous conditions of their work or cannot afford protection.

Capital (environmental) (low)

As input supply is mostly represented by the retail activities, emissions from input production are not of an issue for Ghana. However, there are several environmental concerns related to agro-input supply. Given that there are almost no recycling activities, plastic bags and containers from input products contribute negatively to the local pollution problems. Even bigger suppliers expressed their absence of interest to this issue during the interviews. In addition, in the local markets, inputs are often sold exposed next to food items, which creates potential food contamination.

Capital (financial) (very low)

Most of the small-scale dealers rely on personal savings and profits from their business operations (Krausova and Banful, 2010). Borrowing is somewhat complicated because of high interest rates (see section 2.4.2.) which discourage input dealers from taking loans. Overall, small input dealers lack capital for expansion and knowledge development.

Profitability (high)

According to experts, retail of agro-inputs is a profitable activity (experts interviews). Overall, the profits are sufficient to maintain the livelihood of people engaged in the agro-input business.

Connectivity (very low)

Private input dealers experience problems of connectivity both with their suppliers and customers. Main wholesalers of farming inputs are located in few location across the country such as Accra, Kumasi, Techiman etc., therefore accessing wholesalers requires input dealers to travel significant distances. (Krausova and Banful, 2010). The condition of roads in Ghana is a challenge for the distribution of inputs (MoFA, 2007). Especially, in rural areas and remote villages, roads become unstable and consist of gravel or dirt roads (Hainmueller et al., 2011). This can cause delays in supply and during the rainy season can even cause full disruptions in input supply.

Another issue that decreases connectivity of the private input supply within the cocoa value chain is the presence of counterfeit agro-inputs in the local markets (Jansen, 2015). Counterfeits compromise trust of farmers to input dealers and discourage them from buying inputs on the local markets (Norde and van Duursen, 2003).

Diversity (high)

The diversity of private input supply in Ghana is high, as inputs are imported by several companies and are distributed from multiple hubs throughout the country. On the local level, each input dealer sells various types of inputs (fertilizers, pesticides, fungicides, farming tools, protective clothes, etc.) of multiple brands to the farmers. Input dealers sell their products for all farmers and usually do not specialize on cocoa.

Information & learning (very low)

Information & learning attribute for the private input dealers is assessed as “very low” due to several reasons: first, most local input dealers have limited knowledge of the market on the national, regional and global levels, because most of them source inputs from wholesales and do not have direct links with input importers (IFDC 2002). Second, the reciprocal mistrust between dealers and farmers contributes to poor and unstable information flow. Due to bad experiences with counterfeit inputs, farmers have become suspicious towards input dealers (Jansen, 2015; Norde and van Duursen, 2003; NPAS, 2012; farmers interviews). Input dealers, in turn, prefer not to sell inputs on credit to farmers because of the risk of non-repayment (experts and farmers interviews). Another factor reducing information & learning attribute is that input dealers often lack marketing and management skills and have limited technical

knowledge about the products they sell: as of 2009 one third of input dealers in cocoa growing regions reported to have never received formal trainings (Krausova and Banful, 2010).

The information flow map (see 2.3.3.) presented in section illustrates that the engagement of the private input supply activity in the information flow is limited.

Self-organization (low)

Private input dealers can independently make decisions regarding what products they want to sell. However, as most of input dealers do not have direct linkages with importers, they are limited to choose only from the products available at the wholesales.

The networking of private input sector with other activities of the cocoa value chain is generally limited to the effort of NGOs to link input dealers with farmers (Adom, 2015; Sarpong, 2015). However, without engagement of NGOs, initiatives towards cooperation between cocoa farmers and input dealers seem to be of an exception, rather than a standard.

Transformability (medium)

The "Transformability" attribute is estimated at medium, because the activity has an innovation potential, which is, however, constrained by several factors. There is a lot of room for innovation for private input dealers: improvement of relationships with farmers, creation of denser networks to improve information exchange and logistics, better learning about farmers' needs, more cooperation with NGOs and LBCs, etc. Although, there already are some examples of cooperation with NGOs, overall, small-scale dealers are not engaged in the information flow and, therefore, their capacity of cooperation and networking is somewhat limited. In addition, the majority of input dealers experience financial constraints to meet their investment needs. (IFDC, 2002; Krausova and Banful, 2010).

Resilience attribute	Score of an attribute	Data basis for an attribute
Buffering capacity		Small
Capital (social)		Small
Capital (environmental)		Small
Capital (financial)		Moderate
Profitability		Small
Connectivity		Moderate
Diversity		Small
Information & learning		Moderate
Self-organization		Small
Transformability		Moderate
Equitability	no data	-

Figure 17: Resilience of cocoa "Private input supply"

3.1.2. COCOBOD input supply

Buffering capacity (medium)

COCOBOD sources fertilizers, pesticides and fungicides for cocoa from several international input importing companies and then distributes them through CHED to cocoa farmers. COCOBOD purchases significant quantities of inputs, which is convenient for the input importing companies, as bulk supply is efficient in terms of costs. They compete to sell their products to COCOBOD and, therefore, COCOBOD does not experience input supply disruptions. COCOBOD distributes inputs from the head office in Accra to the regional offices, and from there to the district offices that store it for farmers. Improved cocoa seedlings are grown in 27 cocoa stations throughout the country and are distributed by CHED and by SPD (interview SPD, 2015).

Having no problems with sourcing agricultural inputs, COCOBOD, however, has difficulties in reaching the cocoa farmers because of their amount and remoteness. As a result, farmers complain about uneven and delayed distribution of agro-inputs. Since not all farmers have equal access to inputs (Laven and Boomsma, 2012), the capacity of COCOBOD to increase supply in case of an emergency is questionnable.

Capital (social) (very high)

Governmental input supply is characterized by high social conditions for its workers. COCOBOD's employees are covered by the national social security and national health insurance schemes (SSNIT and NHIS) and, in addition, benefit from free access to the Cocoa Clinic which is a network of healthcare facilities established by COCOBOD.

Capital (environmental) (medium)

The same as with the private input supply, plastic bags and containers are the only environmental issue identified related to the COCOBOD's input supply. COCOBOD staff collect plastic containers from the farmers to prevent counterfeiting of inputs. However, it seems that the garbage collection services are available only in some cocoa growing areas (farmers interviews).

Connectivity (low)

COCOBOD's investments in improved seedlings, replanting, mass spraying and fertilizers' distribution have contributed to the increase of cocoa yields in the past years (Oduro and Omane-Adjepong, 2012; World Bank, 2013). However, COCOBOD's programs and initiatives experience difficulties because accessing all farmers requires huge amount of energy and efforts as 800,000 cocoa households are scattered across six region of Ghana. Delays in distribution of agro-inputs is a widely reported to be a problem (Naminse et al.,2011; World Bank, 2013, farmers interviews), whereas timely application of agro-inputs is crucial for the farming, because a product, if applied too early or late, loses its potency (World Bank, 2013). Another issue, which decreases the connectivity score, is that the amount of fertilizers and seedlings provided by COCOBOD is proportional to the acreage of the cocoa farm. Currently, COCOBOD conducts GPS measurements of cocoa farms and, as of 2015, the progress has

reached 60%-70% of cocoa farms in Ghana (CHED interviews, 2015). Therefore, as of 2015, fertilizers and seedlings are only provided to 60% to 70% of all cocoa farms.

The information assistance is a very important dimension of agro-input supply. Apart from the distribution of inputs and mass spraying exercises, CHED distributes the recommendations elaborated by CRIG among cocoa farmers. According to Frimpong Ayerakwa (CHED, Kumasi, pers. commun. 2015), each extension officer works with 16-20 cocoa communities consisting of about 150 farmers each, i.e. one extension officer from CHED works with 2000-3000 farmers. Most of farmers adopt new practices in a stepwise manner, which means that the adoption of new technologies is rather a slow process (Aneani et al., 2012). Aneani et al. (2012) report the adoption rates of various agricultural technologies developed by CRIG such as use of insecticides at 10.3%, fungicides at 7.5%, manual or herbicide weed control at 3.7%, planting hybrid cocoa varieties at 44% and application of fertilizer at 33%.

Diversity (low)

There are two main reasons that explain the low score for the diversity of COCOBOD input supply. First reason is that CHED and SDP solely rely on one institution – COCOBOD – and any change in its policies affects the whole supply of agro-inputs. Furthermore, agro-inputs are distributed by CHED and SPD agents and, therefore, only one distribution channel is available.

Information and learning (high)

Being the most powerful institutional player within the cocoa value chain, COCOBOD holds a central position in the information flow. Through its subsidiaries, COCOBOD accumulates and transfers most of knowledge on the cocoa production in Ghana. QCC provides statistics on quantity and quality of cocoa beans, CMC collects data on exports and interacts with international buyers and markets. Research unit of COCOBOD CRIG conducts research on various aspects of cocoa production such as diseases, pest resistance, improvement of yield, suitability of chemical inputs for cocoa, socio-economic issues of cocoa farming etc. The recommendations of CRIG are transferred by CHED to cocoa farmers.

Self-organization (high)

COCOBOD input supply has a high level of self-organization. COCOBOD plans its activity based on the Ghana's Cocoa Sector Development Strategy II (CSDS II), developed by COCOBOD and Ministry of Finance, which sets targets for production and productivity growth and for increase of cocoa processing (COCOBOD, 2013). The activities of all COCOBOD subsidiaries are organized in order to meet the targets announces by the strategy. Moreover, COCOBOD makes efforts to improve the networking within the cocoa value chain. To facilitate and optimize the delivery of agro-inputs and provision of extension services CHED forms farmer groups. CHED also makes efforts to link the farmer groups to other actors such as banks, NGOs and interest representation organizations (Frimpong Ayerakwa, CHED, Kumasi, pers. commun., 2015).

Transformability (high)

COCOBOD is the most powerful stakeholder of the cocoa value chain in Ghana and embraces many activities including research, extension and marketing. Its vast engagement in cocoa

sector offers infinite opportunities for diffusion of innovations and technologies. However, it is extremely difficult for one body to coordinate the whole cocoa sector. Nevertheless, COCOBOD has already shown the examples of constructive approach to changes in the past. The introduction of the liberal internal marketing system, privatization of input distribution, and investments in the yield increase programs (cocoa rehabilitation, mass spraying, subsidized fertilizers distribution), contributed to the significant growth of the cocoa production in the past decades (World Bank, 2013; Kolavalli and Vignery, 2011).

Resilience attribute	Score of an attribute	Data basis for an attribute
Buffering capacity		Moderate
Capital (social)		Moderate
Capital (environmental)		Small
Capital (financial)	n/a	-
Profitability	n/a	-
Connectivity		Moderate
Diversity		Moderate
Information & learning		Small
Self-organization		Small
Transformability		Moderate
Equitability	n/a	-

Figure 18: Resilience of cocoa "COCOBOD input supply"

3.2. Production

Buffering capacity (low)

COCOBOD provides farmers with improved cocoa seedlings and with a fraction of required fertilizers, pesticides and fungicides. Farmers are expected to buy the rest from private dealers which is not always possible due to the following reasons: input shops are often not present in the remote areas (see figure 6) and farmers have to travel long distances to the nearest input supplier. Most of the roads in rural areas are made of dirt or gravel which makes travelling difficult or even impossible during the rainy season (Haimueller et al., 2011). Besides, inputs can be simply unavailable, as many input dealers do not stock fertilizers and chemicals suitable for cocoa (World Bank, 2013; Krausova and Banful, 2010). In addition, many cocoa farmers have limited capital for the purchase of inputs (World Bank, 2013).

Overall, the use of agro-inputs by cocoa farmers seems to be low. In a survey conducted by Hainmueller et al. (2011) in all cocoa growing regions in Ghana, only 21% of cocoa farmers applied fertilizers, respectively 37% for insecticides, at least once within 12 months. The study of Aneani et al. (2012) shows lower use of cocoa insecticides at 10.3% and higher use of fertilizers at 33%. IFDC (2012) reports, that as of 2010/11 season, only 20% of are used for cocoa cultivation is being fertilized.

Another factor that decreases the spare capacity of cocoa production to boost, is the cocoa tree itself, which needs at least two years to start bearing fruits. The first yields are low and the tree reaches its full capacity by the 8th year. The improved cocoa hybrids that mature earlier and bear more fruits currently constitute about 31% of tree stock (Oppong, 2015).

In general, cocoa farmers do not keep neither inputs nor output stocks (farmers interviews). Inputs are rarely stored on farms because they are expensive and many farmers cannot afford to buy it ahead. As for cocoa, there is no need for the farmers to keep stocks, because the producer price is fixed. That is why beans, when dry enough, are immediately sold to purchasing clerks.

In rural Ghana, there are organized volunteer groups trained by the National Fire Service (GNFS) and the National Disaster Management Organization (NADMO). Disaster management organizations often have troubles to reach affected areas in rural localities and the volunteer groups armed with simplest tools are the first to react to any disaster happening in the proximity (GNFS and NADMO interviews, 2015). The disaster management organizations help recover houses in the affected areas and provide people with basic domestic items (NADMO interview, 2015).

The first agricultural insurance in Ghana was introduced quite recently, in 2011 (MoFA, 2016). However, cocoa production has not yet benefitted from it, due to the low awareness among cocoa farmers and their conservative attitude towards additional expenses (Afanyedey, GAIP, Accra, pers. communic., 2015). Interestingly, all 13 interviewed farmers expressed a strong interest in having an insurance for their farms. This is consistent with the study of (Nimoh et al., 2011), which also reveals the interest of farmers in insuring their activities. Taking into

account the obvious need of farmers for the agricultural insurance and the fact that such an opportunity has only recently been introduced, the improvement the situation might be expected.

Capital (social) (low)

Cocoa farming includes activities that imply risks for health and safety. Farmers use sharp tools to cut off the cocoa pods and the cases of serious self-cutting happen rather often (Muilerman, 2013). In addition, the agrochemicals used on the farms cause health issues, when used without a protective equipment (Okoffo et al., 2016). COCOBOD and NGOs are making efforts to raise the awareness on this issue among farmers by providing trainings on safe use of agrochemicals (expert interviews). However, there remain cases of spraying without sufficient protective equipment and presence of unprotected workers or household members including pregnant women and children on the farm during spraying (Muilerman, 2013, Okoffo et al., 2016).

Another issue that negatively affects the capital (social) attribute is that rural communities have poor access to healthcare facilities. According to Heyen-Perschon (2005), a half of the rural population in Ghana does not consult medical personnel. People living in the remote areas first try home treatment or go to traditional healer in case of a disease or an injury (Muilerman, 2013). All 13 of the interviewed farmers reported not to have access to social security. As for the National Health Insurance Scheme, it covers only a half of members of the cocoa households (Muilerman, 2013).

Capital (environmental) (low)

Soil degradation is a serious issue for cocoa production in Ghana (UNDP, 2011). Growth in the cocoa production has traditionally been achieved by increasing the cultivated area by clearing the forest and burning the debris (Aneani and Ofori-Frimpong, 2013). Burning the forests for cocoa farms causes depletion of soil nutrient and end up in soil fertility decrease. Hybrid cocoa varieties cause soil depletion faster due to their shorter production cycle and require additional fertilization to compensate for the loss of nutrients (Gockowski et al., 2011). Moreover, Ghanaian farmers adopt low-shade way of growing cocoa and, consequently, full sun plantations dominate over complex agroforest systems reducing biodiversity of local ecosystems (Mann et al., 2010).

Capital (financial) (very low)

During the interviews, four out of thirteen farmers reported to take loans: two from farmers groups, one from neighbors and one from banks. In addition, ten out of thirteen farmers reported to have own savings. This is consistent with the results of Onumah et al. (2014), conducted in Eastern region, which found that farmers in the studied area mainly rely on personal savings or on family or friends. The survey of Hainmueller et al. (2011) shows farmers' saving to range from 10 to 50 GHC depending on the region.

Seasonal payouts from cocoa coupled with the lack of planning skills and limited access to loans do not allow farmers to generate significant savings and funds for investments in inputs and

land expansion. A discussed above, as of now, cocoa farmers do not use insurance to cover potential losses caused by disasters.

Profitability (low)

According to the survey conducted by Hainmueller et al. (2011), the mean annual average household income is 716 Ghanaian Cedi (GHC). The study of Yahaya, et al. (2015) estimates the net profit of farmers in Eastern region at 621 GHC per hectare. However, not all surveys support that cocoa farming is a profitable activity. Asamoah et al. (2013) shows that total household expenditures of sampled farmers exceed their total income and suggests that farmers possibly survive because of debts or savings. Overall, the profitability of cocoa farming activities is questionable, especially taking into account that many farmers cannot afford inputs (World Bank, 2013). The whole story becomes a somewhat vicious circle: limited capital does not allow farmers to invest in agro-inputs, which results in low output of cocoa, which in turn translates into low revenues for farmers insufficient to invest in farming.

Connectivity (low)

On the one hand, Ghanaian cocoa is always in high demand due to its flavor and quality. Encouraged by the demand, LBCs compete for the cocoa purchase and create dense network of district managers and purchasing clerks. This competition is especially beneficial for the farmers from the remote areas because their produce can always be sold to at least one buyer (Laven and Boomsma, 2012; Asante-Poku & Angelucci, 2013).

On the other hand, the access of farmers to input suppliers is limited. Travelling to the nearest shop may be problematic as input supply shops are sparsely scattered over the country (figure 6) and many farmers do not have vehicles. Travelling is especially complicated in the rainy seasons as rains cause washouts of rural roads especially ones made of gravel or dirt (Hainmueller et al., 2011). Overall, the use of inputs in cocoa production in Ghana is rather low (IFDC, 2012; Nunoo et al., 2014), and the accessibility of inputs is one of the factors restraining it (farmers' interviews).

In addition, communication of the production step of the value chain is rather low, as many farmers do not receive required informational support (Baah and Anchirinah, 2011). This can be attributed to the high illiteracy rate among farmers, their remoteness and poor transportation network (Norde and van Duursen, 2003). Limited access to information in the cocoa production activity explains the low awareness of possible markets of certified cocoa and slows promotion of cocoa certification programs (Laven and Boomsma, 2012).

Diversity (low)

Cocoa is grown in six regions in Ghana (figure 10) by small-scale farmers on small plots of land (Muilerman, 2013). Farmers also grow food crops and vegetables for petty trade or self-consumption to make their livelihood more sustainable. Some farmers grow economic trees for timber or spend some time in paid work outside the farm to diversify their income sources (farmers' interviews). However, according to Hainmueller et al. (2011), income from work outside the farm is a small fraction of cocoa farmers' total income and 38% of farmers have no

income from other crops. Anim-Kwapong & Frimpong, (2005) estimate that cocoa accounts for about 70-100 % of the total household incomes, which is consistent with other results in this field (Asamoah et al., 2013; Hainmueller et al., 2011; Peprah, 2015).

However, the diversity of cocoa production is reduced because of the straightforward supply chain organization, where the roles of actors and flows are somewhat predefined. For example, farmers can only sell their cocoa to COCOBOD through LBCs. Furthermore, COCOBOD is the only source of improved cocoa seedlings and supplies a fraction of required fertilizers, pesticides and fungicides. In addition to chemicals provided by COCOBOD, farmers buy products from private input suppliers. However, it happens that private dealers are inaccessible due to poor roads (especially in the rainy season), or appropriate chemicals in local shops are unavailable (World Bank 2013, farmers interviews).

Information and learning (low)

The extension system for cocoa production in Ghana is represented by COCOBOD and NGOs. As mentioned earlier, COCOBOD extension services are based on the research of CRIG and transferred to cocoa farmers by CHED. However, the study of Aneani et al. (2012) shows that the adoption rates of the agricultural technologies of CRIG are rather low: control of capsids with insecticides - 10.3%, control of black pod disease with fungicides - 7.5%, weed control manually or with herbicides - 3.7%, planting hybrid cocoa varieties - 44.0% and fertilizer application - 33.0%. The low adoption rates are likely to be explained by high costs of agro-inputs, lack of funds, limited access to loans and high illiteracy rates among farmers (Asamoah et al., 2013; Laven, 2010; Mohammed et al., 2012; Norde and van Duursen, 2003; Okoffo et al., 2016).

The private extension services market is represented by NGOs. They provide extension for farmers mostly within certification programs and link farmers with input dealers. During the interviews, experts could not estimate the extent to which farmers were covered with NGO extension. The fact that in 2012, the certified cocoa was estimated at 16% (Potts et al., 2014) might provide a rough idea about the role of NGOs in cocoa extension.

