The nexus between sustainable value chain activities and financial benefits of the soybean value chain system in the Northern Regions of Ghana

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Abstract

Soybean is an important crop that contributes to economic freedom and food security. The study of soybean value chain is therefore important to improve on the activities of the chain actors for an overall economic gains. This paper aims to examine the nexus between sustainable value chain and financial benefits of the soybean value chain system in Ghana. Specifically, we employ the triple bottom line model to examine the soybean value chain from economic, social and environmental perspectives using sample data from Ghana. With a sample size of 300 including all actors of the value chain, our findings reveal that chain actors do not differ in their perceptions of overall financial gains that accrued to them with their involvement in chain economic activities. The findings further revealed that perceived financial sustainability of chain activities was affected by tangible financial benefits. Moreover, the results further show that chain actors' perception of social sustainability performance was significantly affected by expected overall financial gains that accrue to them as a result of their participation in chain economic activities.

Keywords: *sustainable value chain, financial benefits, economic activities, social sustainability, financial sustainability*

INTRODUCTION

Over the years, the value chain concept has proven useful for the identification and formulation of projects as well as in the development of strategies for improved agricultural enterprise development (Vermeulen *et al.* 2008). A value chain as introduced by porter (1985) is a full range of activities required to bring a product or service from conception through the different phases of production, transformation and delivery to final consumer and to final disposal after use (Zamora 2016; Kuwornu, Abdulai & Osei-Asare, 2013). The chain consists of a series of actors (or stakeholders) – from input suppliers, producers and processors, exporters and buyers-engaged in the activities required to bring a product from its conception to its end use (Kaplinsky and Morris, 2001). In many parts of the world, the emerging retail revolution is reshaping the way agricultural commodities are produced, procured and sold. Rapid changes in dynamic modern markets affects the entire

value chain-input suppliers, producers, processors, wholesalers, retailers and consumers – with immense impact on competitiveness and future viability of small-scale agricultural producers (Vermeulen *et al, 2008*).

The authors again observe that with modern markets replacing traditional market forms, outlets for small-scale producers are reducing quickly. Coming along with these changes is the risk of increasing poverty, not just for those producers but for entire rural communities. But they also note that, with the right support, small-scale producers can be efficient and reliable providers of quality produce. Such a production system requires a sustainable value chain system. The sustainable value chain system balances three key pillars-economic goals, societal goals and environmental goals, often referred to as the triple bottom line model (Mann and Kaur 2019). Since the triple bottom line model was introduced, it has been applied in several empirical value chain studies (Fearne 2009; Fearne & Dent 2012), but scarcely applied in the Ghanaian context. In the Ghanaian context only the study of Mensah-Bonsu et al. (2019) was identified but even that study was on poultry. There is no application of the triple bottom line model to soybean value chain analysis in Ghana in spite of its capabilities to balance off economic, social and environmental goals. This study is therefore the first to apply the model to examine the soybean value chain system in Ghana. The study further explores the relationship between sustainable value chain activities and financial benefits of the soybean value chain system.

The soybean value chain system is considered because according to Goldbitz (2009), soybeans have become the world's leading food and feed crop, providing more protein and vegetable oil than any other single commodity. He concludes 'the world has come to rely upon this efficient resource to feed both livestock and people directly.' It is within the context of this phenomenon that soybean cultivation in the northern part of Ghana is fast becoming a viable source of cash income, as soybean is increasingly being processed into a number of valuable products used in the fast food, snack, and convenience food and poultry industries in Ghana. The increased demand for processed soybean products has also been spurred on by growing middle class who are becoming increasingly aware of the importance of eating healthy food, for which soybean products are good sources of such foods.

The rural-based economies are being structurally transformed with more urbanized societies and this is opening new market opportunities so that it creates space for poor resourced producers to participate in national economic activities via the value chain approach (Vermeulen *et al.,* 2008). This requires establishing an official value chain system; however, this can only be achieved according to Prakash (2010) if the value chain is designed to overcome the following critical challenges; market integration, production innovation, farmer-based organizations and institutional support. It was to address these constraints in the industry that led to the introduction of value chain project in the four northern regions in the country. This study therefore uses the triple bottom line model to examine the value chain projects and propose policy recommendations to policy makers to improving the soybean value chain system in the Northern regions of Ghana.

LITERATURE REVIEW

Structure and Dynamics of Value Chain System

Insights gained from the definitions and the basic elements of value chain, suggest that value chain concept refers to all the activities and services that bring a product (or a service) from conception to end use in a particular industry –from input supply to production, processing, wholesale and finally, retail (Kaplinsky and Morris 2001). The term is appropriate because value is being added to the product or service at each step of the chain. Thus, knowledge of the structure of value chain is very important, since the structure influences the dynamics of participation and these dynamics in turn influence how well the value chain performs in terms of value chain competiveness, distributional benefits along the chain and addressing the major constraints and opportunities faced by business of multiple levels of the value chain.

Chain sustainability

Chain sustainability activities are increasingly becoming important issues in value chain design and management. In respect of this, the concept of chain sustainability focuses on management practices and design efforts on the search for ways to improve economic performance while reversing the retardation of environmental resources and making the distribution of economic and environmental outcomes more equitable among chain actors. For example, socio-economic system often become caught up in adversarial economy versus environment debate and begins to operate in a linear direction, that is taking resources from natural resource system, making them into products and throwing them away to produce large amount of waste (Flint, 2004). This process can lead to an entire system being unsustainable.

