Analysis of the Maize Value Chain Development in the Northern Region, the case of the Association of Church Development Programme (ACDEP)

F. A. ABDUL-RAHMAN, S. A. DONKOH

Faculty of Agribusiness and Communication Sciences, University for Development Studies,
P. O. Box TL1882, Nyankpala Campus

Corresponding Author's email address: sdonkoh@uds.edu.gh

Abstract

*The study sought to investigate the extent to which the actors in the maize value chain of the Association of Church Development Projects and its partners (ACDEP/PAS) were adopting the tenets to upgrade the processes and products of the chain. Stratified and simple random sampling techniques were used to select a total of 240 maize farmers and 15 input dealers and officials of the intervention organizations. The methods of analysis involved the estimation of a probit model and the use of Kendall's coefficient of concordance as well as some descriptive statistics. The study revealed that majority of the actors; especially the farmers were not adopting the recommended strategies to upgrade the chain in terms of **processes**. For instance, only 2.5%, 18.3%, 0.8%, 2.5% respectively did harrow their plots after ploughing, used certified seeds for planting and carried out germination test before planting their seeds. Also, 65.8% of them applied less than the recommended 150kg of fertilizer per acre. In terms of upgrading their **products**, while all of them (100%) labelled and weighed their produce, none of them did grading or certification of their produce. However, 54.2% as against 45.8% dried their maize on tarpaulin. The probability of participating in the ACDEP/PAS value chain was higher for the following: older farmers, married farmers; ownership of larger farms; and the perception that participation would enhance one's market access. Credit access was the main challenge facing the categories of actors. Other critical challenges facing farmers were high cost of inputs, inadequate tractor/labour services and low price for their produce. There is the need to take a holist approach to solving the problem of inadequate credit. Also, while more actors (e.g. investors in storage facilities) must be encouraged to come on board, the chain must be supported for an effective linkage of all the actors.*

Keywords: *ACDEP, Maize, Northern Ghana, Value chain*

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INTRODUCTION

The Government of Ghana's main policy thrust in agricultural development is to modernize the sector. Modernization is defined as improving access of small-scale farmers to modern productive technologies, irrigation, credit and extension advice, while at the same time opening up rural communities to improved transport and marketing of agricultural produce (MOFA, 2007).Value chain development has received emphasis as a way of integrating the economies. Value chain refers to the string of actors working together to satisfy market

demands for a particular product. It includes input dealers involved in backward linkage activities in the production system as well as forward linkage activities such as transportation, processing and trading. Increasing levels and multiplicity of standards (e.g. food safety and phytosanitary) in international trade present a growing challenge to market access, especially of high value agricultural commodity like maize. In the domestic front, a low consciousness of majority of consumers and producers about food safety does not engender a culture of following good agricultural or manufacturing practices (GAP/GMP) among farmers, processors and traders. There is generally a lack of market orientation among producers and processors. Improvement in the productivity of smallholder farmers and sustainable economic growth are pre-requisites to achieving the full contributions of agriculture to overall growth and development. Recent global policies propose that smallholder farmers can get out of poverty by being better linked to markets. Markets in recent times are changing fast and competition is becoming increasingly stiffer. If businesses aspire to stay in the market, they need to make sure that their products and services meet continuously changing market requirements (Matthias and Muzira, 2009).

Smallholder maize farmers in most developing countries are working to improve their livelihoods in an environment which is characterized by dwindling government support and increased competition among producers, processing companies and supermarkets within agricultural markets (KIT et al, 2006). The main concern in development cooperation is how to reduce poverty. Many development organisations believe that agriculture value chain development is a strategic means of bringing about market access and income to actors, especially the smallholder farmer. Functional value chain is said to be more efficient in bringing products to consumers and therefore all actors should benefit from the value chain development. Competitiveness in agribusiness in both local and international markets is noted to be one of the most commonly quoted objectives of value chain