All visited farmers reported to attend trainings organized by NGOs or COCOBOD with various frequencies from once in two weeks to two times per year. Although farmers unanimously agreed on the usefulness of training, all of them reported that they still feel lack of knowledge on farming practices and expressed the strong wish for getting more extension services. Further, farmers often lack knowledge on the quality requirements, that are established at the levels far from them in the cocoa chain, because quality inspections are carried out by COCOBOD at the points where cocoa beans are already collected at LBCs warehouses (Quarmine, 2013).

Another problem that decreases the information & learning attribute of the cocoa production is mistrust. Many LBCs, when compete for cocoa, attract cocoa farmers with certain benefits such as soap, cutlasses or protective equipment (LBCs' interviews). However, the competition between LBCs does not stop some of purchasing clerks from cheating the farmers. Farmers are payed based on the weight of cocoa and there are reported cases of adjustment of scales by

purchasing clerks (Baah et al., 2012; Norde and van Duursen, 2003). In addition, during the first months after the new producer price is announced, some farmers may be not aware of the new price and accept the lower old price offered by buyers (Hainmueller et al. 2011).

The lack of trust also compromises the access of farmers to loans (Laven, 2010). Banks do not trust farmers because of low repayment rate and misuse of loans (Norde and van Duursen, 2003). Even the credit union of the biggest farmers association Kuapa Kokoo ceased providing loans for its members because farmers did not pay back (Kuapa Kokoo interview, 2015). Moreover, mistrust also affects the access of farmers to agro-inputs, because "input on credit" initiatives of COCOBOD or private input dealers faces high risks non-recoveries (Kolavalli et al., 2012, input dealers interviews).

Self-organization (low)

Self-organization ability take place on two levels: ability of an actor to manage its activities and resources, and the ability for networking and organization into groups. Farmers' ability to manage their activities is hampered by the general lack of education among the cocoa farmers. They usually neither keep records nor plan their activities and investments (Adom, 2015, Amon-Arwah and Owusu-Ansah, 2015). Cooperation among farmers is mostly informal (*nooboa*) and help facilitate farming activities through sharing of labor and knowledge exchange. Nevertheless, the overall majority of farmers is not formally organized (Laven and Boomsma, 2012; World Bank, 2013), although participation of farmers in formal groups may bring certain benefits like access to certification schemes, collective trainings, improved farmers' representation within the value chain and enhanced bargaining power (Norde and van Duursen, 2003). However, additional costs related to participation in formal groups (consultant fees, lead farmer rewards and audit and compliance costs in case of participation in certification scheme (KPMG, 2012) demotivate farmers and hamper the development of such groups (Laven, 2010).

Transformability (medium)

COCOBOD and NGOs make efforts to improve cocoa yields by providing extension services to the farmers on improved production techniques, integrated soil management practices and sustainable farming. Although there are some farmers implementing best practices in their activities, poor communication network and scarce financial resources hinder pro-activeness and innovations for the majority of cocoa farmers.

Equitability (very low)

Farmers' access to inputs is challenged by their remoteness, poor rural roads, lack of vehicles and limited access to loans. As for the COCOBOD supply, a farmer can only receive free inputs when the dimensions of his farm are known. According to CHED, as of 2015, about 60-70% of farms in Ghana are measured with GPS. The process of measuring the farms is in progress, so the situation is expected to improve. According to MoFA (2007) less than one third (31%) of households headed by women owning land because women have difficulties in obtaining land, and their pieces of land may be smaller and less fertile. In addition, women are less involved

in decision-making activities and are less informed about market developments and effective ways of farm management and have even less opportunity to invest in their farms than men (Laven, 2010). Moreover, women may not have legal ownership of tangible assets and thus cannot provide collateral for credit (MoFA, 2007).

Resilience attribute	Score of an attribute	Data basis for an attribute
Buffering capacity		Moderate
Capital (social)		Small
Capital (environmental)		Small
Capital (financial)		Moderate
Profitability		Moderate
Connectivity		Moderate
Diversity		Moderate
Information & learning		Small
Self-organization		Moderate
Transformability		Moderate
Equitability		Moderate

Figure 19: Resilience of cocoa "Production"

3.3. Internal marketing

Internal marketing activity in the cocoa value chain in Ghana is conducted by LBCs and consists of purchasing cocoa from farmers and delivering in to CMC.

Buffering capacity (very high)

LBCs try to maximize their purchases of cocoa because they receive a fixed margin of FOB price and can only increase their revenues by buying more cocoa. LBCs are characterized by a huge flexibility of resources as they hire temporary workers in the operating areas when needed and usually outsource the transportation activity to hauliers (LBCs interviews). Moreover, LBCs operate in different districts and regions and have multiple storage facilities scattered across their operational areas. During the interviews (2015), all six LBCs reported to have insurance to cover potential losses.

Capital (social) (medium)

All six visited LBCs reported to provide social security for their permanent staff. However, most of LBCs' employees are temporary workers (district managers and purchasing clerks), who operate in rural areas and their access to social security health insurance and health facilities is difficult to estimate. With this, internal marketing activity is given medium score for the capital (social) attribute.

Capital (environmental) (high)

Apart from emissions of transporting vehicles, no negative environmental impacts of LBCs have been identified. Moreover, LBCs usually outsource transportation function to hauliers, therefore these environmental impacts are to some extent transferred to another activity.

Capital (financial) (very high)

Initially, LBCs were unable to provide collateral for loans and raise funds to purchase cocoa from farmers (Bank of Ghana, 2003). To help them, COCOBOD introduced the seed fund system. Seed fund is a loan for cocoa purchases distributed at the beginning of the cocoa season. Seed fund has a lower interest rate than the current market rate. In addition, many LBCs are able to raise funds themselves, at competitive interest rates at local banks (Kolavalli et al., 2012). LBCs use insurance as a financial protection against potential losses.

Profitability (medium)

Visited LBCs reported that the internal marketing of cocoa is a profitable activity. Nevertheless, the profit from cocoa is seasonal and the extent to which LBCs are engaged in non-cocoa activities seems to be negligible.

Connectivity (medium)

LBCs play a significant role in the traceability of the material flow, which is especially important for ensuring the quality of cocoa. When there is enough cocoa in a warehouse, LBCs invite QCC to check the quality of the beans, to pack it into special bags and to seal the bags (LBCs interviews). Moreover, internal marketing is based on the dense network of purchasing agents, providing an access to the internal market for cocoa farmers.

Two main issues hamper the connectivity of the internal marketing activity. First, the cocoa villages are quite remote. Some roads in the rural areas are unusable during the rainy seasons, especially those made of dirt or gravel (Haimueller et al., 2011), which slows down primary evacuation of cocoa from the villages. Further, LBCs largely depend on temporary external staff, operating remotely in rural areas. This creates challenges for the coordination of the activity. Coordination is very important as a vast number of purchasing clerks is entrusted with money to purchase cocoa from farmers. All six interviewed LBCs reported embezzlement of resources as a big problem. In addition, in the absence of control, purchasing clerks may take advantage of farmers by adjusting scales (Baah et al., 2012; Norde and van Duursen, 2003). This compromises the public image of an LBC and affects its purchases in the area, as farmers prefer to sell cocoa to the ones they trust (Laven and Boomsma, 2012).

Diversity (low)

The input sourcing system of the internal marketing activity is well diversified. Each LBC purchases cocoa in several districts and regions and has a distributed storage system. In addition, LBCs may have partnerships with foreign buyers within certification programs and deliver cocoa to them through CMC. In such a cooperation, the main role of LBCs is to make sure that their partners are supplied with the certified cocoa from the agreed area. To ensure traceability, LBCs mark bags with special signs and place them in a special place within the warehouses of CMC (LBCs interviews).

However, the internal marketing activity is characterized by the over-dependency on COCOBOD, as it provides LBCs with the capital to purchase cocoa. In addition, LBCs are heavily relying on cocoa-related activities most probably because, first, internal marketing activity already requires a lot of coordination and human resources and, second, there is a lack of incentives for them to switch to other activities as they are provided with financial support from COCOBOD to conduct for cocoa purchases.

Information and learning (high)

LBCs require that purchasing clerks to keep records of all their purchases (LBCs interviews). Records help to plan the activity, to distribute money among clerks and to manage the number of clerks in cocoa districts. Moreover, LBCs use the weather forecasts to plan the primary evacuation from the villages.

Self-organization (medium)

There are examples of networking of LBCs with other actors of the cocoa value chain. During the interviews, five out of six LBCs reported to assist NGOs and farmers' groups in the organization of certification trainings and one reported that such activities are planned for the nearest future. However, the extent of such certification-related activities is not yet large – according to Potts et al. (2014), only around 16% of cocoa in 2012 was certified.

The internal marketing activity is based on the vast network of external staff operating in the remote areas and, hence, comprises many coordination and management activities. To enhance the coordination, LBCs, especially large ones, invest in upgrading their book-keeping

process (World Bank, 2013; LBCs interviews). Despite of these efforts, misappropriation of funds remains the biggest risk for the internal marketing activity (LBCs interviews).

Transformability (medium)

Strengthening relationships with farmers would solve the problem of mistrust and improve the traceability of the activity. Increased trust would also improve farmers' connectivity and diversify their information sources. Moreover, LBCs have the best access to farmers throughout the country and could serve as the gateway for interactions between farmers and other actors of the value chain. Improved connectivity would help to identify new solutions for extension and input supply, and would trigger innovation in the value chain. However, complex structure and the lack of incentives to diversify activities limit initiative of LBCs for innovations.

Resilience attribute	Score of an attribute	Data basis for an attribute
Buffering capacity		Moderate
Capital (social)		Small
Capital (environmental)		Moderate
Capital (financial)		Moderate
Profitability		Small
Connectivity		Moderate
Diversity		Moderate
Information & learning		Moderate
Self-organization		Moderate
Transformability		Moderate
Equitability	no data	-

Figure 20: Resilience of cocoa "Internal marketing"

3.4. Transportation

Buffering capacity (medium)

Loss or damage of vehicle due to poor roads or inadequate driving is a serious risk for any haulier because vehicles and spare parts are very expensive (hauliers interviews). Moreover, as virtually all spare parts are imported, their price increases over time due to the inflation. However, the buffering capacity of the transportation activity is sufficient, because, first, individual hauliers protect themselves with insurances for vehicles and transported goods and, second, the whole transportation activity relies on many businesses scattered throughout the country. The latter also means that the activity has large spare capacities to transport cocoa in case of increased production.

Capital (social) (medium)

Most of hauliers are located in the large urban areas (Pedersen, 2001) where the access to healthcare facilities is good. Moreover, the National Health Insurance Programme facilitates the access to health services for more than 70% of the Ghana population (Ghana Statistical Service, 2014). As for the social security coverage, the majority of hauliers belong to the informal sector, which is in general not covered by the social security schemes (Osei-Boateng & Ampratwum, 2011).

Capital (environmental) (low)

According to Ntiamoah & Afrane, 2008, transportation has relatively minor environmental impact compared to other activities of the cocoa value chain. However, Akpakpavi, (2015) and Nyamekye, 2012 reveal a lack of standards for disposal of used oil, storage and recycling of parts after use, that typically contribute to contamination of water and soils especially in industrial areas. With this, capital (environmental) attribute of transportation activity of the cocoa value chain is given the low score.

Capital (financial) (medium)

Vehicles and spare parts are imported and their price increases over time due to the devaluation of cedi (see section 2.4.2.). Significant financial capital is a critical precondition for launching a transportation business, because purchase and maintenance of vehicles requires significant financial resources. However, high interest rates on loans hampers the ability of hauliers to sustain their business and expand their activities (hauliers interviews). That is why hauliers protect themselves with insurances for vehicles and transported goods (hauliers interviews, insurance companies interviews).

Profitability (high)

As reported by visited hauliers, transportation of goods is a profitable activity in Ghana. However, seasonality of cocoa affects hauliers (Pedersen, 2001). To maintain profitability throughout the year, hauliers diversify their activities and engage in transportation of different commodities such as rice or water (hauliers interviews).

Connectivity (very low)

The transportation activity heavily relies on road network. As hauliers conduct secondary evacuation of cocoa (i.e. from up-country storages to the ports), they use major national and regional routes, which mostly consist of paved roads and are of a good, or at least acceptable quality. However, some roads are more rutted out and prone to car accidents than others. This hampers the connectivity by slowing down the logistics of beans and increasing the costs of transportation, as hauliers constantly need to maintain and repair their trucks, which is rather expensive. Pedersen (2001) shows that rural transporting that accounts only for 4% of total transport distance makes almost a half of total transport costs from Ghana to Europe. Moreover, hauliers face difficulties in management and coordination of their activity due to the lack of communication and recording equipment in vehicles (Pedersen, 2001).

The role of hauliers in the cocoa value chain seems to be limited to the transportation function (actors and experts interviews). Moreover, a certain level of mistrust was reported to take place between hauliers and LBCs, because the risks of not delivering cocoa to CMC are high due to poor state of roads in some areas, excessive speeding and robberies (LBCs and transporters interviews).

Diversity (high)

Being affected by the high seasonality of the cocoa market, hauliers diversify their activities as much as possible (hauliers interviews). In order to keep functioning during the low seasons, they transport rice, water and other commodities (hauliers interviews). In addition, to decrease costs of maintenance and repairing, many hauliers run their own repair garages.

Information and learning (low)

The transportation activity of the cocoa value chain shows a low score for the information & learning attribute. Transportation activity needs to be coordinated to reduce logistical costs, whereas coordination is a challenge for the hauliers, because many vehicles lack communication and recording equipment (Pedersen, 2001). Disruptions in communication between owners and drivers lead to the lack of coordination and increases the risks of failures in the activity.

Self-organization (medium)

Being part of the informal sector, transportation businesses are run by enterprising people who do not fear to invest in risky activities. Visited hauliers reported to plan the routes of their trucks and to take into consideration weather forecasts. However, coordination and management of the activity is hampered by the lack of modern communication equipment in vehicles. According to Pedersen (2001), trucks in general are not equipped with tachometer and speedometer and very few transporters know the distance run by the vehicle.

Transformability (medium)

Although there is room for logistical improvement, flexibility of the haulage sector is limited. According to Pedersen (2001), small businesses focus on the cash flows and are not interested in trainings in truck management.

Equitability (low)

Visited hauliers reported to experience difficulties in getting jobs from LBCs. The mechanism of allocation of contracts to transport the cocoa is unclear.

Resilience attribute	Score of an attribute	Data basis for an attribute
Buffering capacity		Moderate
Capital (social)		Small
Capital (environmental)		Small
Capital (financial)		Moderate
Profitability		Small
Connectivity		Moderate
Diversity		Moderate
Information & learning		Small
Self-organization		Small
Transformability		Small
Equitability		Small

Figure 21: Resilience of cocoa “Transportation”

3.5. Processing

Buffering capacity (medium)

Processors are concentrated in industrial areas – Tema, Takoradi, Kumasi (Sutton and Kpentey, 2012). As fire outbreaks represent a major risk in industrial areas because many machines work on gas and fuels, disaster management services are always available. In addition, processors protect themselves with insurances in case of a disaster or a machine break (processors interviews).

However, the processors experience difficulties in procurement of sufficient quantities of cocoa beans and are bound to operate below their capacities (World Bank, 2013). Processors mainly rely on limited amounts of discounted beans produced during the light season as main-crop cocoa of premium quality is too expensive for exclusive use in processing (Ecobank, 2014). Importing cocoa from abroad is even more inefficient because of the import duty of 20%, applied to protect the domestic market. Another reason of the underutilization of processing capacities is supply shortage of utilities such as gas and water. Stocks of inputs and utilities (gas, cocoa, water) help processors to mitigate the input supply uncertainty but do not allow increasing the cocoa processing.

Capital (social) (high)

Being a part of the formal sector of Ghana's economy, processors provide compulsory social welfare for their employees and pay for their access to Cocoa Clinic (processors interviews). The manager of one processing company reported even to have doctors at the factory. Overall, processing companies work with international partners and try to comply with the international standards on labor safety and hygiene (processors interviews).

Capital (environmental) (low)

Cocoa processing activities produce no or little waste (processors interviews). The products of substantial quality and by-products (shells) are sold to the cocoa waste companies and used for fertilizers, animal feed, creams or shampoos. However, use of fossil fuels in boilers and roasters imply several negative environmental impacts. Cocoa processing contributes to ozone creation, atmospheric acidification, global warming and abiotic depletion (Ntiamoah & Afrane, 2008).

Capital (financial) (medium)

Cocoa processing requires significant funds for establishment and maintenance of the activity. Machinery breakdowns and equipment downtimes lead to huge financial losses for the processors and in order to mitigate these risks, processors insure their activities. However, the underutilization of processing capacities due to the bean and utility shortages limits the possibility of processors to generate significant funds (processors interviews). Although Ghanaian banks provide loans and credits for processing companies, high interest rates (around 40%) discourage processors from taking loans. International companies prefer to take loans abroad to avoid high interests.

Profitability (low)

Processors are exposed to input supply shortages, which limit outputs and reduces income. As processors face high operating costs, the operations may be suspended once income is not enough to cannot cover fixed costs (Ecobank, 2014). This corresponds to a suggestion of Kolavalli and Vignery (2011) that the net profits of cocoa processing may not be significant, because of the low utilization of processing capacities.

Connectivity (very high)

Processing companies are located in easily accessible industrial areas, where cocoa is stored in proximity and the roads are good. Thanks to QCC, processors do not face problems with the quality of cocoa (stakeholders workshop). Visited processors reported to implement strict control over operations, hygiene and quality of products, in order to fulfill the compliance requirements for the European markets. The Ghanaian industry for semi-processed products (cocoa liquor, cocoa butter and powder) is competitive on the world market, while exporting finished products is very challenging (Sutton and Kpentey, 2012).

Diversity (low)

Processing companies process cocoa into different cocoa-based products like liquor, butter and powder. Not surprisingly, cocoa is the main input for all of these products. Nine out of eleven domestic processors rely only on the Ghanaian cocoa (Abubakar, RM&E (COCOBOD), pers. communic., 2016). Importing cocoa from abroad is a more expensive option, which is often not economically efficient because of the import duty of 20% (Asante-Poku and Angelucci, 2013).

Information and learning (very high)

In case of a fire outbreak at a factory, staff is immediately informed by the signals from fire detectors. Moreover, staff is provided training on the safety and is instructed on the emergency procedures (processors interviews, 2015). Visited processors reported that finding a worker with suitable education level is not a problem.

Self-organization (high)

Overall, cocoa processors are well organized and managed. They are aware of their main risks and try to mitigate them (fire detectors, compliance trainings, stocks). Working closely with COCOBOD, processors lack linkage with other actors (Essegbey and Ofori-Gyamfi, 2012). There are efforts to work closer with farmers through NGOs or LBCs. There is no clear picture on the extent to which farmers are engaged in projects run by processors.

Transformability (medium)

Cocoa processing industry in Ghana definitely has room for innovation. For example, Product Innovation department of CRIG develops new products based on cocoa waste. However, so far, none of these products have been produced by cocoa processors. According to Essegbey and Ofori-Gyamfi (2012), weak linkages of processors with scientific institutions limit innovations in the cocoa processing sector.

Equitability (low)

To encourage the domestic processing, COCOBOD sells smaller beans for processors with a discount of 20%. As discussed above, there is a limited amount of discounted cocoa beans sold to processors. This fact already implies certain degree of non-equitability in access to cocoa beans among processors. Those who do not have financial constraints and are able to pay immediately are in a more favorable position.

Resilience attribute	Score of an attribute	Data basis for an attribute
Buffering capacity		Moderate
Capital (social)		Moderate
Capital (environmental)		Small
Capital (financial)		Small
Profitability		Small
Connectivity		Moderate
Diversity		Moderate
Information & learning		Moderate
Self-organization		Moderate
Transformability		Moderate
Equitability		Small

Figure 22: Resilience of cocoa "Processing"

3.6. Food retail

Buffering capacity (low)

Local cocoa products (especially the cheaper ones) are very popular among consumers. However, supply of cocoa products is limited by what local processors offer to the domestic market. During the interviews, it was identified that smaller retailers do not experience difficulties sourcing cocoa products, while the two bigger retailers reported that sufficient amounts of cocoa products are not always available. None of the visited retailers had stocks of cocoa products. This may be explained by the fact that the majority of retailers, especially in traditional food retail, lack cool storage facilities (Meng et al., 2014; Ortiz et al., 2010; retailers interviews), which is posing risk to chocolate and cocoa spreads. Operating cold storage facilities is associated with additional risks because of frequent electricity blackouts.