The review of the literature on sustainable development suggests that chain organizational sustainability, at a broader level consists of three components: the natural environment, society and economic performance as shown in the diagram below. Figure 1 presents a visual representation of these three components and corresponds to the idea of the triple bottom-line, a concept developed by Elkington (2004), which simultaneously considers and balances economic, environmental and social goals from a micro-economic standpoint. Within this context, Carter and Rogers (2008) contend that organization recognize that sustainability is not simply a matter of good corporate citizenship earning points for engaging in sustainable practices such as providing health care benefits to employees but now a fundamental principle of smart management (Savitz and Weber 2007). Thus the triple-bottom line model suggests that at the intersect of social, environmental and economic performance, there are activities that organizations can engage in which not only positively affect the natural environment and society, but which also results in long-term economic benefits and competitive advantage for the firm.

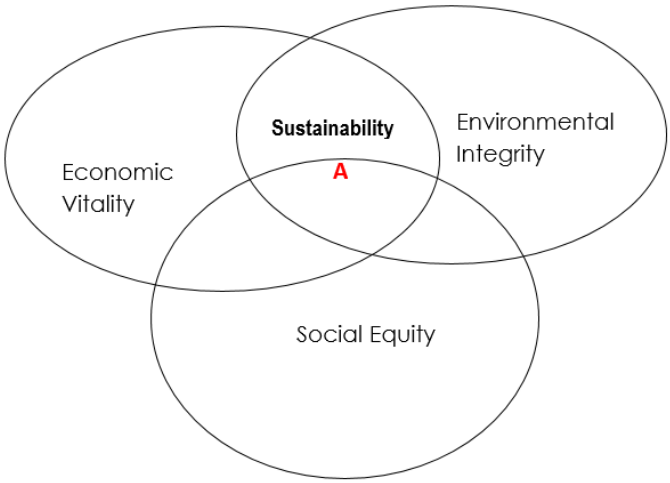

Figure 1: The Triple bottom line sustainability model (Carter and Rogers 2008)

The conceptual model of sustainability above illustrates the relationship among economic, environmental and social issues of concern in decision making. The area marked A the overlay of the three circles represents the nexus of connection among issues. Hence when considered in relation with value chain activities, the model suggest, there are social and environmental values chain activities that lie at the intersection with economic bottom line – these are the activities that are defined as sustainable (Carter and Rogers, 2008 and Flint 2004), potential financial gain as a result of financial with social and or environmental performance. These include: 1) Cost saving due to reduced packaging waste (Shrivastava 1995c; Mollenkopf *et al*.,2005) and the ability to design for reuse and disassembly (Christmann, 2000), 2) Reduced health and safety costs, and lower recruitment and labour turnover cost resulting from safer warehousing and transportation and better working conditions (Carter *et al*., 2007), 3) Lower labour cost – better working conditions can increase motivation and productivity, and reduce the absenteeism of supply chain personnel (Holmes *et al*., 2013), 4) Proactively shaping future regulation-companies that proactively address environmental and social concern can influence government regulation when this regulation is modeled after a company's existing production and supply chain processes, leading to a difficult – to – replicate competitive advantage for companies and their suppliers (Carter and Dresner, 2001), 5) Reduced cost, shorter lead time, and better product quality associated with the implementation of international standards, which provide a framework for environmental management,6) Enhanced reputation – engaging in sustainable behaviour can make an organization more attractive to suppliers and customers to potential employees (Capaldi, 2014) and to shareholders.

According to Carter and Rogers, (2008), while most of the above outcomes are "good" examples of ways in which a firm can improve its sustainability, true sustainability occurs at the intersection of all three areas – environmental, social and economic – and includes multiple activities (example of activities in the aggregates, where an organization explicitly and comprehensively incorporate social, environmental and economic goals

in developing strategic vision and long-term strategic objectives. In their review of supply chain management literature they indicated that the environmental and social aspects of sustainability can extend beyond an organization's boundary to include supply chain activities. When coupled with economic objective to develop a clear, long-term strategy, the inclusion of supply management activities in a firm's sustainability can actually create a longer-lasting and less imitable set of processes. Thus, firms which attempt to simultaneously maximize performance of all three dimensions of the triple bottom-line will outperform organizations that attempt to only maximize economic performance or companies that attempt to achieve high level of social and environmental performance without explicit consideration of economic performance (Flint, 2004 and Carter and Rogers, 2008).