development. It is against this backdrop that over the years the Association of Churches Development Projects and its partners (ACDEP/PAS) have introduced the maize value chain in the Northern Region of Ghana to enhance farmers' access to both local and international markets. However, despite the intervention, it appears the farmers on the ACDEP/PAS value chain continue to face the marketing challenges they used to face. A study to investigate the extent to which the farmers are adopting the tenets of the value chain concept as well as the challenges they encounter is therefore worthwhile. The main objective of this study was to analyse the value chain approach to maize sector development in the Northern region by the ACDEP/PAS. The specific objectives were to (i) analyse the extent to which farmers are adopting the strategies meant to upgrade the maize value chain, (ii) identify the factors influencing farmers' participation in the ACDEP/PAS value chain and (iii) investigate the challenges facing the actors to the efficient functioning of the chain.

ACDEP/PAS Maize Value Chain Intervention in the Northern Region

ACDEP/PAS and MOFA considered the promotion of the maize crop as a way of increasing its competitiveness in domestic, regional and export markets. ACDEP/PAS and MOFA adopted the value chain concept as a strategy of promoting the maize commodity in the Northern Region and the entire country. The main objective of their intervention was to bring about the economic wellbeing of the actors through improved production techniques and access to guaranteed market (ACDEP). The key components adopted in facilitating the maize value chain in the Region include the following: capacity building in Good agricultural practices (GAPs); other value addition techniques; Organisational development (OD); and creating linkages among actors (e.g. linkage to guaranteed market, linkage to financial credit and other services). Maize farmers are sensitised on the benefits of the programme (such as market access) and encouraged to participate.

MATERIALS AND METHODS

Study Area

The Northern Region, which occupies an area of 70,383 square kilometres, is the largest region in Ghana in terms of land area. The main vegetation is classified as vast areas of grassland, interspersed with the Guinea savannah woodland, characterised by drought-resistant trees such as the acacia, baobab, shea nut dawadawa, mango and neem. Agriculture is the main economic activities in the region. Together, they account for the employment of 71.2 % of the economically active population, aged 15 years and older. The main crops cultivated in the region are cereals (rice, millet, maize, and sorghum), legumes (soybeans, groundnut, cowpea, pigeon pea), tubers (cassava, yam) and vegetables. Cash crops include cotton, tobacco, groundnuts, cashew, sheanuts, and soya-beans. The main problems of crop production are with unfavourable weather conditions (drought), erratic rainfall, perennial bush fires and declining soil fertility. Some of these problems are due to poor environmental management relating to inefficient farming practices and hunting for fuel wood (GSS, 2012).

Sample Size, Sampling Techniques and Data Analysis

The selection of the respondents for the study was based on multi-stage sampling procedure. The study area was purposively selected due to the presence of the ACDEP/PAS programme in the area. Two ACDEP/PAS participation districts (Tamale Metropolis and the Tolon District) were then selected using simple random sampling technique. In the second stage, simple random sampling was used to select four maize value chain intervention communities each from the Tolon District and the Tamale Metropolis. Thus in total, eight intervention communities were involved in the study. In the third stage, a stratified sampling technique was used to put the sample population into participants and non-participants of the ACDEP/PAS maize value chain. In the final stage, fifteen maize value chain participants and fifteen non-participants from each community were randomly selected. This gave a total of number of two hundred and forty farmers.

Also two officers each from ACDEP, SFMC, PAS, MoFA and Bonzali Rural Bank were purposively selected for interview. Five input dealers were also selected and interviewed for the study. In total therefore, 255 respondents were interviewed for the research. Focus group discussion (FGD) and key informant interview were also used. Sixteen FGD were conducted with ten participants each for both participants and non-participants of the maize value chain intervention. All the FGD were conducted with the help of a checklist. Simple quantitative data from questionnaires were tabulated and processed with the help of Statistical Package for Social Sciences (SPSS) version 17 and Microsoft office excel 2010.The method of data analysis involved an estimation of a probit model as well as the use of Kendall's Coefficient of Concordance. The outputs are presented in the form of graphs/figure and tables.