Capital (social) (medium)

Overall, food retail belongs to informal sector of Ghana's economy. Informal sector workers in general are not engaged in social security schemes (Osei-Boateng and Ampratwum, 2011). Retailing activity concentrates in urban and peri-urban areas where accessing healthcare facilities is generally not a problem and as the National Health Insurance Scheme covers more than 70% of the population it may be assumed that a significant number of food retailers have health insurance.

Capital (environmental) (low)

In Ghana, retailers sell food and water in plastic bags. These plastic bags can be seen around on the streets (personal observation). Waste is a common problem in both urban and rural areas as Ghana has waste management difficulties (Thompson, 2008).

Capital (financial) (very low)

High costs of loans is a problem widely reported by the actors of the cocoa value chain. Most of visited retailers reported not taking loans because of fear of not repaying them. Retailers listed lack of financial capital for expansion among their major problems. In addition, only seven out of 22 retailers reported to have an insurance.

Profitability (high)

According to experts, food retail activity is generally profitable. The revenue is believed to be sufficient to run current operations and maintain the livelihood of the people engaged in the business.

Connectivity (low)

The domestic consumption of cocoa products is in the process of its development. However, as of now, the share of cocoa products in the food retail is negligible. That is why, the presence and power of retailers in the cocoa value chain is limited and, overall, retailers do not have direct links with other actors of the cocoa value chain. There is also a lack of communication in retail activities as the price information is not formally distributed (Ortiz et al., 2005).

Diversity (very high)

Food retailers offer a wide range of consumables. Apart from local and imported food items, retailers sell chemical household products. Cocoa products account for negligible part of their activities, although most of visited retailers mentioned high demand on the products, especially cocoa drinks and toffees.

Information and learning (low)

According to Ortiz (2005), price information is not formally disseminated. The information channels are most likely to be informal, "through gossiping" (Lyon, 2003, p. 15), and are built on trust. Moreover, as of now, food retail lacking the linkages with the cocoa value chain, as most of processors are rather oriented towards exports of the semi-finished products and not towards the domestic market.

Self-organization (medium)

Although there are trade association of traders involved in agricultural marketing in open-air markets (Shepherd, 2005), their role in the organization of activities of smaller retailers and implication on retailing of cocoa products is not clear.

Transformability (medium)

Food retail has a great potential in creating opportunities for the development of secondary processing through enhancement of the national consumption of cocoa-based products. Currently, although COCOBOD makes an effort to promote domestic cocoa consumption, the majority of food retailers seem not to play any active role in this process. Moreover, as they experience financial and information constraints, their incentives for innovations are limited.

Equitability (low)

According to Ortiz et al. (2010), inclusion in trading networks is rather discriminatory and depends on gender, ethnicity, wealth and age. For example, women may not have legal ownership of tangible assets and cannot provide collateral for credit, which affects efficiency of their business (MOFA, 2007).

Resilience attribute	Score of an attribute	Data basis for an attribute
Buffering capacity		Moderate
Capital (social)		Moderate
Capital (environmental)		Moderate
Capital (financial)		Small
Profitability		Small
Connectivity		Small
Diversity		Moderate
Information & learning		Moderate
Self-organization		Moderate
Transformability		Moderate
Equitability		Moderate

Figure 23: Resilience of cocoa "Food retail"

3.7. Resilience of the cocoa value chain

The resilience of the cocoa value chain shows heterogeneous levels for different activities and attributes (figure 24). While there are actors showing relatively high resilience performance, others are less resilient. Governmental input supply, internal marketing and processing, overall, show *higher resilience performance*.

One of the most important reasons for the high resilience score of the governmental input supply is its proximity to CRIG and its research activities. CRIG conducts research on the resistance of cocoa to pests and diseases and breeds improved varieties of cocoa that have higher yields. It also develops recommendations on use of agro-chemicals to increase the productivity of cocoa. These recommendations are then distributed by CHED among farmers. Diversified sources of inputs is another strength of the governmental input supply. Many international agro-inputs companies compete to sell their products to COCOBOD. Improved seedlings are grown at multiple cocoa stations throughout the country. COCOBOD provides its employees with a competitive benefits package and its input supply activity does not have critical negative environmental impacts.

Internal marketing activity of cocoa represented by LBCs also shows high resilience. LBCs have a vast network of staff around the country and purchase cocoa from different regions and districts. Internal marketing relies on a diversified storage system: LBCs have warehouses in every area where they operate. LBCs buy cocoa from farmers due to the seed fund provided by COCOBOD and protect their activities against potential losses with insurance.

Processors are located in industrial areas close to the cocoa warehouses and ports. This facilitates their access to inputs, as all the cocoa is exported or sold for processing from the

warehouses of CMC. Proximity to inputs significantly reduces the costs and risks associated with logistics. Another advantage of the location in industrial areas is that the disaster management services are always available. In addition, processors train staff on the emergency procedures and install fire detectors that that can warn staff in case of a fire outbreak. Moreover, processors actively use insurance to cover the losses in case of an unwanted event. Although processors show a positive resilience picture, it should be mentioned that there is a key bottleneck in their activity. Processors have a difficult time in procuring quantities of cocoa needed to operate at full capacities, which hinders the value-added opportunities for the domestic processing (World Bank, 2013)

Private input supply, transportation and food retail show *heterogeneous resilience picture*. These three activities of the value chain are characterized by the small sizes of actors mostly belonging to the informal sector of the economy. Although these are different activities of the value chain, they all have quite similar strengths and weaknesses towards possible shocks. All these activities based on a dense network of small businesses are distributed throughout the country. Transportation and trade are very popular activities in Ghana as they bring certain profit that allows maintaining the livelihood of people engaged in these activities. Due to the high diversification, trade and transportation are not dependent on one commodity. Input dealers sell different agro-chemicals, seeds and tools to various farming activities and hauliers transport different commodities and often run repair garages and other small ventures. For food retailers, cocoa makes only a small part of the products they sell. On the other hand, private input dealers, hauliers and food retailers are experiencing several difficulties, which decrease their resilience. Although informal businesses allow generating some profit, in general, it is not enough for investments in business improvement or knowledge development. Access to loans is limited due to high interests on loans and the fact that many small businesses cannot provide collateral. Poor roads, especially in rural areas, are another problem for trade and transportation as these activities heavily rely on logistics.

Cocoa is grown over the large area in Ghana and the probability of the total failure of the cocoa production is very low. However, farming shows the alarmingly *low resilience performance*. Although farmers grow other crops and have livestock, cocoa remains the main source of their income. That is why loss of cocoa yield, due to of drought, bushfire, flood or disease, leads to huge economic losses for farmers and threaten their livelihoods. Although reseeding is possible, return on investments takes time as cocoa tree needs two-three years to start bearing fruits. Another problem decreasing the resilience, is that cocoa farmers have limited access to affordable and timely agro-inputs. Cocoa farmers, hauliers and small input and food traders share similar problems of accessing loans. Very few can provide collateral and ones who can, are hampered by high interest rates. Organized groups offer farmers many advantages such as volume purchasing of inputs, shared tools and labor and improved access to loans and better bargaining power. However, according to World Bank (2013), less than 10% of cocoa farmers participate into cooperative of farmers associations.

Step of the value chain / Resilience attribute	Private input supply	Governmental input supply	Production	Internal marketing	Transportation	Processing	Retail
Buffering capacity							
Capital (social)							
Capital (environmental)							
Capital (financial)		n/a					
Profitability		n/a					
Connectivity							
Diversity							
Information and learning							
Self-organization							
Transformability							
Equitability	no data	n/a		no data			

Figure 24: Resilience scores for all cocoa value chain activities

4. Building resilience of the cocoa value chain: participatory approach

4.1. Stakeholders workshop

The key objective of the stakeholder workshop was to develop a set of interventions for different activities of the cocoa value chain against shocks.

Participants were divided into ten subgroups according to their roles in the value chain. Six subgroups represented pre-production, production and post-production activities of the cocoa value chain, namely input supply, production, internal marketing, transportation, processing and retail. Four subgroups comprised of experts from different fields of expertise: disaster management, researchers, NGOs and administrative representatives of COCOBOD. Each subgroup was assigned a shock, either "drought" or "price fluctuations of cocoa", depending on its relevance to a particular subgroup.

Group "Drought" included two subgroups of actors (input suppliers and farmers) and three subgroups of experts: disaster management organizations, researchers and NGOs. Farmers were assigned to "Drought" because prolonged dryness has direct impacts on the ability of farmers to maintain their functions to conduct farming activities. Input provision helps to mitigate the yield losses related to droughts. Disaster management organizations are very important in tackling impacts of droughts, such as an increased occurrence of bushfires. Researches were assigned the drought shock because of their expertise on soils and the reactions of cocoa trees to drought. NGOs work closely with farmers, providing them with technical assistance and training.

Group "Price fluctuations on cocoa" (further referred as "Price" group) included four subgroups of actors (LBCs, hauliers, processors and retailers) and one expert subgroup that consisted of COCOBOD's administrative representatives.

Although, post-production actors fear droughts, as they may reduce cocoa production, droughts do not happen often and are typically not sudden or severe enough to considerably affect their operations. A severe drought in Western Africa will lead to a significant decline in cocoa yields and may end up in shortages of cocoa in the world market. Figure 13 (see section 2.4.2.) shows that shortages of cocoa result in increase of price on cocoa and, therefore a somewhat compensatory effect is created, especially for the post-production activities, whose assets are typically not affected by droughts and bushfires, which is not the case for the farmers and input suppliers. In contrast, price fluctuations on cocoa and cocoa products are some of the post-production actors' main risks. Hauliers and especially LBCs heavily depend on their share of cocoa price. Cocoa is the main input for processors and, therefore, its price changes directly affect variable costs of processing. Retailers are affected by price fluctuations because the demand on cocoa-based products is very sensitive to price changes. The subgroup consisting of COCOBOD administrative representatives was assigned the "Price" shock because COCOBOD plays an important role when it comes to cocoa price fluctuations. First, COCOBOD exports Ghanaian cocoa and sells it to the domestic processors. In addition, COCOBOD effectively absorbs the short-term fluctuations by fixing the producers price.

The subgroups were asked to develop a set of interventions to better overcome the shock to which they were assigned. Each subgroup worked separately to design a set of potential interventions matching their expertise. The interventions proposed by the participants are summarized in table 8.

4.2. The results of the stakeholder workshop

4.2.1. The "Drought" group

Every actor and expert of the "Drought" group chose "early warning system" intervention. There are at least two reasons explaining this choice. First, knowing about an oncoming drought allows planning of the stocks of fertilizers and preparing new cocoa seedlings. Another reason is that droughts create favorable conditions for bushfires. Early warnings allow disaster management services and local volunteers to prevent propagation of fire and help minimize the affected area.

Private input suppliers and representatives of COCOBOD input departments worked together on a drought scenario. Input suppliers highlighted the importance of the "diverse input sources" and "quality of agro-inputs" against droughts. By providing cocoa varieties suitable for dry climates and inputs capable of enhancing drought resistance, input suppliers address the resilience of the cocoa production. "Trust between actors", according to this group, would allow networking of actors in order to join efforts to overcome the consequences of droughts. In addition, enhancement of trust would contribute to the adoption rates of technologies and better practices among farmers. To mitigate financial losses resulting from lower demand, input suppliers propose "insurance".

Farmers considered financial aspects such as "savings", "insurance" and "alternative income sources" essential to handle losses and support their livelihood through droughts. Financial buffers play several roles in the resilience enhancement of the production activity. First, available capital allows farmers to purchase agro-inputs to mitigate yield losses. In addition, financial capital is crucial for allowing farmers to return back to the cocoa production after a drought is over. Finally, these interventions would support the livelihood of farmers and their families if a drought significantly reduces their yield.

In general, the interventions proposed by the experts of the "Drought" group are consistent. All subgroups of experts chose "governmental support" as an essential intervention against droughts. In addition, they all addressed financial aspects of building drought resilience by proposing "alternative income sources", "savings" or "insurance" intervention. Researches also proposed "trust between actors" to increase the adoption rates of new techniques.

4.2.2. The "Price fluctuations on cocoa" group

Many of interventions proposed by the subgroups of the "Price" group are common between subgroups. One example is the "alternative income source" intervention. Diversification of income appears to be an essential strategy for every post-production activity if the price on cocoa drops.

Another frequently-proposed intervention is “diverse input sources”. Having multiple suppliers enables flexibility in planning and allows minimization of logistical costs. Another measure to minimize the logistical costs is the “infrastructure quality”, which was chosen by transporters and retailers subgroups because they rely heavily on the transportation system. COCOBOD administrative representatives supported the importance of this intervention.

In line with the results of the “Drought” group, none of the actors, except for LBCs, proposed “support from government” as an intervention to build resilience.

In contrast to other subgroups, LBCs and processors chose neither “savings” nor “insurance” intervention. Moreover, they were the only actors who proposed “stocks of inputs/outputs” as a part of their resilience strategy. One possible explanation for the non-financial measures to build resilience is that LBCs and processors are the only actors of the value chain not experiencing significant problems with financial capital. This hypothesis is in agreement with the findings of the resilience assessment.

Not surprisingly, LBCs proposed “quality of output sources” to increase resilience as the quality of beans is the number one precondition for the success of their activity. LBCs also chose “diverse outputs (clients)”, probably because currently there is no price competition for LBCs and they entirely depend on the share of FOB determined by COCOBOD.

Table 8: Interventions to overcome shocks proposed by the workshop participants

Shock	Drought					Price fluctuations on cocoa and cocoa products				
Group	Actors		Experts			Actors				Experts
Interventions to overcome a shock	Input suppliers	Farmers	Disaster management organizations	Researchers	NGOs	LBCs	Transporters	Processors	Retailers	COCOBOD representatives
Early warning system	■	■	■	■	■					
Alternative income sources		■			■	■	■	■	■	■
Savings		■	■				■		■	■
Insurance	■	■		■			■		■	■
Self-organization		■		■	■	■		■		
Support from government			■	■	■	■				■
Diverse input sources	■						■	■	■	
Trust between actors	■			■		■				
Infrastructure quality							■		■	■
Stocks of inputs/outputs						■		■		
Quality of input sources	■									
Independence in decision-making							■			

4.3. Resilience attributes addressed by the participants

Similar sets of resilience attributes were addressed by the interventions proposed by both "Drought" and "Price" groups. These attributes are buffering capacity, capital (financial), connectivity, diversity, information & learning and self-organization (figure 25). Color intensity represents the importance of a resilience attribute for drought or price fluctuations shocks.

The groups gave almost equal importance to ***buffering capacity***. Interestingly, no one from the "Drought" group chose "stocks of inputs/outputs", probably because in the current marketing system farmers have no need to store cocoa as the prices are fixed. Another interesting fact is that only experts from both groups and LBCs, who have the strongest relationships with COCOBOD, mentioned that "Support from government" would increase their buffering capacity. This means that overall the actors of the cocoa value chain tend to rely on self-initiative to deal with shocks.

"Insurance" and "Savings" interventions addressing ***capital (financial)*** resilience attribute were among the most frequent choices for both groups.

Connectivity appeared to be more important for the "Price" group than for the "Drought" group. This can be explained by the fact that the post-production activities of the "Price" group rely heavily on logistics and transportation and the possibility for optimization of logistical costs is an important measure to tackle their reduced income.

"Price" group found ***diversity*** much more important than the "Drought" group. "Alternative income sources" intervention was chosen by all "Price" subgroups, while only farmers and NGOs mentioned it. "Diverse input sources" are also more important for the "Price" group. As mentioned above, the post-production activities heavily rely on logistics. "Diverse input sources" allow actors to reduce costs by optimizing distances and to choose the most reliable partners or cheaper alternatives. Possibility to optimize costs is especially important against the price fluctuations shock because it directly affects the revenues.

Information & learning is much more important for the "Drought" than for the "Price" group. Drought itself is a severe issue and, in addition, it leads to bushfires that may destroy farms and villages. Early warning system is crucially important for rural areas, so that disaster management organizations and local volunteer groups can react timely and prevent the propagation of fire.

Both groups "Drought" and "Price" mentioned ***self-organization*** as an important part for their resilience strategy.

Resilience attribute	*Interventions addressing resilience attribute in case of a drought*	Resilience attribute	*Interventions addressing resilience attribute in case of price fluctuations*
Buffering capacity	Insurance x3 Support from government x3	Buffering capacity	Insurance x 3 Support from government x2 Stocks of inputs/outputs x2
Capital (financial)	Insurance x3 Savings x2	Capital (financial)	Insurance x3 Savings x3
Connectivity	Quality of inputs x1	Connectivity	Infrastructure quality x3
Diversity	Alternative income sources x2 Diverse input sources x1	Diversity	Alternative income sources x5 Diverse input sources x 3
Information and learning	Early warning system x5 Trust between actors x2	Information and learning	Trust between actors x1
Self-organization	Self-organization x3	Self-organization	Self-organization x2 Independence in decision making x1

Figure 25: Resilience attributes addressed by the participants

5. Discussion

5.1. Cocoa and its role for food security in Ghana

Cash crops are seen as an integral part of a strategy to improve the food security in countries with a substantial agricultural sector (Achterbosch, Van Berkum, & Meijerink, 2014). Cash crop production not only provides higher wages and employment opportunities for the rural people, but also supports the full spectrum of ancillary activities in those areas (Achterbosch et al., 2014). With this, cash crops can be seen as supportive to alleviate poverty, one of the primary drivers of food insecurity (FAO, 2008). Cocoa in Ghana is a very typical example of such a cash crop. Although cocoa can be processed into food products, it does not serve as a foundation for a daily diet, unlike plantain, cassava or maize. Its primary contribution to the food security is in providing livelihood for people engaged (directly and indirectly) in the cocoa sector. The cocoa sector provides income for more than six million people engaged in input supply, production, marketing, transportation and processing activities (Anthonio and Aikins, 2009; Gockowski et al., 2011).

In the past, the cocoa production growth has resulted in a significant positive effect on the poverty decline in Ghana. Cocoa production increased from 241,796 MT in 1991 to 734,000 MT in 2006 (FAOSTAT, 2016) which contributed to the reduction of the poverty rate among cocoa farmers from 60.1% to 23.9% respectively (Coulombe and Wodon, 2007). However, the production growth rates have slowed down in recent years, reaching just under 900,000 MT in 2013/14 (Abubakar, RM&E (COCOBOD), pers. communic., 2016, COCOBOD, 2015). To support more growth in the cocoa industry, the Ghanaian government has decided to invest particularly into the processing of cocoa. The development of food processing is expected to be beneficial in terms of food security because it (1) adds value and generates additional income and (2) improves the resilience of value chains through diversification of products and income sources.

As of 2013/2014, around 20% of Ghanaian cocoa was processed into semi-processed products (liquor, butter, powder). While semi-processed cocoa products from Ghana are competitive on the world market, this is less the case for higher processed products, such as confectionaries (Sutton and Kpentey, 2012; processors interviews). Another potential market niche is the development of non-traditional cocoa-based products, such as shampoos, soaps, jellies, alcohol, etc. Although, CRIG is conducting research on this, the processing industry in Ghana is still lagging behind in developing competitive products. The development of secondary processing of cocoa into various finished products would enhance the value addition and diversification of the cocoa value chain in Ghana. In return this would provide further opportunities to increase income and contribute to aspects of food security.

5.2. The impact of the partially liberalized marketing system on the resilience of the cocoa value chain in Ghana

Since the marketing system determines resource flows within a system, it also has impacts on the resilience of the cocoa value chain in Ghana. The rather regulated flow of materials, driven by COCOBOD, includes a three-step quality control to ensure a reliable supply of consistently high quality of cocoa to the international markets. The policy of fixed prices further contributes to the continuous supply of cocoa to the world market, as the revenues of farmers, LBCs and transporters are secured for a one-year period. However, fixed prices reduce the bargaining power of actors, thus reducing incentives for self-organization and the constant exchange of information between the value chain actors.