METHODS

Data

The data for the study was collected from the four northern regions of Ghana using purposive sampling technique. Three of the regions (Northern region, upper East and upper West regions) fall in the Guinea Savannah agro ecological zone. The guinea savanna zone is one of the hottest and driest agro-ecological zones in the country with the mean annual day temperature hovering around $40^{O}C$ or more. The mean annual rainfall is about 1000mm with a unimodal rainfall distribution from May to September that supports only one cropping season in a year (Buckle, 1996). Major crops that thrive well here include millet, sorghum, soybean, cowpea, peanut, yam and cotton. Most crop production activities in the agro-ecological zone are done under small-scale production system and rain-fed conditions. The regions were selected based on initial review of document of soybean production and value chain activities in the regions of Ghana. The selected regions include: Northern, Upper East, Upper West and Brong-Ahafo regions. Three of the regions host key components of the commercial soybean value chain in Ghana: the Northern and Upper East and Upper West regions have highest concentration of soybean producers in the country, and the fourth region, Brong Ahafo is the location for the major soybean processing factory in the country in addition to a number of small- scale soybean processing facilities. Available socio-economic data suggest that 80% of the population in these regions depend on subsistence agriculture (Ghana's MoFA: Facts& Figures 2009, 2011) for their livelihood, and this study was designed to ascertain how this type of production system has been well integrated into the value chain system to improve the market for raw soybean.

Purposive, stratified, random and snow balling sampling techniques were employed to obtain appropriate sample size from which to gather relevant data for the study. The population for the study was made up of the total number of the various stakeholder types who have been registered with the soybean value chain project in the in the northern part of Ghana. The various chain actors contracted under the scheme were stratified into the following subgroups: (1) small-scale soybean producer cultivating less than five hectares of farm land and does not belong to any farmer organization {i.e. independent small-scale producers (ISSP)} (2) small-scale soybean producers cultivating less than five hectares of farm land and a member of a farmer organization {ie group-based small scale producers(GSSP)} (3) large-scale soybean producers cultivating over five hectares

farm land and do not belong to farmer-based organization {i.e. independent large-scale producers(ILSP)} (4) large-scale soybean producer cultivating over five hectares of land and a member of a farmer-based organization {ie group-based large-scale producer (GLSP)}.

Project report obtained from the facilitating organizations identified 3,000 soybean producers currently registered with soybean value chain project. After a series of consultation with project managers and a review of the report, the stratified sampling technique was adopted to stratify the entire population of 3,000 registered farmers associated with the project into the following categories of soybean producers and their proportions within the total population as follows: (1. Independent Sample-scale Producers (1,000), (2. Group based small-scale producers (1,000), (3. independent large-scale producers (600), and (4. Group-based large-scale producers (400). 10 percent of producers were randomly selected from the populations of each producer category to obtain a sample size of 300 respondents.

However, major weaknesses of this technique is that there is the need for accurate information on proportion of population in each stratum since this could lead to an increase in error, and also an increase possibility of faulty classification in the absence of stratification. The weaknesses were however dealt with in this particular study with a careful review of project documents obtained from facilitating organizations to provide the basis for the stratification.

The population of the other stakeholders apart from the producers are scattered over the communities in the study area and it is not easy to find them in the communities where they are supposed to be located. For these reasons the snowball sampling technique was the appropriate sampling procedure used to obtain the sample size of each stakeholder type. Some key informants who themselves were qualified to be included in the sample were identified and then interviewed with the appropriate research instrument. These persons in turn led to more persons who were also interviewed. The process continued till an appropriate sample size of each stakeholder type was obtained. Thus, the following sample sizes were obtained for each of stakeholder type identified. Input suppliers =22, producers=223, buyers (e.g. aggregators and processors) =9, and service providers (e.g. financial, tractor and haulage services) = 46. Snowball or chain referral sampling was particularly useful in this study because of the wide geographical spread of the identified key stakeholders.

The primary data used for this study were obtained from selected representatives of key actors and stakeholders associated with soybean value chain project. Questionnaire, interview schedule and focus group discussion were the three main instruments used to generate the primary data collected over a period of four (4) months (January- April 2012). The questionnaire was designed to generate the primary data to address the objectives of the study. The questions were designed to elicit data from all stakeholder types on the following items: chain economic activity, input requirement to role play effectively, gains from the participation in chain economic activity, Challenges encountered in the performance of role in the chain system, specific functional role in the chain system. The questionnaire was pre-tested with similar value chain actors and stakeholders in

a different commodity value chain system in the same study area. Participants were asked to comment on the format of the questionnaire including specific aspects such as wording, length and the order of the questions. The feed-back obtained after this exercise was incorporated to improve the quality of the questionnaire.

Twenty-five experienced enumerators were recruited from extension agents in the offices of Ministry of Food and Agriculture (MoFA), Ghana in the study area. The enumerators were given a day's training on how to administer the questionnaire. On the field, each questionnaire was administered for an average duration of one and half hours. To increase the response rate, each enumerator stayed with each respondent for as long as it took to complete a questionnaire.

Interview schedule was the last of the data collecting instruments that was designed to gather the primary data for analysis in this study. The interviews were largely open-ended; using interview guides which specified broad themes to be covered and key issues to be explored. The interview schedule was designed to cover broad areas of interest like the kind of product/ service provided by an actor in the chain, the number of years the actor had provided the service/ product, sources of input, problems associated with the sources of inputs, suggestions to solve problems and energy used and its impact on the environment.