The Probit model

The Probit model is suitable for estimations where the dependent variable is categorical. In this study we seek to investigate the factors influencing participation in the ACDEP/PAS value chain. This means that the dependent variable (participation or non-participation) is binary and therefore the probit model must be used. Golderberger (1964) came up with the probit analysis model. In this model it is assumed that there is an underlying response variable y_i^* defined by the regression relationship:

$$y_i^* = \beta' x_i + u_i \qquad (1)$$

where:

y_i^* is the dependent variable measuring participation in ACDEP/PAS value chain.

x_i are the socioeconomic factors influencing participation

β are parameters measuring the effect of the socioeconomic variables on participation

u_i are the error terms measuring omitted variables and other statistical errors affecting the model.

We do not observe y_i^* in practice. What we observe is a dummy variable y defined by

$$y = 1 \quad if \quad y_i^* > 0$$
$$y = 0 \quad otherwise \quad (2)$$

Thus, if a farmer participates, $y = 1$ and if he/she does not, $y = 0$. In this particular case, $\beta' x_i$ is $E(y_i^* / x_i)$.

(3)

From the relations above we get

$$prob(y_i = 1) = prob(y_i > -\beta' x) = 1 - F(-\beta' x) \quad (4)$$

where F is the cumulative distribution function of u

The likelihood function is

$$L = \prod_{y_i=0} F(-\beta' x_i) \prod_{y_i=1} \left[1 - F(-\beta' x_i)\right] \quad (5)$$

The functional form for F of the probit model gives us

$$F(-\beta' x_i) = \int_{-\infty}^{-\beta' x_i / \sigma} \frac{1}{(2\pi)^{\frac{1}{2}}} \exp\left(-\frac{t^2}{2}\right) dt \quad (6)$$

where t is a standardized normal variable (i.e. $t \sim N(0,1)$).

The Maximum Likelihood Estimation (MLE) is used to estimate the coefficient (β_i) of the various factors. The theoretical model translates into the empirical model below:

Participation=β_0+β_1Age+β_2Marital status +β_3Education + β_4*Farm size* + β_5*Phone ownership* + β_6*ACDEP enhances market access* + u

(7)

The *a priori* expectations are that all the explanatory variables have positive influence on the dependent variable (participation).

The Kendall's Coefficient of Concordance (W)

The Kendall's Coefficient of Concordance (W) is a non-parametric inferential statistical procedure used to rank (in this context) a given set of challenges from the most important to the least important, and then measures the degree of agreement/concordance between the respondents (Edwards, 1964). In this case, respondents are asked to rank some pre-determined challenges by assigning **1** to the most important; **2** to the second most important, **3** to the third most important, in that order. The least score rank is the most important while the one with the highest score is ranked as the least important. The total rank score computed is then used to calculate for the Coefficient of Concordance (W) to measure the degree of agreement in the rankings. The limits for W cannot exceed 1.00 and cannot be negative. It will be 1.00 when the ranks assigned by each respondent are the same as those assigned by other respondents and it will be 0.00 when there is a maximum disagreement among the respondents.

The formula for the coefficient of concordance (W) is given as:

$$W = \frac{n[\sum T^2 - (\sum T)^2 / n]}{nm^2(n^2 - 1)} \quad or \quad nT / nm^2(n^2 - 1)$$

(8)

Where:
T = sum of ranks for the indicators being ranked;
m = number of respondents; and
n = number of challenges being ranked
Note that W is an index that measures the ratio of the observed variance of the sum of ranks and the maximum possible variance of the sum of ranks.
The maximum variance (T) is given by:

$$T = m^2(n^2 - 1)/12 \quad (9)$$
$$VarT = [\sum T^2 - (\sum T)^2 / n] \quad (10)$$

The Coefficient of Concordance (W) may then be tested for significance in terms of the F distribution as follows:

F-ratio $(F_c) = (m-1) \times W / 1 - W$

(11)

Degree of freedom for numerator

$$(df) = (n-1) - (2/m) \quad (12)$$

Degrees of freedom for the denominator

$$(df) = (m-1)\{(n-1) - (2/m)\} \quad (13)$$

RESULTS AND DISCUSSION

Socio-Demographic Characteristics of Respondents

From the findings, 68.3% were male and 31.7% were female. However, there were more male in the participatory category than in the non-participatory category. Thus, while as high as 70% were male in the participation category, 68.3% were male in the non-participatory category. The male dominance in the maize production sector confirms the notion that farming in the Northern Region of Ghana is traditionally and culturally dominated by men. This could also be due to the fact that male farmers have greater access to farm land and also physically stronger than female farmers in maize production.