As COCOBOD conducts many important activities (input supply, marketing of cocoa, etc.) it also collects a lot of data about cocoa which places COCOBOD at the center of the information flow of the value chain. Although, the COCOBOD interacts with other cocoa actors, it is likely that its strong position in the value chain may lead to information asymmetries. Those actors who, for any reason, have less contact with COCOBOD are mostly left out from the information flow because peer-to-peer networking between actors of the cocoa value chain and COCOBOD is very important. Despite COCOBOD's importance as a source of information, it also faces certain limitations especially related to input supply and extension services. The sheer number and the remoteness of farmers may lead to failures in the information flow because reaching all cocoa farmers requires immense resources and efforts from COCOBOD. These failures can lead to slow adoption of new agricultural technologies and weaken the opportunities for farmers to provide feedback.

Overall, it may be concluded that the current structure of the cocoa value chain allows during normal times to provide a stable supply of high-quality cocoa beans for international buyers. During times of shocks, the resilience of the cocoa value chain in Ghana is perceived to be medium to low. The rigid structure of the chain (with COCOBOD has the key actor) has a somewhat discouraging effect on the ability and willingness of actors to cooperate and conduct networking. This leads to a rather fragmented information flow and low connectivity among the value chain actors. Furthermore, the fact that numerous activities of the value chain are in the hands of a single stakeholder (internal marketing, quality control, export, research, extension and input supply is done by COCOBOD) contributes to low diversity throughout the value chain. In addition, the presence of a powerful institutional body in the cocoa sector discourages smaller players from taking individual responsibility and thinking outside the boundaries of their pre-defined roles. For example, many farmers who benefit from input programs of COCOBOD refrain from investing in inputs themselves. Further, as quality inspections are carried out by COCOBOD when cocoa beans are already collected at LBCs warehouses, farmers appear to lack knowledge on the quality requirements.

As a result, the current structure of the value chain essentially encourages actors to rely on governmental support in case of a shock. A shock resulting in reduced profitability of

COCOBOD is expected to compromise COCOBOD's ability to support the value chain activities adequately and therefore, the functioning of the value chain**.**

5.3. Building resilience of the cocoa value chain in Ghana

For both, drought and price fluctuations shocks, the interventions for resilience enhancement proposed at the stakeholder workshop address to a large extent the resilience deficiencies identified during the resilience assessment. For example, actors proposed the intervention to generate "*alternative income sources"* as helpful to better deal with droughts and price fluctuations. This can be explained by the fact that currently many actors of the cocoa value chain are strongly dependent on the income from only cocoa. Having almost no alternative income makes it difficult for farmers, LBCs and processors to absorb a shock that has interrupted or impeded their functioning. As for private input suppliers, hauliers and food retailers, cocoa accounts for only a fraction of their total income. Therefore, they are expected to be more resilient to face shocks, such as droughts and price fluctuations, as their income is more diversified.

Interestingly, "*support from government*" intervention was only proposed by experts and LBCs, but none of the other actors chose it. Instead, actors proposed insurance, savings and/or stocks to withstand droughts or cocoa price fluctuations. This shows that most of actors of the cocoa value chain rely on their own capacities rather than expect help from the government. For example, insurance and loans are actively used by LBCs, transporters and processors. The latter also keep stocks of inventories in order to maintain uninterrupted processing operations even for times when the supply of cocoa, water or gas is interrupted. However, there is still room for improvement, as farmers are not yet covered by yield insurances and have limited access to loans.

To conclude, actors and experts agreed that interventions leading to a diversification of income sources, enhanced networking, local cooperation as well as trust between actors should be prioritized in order to increase the resilience of the cocoa value chain against shocks.

Conclusion

In this study, the resilience of the cocoa value chain in Ghana was assessed based on the resilience guidelines developed by the Sustainable Agroecosystems Group of ETH Zurich.

The results from the resilience assessment show that the current structure of the cocoa value chain ensures a stable supply of cocoa during normal times (no shock). Cocoa of Ghana is of high interest for merchants and processors worldwide due to its high quality and consequently, attracts a large volume of foreign investments into the Ghanaian cocoa industry. These investments allow to intensify the development of a diversified domestic cocoa processing industry in order to increase value addition. Being interested in Ghanaian cocoa, international players also invest in NGOs who provide technical assistance to cocoa farmers in order to increase cocoa outputs and to improve environmental and social conditions of rural communities.

However, as of today, low diversification is weakening the resilience performance of the cocoa value chain. Over-dependency on income generated from the production of cocoa makes it difficult for farmers, LBCs and processors to absorb a shock that has interrupted or impeded their activities. The regulated material flow of the value chain decreases the diversity of supply channels between actors, reduces logistical flexibility and also demotivates actors from acting beyond their main functions. Consequently, the cooperation within the value chain is limited. The reliance of many activities on COCOBOD further contributes to a low diversification throughout the value chain. This means that in case of a shock a lot of responsibility falls on COCOBOD to provide support and assistance. Furthermore, the overreliance on governmental support discourages actors from developing alternative resilience strategies.

During a stakeholder workshop, participants, representing different activities of the value chain, developed sets of interventions to improve the resilience against droughts and world price fluctuations on cocoa. Early warning system was found to be crucially important against drought, whereas diversification of income sources was the main proposition against price fluctuations. Savings, insurance and self-organization were proposed to be helpful against both shocks.

To conclude, the study provides an overview about the ability of the cocoa value chain in Ghana to withstand shocks. The methodology allowed revealing major bottlenecks in terms of resilience performance. However, the study is based on available literature combined with a small number of qualitative interviews with stakeholders. Hence, the study should be seen as an initial step (pilot study) towards understanding the resilience of the cocoa value chain in Ghana against shocks. A more detailed investigation is needed in order to develop with greater detail for each value chain process an efficient set of interventions to address deficiencies in the resilience performance.

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Interviews

I would like to thank the following persons interviewed between November and December 2015:

Name	Position	Organization	Place of Interview
Emmanuel A. Opoku	Deputy Director	Research, Monitory and Evaluation Department, COCOBOD	Accra
Charles Owusu Dankwa	Operations/Shipping Manager	Resigha	Kumasi
Naphtali K.B. Gyempeh	Branch Manager/Agronomist Ashanti, Brong-Ahafo Regions	Dizengoff Ghana	Kumasi
Evelyn Rose Afanyedey	Agro-Meteorologist	Ghana Agricultural Insurance Pool	Accra
William Yaw Nuamah		OLAM (Inputs)	Tema
John Scott Donkoh	Plant manager	OLAM (processing)	Kumasi
Amos Kojo Quaye	Research Scientist	Soil Science Division, CRIG, COCOBOD	New Tafo
Adu-Gyamfi Sarpong	Programme Officer, Cocoa	Solidaridad	Kumasi
Robert Asugre	Lead Technical Expert CORIP	IFDC	New Tafo
Prince Gyamfi	Programme Coordinator	International Cocoa Initiative	Kumasi
Edward Yeboah	Senior Research Scientist & Head, Soil Microbiology Division	Soil Research Institute	Kumasi
Stanley Asomani Asante	Sustainability Coordinator	Cocoa Merchants	Kumasi
Kwame A. Sintim	Trader	Cocoa Marketing Company, COCOBOD	Accra
Charles Brefo-Nimo	Project Manager (Cocoa-Eco)	SNV	Kumasi

George Yao Klu	Dep. WPO Manager/ Area Coordinator	Cocoa Marketing Company, COCOBOD	Kumasi
Anthony Adom	Senior Associate, Sustainable Agriculture	Rainforest Alliance	Western Region
Rita Emefa Avle-Gavor	Training Associate	International Cocoa Initiative	Kumasi
Julius Mark Kojo Opoku Martinson	Regional Manager, Ashanti	Quality Control Company, COCOBOD	Kumasi
Magaret Frimpong Ayerakwa	Principal Technical Officer, Ashanti	CHED, COCOBOD	Kumasi
Willam M. Wiafe	Technical Manager	CHED, COCOBOD	Accra
Nana Agyemang Ansong	Deputy Marketing Manager (External)	Cocoa Production Company	Tema
Francis Kwame Padi	Principal Research Scientist	CRIG, COCOBOD	New Tafo
Fuad M. Abubakar	Senior Research Analyst at Ghana Cocoa Board	Research, Evaluation & Monitoring Department, COCOBDO	Remote (mail)
Adasi L.B.	Public Relations Officer	CRIG, COCOBOD	New Tafo
Kennedy Owusu Nyarko	Assistant Regional Manager	SPD, COCOBOD	Kumasi
Samuel Appenteng	Deputy Research and Development Manager	Kuapa Kokoo Limited	Kumasi
Charles Tieku	Relationship Manager of Agricultural Development Bank	Agricultural Development Bank	Kumasi
Frederick Amon-Armah	Research Scientist	CRIG, COCOBOD	New Tafo
Frank Owusu-Ansah	Research Scientist	CRIG, COCOBOD	New Tafo
Merci Asamoah	Head of Social Science and Statistics Unit, Senior Research Scientist	CRIG, COCOBOD	New Tafo
Anthony Appiah	Assistant Divisional Fire Officer,	Ghana National Fire Service	Ejisu

Appendices

Appendix 1. Shocks, disturbances and problems reported by stakeholders

		Change in environment	Unexpectedness	Result	Result of the workshop
Input suppliers (Private and COCOBOD)	Bushfires	1	1	2	W
	Floods	1	1	2	W
	Diseases and pests infestation*	1	1	2	W
	Inflation*	1	1	2	W
	Drought*	1	1	2	W
	Climate change	1	0	1	
	Roads in rural areas	0	0	0	
	Inefficient supply system	0	0	0	
	Low payback from farmers	0	0	0	
	Competition with COCOBOD	0	0	0	
Farmers	Bushfires	1	1	2	W
	Floods	1	1	2	
	Illegal activities	1	1	2	W
	Personal health	1	1	2	
	Electricity shortage	1	1	2	
	Changes in governmental policies	1	1	2	W
	Diseases and pests infestation*	1	1	2	W
	Inflation*	1	1	2	W
	Cocoa price fluctuations*	1	1	2	W
	Drought*	1	1	2	
	Climate change	1	0	1	
	Smuggling	1	0	1	
	Ageing of farmers	1	0	1	
	Ageing of trees	1	0	1	
	Roads in rural areas	0	0	0	
	Low yields	0	0	0	
	Inadequate input supply to farmers	0	0	0	
	Financial constraints	0	0	0	
	Low international prices	0	0	0	
	Lack of knowledge	0	0	0	
	Problems of land tenure	0	0	0	

	Schools are not available everywhere	0	0	0	
	Healthcare is not available everywhere	0	0	0	
	No social security for farmers	0	0	0	
	Lack of potable water	0	0	0	
LBCs	Bushfires	1	1	2	
	Illegal activities	1	1	2	
	Electricity shortages	1	1	2	
	Theft and robbery	1	1	2	
	Diseases and pests infestation*	1	1	2	W
	Inflation*	1	1	2	W
	Cocoa price fluctuations*	1	1	2	W
	Drought*	1	1	2	
	Fluctuations of cocoa supply*	1	1	2	W
	Climate change	1	0	1	
	Smuggling	1	0	1	
	Ageing of trees	1	0	1	
	Ageing of farmers	1	0	1	
	Price increase on fuel	1	0	1	
	Mistrust between actors	0	0	0	
	Roads in rural areas	0	0	0	W
	Low yields (supply)	0	0	0	W
	Lack of knowledge of farmers	0	0	0	
	Bad warehouses	0	0	0	
	Cocoa is mixing with petrol products	0	0	0	
	QCC delays grading and sealing of cocoa	0	0	0	W
	Inadequate input supply to farmers	0	0	0	
Transporters	Floods	1	1	2	W
	Robbery	1	1	2	
	Diseases and pests infestation*	1	1	2	W
	Inflation*	1	1	2	W
	Drought*	1	1	2	W
	Roads in rural areas	0	0	0	
	High interests on loans	0	0	0	

	Expensive inputs	0	0	0	
	Expensive maintenance	0	0	0	
	Difficulties with cooperation with LBCs	0	0	0	
	Bribes to police	0	0	0	
Processors	Fire in factories	1	1	2	W
	Floods	1	1	2	W
	Cocoa supply shortages	1	1	2	W
	Unstable utility supply (gas, energy, water)	1	1	2	W
	Machinery breakdown	1	1	2	W
	Labor unrest	1	1	2	
	Changes in governmental policies	1	1	2	W
	Inflation*	1	1	2	
	Price fluctuations on cocoa and cocoa products*	1	1	2	W
	Fluctuations of cocoa supply*	1	1	2	
	Smuggling	1	0	1	
	Cocoa substitutes on the market	0	0	0	
	High cost of power	0	0	0	
	Low demand on confectionary products	0	0	0	
	Milk and sugar are imported	0	0	0	
	High interests on loans	0	0	0	
Retailers	Floods	1	1	2	W
	Electricity shortages	1	1	2	
	Diseases and pests infestation*	1	1	2	W
	Drought*	1	1	2	W
	Cocoa products supply shortages*	1	1	2	
	Inflation*	1	1	2	W
	leaking storages	0	0	0	
	Roads	0	0	0	

Appendix 2. Resilience questionnaires with answers

Private input supply

Question	Rating		Attrib.
Are input resources available, accessible and affordable?		Survey conducted by Krausova and Banful (2010) has shown that in 2008 and 2009 20-30% of surveyed input dealers did not sell fertilizers. The further study revealed that 29% were not selling fertilizers also because they could not obtain them.	Buffering capacity
		World Bank 2013: "most farmers interviewed reported difficulties in obtaining fungicides (registered or otherwise). In addition, virtually no private input suppliers visited during this assessment had either copper fungicides or metalaxyl in stock."	
		IFDC 2002: "Because Ghana does not have facilities for domestic production of fertilizers, it has to depend on imports to meet its fertilizer requirements. With a depreciating exchange rate, the value of imported goods increases in direct proportion to the depreciation of currency."	
		Farmers' interviews: 7 out of 13 farmers reported that inputs are not always available/affordable/accessible.	
Does the actor maintain stocks of inputs and/or of products?		Survey conducted by Krausova and Banful (2010) has shown that in 2008 and 2009 20-30% of surveyed input dealers did not sell fertilizers. The further study revealed that 18% were not selling fertilizers also because they could not afford to stock them	
		Difficult to estimate based on two respondents. However, farmers are complaining on the unavailability of inputs. Also, it is not likely that small input dealers have distributed network of stock	
		Input suppliers' interviews: one supplier reported to have stocks also in satellite shops. Another one said that there used to be stocks but not anymore, although efforts are made to improve on that.	
		IFDC 2002: "Because of inadequate infrastructure (roads and warehousing facilities), inputs are generally not available on time."	
Does actor have spare capacity in case of increased demand?		Visited 2 big input suppliers reported that all the products come from abroad and are stored in Accra. New orders take time. Smaller input dealers have limited financial resources and can not afford to buy/ store big amounts of products.	
Is there an access to business insurance against losses/damages?		Insurance companies in general are favorable to retail activities. Big companies have insurances. However, the extent to which all input suppliers from smallest to biggest are using insurance is unknown.	

Are there protective measures used to protect health of laborers?		Evidence from local markets: people are selling inputs exposed, not covered and do not use any protection. Sellers inhale and touch inputs	Capital (social)
		Osei Boateng and Ampratwum 2011: “Many workers in the informal sector are either ignorant about hazardous practices or substances or simply cannot afford protective gadgets.”	
Is there an access to social security?		Osei Boateng and Ampratwum 2011: “The numbers of informal sector workers who have access to social benefits through institutionalized social security schemes are negligible. By March 2011, the Informal Sector Fund, a subsidiary pension scheme operated by the Social Security and National Insurance Trust (SSNIT) had enrolled 83,448 (SSNIT Informal Sector Fund, 2011); 85 percent of which were formal sector members.”	
		Ghana Statistical Service (2014) indicates that 70.9 percent of currently employed population over 15 are not entitled to any social security.	
Is there an access to health insurance?		Osei Boateng and Ampratwum 2011: “Ghana operates a National Health Insurance Scheme based on premium subscription. Formal sector workers who are members of the SSNIT pension scheme are covered but informal sector members pay direct premium of between GH¢7.20 to GH¢ 48.00 (US$ 5.14 - $34.29). By 2009, premium contributors [to NHIS] (presumably informal sector workers) numbered 4,132,783, representing about 29 percent of the scheme’s total membership. The number represents about half of estimated informal sector workforce in Ghana.“	
		Ghana Statistical Service (2014)“Overall, 67.6 percent of the population are registered or covered by the health insurance scheme”	
Is there an access to healthcare organizations?		IFDC 2002: "most of the input retailers remain concentrated in urban or peri-urban areas"	
		Healthcare organizations concentrate in urban areas.	
Are there emissions/ wastes from the activity?		Evidence from local markets: inputs are exposed to sun, are sold next to the food	Environmental capital
Are wastes reused/recycled?		Smaller dealers most likely are not interested in recycling and correct waste disposal	
Is there an access to external financing (loans, credits)?		Krausova and Banful 2010: ".. access to loans for agricultural input enterprises is very low. Ninety percent of enterprises reported that their startup financing came from the personal resources of the owner/manager and another 9 percent reported receiving loans	Financial capital

		from family members. Eighty-one percent of agricultural input dealers rely on profit from business operations to finance the running of the enterprise."	
		IFDC 2002: "High interest rates, associated currency depreciation and inflation, and stringent collateral requirements make borrowing for business development almost impossible and/or unreasonable. " IFDC 2002: "Few traders can afford to borrow from banks."	
Does the actor have possibility to generate funds for investment, maintenance, expansion?		Krausova and Banful 2010: "The majority of agricultural input dealers perceive lack of capital (79 percent)"	
		IFDC 2002: "Very high prices discourage demand and therefore lead to reduced incentive for investment in the input business." IFDC 2002: "Dealer network development in Ghana is constrained by the limited skills of potential dealers, willful defaults, and the poor capitalization of potential retailers and the small-scale and dispersed farmer-clients in rural areas."	
Is there an access to business insurance against losses/damages?		Insurance companies in general are favorable to retail activities. Big companies have insurances. However, the extent to which all input suppliers from smallest to biggest are using insurance is unknown.	
Does the activity generate net positive profit?		Inputs are undersupplied and demand for fertilizers is high	**Profitability**
Is transportation system diverse, spatially distributed and equitably accessible?		Krausova and Banful 2010 “high cost of transporting products (48 percent) is perceived as a challenge to operating an agricultural-input retail business.” Krausova and Banful 2010 "agricultural inputs dealers in all regions have to travel significant distances to access their suppliers. " Krausova and Banful 2010 "The median distance between an agricultural input dealer and its supplier is highest in the Upper West, Volta, and Western regions; the highest is the 152 kilometer observed in the Western region."	**Connectivity**
		IFDC 2002: "The paucity of rural roads makes the expansion of dealer networks into rural areas difficult. As a result, most of the input retailers remain concentrated in urban or peri-urban areas, and many farmers have to travel 30-50 km for a bag of fertilizers or seed." IFDC 2002: "The procurement cost constitutes the most important factor influencing fertilizer price, averaging between 54% and 56% of the final retail price (Schiere, 1998)."	

Does the quality control assure appropriate traceability?		During the interviews, actors and experts mentioned that there fake input products at input market in Ghana	
		COCOBOD establishes a list of approved chemicals for cocoa.	
		According to Jansen (2015) in Ghana, there are difficulties with input smuggling and counterfeit agrochemicals	
Are there always clients for production?		Input suppliers' interviews: Farmers do not have access to loans and they often do not have money to buy products	
		In spite of the subsidy, farmers cannot afford the inputs. Dr. Asante said: "with such a small market it is not surprising that other private companies are not willing to enter the market directly." https://www.modernghana.com/news/11153/government-asked-to-withdraw-subsidies-on-cocoa-inputs.html	
		Krausova and Banful 2010: "For the majority of southern regions, lack of customer demand is the number two most frequently cited obstacle. "	
Does the communication support enable appropriate connectivity?		IFDC 2002: "dealers and importers have limited information about prices, supplies, and other market conditions in the national, regional, and global markets." IFDC 2002: "Information on sales, inventories, and warehouse conditions is either not available or incomplete and poorly recorded. There is no systematic collection and dissemination of local and international market information."	
Are there any single inputs/ processors/ stakeholders that this activity depends upon, with no alternative?		No	**Diversity**
Are input resources sourced from multiple sources?		IFDC 2002: "All of the mineral fertilizer products used in Ghana are imported from abroad. Currently, the imported products are sourced through direct private importation primarily from Western Europe—particularly from France (HydroAgri) and in a lesser degree from Holland (Cheminex) and Ireland (Dynochem). A small proportion is imported from Côte d'Ivoire (Hydrochem), Russia, Belgium, Morocco, Bulgaria, Israel, and Tunisia." IFDC 2002: "Since the late 1980s, four dominant importers have been involved in the importation and distribution of chemicals for crop protection (CPP) in Ghana: Chemico, Wienco, Reiss & Co., and Dizengoff. As in many West African countries, these companies get their supplies of ready-to-use CPPs from big multinational firms."	