In all eight, (8) interviews were conducted each lasting three hours with the following actors in the chain: nucleus farmers or their representatives , large-scale farmers, small- scale farmers, tractor service providers, seed growers, input suppliers, credit officers, processors, representatives of senior management of facilitating organizations and value chain management committee members. Some of these participants were purposefully selected while the ones representing organizations/firms were nominated by the heads of their organization/firm. The interviews were conducted to observe as well as to have insights and validate some of the key issues that were raised during the focus group discussion session and respondent survey. The interviews were held either in organization's premises, if participants were from organizations and farming communities if the participants were farmers. However, with all other participants it was in office locations that were agreed upon for that purpose. Some interview sessions were captured on tapes with permission of participants while others were captured as written records. All interviews were conducted between March and April 2012.

In this study chain sustainability is delineated as a construct that has three dimensions – that is, environmental, financial (note that financial is the same as economic in this study and social in an attempt to determine stakeholders' perception of the soybean value chain system performance on the sustainability of chain activities in relation to the tangible and intangible economic benefits that accrue to economic actors of the chain. Hence, this study operationalized all three dimensions of the chain sustainability construct by formulating composite statements which captured the range of commercial benefits discussed on a ten point likert scale- Scale: 1=extremely poor, 2=moderately poor, 3=slightly poor, 4=poor, 5=average, 6= slightly good, 7=moderately good, 8=good, 9=very good, 10=excellent. A weighted average of the ten-point likert scale was used to assess the actors perception of the chain activities across the sustainability constructs.

RESULTS

The Perception of key stakeholders' sustainability indicators

We present stakeholders perception of key value chain activities relative to environmental, social and economic sustainability in Table 1. The results have been discussed according to actors starting from input suppliers, producers, aggregators, logistic service providers, financial service providers and chain facilitators.

Input suppliers

There was a high degree of consensus among input suppliers within the chain that environmental sustainability within the chain was generally moderately good (7.3) as far as their business operations are concerned (Table 1). They attributed this to the fact that: First, they are very much aware of the negative impact on the environment of some of their business activities. For example, fertilizer and agro-chemical suppliers were of the opinion that improper disposal of agro-chemical containers/packaging material with chemical residue are environmentally hazardous, and admitted that there have been reported cases of chemical poisoning of humans, and animals as a result of this practice. Secondly, discussants observed that through training workshops and seminars organized by accredited agents of major agro-chemicals companies such as Wienco and Dizenghof from time to time do equip them with skills on proper handling and disposal of fertilizer and agro-chemicals supplied by these companies. In addition, chain facilitators' environmental specialists regularly provide up-to-date information on sound environmental and best practices in their business operations that help them to minimize negative impact of their business operations on the environment from time to time.

With regards to financial sustainability, performance was also deemed to be moderately good among this group during the interview (Table 1). There was consensus on the fact that incomes have generally improved with this group, since their involvement in the chain. This has therefore led to significant improvement on their ability to save as well as contribute to community development projects.

Social sustainability performance was also generally considered slightly good according to Table 1. The group attributed this to the social network system which has evolved over the years, and which has been further strengthened by the advent of mFarm ICT Platform that links actors and facilitate the exchange of technical, business and market information to enhance information flow within the group and along the entire chain. A value chain development and management committee formed with representatives of major actors in the upstream segment of the chain has been vested with the responsibility to ensure accountability and equity in the distribution of chain benefits upstream and this also appears to explain their slightly good perceptions of social sustainability performance in the chain.

Producers

Discussants representing all categories of producers in the chain were unanimous in their verdict on moderately good performance of environmental indicators as far as the farm business activities are concerned (Table 1). In relation to financial and social sustainability, discussant rated moderately good and slightly good, respectively for the farm business activities concerned. Discussants agreed that their participation in environmental sustainable activities/practices by chain facilitators has (i) created awareness among their ranks of farm production activities that are environmentally damaging. Examples cited include, indiscriminate application of agro-chemical to control pests, diseases and weeds, uncontrolled bush burning and many such environmentally damaging activities (2) built their capacity to deal with negative environmental outcomes of farm production practices if they occur, for example, training on the control of uncontrolled fire outbreaks on farm and training on proper application of fertilizers and other agro-chemicals, as well as the use of organic fertilizer instead of inorganic fertilizer. Environmental specialists with chain facilitators have instituted a programme that update farmers regularly on sound environmental practices throughout the year for farmers and this has also been cited by participants as one of the key factors that underscores the rating of environmental sustainability among producers (Table 1).

The implementation of government's policy on producer price for soybean at the beginning of the planting season appears to have significantly improved farmers' income within the chain and thus improved farmers' ability to save, hence a key underlying factor for financial sustainability in the chain. Participants were also keen to point out that their involvement with the value chain's economic activities has also improved their capacity to contribute financially to development activities in their communities as well as chain improvement activities.

Social sustainability performance was also considered as being slightly good as shown in Table 1 and they attributed this to the opportunities created by the pre- and post-season events, and the existence of farmer-based organizations, the nucleus farming concept and the formation of the value chain development and management committee all of which play significant roles to ensuring accountability and adherence of chain members to the rules and regulations set out to control chain activities for the benefit of chain members upstream.

From Table 1, it could be seen that sustainability performance among producers is generally moderately good. However, there was the need to reduce fossil-fuel-based mechanized operations in farm production operations that tend to increase carbon emission load that is normally associated with upstream activities and creates biodiversity instability brought on by expanding farm production activities upstream. When these issues are properly dealt with by chain managers then sustainability could be further improved along the chain to the benefit of all.