Age is significant in determining the productivity of labour force. The modal age class is 20-30 representing 40.8% of the respondents, followed by 31-40 age group (33.3%), 41-50 (17.9%), and 51-60 (7.1%). The 61-70 age group recorded the least percentage (0.8%). This finding suggests that, maize production is dominated by the youth. The reason might be that the youth are very energetic, active and passionate as far as commercial maize production and adoption of new technologies are concerned. This distribution pattern is similar for both participants and non-participants except that the modal class in the participation category is 31-40.

Majority of the respondents (92.9%) were married while 6.7% were single. In terms of category of farmers, 98.3% of the participants were married while 87.5% of the non-participants were married. Thus, majority of the participants and non-participants in the ACDEP/PAS value chain intervention are married. Also, from the result, 67.1% of the respondents had a fairly large family size of 6 and above, while 32.9% had between 1 and 5 members. While as high as 44.2% of the non-participants had household sizes between 1 and 5, only 21.7% of the participants had household within this range. Thus there are more farmers with larger household among the participants than the non-participants. The large family size

constitutes family labour which most of the respondents rely upon in carrying out certain tasks in maize production and processing. Education plays a significant role in the status and the economic activity of an individual. From the results, 84.6% of the respondents had no formal education, 2.5% had non-formal education while 9.6% had attained primary education. Only 3.3% of the total respondents attained Senior High School level. There were more farmers with no formal education among the participants (90%) than in the non-participants (79.2%). Similarly, more participating farmers had secondary education (4.2%) than non-participants (2.5%).

Upgrading in Maize Value Chains

One of the objectives of the study was to investigate the extent to which farmers in the ACDEP maize value chain were applying the tenets of the value chain concept to upgrade the value of their maize; specifically, the use of certified seeds for planting, carrying out a germination test before planting, adoption of modern methods of land preparation, planting and farming in general as well as the number of fertilizer bags applied per acre. The findings are summarized in Table 1.

Use of Certified Seeds for Planting

The use of improved maize seed varieties is no doubt part of the solution towards increased and sustainable maize production to meet the country's food security needs and income of smallholder farmers. However, from the table, only 18.3% of the ACDEP/PAS maize value chain actors used certified seeds for planting, the remaining 81.7% used their own seeds for planting. Availability, accessibility and utilisation of certified seeds do not only increase productivity and incomes of farmers but also improves the quality of their produce that can lead to certification for the international market. The farmers who used certified seeds indicated that the seeds had high germination percentage, were resistant to common diseases and drought, and showed good agronomic characteristics, such as stalk and root strength and good grain size that meet the market

requirements than their own seeds stock. On the other hand, the reasons given for not using certified seeds which were revealed during FGD were high cost and the high demand for fertilizer, especially the hybrid seeds which are heavy feeders. The farmers also indicated that, they trusted their personal preserved seeds. However, they admitted that the certified seeds performed better than their own seeds. Thus, certified seeds present higher potential yields, but the price according to this group is higher and pose a challenge. This agrees with Badstue (2006) in his study of maize farmers in Central Valleys of Oaxaca in which farmers indicated trust and confidence in their own seeds.

Germination test before planting

From the table, only 0.8% of the respondents carried out a germination test before planting their seeds. Of all the quality measurements of seeds lots, none is more important than the potential germination of the seeds.