		Krausova and Banful 2010: "Six companies control almost 50 percent of the wholesale supply of goods carried by agricultural input dealers"	
Are the stocks spatially distributed?		"The main registered wholesalers/retailers include Sefa and Jane (Kumasi), AGLOW (Accra), AgriMat (Accra), Chinese Woman (Kumasi), Obek Agro Services (Kumasi), SMAKO (Nsawam), Iddissal (Tamale), and Dagx Agrofarma (Accra-North)." "Information on sales, inventories, and warehouse conditions is either not available or incomplete and poorly recorded."	
Is income generated by diverse activities/products? Does the livelihood depends on diverse activities/products?		Products may be different but all related to farming activities	
Is an atmosphere of trust and respect cultivated between actors?		Input suppliers' interviews: providing products in credit is risky: payback from farmers is low	**Information and Learning**
		"Two men suspected to have sold fake cocoa insecticides to farmers in the Ashanti Region have been arrested and handed over to police." "Some of the farmers had bought the chemicals sold in bottles in large quantities, some on credit between 5 Ghana cedis 10 Ghana cedis. They became suspicious about the efficacy of the chemicals after applying them for months without results." http://business.myjoyonline.com/pages/news/201105/65133.php	
		Norde and van Duursen 2003: "Mistrust is also found with respect to inputs. Fake inputs have been sold to the farmers, who on their turn have become suspicious towards input providers."	
		According to Jansen (2015), in Ghana, there are difficulties with input smuggling and counterfeit agrochemicals	
		IFDC 2002: "For importers, the difficult access to foreign exchange and the lack of trust by suppliers translate into less than favorable terms of payment at almost prohibitive interest rates (42% to 48% per annum)."	
Is the knowledge base of actors		Krausova and Banful 2010: "Sixteen percent of agricultural input dealers perceive lack of technical knowledge as a significant challenge to the running of their enterprise"	

sufficient for their activity?		Krausova and Banful 2010: "On average, only 56 percent of all agro-dealers received some form of training in the last two years. " (63,5 for cocoa growing regions)	
		IFDC 2002: "Many of the dealers who are currently involved in the input business do not have adequate marketing and management skills, and their technical understanding of product characteristics is also limited."	
Does the communication support enable appropriate connectivity?		IFDC 2002: "dealers and importers have limited information about prices, supplies, and other market conditions in the national, regional, and global markets." IFDC 2002: "Information on sales, inventories, and warehouse conditions is either not available or incomplete and poorly recorded. There is no systematic collection and dissemination of local and international market information."	
Is the actor planning his activity?		Planning seems to be a problem: farmers complain about unavailability of products. Issues with delivery from abroad and customs delays contribute to an uncertainty of this activity	**Self-organization**
		World Bank 2013: "most farmers interviewed reported difficulties in obtaining fungicides (registered or otherwise). In addition, virtually no private input suppliers visited during this assessment had either copper fungicides or metalaxyl in stock."	
		IFDC 2002: "Many of the dealers who are currently involved in the input business do not have adequate marketing and management skills, and their technical understanding of product characteristics is also limited." IFDC 2002: "Potential dealers lack the knowledge of how to effectively reach out to the farmers to sell their products and how to bring finance into the business through their own arrangements. They also lack the knowledge for planning and forecasting quantities, timing, and prices according to the market situation and the needs of the farmers of the area. Consequently, the rural markets in the business are still undeveloped. "	
Does the actor know what the main risks for his activity are?		While actors know their current risks (e.g. inflation) it is unlikely that smaller input dealers are aware of global risks that farmers (their clients) deal with and hardly try to anticipate it.	
Does the actor have autonomy and control over the activity, and his own resources?		Private input dealers have full autonomy over their activity and resources. Government intervenes private cocoa input supply by establishing the list of inputs suitable for cocoa.	

Is self-organization, networking, initiative, association among actors enabled?		IFDC 2002: "dealers and importers have limited information about prices, supplies, and other market conditions in the national, regional, and global markets."	
		Bigger input dealers have better communication with farmers (through COCOBOD's extension services and NGOs). However, private cocoa input supply is not well organized and it is difficult to define its network	
Is there opportunity for experimentation and innovation?		There is a big room for change and innovation for private input dealers. Innovativeness is hindered by poor communication, financial constraints and lack of technical understanding among dealers.	**Transformability**
Is there equitable/ fair access to inputs (generational, gender, racial, religious etc)?		Not identified	**Equitability**

COCOBOD input supply

Question	Rating		Attrib.
Are input resources available, accessible and affordable?		Inputs are sourced from many large international input importers Seedlings are grown in 27 cocoa stations	**Buffering capacity**
Does the actor maintain stocks of inputs and/or of products?		There are stocks all around the country. However, farmers complain about delays of delivery of inputs	
Does actor have spare capacity in case of increased demand?		COCOBOD has difficulties in distribution of inputs. Not all farmers are supplied and there are constant delays in delivery of inputs to farmers.	
Is there an access to social security?		Yes, this is a governmental organization	**Social capital**
Is there an access to health insurance?		Yes, in addition, COCOBOD pays for services in Cocoa clinic	
Is there an access to healthcare organizations?		Yes, including free access to Cocoa Clinic	

Are there critical emissions/ wastes from the activity?		Containers from chemicals	**Environmental capital**
Are wastes reused/recycled?		There are efforts to collect used containers to prevent counterfeits, however the extent is not clear	
Are there measures, management, stewardship, planning, protection schemes which are enforced to protect resources and habitats?		Extension officers teach farmers on safe application of inputs However, the extent to which farmers implement these recommendation is unclear	
Is transportation system diverse, spatially distributed and equitably accessible?		Norde and van Duursen 2003: "Increased communication with farmers is difficult to attain because of 1) illiteracy of farmers. Many farmers can not read or write. Any written from of information is therefore ineffective and inefficient, 2) bad road conditions. Although the geographical distances are do-able in most cases, the average speed of travel is very low, 3) remoteness of farmers – especially in the western region, 4) the mere quantity of farmers. The energy and resources required to reach out to all the individual farmers is enormous."	**Connectivity**
		During the interviews it was confirmed many times that roads in rural areas where the cocoa production takes place are bad.	
Does the quality control assure appropriate traceability?		CHED only distributes inputs approved by COCOBOD	
How efficiently the input supply reaches farmers?		Farmers' interviews: inputs are supplied with delays	
		CHED: 60% of farms are measured (i.e. can get fertilizers)	
		SPD: Farmers only get seedlings when the farm is measured. Respondent assumed around 60% of farms are measured Not all farmers are receiving seedlings due to the lack of plants	
Does the communication support enable appropriate connectivity?		"Increased communication with farmers is difficult to attain because of 1) illiteracy of farmers. Many farmers can not read or write. Any written from of information is therefore ineffective and inefficient, 2) bad road conditions. Although the geographical distances are do-able in most cases, the average speed of travel is very low, 3) remoteness of farmers – especially in the western region, 4) the mere quantity of farmers. The energy and resources required to reach out to all the individual farmers is enormous."	

		Baah and Anchirinah 2010: "Studies by Baah (2006, 2007a) and Ministry of Manpower Youth and Employment (2008) indicate that the state of cocoa extension is far from the desired. For instance, in a study of over 3,000 cocoa farming households in 2007 – 2008, the national programme for the elimination of worst forms of child labour in cocoa (Ministry of Manpower, Youth and Employment, 2008) found that over 73% of farmers have received no extension support in the year preceding the study." Baah and Anchirinah 2010: "A recent survey of over 3,000 cocoa households revealed that 73% of respondents have not met an extension agent or received any extension support in a year (Ministry of Manpower, Youth and Employment, 2008)" "This study has adduced evidence suggesting that stakeholders in the cocoa sector concur that cocoa farmers are not receiving the information and extension support that they require. "	
		Aneani F., Anchirinah V. M., Owusu-Ansah F. and M. Asamoah (2012): "The adoption rates of the CRIG-recommended technologies such as control of capsids with insecticides, control of black pod disease with fungicides, weed control manually or with herbicides, planting hybrid cocoa varieties and fertilizer application were 10.3%, 7.5%, 3.7%, 44.0% and 33.0%, respectively."	
		Norde and van Duursen 2003: "Currently, there is approximately one agric officer for approximately 3000 farmers. Also, the allocation of resources (both human and financial) is inadequate in most districts. This limited capacity is one of the main problems heard of when speaking to farmers about agric-officers in the field. It is generally stated that – since the take over – the incentives for the agric officers to do the job properly have been largely decreased (low salaries). Furthermore, most of the officers don't have their own mode of transportation; making is very difficult and time consuming to visit the farmer communities." Norde and van Duursen 2003: "Farmers have a high demand for extension services and the current system does not have the capacity to provide it adequately. So, since an increased productivity is in the interest of numerous stakeholders, there is a market for privatised extension services."	
Are there any single inputs/ processors/ stakeholders that this activity depends upon,		Fully depends on COCOBOD and its financing	**Diversity**

with no alternative?			
Are input resources sourced from multiple sources?		Inputs are sourced from many large international input importers. Importers are very interested in selling their products to COCOBOD to minimize risks associated with logistics and demand fluctuations in the remote areas.	
Are products sold/distributed via multiple diverse channels and markets?		Only COCOBOD agents distribute inputs	
Are records kept? (of past experiences, techniques, knowledge, disturbances)		COCOBOD has the most information on cocoa sector in Ghana. However, there are several issues and information gaps: • Only 60 % of farms have been measured so far. • Research and monitoring: no information available from farmers on their productivity by region • CRIG Soil research: no detailed soil maps.	**Information and learning**
Is an atmosphere of trust and respect cultivated between actors?		Farmers' interviews: overall, farmers reported to trust COCOBOD extension and input services and find extension services very useful	
Is the knowledge base of actors sufficient for their activity?		COCOBOD accumulates most of knowledge on the cocoa production in Ghana. CRIG conducts research on various aspects of cocoa production such as diseases, pest resistance, improvement of yield, suitability of inputs for cocoa, socio-economic issues of cocoa farming etc. Extension officers implement the recommendation elaborated from the top.	
Is the actor planning his activity?		Yes	**Self-organization**
Are there long-term plans (e.g. 50 years) to manage supply, demand and capacity?		The long-term plan of CHED is to improve the livelihoods of farmers, reduce poverty and increase the yield without compromising the quality	
Are records kept? (of past experiences, techniques, knowledge, disturbances)		COCOBOD has the most information on cocoa sector in Ghana. However, there are several issues and information gaps: • Only 60 % of farms have been measured so far (Frimpong Ayerakwa, pers.comm. 2015). • Research and monitoring: no information available from farmers on their productivity by region • CRIG Soil research: no detailed soil maps	

Are there plans to address any risks from hazards and emergency situations with scripts for actors in case of such an event?		For some issues. For example, in case of CSSVD outbreak there is a procedure to cut off the infected area and to replant it with new trees.	
Is self-organization, networking, initiative, association among actors enabled?		CHED: CHED Interacts with NGOs and input dealers. CHED forms farmers groups and facilitates their access to banks. Within COCOBOD interacts with Seed Production Unit and Cocoa Research Institute	
		SPD: Within COCOBOD SPD interacts with CRIG, CHED and QCC. Interacts with farmers and NGOs	
		Problems with communication, transportation and lack of organized response from farmers, hiders the networking.	
Is there opportunity for experimentation and innovation?		Yes, COCOBOD is the most powerful stakeholder of the cocoa value chain, which embraces many activities including research and extension.	
Does the activity and its leaders show openness to change? Has this been shown in the past?		1. Liberalization of internal marketing system 2. Implementation of programmes aimed to increase the production levels: The Cocoa Diseases and Pests Control Programme or Mass Spraying programme aims to tackle with capsids attacks and black pod disease. Cocoa "Hi Tech" Programme was introduced to replenish soil fertility and to improve the yields. The problem is in low connectivity. Bad roads, limited access to all farmers and high costs of implementation of programmes hinder flexibility of COCOBOD to innovate.	**Transformability**

Production

Question	Rating		Attrib.
Are input resources available accessible and affordable?		Most of interviewed farmers reported that there are not enough inputs from COCOBOD and there are delays in COCOBOD's supply. Inputs from private dealers are expensive and they are not always available or accessible.	**Buffering capacity**
		CHED: COCOBOD provides only a part of inputs needed. Fertilizers and seedlings are provided for farms which are measured with GPS (around 60% for now).	

		SPD: there is a lack of seedlings: not all farmers are supplied with seedlings	
		Laven and Boomsma 2012: "input supply chains are underdeveloped, and there is no clarity on how such a supply chain can improve. In Ghana, the state-owned cocoa marketing board (COCOBOD) pursues a subsidy approach, providing inputs at below-market price, but effectiveness and coverage are insufficient to boost productivity sufficiently."; "In Ghana the use of fertilizer has increased over the last decade. Nevertheless there is not enough fertilizer being made available locally. Demand for fertilizers outreaches supply."	
		World Bank 2013: "most farmers interviewed reported difficulties in obtaining fungicides (registered or otherwise). In addition, virtually no private input suppliers visited during this assessment had either copper fungicides or metalaxyl in stock."	
		World Bank 2013: “Cocoa farmers in Ghana have a difficult time in procuring fertilizers, fungicides, pesticides, and other inputs that would otherwise help to increase their yields and reduce losses to pests and diseases. Only 14% of farmers in a recent survey reported having ready access to fertilizers when they needed them, for example. In addition to frequent lack of market availability, the high cost of inputs often places them out of reach for most Farmers”	
		IFDC 2012: “There are an estimated 1.6 million ha under cocoa cultivation in Ghana. As of the 2010/11 season, only 20 percent of this area is being fertilized, with 2,600,000 bags (0.13 million mt) on 325,000 ha. This translates to an application rate of 8 bags/ha. Fertilized fields, on average, yield at least two times more than the unfertilized fields, according to COCOBOD.”	
		Hainmueller et al. 2013: “We find that the percentage of farmers using fertilizer is extremely low, never above 5% during any month.”	
Does the actor maintain stocks of inputs and/or of products?		Farmers sell their cocoa to LBCs as soon as it is dry enough. As for inputs, according to different sources, most of farmers lack planning skills and do not plan use of input.	
Are multiple varieties of crop used? Are the varieties used adapted to local environmental conditions/resi		Kolavalli and Vigneri 2011: “Hybrid varieties outperform the older “Amazons” and “Amelonado” varieties in two ways—by producing trees that bear fruit in three years compared with at least five years for the older varieties, and by producing more pods per tree.”	
		Oppong 2015: ”Improved hybrids constitute about 31% of tree stock”	
		Padi, 2015: taking into account the plant resistance is developed within pathology and enthomology groups of CRIG, the breeding department ensures that hybrids establish well in the fields.	

stant to diseases?		Anim Kwamponf and Frimpong, 2005: “The Cocoa Research Institute of Ghana in anticipation of future climate change and taken cognizance of the debilitating effect of drought on cocoa production is continuously developing drought tolerant, high yielding and disease resistant cocoa planting materials and improved agronomic practices to sustain cocoa production and farmers’ livelihood.”	
Does actor have spare capacity in case of increased demand?		CRIG Plant Breeding: “Cocoa trees start bearing fruits after 2-3 years. Initial yields are low. The highest yields are between 8-18 years.”	
		Aneani and Ofori-Frimpong 2013: Currently, the national cocoa yield average is around 400 kilograms per hectare, which is at least 30 to 50 percent lower than what a potential yield output could be.	
		Norde and van Duursen 2003: “One of the main perceived difficulties to increase the production is a lack of money to buy inputs. The current credit facilities are inadequate.”	
		Laven and Boomsma 2012: "input supply chains are underdeveloped, and there is no clarity on how such a supply chain can improve. In Ghana, the state-owned cocoa marketing board (Cocobod) pursues a subsidy approach, providing inputs at below-market price, but effectiveness and coverage are insufficient to boost productivity sufficiently"	
		Cocoa production in Ghana is based on smallholder farmers. About 700,000 households are growing cocoa mostly on plots of 2-3 ha with small plantations (ICCO, 2006).	
Is there an access to business insurance against losses/damages?		COCOBOD Social Science: No insurance companies willing to insure farmers.	
		Farmers’ interviews: none of the interviewed farmers had an insurance. Insurance companies also confirm that they do not offer insurance for farmers. There is an effort of Ghana Agricultural Insurance Pool to develop insurance schemes for organized group of farmers but it is not yet implemented for cocoa farmers.	
Is there an access to disaster management organizations?		Farmers’ interviews: there are volunteers groups trained by fire service but they rely on simplest methods.	
		National Fire Service: Fire service provides training for volunteer groups in rural communities on how to avoid and tackle bushfires. Trainings last 6 month and are followed up by “refreshing trainings”. They also provide volunteers with boots, cutlasses, protection cloth and fire beaters. While the volunteers are tackling with the fire outbreak, Fire Service tries to reach the affected area. They have a call center 192. They use water against the fire. NADMO coordinates mobilization of disaster management services. Its main functions are: prevention, management and reconstruction. The biggest problem of disaster management organizations, according to NADMO is reaching the areas affected by the disaster.	