Table 1: Discussants' indicator assessment score for chain sustainability construct

Specific chain	Indicator	Input suppliers	Soybean producers	Buyers/ aggregators	Processors	Logistic service providers	Financial services providers	Chain facilitators
Environmental								
i	Awareness of environmental hazards	7.2	7.0	3.0	4.8	4.9	4.0	5.6
ii	Sensitization to sound environmental practices	7.1	7.5	4.0	4.6	5.0	4.7	6.2
iii	Capacity to deal with environmental hazards	7.5	7.2	3.2	4.4	5.1	5.4	5.0
Total		7.3	7.2	3.4	4.6	5.0	4.7	5.6
Financial								
i	Satisfied with income earnings capacity	6.9	6.7	2.2	5.0	5.0	4.7	6.2
ii	Ability to save income	7.7	7.3	5.0	4.2	5.0	4.7	7.0
iii	Ability to reduce indebtedness	7.6	6.5	5.5	4.8	5.0	4.8	6.5
Total		7.4	6.8	4.2	4.7	5.0	4.7	6.6
Social								
i	Satisfied with equitable distribution of benefits	6.4	5.6	6.6	4.8	6.8	4.9	5.6
ii	Satisfied with value chain ability to provide social network system that supports weaker members	6.0	7.0	5.0	6.7	6.0	5.6	5.8
iii	Improved ability to contribute community development project	6.2	6.5	6.2	6.6	6.5	5.7	6.0
Total		6.2	6.4	5.9	6.0	6.4	5.4	5.8
Total average score		**6.9**	**6.8**	**4.5**	**5.1**	**5.4**	**4.9**	**5.9**

Scale: 1=extremely poor, 2=moderately poor, 3=slightly poor, 4=poor, 5=average, 6= slightly good, 7=moderately good, 8=good, 9=very good, 10=excellent

Aggregators

The results presented in Table 1 highlights the responses of aggregators when they were asked to evaluate their perceived performance of all the aspects of chain sustainability – environmental, financial and social. The results indicated that performance of chain environmental sustainability was ranked slightly poor 3.4 (Table 1) to underscore the claim that they are not aware that any of their business operations has detrimental effect on the environment and have therefore, not received any training within the chain to handle such threats from their business operations. The aggregators also ranked the performance of chain financial sustainability poor, asserting that government-backed producer price of Gh¢70.0 per 100kg bag of raw soybean has significantly eroded their profit margins, and therefore impaired their ability to save and invest in chain improvement activities. Discussants agreed that the policy should be reviewed and if possible prices should be determined by supply and demand conditions on the market.

Aggregators' evaluation of chain social sustainability performance was ranked slightly good (Table 1). This they attributed to their inability to organize themselves into an association/business group as chain members, thus denying them of a key social infrastructural system that could have enhanced social networking among them to improve their perception of chain social sustainability performance. The situation is also not helped by the attitude of chain facilitators in the sense that, it appears to be a deliberate policy to discourage aggregators from organizing themselves into a business association or group. Chain managers believe that if they are allowed to do so they could constitute themselves into a very powerful buying cartel, a phenomenon that might undermine competitive pricing in the chain.

Processors

Table 1 provides a summary of the results of small-scale processors assessment of their perceived performance of all three components of overall chain sustainability. Discussants unanimously agreed that their participation in the value chain has made them aware of certain aspects of their business operation that are potentially damaging to the environment. They cited examples like discharge of hot affluent and pollutants into surrounding water bodies/ streams close to areas where their plants are cited, the use of fossil-based-fuel in some mechanized operations as well as the accumulation of foul-smelling sludge discharged as waste from the oil extraction process.

However, they were quick to add that they are given regular training on how to handle some of these environmental challenges through workshops and seminar organized by Ghana Environmental Protection Agency from time to time. In an interview with a senior manager of the Ghana Nuts Limited, a leading agro-processing factory in Techiman which is involved with the soybean value chain project revealed that the factory has set up an ultra-modern waste treatment plant that handles all waste generated during processing on their premises.

On financial sustainability, discussants adjudged the perceived performance on all indicators as average (Table 1). However, they lamented about the recently introduced produced price of GH¢70.00 per 100kg bag of raw soybeans; and suggested that the price should be reviewed downwards for the price of Ghana's soybean to be competitive with the price of imported soybeans. Indicators specified to determine social sustainability performances within the chain were assessed as slightly good (Table 4) by the discussants and insisted that inbuilt social infrastructures (i.e. the pre- and post-season events and mFarm ICT Platform as well as the formation of business association) within the chain have assisted chain efforts at value integration of all economic actors to ensure chain accountability as well as equity in the distribution of economic gains along the chain.

Logistic service providers

Most logistic services are provided by tractor operators, hence they were the ones who represented this group in the focus group discussion and their views expressed during the discussion were supplemented with the views of transport operators who were interviewed during the studies. The summary of the result of the discussion is presented in Table 1. The results indicate that their assessment of all the aspects of sustainability on the scale of performance was generally average, implying that they were adequately equipped to recognize the negative effect of their business operations on the environments. When discussants were asked to give examples of such activities, they noted in particular the use of fossil fuel in most of their operations including ploughing and harrowing of farm lands as part of land preparation for sowing that are key business operations, and that they have detrimental effect on the environment. However, they also noted that chain environmental specialists from the chain facilitating organizations are providing regular training to help them minimize these threats.

On financial sustainability, the consensus was that business is generally average since their involvement in the value soybean value chain. They however, expressed concern over the inability of some producers to honour "gentleman' agreement to pay in-kind for services rendered to them at the end of each harvest season. This appears to create tension in their relationship with producers at the end of every harvest season. They also expressed disquiet over the rising cost of fuel and auto parts, and this they indicated was eroding economic gains in the chain.

Social sustainability according to the discussants was well grounded in the chain activities as far as they are concerned, because most of them are either farmers, aggregators or both, providing the basis for a working relationship that enhances social sustainability. Moreover, they concluded that the advent of mFarm ICT Platform and pre-season and post-season events and other social activities organized by chain managers with active cooperation of all chain actors was providing avenues for both formal and informal interactions to enhance social networking.

Financial service providers

Financial service providers are not directly involved with product flow within the value chain; hence their linkages with clients within the chain are mainly transactional. Thus, looking on from the outside, they assessed all aspects of sustainability on the performance scale as generally average and believed that there is still scope for improvement.

Chain facilitator

As key component of their strategy, chain facilitators are keen to ensure that there is significant improvement on its performance scale of all dimensions of chain sustainability-environment, financial and social. Thus, their evaluation of sustainability performance within the chain is generally slightly good but quickly added that there is still more scope for improvement (Table 1).

Perception of Key Stakeholders on various chain activity performance scale

This section presents the results of the survey, which was mainly focused on the quantification of the benefits that key stakeholders attach to the chain activity of all three dimensions of the chain sustainability construct when evaluating the tangible and intangible financial benefits that accrue to them as they participate in the economic activities of the soybean value chain system. The results provide hints as to what motivates stakeholders' continuous participation in the value chain, and insights as to how the phenomenon can be harnessed to develop a sustainable and viable value chain system that creates space for the various actors to engage in meaningful economic activities.

Results of factors influencing tangible and intangible financial benefits across stakeholder types

All constructs of chain activity performance scale were conceptualized as two-factor constructs: the first factor was referred to as tangible financial benefits and the second factor as intangible financial benefits. The term tangible and intangible have been applied to describe the perceived financial benefits that accrue to the various actors in the soybean value chain in Ghana. Tangible financial benefits is so referred to because the items that were loaded contain statements that describe gains that can clearly be seen to exist and intangible financial benefits had items loaded to describe gains that do not exist as physical assets but still valuable to the chain actor.

On the three aspects of chain sustainability – environmental, financial and social sustainability – the factor loadings in respect of the tangible and in tangible financial benefits constructs are presented in Tables 2-4. For environmental sustainability, the first factor, tangible economic factor has four items loaded onto it and these are: reduction in total business expenditure, safeguard unique product characteristics, improved value of business assets, satisfied with price received for product sold. However, with alpha value of 0.54 which was less than 0.6 the conventional cut off point, it implied that

the statements used did not significantly contribute to the variance of the tangible financial benefit factor (Table 2). Thus these statement items were not used for any further analysis.

Table 2: Factor analysis for financial benefit of environmental sustainability performance across stakeholder types

Factor and Items Financial benefit of environmental sustainability performance KMO	Factor loading
Tangible Economic Benefit of Environmental Sustainability Performance	
Explained variance = 42.82% KMO = 0.725 Cronbach Alpha = 0.544	
Ability to reduce total business expenditure of my farm business operations	0.733
Capacity to safeguard the unique compositional characteristics of my farm produce	0.789
Improving my specific business asset value within the chain	0.662
Receiving premium product prices for my produce from my buyers	0.646
Improving my returns on investment in business assets in the chain *	
Intangible Economic Benefit of Environmental Sustainability Performance	
Explained variance = 50.83% KMO = 0.742 Cronbach Alpha = 0.755	
Improved capacity to comply with national and international environmental regulatory requirement	0.698
Ability to protect my market share gained through my participation in this chain	0.743
Sharing the risk and rewards with other chain partners	0.609
Strengthening business relationship with other chain actors in this chain	0.775
Ensuring that my business cooperates with other chain partners to solve environmental problems when they arise	0.729

*Item suppressed in exploratory factor analysis for less than 0.5 factor loading

The second factor loaded five items: improved capacity to comply with national and international regulatory requirement; ability to protect competitive advantage through participation in chain environmental training, shared risks and rewards gained through sound environmental practices, collaborating with chain partners to solve environmental problem when they arise, and strengthen collaboration and cooperation with environmental regulatory bodies such as Ghana Environmental Protection Agency (GEPA). With an alpha coefficient of 0.755 which was higher than 0.6 the conventional cut off point and explained variance of 51% (Table 2), there was an indication that the underlying construct of this factor was adequately reflected by these statements.