Is there enough tools, are they in good conditions?		Asante-Poku & Angelucci, (2013): Although mechanized systems have been developed to ease the labor burden, this often damages the beans and hence is not very popular among farmers (ICCO, 2012). Asante-Poku & Angelucci, (2013): Cocoa farmers in Ghana continue to rely on the traditional methods such as the hoe and cutlass method for farming (GAIN, 2012).	
		Farmers' interviews: 2 of interviewed farmers did not have spraying machines. The rest had it in collective use. As for cutlasses and hoes, most of farmers said that they have enough.	
Are there protective measures used to protect health of laborers?		Farmers' interviews: only one farmer out of 13 reported not using the protection while spraying. 4 farmers said that they are taking used containers from chemicals for domestic usage.	Capital (Social)
		According to the study of Antwi-Agyakwa et al. (2015), farmers used very minimal protective clothing during pesticides application.	
		Fianko et al. 2011: "Human exposure to pesticides in Ghana may be excessive, especially through ground application in cocoa, pineapple, cotton and vegetable farms where compounds of high toxicity are often used. Large number of workers, labourers, and spraying observers are involved in spraying of these farms but unfortunately, they are often not equipped with protective clothes or masks."	
		Muilerman 2013: "Agrochemicals are the source of the most severe occupational and health safety (OSH) risks. Among the most alarming observations during the survey were the frequent presence of unprotected cocoa farmers and household members (including pregnant women and children) during spraying, the large percentage of cocoa farmers who touched farm chemicals with their bare hands, and the dangerous techniques cocoa farmers employ to assess the potency of farm chemical mixtures." Muilerman 2013: "Half of the respondents had injured themselves in such a way in the last 2 years that they needed treatment."	
		Okoffo et al. 2016: "The results further revealed that 35 and 45 % of farmers put on full and partial PPE [including cap/hat, respirators, goggles, rubber gloves, overall and wellington boots (rubber boots)] respectively during pesticide application. However, twenty percent (20 %) of farmers applied pesticides without wearing PPE, and gave reasons of high cost of PPE, non-availability in the market, not having PPE, discomfort in usage of PPE, and no need for PPE among others."	
Are wages/incomes "living wages"?		Asamoah et al. 2013 "A comparative analysis of the survey data with GSS [Ghana Statistical Survey] poverty lines indicated that 7.4 percent and 11.4 percent of the total members living in the 637 households surveyed were extremely poor and poor respectively."	
		7 out of 13 farmers reported that their income is not enough to sustain	

Is there an access to social security?		There is no national social security scheme for farmers for now.	
		Farmers' interviews: only one farmer out of 13 had social security because he used to be a school teacher.	
		Ghana Statistical Service (2014) indicates that 70.9 percent of currently employed population over 15 are not entitled to any social security.	
Is there an access to health insurance?		Muilerman 2013: "On average, only half of the members in cocoa farmers' households are covered [with national health insurance scheme]."	
		Ghana Statistical Service 2014: "The proportion of the population registered or covered in by a health insurance scheme in the urban areas (71.5%) is higher than in the rural areas (63.9%)."	
		Farmers' interviews: all 13 interviewed farmers reported to have national insurance	
Is there an access to healthcare organizations?		Muilerman 2013: "Often respondents will seek medical help from modern health facilities only after trying home and herbal treatment and/or the pharmacist. Traditional healers may still perform first aid in case of accidents."	
		Heyen-Perschon 2005: More than a half of the rural population is not consulting medical personnel.	
Are multiple varieties of cocoa used? Are the varieties used adapted to local environmental conditions/resistant to diseases?		Kolavalli and Vigneri 2011: "Hybrid varieties outperform the older "Amazons" and "Amelonado" varieties in two ways—by producing trees that bear fruit in three years compared with at least five years for the older varieties, and by producing more pods per tree."	**Environmental capital**
		Oppong 2015: "Improved hybrids constitute about 31% of tree stock"	
		According to SPD, there no distribution of CSSVD tolerant varieties	
Are soils for cocoa in good conditions?		CRIG Soil Research: Soils are depleted, soil fertility is the main reason for low yields in Ghana	
		UNDP 2011: "degradation is a serious issue affecting the sustainability of cocoa production in much of West Africa. Impacts are felt on two scales: locally, as degraded soils can no longer sustain satisfactory cocoa productivity, and regionally, since farmers often move on from a particular area once the soil has become depleted."	
Are resource (soil, water, fuel, forests, minerals...) use rates due to the activity		Aneani and Ofori Frimpong 2013: "… in Ghana, most of the farmers establish their farms through clearing of the forest and burning the debris. This activity causes deforestation, land ruin, and depletion of soil nutrient (Quansah, Drechsel, Yirenkyi, & Asante-Mensah, 2000)"	
		Gockowski and Afari-Sefa 2011: "However, these systems [hybrid varieties], when not accompanied with fertilizer, can rapidly deplete soil nutrients and	

below regeneration rates rather than depleting them?		tend to have shorter production cycles because of the physiological stresses of higher yields as can be observed in the Western region of Ghana."	
		UNDP 2011: "The use of slash and burn techniques has led to reduced soil fertility through elevated nutrient release, loss of soil structure and stability, and lack of natural forest mulching that reduces soil and water loss from erosion and from poor water infiltration and retention in the soil. Near abandonment of traditional cocoa agroforesty systems in favor of zero shade cultivation methods has also resulted in widespread land degradation in the cocoa growing areas."	
		Ruf 2011: “The results obtained in Enchi and in the four other cocoa producing regions of Ghana demonstrate that as a whole the smallholder population is increasingly making a deliberate choice in favour of full sun or very light shade. Complex cocoa agroforests are rapidly disappearing in Ghana”.	
Are there critical emissions/ wastes from the activity?		Ntiamoah and Afrane 2008: “Though the use of the pesticides and fertilizer are assumed to be within acceptable limits, this study has revealed that they are a major contributor to the impacts in the cocoa production stage.”	
Are wastes reused/recycled?		Only 3 farmers out of 13 reported to give the plastic containers from fertilizers back to extension officers for reuse. Other farmers told that there was no such an option.	
		COCOBOD tries to collect plastic containers to prevent counter-feit distribution but it is not clear to what extent does the garbage collection programme work	
Are there measures, management, stewardship, planning, protection schemes which are enforced to protect resources and habitats?		COCOBOD and NGOs try to implement sustainability programmes and teach farmers safe and environmentally friendlier agricultural practices but the results of actual implementation of these practices by farmers is unclear.	
Is there an access to external financing (loans, credits)?		Farmers’ interviews: 19 out of 13 farmers do not take loans, 2 take loans from farmers’ association to which they belong and 1 farmer belong to organized group that has access to bank loans.	**Financial capital**
		CRIG Social Science: farmers have almost no access to credits.	
		Laven and Boomsma 2012: "Most cocoa farmers are not bankable. Increasingly business partners provide credit (in kind) to farmer groups."	

		Norde and van Duursen 2003: “One of the main perceived difficulties to increase the production is a lack of money to buy inputs. The current credit facilities are inadequate. Besides the fact that the distance to banks is high and that the history of banking in Ghana is overshadowed by cheating and low recovery rates, the prevailing interest rates are high (approximately 30%). This makes it very hard for a farmer to 1) borrow money and 2) to pay it back.”	
		Ghana Statistical Service (2014): 88% of rural households reported not to apply for loans within the past 12 months. About 60% members of rural households did not try to obtain loan because they already had too much debt to pay. 40% indicated that interests are too high. 54% could not provide collateral.	
Does the actor have possibility to generate funds for investment, maintenance, expansion?		Farmers’ interviews: 10 out of 13 farmers reported to have own savings.	
		CRIG Social Science: farmers usually have no knowledge on planning and savings.	
		Ghana Statistical Service: only 21.5 percent of households in the rural localities have savings accounts. In the rural localities, 45.4 percent of all households said they did not have enough money or income to operate a savings account, 29.2 percent said they did not have a regular income.	
Is there an access to business insurance against losses/damages?		COCOBOD Social Science: No insurance companies willing to insure farmers.	
		Farmers’ interviews: none of the interviewed farmers had an insurance. Insurance companies also confirm that they do not offer insurance for farmers. There is an effort of Ghana Agricultural Insurance Pool to develop insurance schemes for organized group of farmers but it is not yet implemented for cocoa farmers.	
Does the activity rely on distortionary subsidies?		CHED, CRIG Social Sciences: Farmers get a part of inputs for free from COCOBOD and are not really enthusiastic about buying more on free market	**Profitability**
Does the activity generate net positive profit and is still profitable in case of changes in demands/price?		Asamoah et al. 2013 "Indeed, total household expenditure in 2010 (GH¢5329.90), exceeds mean total income (GH¢4,596.25) by about (GH¢734.00), but this does not even include farm level expenditure as in the case of total household income which includes on-farm activities, and thus, further deepens the excess of expenditure over income. This excess also shows that either farmers are indebted and are on loans or that they are cushioned by their livestock, stock of wealth or on social capital which they indicated as earlier as support during any vulnerability. Interestingly, social obligations, communication and transport expenditure (i.e. the last five items on Table 8) seem to be high accounting for 20.7 percent of the expenditure of the farm households."	
		Results of the economical analysis conducted in Eastern region of Yahaya et al. (2015) showed that “the average production cost of cocoa was GHC 1.34 per kg and profit margin was GHC1.80 per kg in cocoa producer enterprises. The gross margin and net profit were calculated as GHC 956.78 and GHC	

		621.24 per hectare respectively. Relative profit was calculated as 1.49 which indicates that cocoa production in the study area is profitable."	
		7 out of 13 farmers reported that their income is not enough to sustain	
Is the financial flow permanent throughout the year?		CRIG Plant Breeding: Cocoa trees start bearing fruits after 2-3 years. Initial yields are low. The highest yields are between 8-18 years. After 25 years - economic lifespan	
		CRIG Social Science: specificity of the cocoa production: farmers have a bunch of money in January (due to the seasonal nature of cocoa). This requires knowledge on planning and savings, which farmers usually do not have.	
		Vignery and Santos (2008): "They [farmers] face serious liquidity constraints and with most of yearly income coming during the main harvest season, producers often find themselves short of cash by the time they reach the lean season, which falls roughly in the middle of the crop year."	
Are crop, livestock and forest production systems connected, and used symbiotically?		Farmers' interviews: 8 out of 13 farmers used organic fertilizers (poultry manure, cocoa husk, compost).	**Connectivity**
		CHED and NGOs teach farmers to plant economic and shade trees but the extent of the implementation is not clear.	
		CRIG Soil Research: Poultry manure becomes more and more popular	
		Ruf 2011: "Our examination of cocoa farmers' strategies in Ghana has shown that agroforests are now far from being complex. After forest clearing from the 1940s to 1970s/1980s, which led to the development of agroforests, farmers are now clearing the surviving forests and agroforests and replacing them with full sun farms, either of cocoa or rubber and oil palm, and possibly teak."	
Are there always clients for production?		Knudsen and Fold 2011: "The system ensures small-scale farmers' access to markets because there are more buyers in rural areas than previously, which reduces the dependence and asymmetrical power relationship between one buyer and many sellers. It has also become much easier to hand over the cocoa beans, as the LBCs have located their purchasing sheds within a much denser network than the one that previously existed."	
		Laven and Boomsma 2012: "The partly state-owned LBC (PBC) is also present in more remote areas which are avoided by LBC due to high transaction costs."	
		Asante-Poku & Angelucci (2013): "The price uniformity allows that farmers all over the country benefit equally (that is if transportation costs are not taken into account). However, in Ghana, farmers have the advantage that there are a large number of LBCs to choose from and as such farmers tend to choose LBCs that offer cash and credit facilities."	
		LBCs compete for quantities of cocoa purchased; they buy as much cocoa as they can. Produce Buying Company is present in the remotest areas.	

Is transportation system diverse, spatially distributed and equitably accessible?		Farmers' interviews: all farmers reported bad state of roads that makes it difficult to travel around and to reach facilities in case of an emergency.	
Does the communication support enable appropriate connectivity?		Laven and Boomsma 2012: "Most cocoa farmers lack an overview of possible markets (e.g. UTZ Certified, fair trade) they can supply their cocoa to."	
		Norde and van Duursen 2003 "Increased communication with farmers is difficult to attain because of 1) illiteracy of farmers. Many farmers can not read or write. Any written from of information is therefore ineffective and inefficient, 2) bad road conditions. Although the geographical distances are do-able in most cases, the average speed of travel is very low, 3) remoteness of farmers – especially in the western region, 4) the mere quantity of farmers. The energy and resources required to reach out to all the individual farmers is enormous."	
		The study of Baah and Anchirinah (2010) "has adduced evidence suggesting that stakeholders in the cocoa sector concur that cocoa farmers are not receiving the information and extension support that they require."	
		CRIG publishes and distributes among farmers a newspaper, which explain farming practices in simple words and in local language. There are also radio programmes. Farmers can call back if they have further questions or problems (kind of a feedback). CRIG started monitoring of the Cocoa Rehabilitation Programme launched in 2013 (to check) about the year ago. They engage around 2000 farmers for monitoring (random samples).	
		CHED divides cocoa growing area to operational areas. Each extension officer works with 16-20 communities. Farmers get extension services from officers and can provide them a feedback. CHED also runs radio programmes at community-based radio stations	
		Aneani F., Anchirinah V. M., Owusu-Ansah F. and M. Asamoah (2012): "The adoption rates of the CRIG-recommended technologies such as control of capsids with insecticides, control of black pod disease with fungicides, weed control manually or with herbicides, planting hybrid cocoa varieties and fertilizer application were 10.3%, 7.5%, 3.7%, 44.0% and 33.0%, respectively."	
Are there any single inputs/processors/stakeholders that this activity		Farmers can sell cocoa only to representatives of COCOBOD - LBCs. Farmer get seedlings only from COCOBOD. As a part of inputs comes from COCOBOD, many farmers prefer to rely on this supply and do not buy more inputs from private dealers. Moreover, inputs are considered expensive and are not always available or even accessible	**Diversity**

depends upon, with no alternative?		(especially in the remote areas). In addition, some farmers fear to buy fake inputs on the market.	
Are input resources sourced from multiple sources?		Fertilizers, pesticides and fungicides are sourced from COCOBOD and private input suppliers. Seedling are only received from COCOBOD.	
		Farmers' interviews: 7 out of 13 farmers reported to get inputs from COCOBOD and to buy the rest themselves if needed.	
		Laven and Boomsma 2012: "Input supply chains are underdeveloped, and there is no clarity on how such a supply chain can improve. In Ghana, the state-owned cocoa marketing board (COCOBOD) pursues a subsidy approach, providing inputs at below-market price, but effectiveness and coverage are insufficient to boost productivity sufficiently"	
		Jansen 2015: "Distortions from free fertilizer (Hi-Tech) and free sprayings (CODAPEC) are erratic, often late or insufficient while crowding out the private sector"	
Does the activity have multiple production sites/ machines which are spatially distributed?		Cocoa is grown in 6 regions in Ghana	
Are products sold/distributed via multiple diverse channels and markets?		Farmers sell their cocoa only to COCOBOD through LBCs.	
		Laven and Boomsma 2012: "With certification, farmer groups, LBC and other certificate holders are able to 'directly' access global markets for their certified produce (which is small-scale)." Laven and Boomsma 2012: "Most cocoa farmers lack an overview of possible markets (e.g. UTZ Certified, fair trade) they can supply their cocoa to. Farmers sell cocoa to PCs in their communities, giving preference to the ones they know, trust and who pay promptly" Potts et al. 2014 estimate the cocoa production in Ghana under third-party audited certification at 16% in 2012	
		Studies of Vignery and Santos (2008) and Anang (2011) show that farmers' choices are often restricted to one buyer. (Anang, 2011) explains it as follows: "a strong buyer loyalty, with producers preferring to sell to those buyers who provide certain incentives and cash rewards."	
		Farmers' interviews: 9 out of 13 farmers reported to sell cocoa to one LBC	

Is income generated by diverse activities/products?		Visited farmers grow food crops and vegetables for sale or self-consumption. Some farmers grow economic trees. COCOBOD and NGOs teach farmers to diversify their activities. However, the share of other source of income is not clear.	
Are records kept? (of past experiences, techniques, knowledge, disturbances)		CRIG Social Science: Farmers usually have no knowledge on planning and do not keep records	Information and learning
Are extension and advisory services available?		Norde and van Duursen 2003: "Currently, there is approximately one agric officer for approximately 3000 farmers. Also, the allocation of resources (both human and financial) is inadequate in most districts. This limited capacity is one of the main problems heard of when speaking to farmers about agric-officers in the field. It is generally stated that – since the take over – the incentives for the agric officers to do the job properly have been largely decreased (low salaries). Furthermore, most of the officers don't have their own mode of transportation; making is very difficult and timeconsuming to visit the farmer communities." Norde and van Duursen 2003: "Farmers have a high demand for extension services and the current system does not have the capacity to provide it adequately. So, since an increased productivity is in the interest of numerous stakeholders, there is a market for privatized extension services."	
		Dr. Francis Baah announced that "there are about 205 extension officers in the country and efforts are being made to employ about 100 people to guide cocoa farmers with essential technical know-how to produce more cocoa for the nation." (2014) (http://news.peacefmonline.com/pages/news/201406/202234.php)	
		Farmers' interviews: Visited farmers reported various frequencies of extension services from once in 2 weeks to 2 times per year. All farmers said that they need more knowledge.	
		Baah and Anchirinah 2010: "Studies by Baah (2006, 2007a) and Ministry of Manpower Youth and Employment (2008) indicate that the state of cocoa extension is far from the desired. For instance, in a study of over 3,000 cocoa farming households in 2007 – 2008, the national programme for the elimination of worst forms of child labour in cocoa (Ministry of Manpower, Youth and Employment, 2008) found that over 73% of farmers have received no extension support in the year preceding the study." Baah and Anchirinah 2010: "A recent survey of over 3,000 cocoa households revealed that 73% of respondents have not met an extension agent or received any extension support in a year (Ministry of Manpower, Youth and Employment, 2008)" "This study has adduced evidence suggesting that	

		stakeholders in the cocoa sector concur that cocoa farmers are not receiving the information and extension support that they require. "	
		Aneani F., Anchirinah V. M., Owusu-Ansah F. and M. Asamoah (2012): "The adoption rates of the CRIG-recommended technologies such as control of capsids with insecticides, control of black pod disease with fungicides, weed control manually or with herbicides, planting hybrid cocoa varieties and fertilizer application were 10.3%, 7.5%, 3.7%, 44.0% and 33.0%, respectively."	
		Hainmueller et al., 2011 ".. the results suggest that few farmers engage in practices that are recommended for raising productivity. While 90% of farmers report that they did weed at least once in the last year, only 70% report doing any pruning, only 21% report applying fertilizer, and only 37% report applying pesticides. Fertilizer use is as low as 9% in the Eastern region." "Overall we find that the adoption of recommended farming practices is rare among the cocoa farmers."	
		farmers often lack knowledge on the quality requirements that are established at the levels far from them in the cocoa chain because quality inspections are carried out by COCOBOD at the points where cocoa beans are already collected at LBCs warehouses (Quarmine, 2013).	
Does the actor have access to weather information?		Farmers' interviews: all 13 farmers had access to weather information through TV or radio.	
Are there early warning systems for disturbances?		During the workshop actors reported that the main source for information about disturbances and emergencies are mass media communication tools such as radio and television. Apart from mass media, rural communities rely on informal communication channels. The efficiency of the early warning systems in Ghana is unclear.	
Is an atmosphere of trust and respect cultivated between actors?		Baah et al. 2012: "Farmers contended that having many buying companies have not eliminated corrupt practices and that the malpractices are institutionalized but only the PCs are singled out for criticism. They mentioned that these malpractices have been known for years but very little has been done to address them."	
		Norde and van Duursen 2003: "Mistrust is a large problem in the cocoa sector in Ghana and this affects almost all areas. Historically, the farmers were cheated by the LBCs. The scales on which the cocoa bags were weighted form the basis for the amount paid to the farmer. These scales have often been tempered with. In the past, and even now, these practises still prevail. It was even stated that, on average, 4 kg of cocoa is stolen from the farmer on every (62,5 kg) bag of cocoa."	

		Norde and van Duursen 2003: "Furthermore, the banks sometimes mistrust the farmers. The farmers sometimes did not use the money for the agreed purpose, like buying inputs to improve farm yield. Instead, the farmer used it to build a house or simply to buy food for the family. So, the recovery rate of the loans became a problem, as the investment did not pay back."	
Is the knowledge base of actors sufficient for their activity?		Asamoah et al. 2013: "Ghanaian cocoa farmers still have low level of education. Only less than five percent of the sample heads had obtained formal education above senior high school and this, no doubt, has implications on efficient application of pesticides for diseases and pest management."	
		Norde and van Duursen 2003: "The main problem facing the farmer communities is lack of good education. In most cases, there are schools (although sometimes very remote) but there is a lack of (qualified) teachers and a lack of ordinary schoolbooks. The prevailing levels of illiteracy hamper the exchange of knowledge and access to information."	
		Mohammed et al. 2011: “Smallholder farmers are generally aged and also has very high illiteracy rate. These threaten the sustainability of the sector and also limit their ability to apply new technologies to enhance production.”	
Is the attitude towards doubts, uncertainty and failures open and constructive?		Baan and Anchirinah 2010: "Small-scale farmers are the most important stakeholders in as far as cocoa cultivation is concerned because they produce nearly all of Ghana’s output. However, interactions with the stakeholders indicate that farmers exert little influence in the formulation and implementation of policies that affect their activities and livelihood. "	
Is the actor planning his activity?		CRIG Social Science: Farmers usually have no knowledge on planning and do not keep records.	**Self-organization**
		Rainforest Alliance: Planning is a problem for farmers.	
Are records kept? (of past experiences, techniques, knowledge, disturbances)		CRIG Social Science: Farmers usually have no knowledge on planning and do not keep records	
Does the actor know what the main risks for his activity are? Is there capability to identify and anticipate		Farmers’ interviews: farmers listed shocks to which they are exposed. They were well aware of climate change and its implications of farming activities. Evidences from experts confirm the shocks mentioned by farmers.	

problems (and risks)?			
Does the actor have autonomy and control over the activity, and his own resources?		CRIG Social Science: “there is a problem of land tenure a. caretakers are not thinking for a long-term success. b. farm is divided into many small pieces among family when inherited.”	
		Knudsen and Fold 2011: "land rights are not stable and cannot be taken for granted." Knudsen and Fold 2011: "In practice, the abunu contract is not necessarily clearly agreed upon at the outset of the landowner–tenant relationship, but according to Takane (2002), the ambiguity in the contractual outcome constitutes both uncertainty and flexibility for both parties."	
		Acheampong et al. 2014: "instead of one person having all the rights to a given plot of land and the resources on it, the bundle of rights may be divided up. It may be divided according to the resource: the land is owned by one person, the trees by another. It may also be divided according to the way the resource is exploited: one person may be considered the owner of a tree and have exclusive rights to chop it down or collect the firewood but many other people may have rights to collect fruits or leaves. Or, the rights to the resource may change over time: one person may hold land for cultivation purposes during the rainy season while it becomes pasture with much less restrictive rules of access during the dry season (Freudenberger 1994: 5). "	
		Laven and Boomsma 2012: "Farmers unwillingness to invest can also be linked to the unlikeliness of reaping the future benefits of the investment (e.g. sharecroppers might not be sure if they will receive part of the premium for certified cocoa, or whether the land-owner will claim this reward)."	
		COCOBOD have a right to clear off the farm in case of CSSVD.	
Is self-organization, networking, initiative, association among actors enabled?		CHED encourages and organizes farmers' groups to facilitate the input provision and for some cases improve the access to credits. 4-5 in a community app. 30 farmers per group	
		Laven and Boomsma 2012: "The overall majority of cocoa farmers is not formally organized." Laven and Boomsma 2012: "This (forming farmers' groups) is a powerful idea but first experiences with lead farmers show that there are quite a number of issues that need to be resolved before this model is really effective. This can be because of a misperception of who actually the lead farmers are, and whether or not they have the legitimacy to act on the behalf of other farmers or whether they have sufficient knowledge and expertise to train other farmers. It can also be challenging to keep lead farmers motivated and committed, as being a lead farmer is time-consuming." Laven and Boomsma 2012: "There is little incentive in place for farmers to organize in more traditional organizations, like cooperatives. Cooperatives not only have a bad reputation, but also because the benefits of being	

		organized are not immediately clear (e.g. there is not a lot of room for collective negotiation as prices are fixed)."	
		Potts et al. 2014: the cocoa production in Ghana under third-party audited certification was estimated at 16% in 2012	
		Norde and van Duursen 2003: "64% of the farmers believe that the farmers should start a co-operative. This is obviously true but in reality, the average farmer does not have an attitude of initiative, self-determination, and does not feel responsible, especially when it comes to group matters or communal issues." Norde and van Duursen 2003: "Currently, most farmers work individually and don't exchange information regarding farm management practices. They hardly work together. The problems are that they are ill informed as a group. They don't exploit opportunities with respect to bargaining power, credit facilities, economies of scale and communal improvement projects. A lack of organisational capacity also has limiting effect on the potential gains from the government, the banks, the LBCs, the CRIG research Institute and some NGO's. Because of this lack of organisation, the farmers are ill prepared for complete liberalisation."	
		Baah et al. 2012: "…. whilst governmental interest may be necessary to safeguard their interest, the absence of a strong, truly representative farmers' organization means that farmers have little leverage in these matters. "	
		World Bank 2013: "Among cocoa farmers in Ghana, less than 10% are members of a cooperative or other farmer association. This limits their ability to benefit from a number of typical advantages offered by farmer grouping such as volume purchasing of inputs, shared labor, and credit saving schemes. Related to this are low literacy rates among rural farming communities throughout Ghana that hinder farmers' capacity to manage their limited resources more effectively."	