The social sustainability dimension, tangible financial benefit factor had four items loaded onto it (Table 3) with associated alpha value of 0.787 and explained variance of 61%. It meant that the factor measurement scales used, explained adequately the underlying construct. For the intangible financial benefit factor the alpha coefficient was 0.795 and the explained variance is 62%, thus suggesting that the statements specified under this factor adequately explained the underlying construct.

Table 3: Factor analysis for financial benefit of social sustainability performance across stakeholder types

Factor and Items Financial benefit of Social Sustainability	Factor loading
Tangible financial benefit of social sustainability	
Explained variance = 61.07% KMO = 0.783 Cronbach Alpha = 0.787	
Earning satisfactory business profit to enhance continued association with other chain actors to achieve shared business goals for the value chain.	0.810
Increase financial returns on investment in business assets to improve value chain activities	0.773
Improve business' financial capacity to support community development	0.757
Reduce transactional cost in business activities to enhance collaboration among chain actors.	0.784
Intangible financial benefit of social sustainability	
Explained variance = 61.97% KMO = 0.772 Cronbach Alpha = 0.795	
The development of social network system within this chain supports the most vulnerable business entities in the chain.	0.800
Development of social capital assets/infrastructure in the value chain system to	0.823
Development system of rewards and sanctions regimes to ensure distributional equity for all actors within the chain	
Evolution of chain regulatory structures ensures accountability of all chain participants	

*Item suppressed in exploratory factor analysis for less than 0.5 factor loading

Finally financial sustainability dimension had in the first and second factors loaded with three items each on the factor measurement scale. For the first factor it includes: my business is generating enough revenue in chain economic activities, profits earned by my business are satisfactory to enable me invest part in chain development activities, my business has improved its financial capacity to reduce its indebtedness to creditors.

For the second factor they are: general satisfaction with financial gains since participation in value chain activities, perceived improved credit worthiness with financial institutions my business deals with, and an improved financial position has enabled my business to institute equitable incentive distribution system for the benefit of my workers. The respective alpha values were 0.643 for the first factor, (tangible financial benefit) and 0.698 for the second factor (intangible financial benefits). Since they were all above the conventional cut off point of 0.6 (Table 4), it suggested that the measurement scales are deemed to be good measure of the underlying constructs of the two factors. In an attempt to compare

chain activity performance scales across stakeholder types, the retained items from the factor analysis were subjected to one-way analysis of variance (ANOVA). Specifically, the ANOVA was used to analyze the impact of variance of each chain activity performance factor independently (Table A-Table C in Appendix).

Table 4: Factor analysis for financial benefit of financial sustainability performance across stakeholder types

Factor and Items Financial benefit of financial sustainability performance	Factor loading
Tangible financial benefit of financial sustainability performance **Explained variance = 62.09% KMO = 0.658 Cronbach Alpha = 0.643**	
My/our business is generating enough revenue from my/our business activities to be able to continue to engage in the economic chain activities.	0.826
Business participation in the value chain activities has enabled me /us to generate satisfactory profit to invest in chain activities that benefit all chain actors	0.757
Business improve its financial capacity to reduce its indebtedness to creditors	0.779
Intangible financial benefit of financial sustainability performance **Explained variance = 62.38% KMO = 0.665 Cronbach Alpha = 0.698**	
Business is generally satisfied with financial gains made as result of participation in the value chain activities.	0.753
Perception of my/our business' credit worthiness has generally improved with financial institutions.	0.810
0.810	
Improved financial position in the chain has enabled me/us to institute incentive distributional equity system for the benefit of all	0.806

*Item suppressed in exploratory factor analysis for less than 0.5 factor loading

Analysis of Variance of Financial Benefit of Sustainability Performance Construct Across Stakeholder Types

The results of the financial benefits of environmental sustainability dimensions of chain sustainability performance in Table A in Appendix indicates that there were no significant differences in the overall tangible and intangible financial benefits as far as these dimensions of chain sustainability were concerned, implying that chain actors do not differ in their perceptions of overall financial gains that accrued to them with their involvement in chain economic activities. Consequently, their perceptions of environmental sustainability of chain activities were not influenced by expected financial gains that may likely accrue to them.

The impact of overall financial benefits of perceived financial sustainability is shown in Table B in Appendix. The results revealed that there was significant difference in the overall tangible financial

benefit across all stakeholder types at 10% level of probability while intangible financial benefits across stakeholder types in the chain was not statistically significant. These results suggested that perceived financial sustainability of chain activities was influenced to some extent by expected tangible financial benefits that may accrue to members. Meanwhile, the overall intangible financial benefit did not elicit such influence among the stakeholders in the chain.

Table C in Appendix shows the results of the influence of perceived tangible and intangible financial benefits of social sustainability chain activity as accrued to chain members. The results reported significant differences at (p<0.05) level in overall tangible and intangible financial benefits that accrued to chain members. This result implied that stakeholders' perception of social sustainability performance was significantly affected by expected overall financial gains that accrue to them as a result of their participation in chain economic activities.

CONCLUSION

The results of the value-chain analysis concluded that sustainability performance assessment among the various chain actors was deemed to be generally good on all the three dimensions of the chain sustainability construct. On the basis of the results of principal component analysis it can be concluded that on the three dimensions of the sustainability construct-environmental, social and financial- chain actors were satisfied with both tangible and intangible financial benefits that accrue to them with their participation in the soybean value chain since the statements that explained these two factors were all associated with alpha value of at least 0.6 of the conventional cut-off point suggesting that the measurement scales are deemed to be good measure of the underlying constructs of these two factors (i.e. tangible and intangible financial benefits).