Is there opportunity for experimentation and innovation?		Aneani F., Anchirinah V. M., Owusu-Ansah F. and M. Asamoah (2012): "The adoption rates of the CRIG-recommended technologies such as control of capsids with insecticides, control of black pod disease with fungicides, weed control manually or with herbicides, planting hybrid cocoa varieties and fertilizer application were 10.3%, 7.5%, 3.7%, 44.0% and 33.0%, respectively." Aneani F., Anchirinah V. M., Owusu-Ansah F. and M. Asamoah (2012): "Fertilizer adoption decision is affected by access to credit and number of cocoa farms owned by the farmer. The decision on weeding frequency is also influenced by gender of the farmer and cocoa yield. The adoption of cocoa variety is affected by age of the farmer and educational status. The adoption decision on frequency of spraying against capsids tended to be influenced by migration, cocoa farm size and yield. The adoption rates of insecticide and fungicide applications to control pests and diseases were low as compared to those of hybrid variety use and fertilizer application. This might be due to the inadequate funds of the farmers to purchase the relatively expensive chemicals, scarcity of labour and the fear that, for example, herbicides would kill intercrops like cocoyam (MASDAR, 1998)"	**Transformability**
		There is definitely a room for innovation, e.g. to cover the yield gap and to improve socio-economic conditions of cocoa farmers.	
Is the land tenure of the activity equipped with fair rights? Is there equitable access to land for the activity?		Throup 2011: "Customary land law governs the allocation of property rights in Ghana, and even in the capital city of Accra, the local Ga chiefs regularly intervene to oppose development projects and land transfers supported by the mayor and the City Council. Control over the allocation of land under customary law rests with the head of the family, and only he has the authority to sell, mortgage, or lease the property. This can lead to frequent conflicts, especially because the customary laws of different tribes are sometimes diametrically opposed. "	**Equitability**
		Laven and Boomsma 2012: "Farmers unwillingness to invest can also be linked to the unlikeliness of reaping the future benefits of the investment (e.g. sharecroppers might not be sure if they will receive part of the premium for certified cocoa, or whether the land-owner will claim this reward)."	
Is there equitable/ fair access to inputs (generational, gender, racial, religious etc)?		CHED: Only farmers whose farms are measured receive fertilizers. It is estimated that 60% of farms are measured now	
		Not all farmers receive seedlings (not enough or their farms have not been measured yet)	
		Laven and Boomsma 2012: "Not all farmers benefit equally from subsidized prices; no equal opportunity for accessing inputs"	
		MOFA 2007 "Majority of women in agriculture have limited access to land, labour and capital due to cultural and institutional factors. Access to land is often restricted to usufruct rights only; women cannot provide collateral for credit because they may not have legal ownership of tangible assets."	

		MOFA 2007: “Discrimination against women in the land allocation processes is widely reported. Fewer women obtain land, and when they do they often have smaller and less fertile pieces of land, which they tend to hold on less secure terms than those of men. Less than one third (31%) of households headed by women own land.”	

Internal marketing

Question	Rating		Attrib.
Are input resources available, accessible and affordable?		Yes, LBCs operate in different areas and compete to buy more from farmers. Competition may be dense, therefore LBCs try to purchase cocoa as fast as possible.	Buffering capacity
Does the actor maintain stocks of inputs and/or of products?		LBCs’ interviews: all 5 respondents had stocks	
		Stocks are necessary for LBC’s activities. After having purchased it from farmers, they collect cocoa and invite QCD to check its quality.	
Does actor have spare capacity in case of increased demand?		yes, LBCs revenues depend on the quantities of cocoa purchased.	
Is there an access to business insurance against losses/damages?		LBCs’ interviews: all 6 LBCs reported to have full insurance for cocoa, storages and vehicles.	
Is there an access to social security?		LBCs’ interviews: LBCs pay social security only for their permanent workers	Social capital
Is there an access to health insurance?		No information available	
Is there an access to healthcare organizations?		Yes, most of employees live in cities or village, where the healthcare facilities are available.	
Are there critical emissions/ wastes from the activity?		No identified critical emissions or wastes	Environmental capital
Are there measures, management, stewardship, planning, protection schemes		LBCs’ interviews: 4 of 6 LBCs reported to collaborate with NGOs and certification bodies to teach farmers on how to resist climate change and grow cocoa in a more sustainable way.	
		Potts et al. 2014 estimate the cocoa production in Ghana under third-party audited certification already at 16% in 2012.	

which are enforced to protect resources and habitats?			
Is there an access to external financing (loans, credits)?		almost all LBCs finances are external, from COCOBOD or from banks	**Financial capital**
Does the actor have possibility to generate funds for investment, maintenance, expansion?		Kovalalli et al. (2012): "Many of the local LBCs now appear to be in a position to raise funds domestically at competitive rates as banks have realized that cocoa purchasing is a viable operation."	
Is there an access to business insurance against losses/damages?		LBCs' interviews: all 5 LBCs reported to have full insurance for cocoa, storages and vehicles.	
		2 visited insurance companies confirmed provision of services to LBCs	
Does the activity rely on distortionary subsidies?		COCOBOD provides money (seed fund) on the lower interests for LBC to buy cocoa from farmers on behalf of COCOBOD	
Does the activity generate net positive profit and is still profitable in case of changes in demands/price?		LBCs' interviews: LBCs make good profit	**Profitability**
Is the financial flow permanent?		Most of operations take place at the end of cocoa seasons. It is unclear to what extent are LBCs engaged in non-cocoa activities.	
Is transportation system diverse, spatially distributed and equitably accessible?		LBCs' interviews: 4 of 5 LBCs reported that rural roads is of a big problem for their activities.	**Connectivity**
Does the quality control assure appropriate traceability?		Quality is assured by QCC	
Are there always clients for production?		COCOBOD buys all cocoa; world demand on Ghanaian cocoa is very high. In addition, LBCs can sell certified cocoa through COCOBOD to companies abroad	

Does the communication support enable appropriate connectivity?		Many actors are engages in the cocoa purchase on the regional level. Therefore, it is indeed difficult to ensure a transparent process of purchase and delivery of cocoa. Lack of transparency leads to embezzlement of funds. All 6 interviewed LBCs listed mistrust among their biggest problems.	
		World Bank, 2013: "In addition to operational risks linked to the external environment, LBCs face internal risks. Based on the responses of those interviewed, principal among these are financial management risks related to the misappropriation of company funds and assets. Though difficult to estimate, associated annual losses stemming from theft or embezzlement are thought to be considerable."	
Are there any single inputs/ processors/ stakeholders that this activity depends upon, with no alternative?		COCOBOD (buys cocoa and provides money to purchase cocoa from farmers)	**Diversity**
Are input resources sourced from multiple sources?		LBC buy cocoa from farmers in all cocoa growing regions	
Are the stocks spatially distributed?		Yes, in all districts where LBC buy cocoa	
Are products sold/distributed via multiple diverse channels and markets?		LBC sell cocoa only to COCOBOD. There is an opportunity to collaborate with international companies on a delivery of certified cocoa. Cocoa is collected from certified households, delivered to COCOBOD and then sold to international partners (according to Potts et al. (2014), around 16% in 2012 was certified).	
Is income generated by diverse activities/products? Does the livelihood depends on diverse activities/products?		LBCs' interviews: 2 of 5 LBCs only purchased cocoa, other purchased also cashew. Stakeholders workshop: Cocoa is the main activity of LBCs.	
Are records kept? (of past experiences, techniques, knowledge, disturbances)		World Bank, 2013: "In efforts to combat such risks [embezzlement of funds], some of the largest LBCs have made sizable investments in recent years in upgrading their book-keeping and workflow processes."	**Information and learning**

Does the actor have access to weather information?		yes	
Is an atmosphere of trust and respect cultivated between actors?		LBCs' interviews: All 5 LBCs reported that trust is a problem. There is a lack of trust with district managers, purchasing clecks and haulers. Farmers sometimes try to sell cocoa, which is not sufficiently dry.	
		Laven and Boomsma 2012: "For PCs, getting commission based on volumes, gives a perverse incentives to be very strict on quality control while buying their cocoa."	
		QCC: LBCs force farmers to sell cocoa as quickly as possible and it affects the quality of beans	
Is the knowledge base of actors sufficient for their activity?		Yes, LBCs hire people with enough knowledge level based on recommendations ad interviews	
Are records kept? (of past experiences, techniques, knowledge, disturbances)		yes	**Self-organization**
Does the actor have autonomy and control over the activity, and his own resources?		LBC get their licenses from COCOBOD. They work with many people in remote areas, which makes it difficult to control the activity	
Is self-organization, networking, initiative, association among actors enabled?		LBCs provide certification trainings for farmers, but the extent is not large (according to Potts et al. (2014), around 16% of cocoa in 2012 was certified).	
Is there opportunity for experimentation and innovation?		Definitely. LBCs are a link between farmers and other actors. Their position in the value chain opens infinite opportunities to improve the connectivity. There are examples of cooperation of LBCs with NGOs to organize farmers' groups and facilitate delivery of inputs and extension. However, mistrust between actors and vast purchasing network hamper flexibility of LBCs to change and innovate.	**Transformability**

Transportation

Question	Rating		Attrib.
Are input resources available, accessible and affordable?		Transporters' interviews: all three transporters reported that trucks and spare parts are very expensive. Everything is imported.	Buffering capacity
Does actor have spare capacity in case of increased demand?		Yes, visited transporters say that they always look for more job.	
Is there an access to business insurance against losses/damages?		Transporters' interviews: bad roads destroy vehicles and maintenance is very expensive. That is why insurance is necessary for the activity	
		Two visited insurance companies confirmed to offer insurance to transporters	
Is there enough tools, are they in good conditions?		Transporters' interviews: Trucks are heavily destroyed by the roads	
		Pedersen 2001: "Loading and unloading is almost universally done manually, as forklift and other mechanical equipment in general is only available at the harbours and the multinational companies, for instance the mining companies."	
Is there an access to social security?		According to Most Akpakpavi (2015), most of automobile repair garages in Ghana operate under informal sector.	Social capital
		According to Ghana Statistical Service (2010), the informal economy accounts for 85% of total employment. http://www.statsghana.gov.gh/docfiles/employ_15_64_reg_dist_2010.pdf	
		Osei Boateng and Ampratwum 2011: "The numbers of informal sector workers who have access to social benefits through institutionalized social security schemes are negligible. By March 2011, the Informal Sector Fund, a subsidiary pension scheme operated by the Social Security and National Insurance Trust (SSNIT) had enrolled 83,448 (SSNIT Informal Sector Fund, 2011); 85 percent of which were formal sector members."	
		Transporters' interviews: 2 of 3 transporters did not provide social security for their employees.	
		Ghana Statistical Service (2014) indicates that 70.9 percent of currently employed population over 15 are not entitled to any social security.	
		Osei Boateng and Ampratwum 2011: "Ghana operates a National Health Insurance Scheme based on premium subscription. Formal	

Is there an access to health insurance?		sector workers who are members of the SSNIT pension scheme are covered but informal sector members pay direct premium of between GH¢7.20 to GH¢ 48.00 (US$ 5.14 - $34.29). By 2009, premium contributors [to NHIS] (presumably informal sector workers) numbered 4,132,783, representing about 29 percent of the scheme's total membership. The number represents about half of estimated informal sector workforce in Ghana."	
		Ghana Statistical Service (2014)"Overall, 67.6 percent of the population are registered or covered by the health insurance scheme"	
Is there an access to healthcare organizations?		Pedersen 2001: "A large share of the trucks are located in the large urban areas."	
		Healthcare organizations concentrate in urban areas.	
Are there critical emissions/ wastes from the activity?		According to Ntiamoah and Afrane (2008), the transportation stage is relatively the most environmentally friendly compared to other activities of the cocoa value chain.	**Environmental capital**
		During the field work, it was observed that many transporters have their own repair garages, which helps them to reduce maintenance and repair costs for their vehicles. The wastes of such a garages are oil and used spare parts.	
Are wastes reused/recycled?		Study of Akpakpavi (2015) and Nyamekye (2012) reveal lack of disposal standards for used oil disposal and storage and recycling of parts after use. Wastes are usually dumped at landfills and contribute to contamination of water and soils especially in industrial areas.	
Is there an access to external financing (loans, credits)?		Transporters' interviews: 2 of 3 transporters reported not to take loans because of high interests.	**Financial capital**
		Trucks and spare parts are very expensive; therefore, external financing is crucially important. All three visited transporters mentioned it as a factor restricting their activities.	
Does the actor have possibility to generate funds for investment, maintenance, expansion?		Visited transporters say that savings is their strategy to cope with high interests on loans. Nevertheless, it is difficult for small and medium enterprises to sustain their businesses and invest in expansion because spare parts and trucks are very expensive.	
Is there an access to business insurance against losses/damages?		Transporters' interviews: bad roads destroy vehicles and maintenance is very expensive. That is why insurance is necessary for the activity	
		Two visited insurance companies confirmed to offer insurance to transporters	

Does the activity generate net positive profit and is still profitable in case of changes in demands/price?		yes	**Profitability**
Is the financial flow permanent throughout the year?		Pedersen 2001: "The high seasonality of the transport market means that very few trucks drive for more than 200 days a year and most drive considerably less. Many of the trucks active in the cocoa evacuation only operate 6 months a year and as there is typically only one driver per truck they clearly do not drive every day during that period. The many trucks needed to satisfy the peak transport demand means that there is a large over-supply during the low season. Therefore many trucks are only kept in operation during the peak season."	
		Hauliers' interviews: To mitigate the seasonality, transporters diversify their activities	
Is transportation system diverse, spatially distributed and equitably accessible?		Pedersen (2001) shows that rural transporting that accounts only for 4 % of total transport distance makes almost a half of total transport costs from Ghana to Europe and is almost 500 times more expensive than maritime transport in USD tonne-km (Pederson 2001).	**Connectivity**
		Transporters' interviews: roads are bad. Vehicles get in the accidents and require constant maintenance.	
Are there always clients for services?		It is a big problem for transporters to get orders from LBCs. LBCs buy own trucks and do not give work to transporters or send them to the areas with the worst roads.	
		Pedersen 2001: "The high seasonality of the transport market means that very few trucks drive for more than 200 days a year and most drive considerably less. Many of the trucks active in the cocoa evacuation only operate 6 months a year and as there is typically only one driver per truck they clearly do not drive every day during that period. The many trucks needed to satisfy the peak transport demand means that there is a large over-supply during the low season. Therefore many trucks are only kept in operation during the peak season. Still the trucks which do operate during the low season often have to wait days or even weeks at the lorry parks for new long distance jobs."	
Does the communication support enable appropriate connectivity?		Pedersen 2001: "One of the large problems especially in the African/Ghanaian trucking industry is the difficulties in matching the supply and demand of transport due to poor communication." Pedersen 2001: "However, the efficiency of the trucking industry is low. This is partly due to a combination of old trucks, poor	

		management and a system of traffic coordination which limits competition; but there is also a number of structural reasons for the low efficiency, such as an unbalanced and seasonal market which makes it difficult to obtain return freight, and a poor road and communication infrastructure, which results in low speed and makes it difficult to link supply and demand." Pedersen 2001: "Also practically none of the trucks have modern communication equipment, such as radio or telephone."	
		Although transportation is an important step of the cocoa value chain, transporters seem to be excluded from the information flow. During the interviews, it was reported that mistrust takes place between transporters and LBCs. There are plans to transport cocoa by railway, once the railway system is reconstructed.	
Are there any single inputs/ processors/ stakeholders that this activity depends upon, with no alternative?		No, the activity is characterized by the high level of diversification of input and output channels.	**Diversity**
Is income generated by diverse activities/products?		Transporters' interviews: all three transporters reported to have farms and transport many commodities such as rice, water etc. Also, every visited transporter had maintenance garage.	
		Pedersen 2001: "The high seasonality of the transport market means that very few trucks drive for more than 200 days a year and most drive considerably less. Many of the trucks active in the cocoa evacuation only operate 6 months a year and as there is typically only one driver per truck they clearly do not drive every day during that period. The many trucks needed to satisfy the peak transport demand means that there is a large over-supply during the low season. Therefore many trucks are only kept in operation during the peak season. Still the trucks which do operate during the low season often have to wait days or even weeks at the lorry parks for new long distance jobs."	
Are records kept (of past experiences, techniques, knowledge, disturbances)?		Pedersen 2001: "practically none of the trucks have modern communication equipment, such as radio or telephone. Very few even in the large companies are equipped with a tachometer and even the imported truck that do have it do not use it. Even the speedometer mostly do not function, which is one of the reasons why very few transporters know how many kilometres a year their trucks run."	**Information and learning**
Does the actor have access to		Yes, radio, TV	

weather information?			
Is the knowledge base of actors sufficient?		Pedersen 2001: “However, the low efficiency is also due to inefficient management of the trucks. The many absentee truck owners with no training in truck management and little interest in it is one reason.	
Is an atmosphere of trust and respect cultivated between actors?		Some LBC reported to mistrust hauliers to transport cocoa.	
Is the actor planning his activity?		Transporters’ interviews: transporters plan logistics to place vehicles closer to evacuation sites.	Self-organization
		Pedersen 2001: “In the absence of the owner it is the driver who becomes responsible for the daily management of the truck, but often without any knowledge about the financial status of the enterprise and without the power to make the necessary decisions. And where absentee owners own more than one truck they will tend to be operated individually with little or no coordination.”	
Are records kept (of past experiences, techniques, knowledge, disturbances)?		Pedersen 2001: “practically none of the trucks have modern communication equipment, such as radio or telephone. Very few even in the large companies are equipped with a tachometer and even the imported truck that do have it do not use it. Even the speedometer mostly do not function, which isone of the reasons why very few transporters know how many kilometres a year their trucks run.”	
Does the actor have autonomy and control over the activity, and his own resources?		Pedersen 2001: “The commercial trucking industry is organised jointly by the government and a number of trade unions and associations, but the government regulation is very limited. Anyone with a vehicle can operate it commercially.”	
Is there opportunity for experimentation and innovation?		There is a room for logistical improvement.	Transformability
		Pedersen 2001: “However, the low efficiency is also due to inefficient management of the trucks. The many absentee truck owners with no training in truck management and little interest in it is one reason. As is typical in small African businesses investments are treated as sunk cost, and focus is on the cash flows only and savings for reinvestment and maintenance are most often not made.”	
Is there equitable/ fair access to inputs (generational,		Transporters reported difficulties to get order from LBCs for cocoa transportation	Equitability
		“…. Market [of bigger haulage companies] is not competitive, rather contracts appear often to be allocated politically, and according to	

gender, racial, religious etc)?		some interviewed persons in the transport industry large kick-backs have to be paid to get the contracts."	