The analysis of variance (ANOVA) result reveals that perceptions of environmental sustainability of chain activities were not influenced by expected financial gains that may likely accrue to them. However, the perception of social sustainability performance was significantly affected by expected overall financial gains that accrue to them as a result of their participation. Meanwhile, these results suggested that perceived financial sustainability of chain activities was influenced to some extent by expected tangible financial benefits that may accrue to members but the overall intangible financial benefit did not elicit such influence among the stakeholders in the chain.

Based on the findings of the study, the following recommendations are made: 1) That for the sustainability of environmental activities, there should be public-private partnerships efforts to establish a waste treatment plant to process the excessive waste generated along the chain into other useful products such as hog feed and organic fertilizer, increase the number and improve the quality of training

sessions that sensitize chain actors on the impact of their operations on the environment and environmentally sound business practices that reduce negative effect of such operations on the environment. Furthermore, the training should equip the participants with skills to deal with negative effects of their business operations on the environment when they do occur, 2) That social sustainability could be improved when chain stakeholders work together to evolve chain social infrastructural system that ensure accountability, equitable reward system that favours those who contribute time, efforts and resources to chain development as well a sanction regimes that ensure compliance to chain rules and regulations. Furthermore, chain facilitators should assist with the setting up of social development fund with contributions from all actors of the chain to provide social amenities like health clinics, schools, markets, as well as social centers in areas with high concentration of soybean producers to stem the migration of would-be young farmers from these area to adjacent urban centres, 3) That for financial sustainability of chain economic activities, the efforts of chain facilitators should be directed towards the evolution of financial reward system that is seen to be equitable and transparent, to disabuse the minds of the poor-resourced members of the chain to the effect that the well-endowed members downstream are taking advantage of their vulnerability to exploit the system to their advantage, intensify chain development and management activities that enhance the poor resourced members' income earning capacity through increased productivity and efficient marketing of produce or product. Consequently, the project managers of the chain should ensure that extension services are improved to deliver project objectives that improve capacity to meet buyers' requirement in terms of volumes and quality of product, and finally chain managers should encourage financial institutions associated with the economic activities of the chain to institute regular training programmes on credit management to equip chain actors to use credit wisely.

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Table A: Analysis of variance (ANOVA) for financial benefit of environmental sustainability across the stakeholder types in the soybean value chain system in Ghana

Financial benefit of Environmental Sustainability Performance	**Stakeholder Type**				**F-values**	**Sig**
	PRD	**INP SUP**	**SEV PVR**	**BUY**		
	μ (σ)					
	n = 223	**n = 22**	**n = 46**	**n = 9**		
Tangible financial benefit of Environmental Sustainability Performance	1.780 (0.477)	1.972 (0.442)	1.896 (0.376)	1.750 (0.500)	1.762	0.154
Intangible financial benefit of Environmental Sustainability Performance	1.891 (0.507)	1.909 (0.451)	1.817 (0.401)	1.644 (0.296)	1.014	0.387

(s) = mean , "figures in parenthesis are standard deviation" PDR = Producers, INP SUP = Input Suppliers, SEV PVR = Service Providers, BUY = Buyers

Table B: Analysis of variance (ANOVA) for financial benefit of financial sustainability performance across the stakeholder types in the soybean value chain system in Ghana.

Financial benefit of Financial Sustainability Performance	Stakeholder Type				**F-values**	**Sig**
	PRD	**INP SUP**	**SV PVR**	**BUY**		
	μ (σ)					
	n = 223	n = 22	n = 46	n = 9		
Tangible financial benefit of financial Sustainability Performance	1.847 (0.484)	2.090 (0.536)	1.942 (0.446)	2.000 (0.666)	2.121	0.098**
Intangible financial benefit of Financial Sustainability Performance	1.695 (0.537)	1.848 (0.531)	1.746 (0.531)	1.925 (0.547)	1.049	0.371

(s) = mean, figures in parenthesis are standard deviation ** $p<0.10$, PDR = Producers, INP SUP = Input Suppliers, SEV PVR = Service Providers, BUY = Buyers

Table C in Appendix: Analysis of variance (ANOVA) for financial benefit of social sustainability across the stakeholder types in the soybean value chain system in Ghana

Economic benefit of social sustainability	**Stakeholder Type**				**F-values**	**Sig**
	PRD	**INP SUP**	**SEV PVR**	**BUY**		
	μ (σ)					
	n = 223	n = 22	n = 46	n = 9		
Tangible financial benefit of social sustainability	1.831 (0.482)	1.988 (0.599)	2.054 (0.485)	2.000 (0.500)	3.149	0.025*
Intangible financial benefit of social sustainability	1.701 (0.538)	1.840 (0.590)	1.945 (0.496)	1.833 (0.572)	2.906	0.035*

(s) = mean, "figures in parenthesis are standard deviation" * $p<0.05$, PDR = Producers, INP SUP = Input Suppliers, SEV PVR = Service Providers, BUY = Buyers