Processing

Question	Rating		Attrib.
Are input resources available, accessible and affordable?		Processors' interviews: both interviewed companies constantly experience bean supply and energy shortages.	Buffering capacity
		Kolavalli and Vigneri 2011: "The government allows only a limited quantity of low-quality beans to be used for local processing, which has resulted in considerable underutilization of existing capacity in the country"	
		J. Acheampong 2015: "In 1966, the Asutuare sugar factory in the Eastern Region started operations while the sugar mill at Komenda in the Central Region also began operations in 1967. Both factories have ceased productions and the country continues to import sugar to date. "http://www.graphic.com.gh/business/business-news/45869-moves-to-revive-sugar-production.html#sthash.Ok3rLkEx.dpuf	
		According to Sutton and Kpentey (2012), cocoa beans are mainly sourced from COCOBOD CMC, milk and sugar are imported. Packaging materials - local. Power is expensive and unreliable	
		At the workshop, bean and utility supply shortages was mentioned among 5 most significant shocks affecting processing activities.	
		COCOBOD Official Site 2016: On the average, only 10 – 15% of cocoa produced in Ghana is small size beans which is sold at a 20% discount to the local processing companies. 85-90% is big size beans which is of premium quality and is sold on the international market at a premium. https://cocobod.gh/news_details/id/92/ GHANA%20DID%20NOT%20IMPORT%20ANY%20COCOA%20FROM%20COTE%20D%E2%80%99IVOIRE	
Does the actor maintain stocks of inputs and/or of products?		Processors' interviews: processors try to have as much stocks as possible to cope with unreliable bean and utility supply.	
Does actor have spare capacity in case of		Processors interviews: companies already experience shortages, which makes them to function below their capacities. Unstable and insufficient supply significantly limits the processing capacities.	

increased demand?			
Is there an access to business insurance against losses/ damages?		Both processors reported to have full coverage insurances. Interviews with 3 insurance companies confirmed that processing companies have good access to insurance.	
Is there an access to disaster management organizations?		Disaster management organizations are available in industrial areas	
Are there protective measures used to protect health of laborers?		One of the visited processors had a doctor available in the factory.	**Social capital**
		Processors interviews: processing companies work with international partners and try to comply the international standards. Therefore, they try to maintain labor safety standards.	
Is there an access to social security?		Cocoa processing operate under formal sector of Ghana's economy and provide compulsory social welfare to their employees.	
		Processors' interviews: both processors reported that their workers are covered with national Ghanaian insurance scheme.	
Is there an access to health insurance?		Processors' interviews: both processors reported to provide healthcare insurance that covers services at Cocoa Clinic.	
		Formal workers are more likely to be covered by the National Health Insurance Scheme	
Is there an access to healthcare organizations?		Cocoa processing factories are concentrated in industrial areas close to inland or coastal ports such as Tema, Takoradi and Kumasi. There are many healthcare facilities around these areas. Workers of cocoa processing industry have access to Cocoa Clinic.	
Are there critical emissions/ wastes from the activity?		Afrane 2008: "Industrial processing of cocoa beans was found to be the most predominant stage in the environmental impacts of photochemical ozone creation potential (95.84%), global warming potential (80.89%), atmospheric acidification potential (96.47%) and abiotic depletion potential (76.35%). The production and consumption of fossil fuels in boilers and roasters were identified as the main cause of environmental impacts in the cocoa processing stage."	**Environmental capital**
Are wastes reused/recycled?		Afrane 2008: "The main by-product from the processing industry, cocoa shell, is no longer considered a solid waste, as it is being processed and packed for sale as animal feed by the Cocoa Processing Company"	

		Visited cocoa waste company reported to collect wastes from cocoa processing factories.	
		Processors' interviews: both processors reported to sell cocoa shells for fertilizers.	
Is there an access to external financing (loans, credits)?		Although Ghanaian banks provide loans and credits for processing companies, inflation and high interest rates (around 40%) discourage processors from taking loans. International companies prefer taking loans abroad to avoid high interests and inflation of cedi.	**Financial capital**
Does the actor have possibility to generate funds for investment, maintenance, expansion?		Underutilization of processing capacities due to bean and utility shortages limits possibility to generate autonomously significant funds. Companies that belong to bigger international chains can get funding from their "mother" companies.	
Is there an access to business insurance against losses/damages?		Both processors reported to have full coverage insurances. Interviews with 3 insurance companies confirmed that processing companies have good access to insurance.	
Does the activity rely on distortionary subsidies?		ActionAid Ghana 2014: "Here companies are given time limits typically between 5 to 15 years from the start of their operations in Ghana where they are exempt from paying taxes." ActionAid Ghana 2014: "Commercial Processors of cocoa by-products enjoy 5 years income tax exemption from the date of start of operation"	**Profitability**
Does the activity generate net positive profit and is still profitable in case of changes in demands/price?		Kolavalli and Vignery 2011: ".. because of the limited conditions under which semi processed cocoa can be transported effectively (Fold, 2002), it is not clear whether local value adding will be sufficiently profitable for international companies to expand their operations in the country. Informal discussions with the private sector participants indicate that the net benefits from processing locally may not be significant, particularly because the government allows only a limited quantity of low-quality beans to be used for local processing, which has resulted in considerable underutilization of existing capacity in the country"	
		Jansen 2015: "Domestic grinders are generally not profitable and are in debt."	
		Processors' interviews: one company reported to be profitable. Another company had constant losses due to the undersupply of beans.	

		Jansen 2015: “Processing companies face high operating costs.”	
Is transportation system diverse, spatially distributed and equitably accessible?		Processing companies are located in easy accessible industrial areas, where the roads are good.	Connectivity
Does the quality control assure appropriate traceability?		Processors’ interviews: thanks to QCC, cocoa beans can be traced up to a district level. On the factory level, the quality of beans, all processing activities are under rigorous control.	
		Kolavalli and Vigneri 2011: “Companies tend to fulfill the compliance requirement for the European markets, some companies have laboratories for quality control.”	
		Jansen 2015: “In-country processing companies do not always meet quality and hygiene standards demanded by end-users. “	
Are there always clients for production?		Processors’ interviews: processors reported high demand on semi-finished products.	
		Sutton and Kpentey 2012: "Ghana’s semi-processed products such as cocoa liquor, cocoa butter and cocoa cake are competitively priced on the world market. However, the industry is not competitive in the market for finished products, and the biggest challenge is to move into exporting finished products to the international market."	
		According to Cocoa Processing Company, demand for cocoa products in Ghana is undersupplied.	
		Local witness: “African people do not like processed food. Parents prefer not to give it for children so they do not grow soft. Even if a guest gives a chocolate for a child, parent will not like it.”	
Does the communication support enable appropriate connectivity?		Processors interviews: communication within facilities are well organized. Communications with the COCOBOD are highly formalized.	
Are there any single inputs/ processors/ stakeholders that this activity		Raw cocoa comes mostly from COCOBOD. There is an opportunity to import cocoa from abroad but this is a more expensive option that is often not economically efficient. To protect the domestic market, Ghana applies a duty of 20 percent on cocoa imports (Asante-Poku & Angelucci, 2013).	Diversity

depends upon, with no alternative?		According to Abubakar (2016), 2 out of 11 processors import beans in addition to purchases from CMC.	
Are input resources sourced from multiple sources?		Raw cocoa comes mostly from COCOBOD. There is an opportunity to import cocoa from abroad but this is a more expensive option that is often not economically efficient. To protect the domestic market, Ghana applies a duty of 20 percent on cocoa imports (Asante-Poku & Angelucci, 2013). Processors interviews: Milk and sugar are imported.	
Are products sold/distributed via multiple diverse channels and markets?		Processors sell most of semi-processed products abroad to different companies.	
		Sutton and Kpentey 2012: "Ghana's semi-processed products such as cocoa liquor, cocoa butter and cocoa cake are competitively priced on the world market."	
Is income generated by diverse activities/products?		Overall, all produce of cocoa processing companies is cocoa-based.	
		According to Sutton and Kpentey (2012), biggest cocoa processing industry in Ghana mainly produce cocoa-based products, although in different forms	
		Main semi-finished products of cocoa processors in Ghana are: cocoa liquor, cocoa butter and cocoa powder (Asante-Poku & Angelucci, 2013).	
Are records kept? (of past experiences, techniques, knowledge, disturbances)		Cocoa processing activities are well organized and managed	**Information and learning**
Are there early warning systems for disturbances?		Processors' interviews: both visited factories had fire detectors.	
		Processing equipment works on gas or fuel. Overall, there is much attention paid to avoid and prevent fire.	
Is the knowledge base of actors sufficient for their activity?		Visited processors reported that there is no lack of educated workers	
Is there investment in education and knowledge development of actors?		Processors provide compliance trainings for employees.	

Is the actor planning his activity?		Planning is needed to overcome constant bean and utility supply shortages.	**Self-organization**
Are records kept? (of past experiences, techniques, knowledge, disturbances)		Cocoa processing activities are well organized and managed	
Does the actor know what the main risks for his activity are? Is there capability to identify and anticipate problems (and risks)?		yes	
Are there plans to address any risks from hazards and emergency situations with scripts for actors in case of such an event?		Yes processors organize trainings on how to avoid fire and how to act if there is a fire outbreak in the factory.	
Does the actor have autonomy and control over the activity, and his own resources?		Companies that belong to international operate within strategic objectives of their parental chains. Local companies are more flexible	
Is self-organization, networking, initiative, association		Processors make efforts to closer work with farmers through NGOs or LBCs. There is not much information on the extent to which farmers are engaged in projects run by processors. Obviously, there could be more links to other actors. For example, processors do not organize mass production of products developed by Product Innovation department of CRIG.	

among actors enabled?		Essegbey and Ofori-Gyamfi 2012: "The major challenge facing the processing companies suggests that there should be greater linkages among them to enable joint strategizing. Moreover, although the processing companies relate strongly with the COCOBOD and the regulatory bodies such as the Food and Drugs Board and the Ghana Standards Board as they are required to do by the state regulations, their linkage with scientific institutions are not that strong. It is a weakness which does not facilitate innovation in the sector."	
Is there opportunity for experimentation and innovation?		Definitely. For example, in CRIG there is a department developing new products from cocoa waste. So far, these products have not been produced in mass.	**Transformability**
		Openness to change is restricted by unstable input supply and financial constraints associated with it. International companies operating under big supply chains often lose flexibility and initiative to innovate.	
		Essegbey and Ofori-Gyamfi 2012: "their [cocoa processors'] linkage with scientific institutions are not that strong. It is a weakness which does not facilitate innovation in the sector."	
Is there equitable/ fair access to inputs?		There is a limited amount of cocoa beans sold to processors. This fact already implies certain degree of non-equitability in access to cocoa beans among processors. The procedure on the proportions that go to different processors is not clear. Apparently, those who do not have financial constraints and are able to pay immediately are in a more favorable position.	**Equitability**

Food retail

Question	Rating		Attrib.
Are input resources available, accessible and affordable?		Retailers' interviews: two bigger retailers reported that cocoa products are not always available, whereas none of 20 small retailers has mentioned problems of getting cocoa products.	**Buffering capacity**
Does the actor maintain stocks of inputs and/or of products?		Retailers' interviews: none of the interviewed retailers had stocks of cocoa products. However, retailers reported that there is no need for that.	
Does actor have spare capacity in case of increased demand?		Retailers are limited by the capacities of local processing.	

Is there an access to business insurance against losses/damages?		Retailers' interviews: 7 out of 22 interviewed retailers reported to have an insurance	
Is there enough tools, are they in good conditions?		During the interviews retailers complained that chocolate melts because of inappropriate storage conditions.	
		Ortiz et al. 2010: "These goods [perishable items] tend to be sold directly to the consumer by the wives of producers and generally must reach the consumer within 24 hours due to lack of refrigeration." Ortiz et al. 2010: "Storage facilities are also a critical problem, since their shortage is posing great risks to perishable goods."	
		Meng et al. 2014: "Although open-air markets lack cold storage facilities and proper protection of product freshness, they appeal to buyers with competitive prices and travel convenience."	
Is there an access to social security?		Retailers' interviews: 3 of 22 retailers had social security.	**Social capital**
		According to Meng et al. (2014), traditional food retail outlets such as open-air markets and street hawking remain important in meeting the needs of low-income and rural households	
		MOFA and World Bank 2008: "the retail food market consists of (a) traditional open air markets with 65 percent of the total retail food sales; (b) small convenience stores and groceries with 30 percent of the food retail market; and (c) supermarkets with 5 percent of the market."	
		Ghana Statistical Service (2014) indicates that 70.9 percent of currently employed population over 15 are not entitled to any social security.	
		According to Ghana Statistical Service (2010), the informal economy accounts for 85% of total employment. http://www.statsghana.gov.gh/docfiles/employ_15_64_reg_dist_2010.pdf	
		Osei Boateng and Ampratwum 2011: "The numbers of informal sector workers who have access to social benefits through institutionalized social security schemes are negligible. By March 2011, the Informal Sector Fund, a subsidiary pension scheme operated by the Social Security and National Insurance Trust (SSNIT) had enrolled 83,448 (SSNIT Informal Sector Fund, 2011); 85 percent of which were formal sector members." Osei Boateng and Ampratwum 2011: "Urban food traders and processors include food sellers in the market, itinerant wholesalers	

		and retailers, bakers, caterers and cooked-food sellers. [….] They are also low-income earners and have no social security protection"	
Is there an access to health insurance?		Ghana Statistical Service (2014)"Overall, 67.6 percent of the population are registered or covered by the health insurance scheme"	
Is there an access to healthcare organizations?		Food retailers concentrate in urban and peri-urban areas, where access to healthcare facilities is generally not a problem	
Are there critical emissions/ wastes from the activity?		Products are sold in plastic bags, which contributes a lot to household rubbish.	**Environmental capital**
		Products are sold in plastic bags and then this plastic can be seen around all the city on the streets. Seems that for now there is no solution to it (personal observation)	
Are wastes reused/recycled?		Tompson (2008): "Ghana has waste management difficulties that extend from the state to the local municipalities, and refuse of all shapes and sizes is a common site in both urban and rural areas. These difficulties are concentrated and complicated by population pressures in the few heavily populated cities of which Accra is the most prominent."	
Is there an access to external financing (loans, credits)?		Ortiz et al. 2010: "finance is available through informal savings, credit associations, suppliers, money-lenders and rotating credit, however they may be expensive and they can be used exploitatively if individuals become tied into debt relations over many years (Ministry of Food and Agriculture, 2007)"	**Financial capital**
		Retailers' interviews: 4 out of 22 retailers reported to take loans	
Does the actor have possibility to generate funds for investment, maintenance, expansion?		Interviewed retailers told that profit is not sufficient for expansion and interests for loans are too high.	
Is there an access to business insurance against losses/damages?		Retailers' interviews: 7 out of 22 interviewed retailers reported to have an insurance	
Does the activity generate net positive profit and is still profitable in case of changes in demands/price?		Yes	**Profitability**

Is the financial flow permanent throughout the year?		Yes	
Is transportation system diverse, spatially distributed and equitably accessible?		In general, roads are bad, but retailers did not report it among the main problems during the interviews.	Connectivity
		"Road and transport infrastructure for the movement of agricultural commodities and inputs are inadequate, which aggravate women's time constraints and hinder their productive work (since are women who head-load goods when transport facilities are not available)"	
Are there always clients for services?		According to Cocoa Production Company, current demand for cocoa products is undersatisfied.	
		Retailers' interviews: 21 out of 20 retailers reported high demand on cocoa products	
Does the communication support enable appropriate connectivity?		Ortiz et al. 2010: "Price information is not formally disseminated; rather it is obtained by talking to others traders that were in the market."	
Are there any single inputs/ processors/ stakeholders that this activity depends upon, with no alternative?		no	Diversity
Does the actor have voice in the value chain decision making? Is there room for actors to have and express diverse opinions?		Retailers do not seem to intentionally promote consumption of cocoa products in Ghana, except of special Christmas gift offers.	
Are input resources sourced from multiple sources?		Yes	
Is income generated by diverse		retailers sell food and household chemical goods	

activities/products?			
Is an atmosphere of trust and respect cultivated between actors?		The information channels are most likely to be informal and built on trust.	Information and learning
		Osei Boateng and Ampratwum 2011: "There are however widespread evidence of failures of informal social security arrangement. Growing economic constraint and urbanization have affected kinship ties and ability for family members to provide support. More often, members of the family are either too poor themselves or have other competing demands for their resources (Osei-Boateng, Unpublished). Traditional savings mechanisms are also often characterized by theft and misappropriation. The essence of social security is sometimes missing in informal social security arrangements. Mutual associations and schemes rely on the loyalty and effort of their members to contribute, hence excluding the poor from benefiting."	
		One of retailers reported the failures in delivery arrangements. There is a lack of dispute mechanisms on inadequate quality or quantity a cocoa product delivered from the supplier.	
Is the knowledge base of actors sufficient for their activity?		Osei Boateng and Ampratwum 2011: "Urban food traders and processors include food sellers in the market, itinerant wholesalers and retailers, bakers, caterers and cooked-food sellers. These workers are mostly women, predominantly illiterate or semi-illiterate. They acquire their knowledge and skills largely from family."	
Does the actor have autonomy and control over the activity, and his own resources?		There is no state-regulated price policy in Ghana. Retailers seem to have autonomy in their activities.	Self-organization
Is self-organization, networking, initiative, association among actors enabled?		Although there is an evidence of formal and informal trade association in local markets (Lyon 2003), their role in the organization of activities of smaller retailers and implication on cocoa products retail is not clear.	
		Osei Boateng and Ampratwum 2011: "Traditional social networks have also been a source of social assistance to many operators in the informal sector. Extended family members provide for the aged and the disabled, the sick and the unemployed members of the family, the new born child and the mother, the orphaned and even the complete stranger (Kumado and Gockel, 2003). Mutual help associations based on either neighbourhood or trade are common among informal sector operators and provide avenue for sharing financial and social risks."	

		Osei Boateng and Ampratwum 2011: "There are however widespread evidence of failures of informal social security arrangement. Growing economic constraint and urbanization have affected kinship ties and ability for family members to provide support. More often, members of the family are either too poor themselves or have other competing demands for their resources (Osei-Boateng, Unpublished). Traditional savings mechanisms are also often characterized by theft and misappropriation. The essence of social security is sometimes missing in informal social security arrangements. Mutual associations and schemes rely on the loyalty and effort of their members to contribute, hence excluding the poor from benefiting."	
		The domestic retail of cocoa products accounts for a negligible share of income in the cocoa industry. Therefore, the inclusion and influence of the retail activity in the cocoa value chain is very limited.	
Is there opportunity for experimentation and innovation?		Retailers could play an important role in the promotion of domestic cocoa consumption.	**Transformability**
		Several factors hamper innovation and flexibility of the retail activity: limited access to loans and low connectivity (poor roads and lack of stable information channels).	
Is there equitable/ fair access to inputs (generational, gender, racial, religious etc)?		Ortiz et al. 2010: "women face more difficulties in obtaining formal credit, which has affected the size of load generally transported and the frequency of trips made" Ortiz et al. 2010: "price information is not formally disseminated; rather it is obtained by talking to others traders that were in the market. The situation becomes more complicated because inclusion in networks is not homogenous but discriminatory and depends on factors such as gender, ethnicity, wealth and age." Ortiz et al. 2010: "In central Ghana male are in the most likely to use broadcasted price information and in coastal Ghana, women have less access to radio."	**Equitability**
		MOFA 2007: "Majority of women in agriculture have limited access to land, labour and capital due to cultural and institutional factors. [……] women cannot provide collateral for credit because they may not have legal ownership of tangible assets"	