Methods of Land Preparation

The study revealed that only 2.5%, as against 97.5%, carried out harrowing after ploughing. Proper land preparations which include harrowing are often carried out on the field to follow the rough finish left by ploughing operations. The purpose of harrowing is generally to break up soil lumps and provide a finer finish, a good tilth or soil structure that is suitable for plant use. Harrowing can also be used to remove weeds and to level the soil hence, making more land available for planting. Improper land preparations (ploughing only) sometimes create gutters on the fields. This may have an effect on the planting population of the farm and perhaps a negative effect on the output.

Methods of Planting

The results showed that, 32. 5% of the respondents interviewed planted their maize in rows with the recommended spacing. While crop yields are sometimes limited by factors beyond the control of the farmer, such as lack of rain, they are most often limited by one or more of the factors farmers can control, such as planting with the correct spacing and in rows.

The planting operation is essential for good results in production. The consequences of deficiencies in this respect will negatively affect the whole cultivation process from pest management, harvest, yield, product quality and profits. The objective in using the correct spacing of crop plants is to obtain the maximum yield without sacrificing quality. This also ensures efficiency in farm operations.

Number of Fertilizer Bags Applied Per Acre

With respect to fertilizer application, the analysis from Table 1 shows that 62.5% of the farmers applied 1-2 (50kg) bags per acre. Also, 34.2% applied between 3-4 bags per acre while 3.3% did not apply fertilizer at all. The recommended fertilizer application rate per acre by MOFA is 3 (50kg) bags (i.e. 150kg/acre). The findings indicate that as high as 65.8% of the ACDEP farmers applied fertilizer below the MOFA recommended dosage. Against the backdrop that the soils are becoming more infertile the recommended dosage even needs to be revised upwards.

Farming Systems

As indicated in Table 1, 60%, 23.3% and 16.7% of the farmers were engaged in mono cropping, mixed cropping and mono culture respectively. This might have accounted for their low yields, especially with the mixed cropping and mono culture. Conclusions can be drawn from this study that the farmers are not doing enough to upgrade the value chain in terms of processes. Though, their output per acre of 10 maxi bags seems to be better, much needs to be done to be able to achieve the potential yield by using the best practices. Post-harvest processes are also relevant to ensure that the gains from the farms do not go waste but rather meet both domestic and export demand. Farmers' involvement in these post-harvest activities is however discussed in the next section.

Products Upgrading of the Maize Value Chain

As a result of globalisation, the quality of the product of the value chain has become increasingly important as the export market has

become more quality conscious. The challenge of standards lies in achieving them by allowing market access without excluding the poor from participating in value chain interventions. In this section, we shall discuss the extent to which the farmers in the study areas sought to upgrade their product. The results are presented in Table 2.

Methods of Shelling Maize

The use of shellers/threshers to shell maize helps in improving the quality of the maize and minimises losses. It also reduces the chances of pebbles getting into the grains. The findings reveal that 54.2% of the respondents shelled their maize with shellers and tarpaulin while 45.8% shelled their maize with the traditional methods such as the use of hands and sticks on the bare floor.

Grading/Sorting of Maize

Grading or sorting is a method aimed at improving the quality of the maize produce. It is also meant for easy classification of the maize into different grades. From the table, only 2.5% of the respondents graded or sorted their maize before selling. The 2.5% who sorted their maize before selling indicated that they had adopted grading techniques via selection by grain size and level of insect infestation. On the other hand, the respondents who did not grade their maize before selling argued that the shellers they had used in shelling their maize were able to sort the maize grains into sizes (big and small grains) and therefore there was no need to spend time sorting it again. Similar responses were given during the FGD by the value chain participating farmers. It was observed that fewer farmers were willing to adopt grading via sorting by grain size and level of insect infestation. The study revealed contradiction between farmers' knowledge of quality enhancement and willingness to practice it. In the sense that they were aware of the quality enhancement techniques for the production of their maize but a significant number of them were unwilling to practice them. The awareness of farmers may be attributed to the training

offered them by the maize value chain facilitating agencies.

Weighing of Maize

Weighing is very important in the value chain upgrading process because it eliminates or reduces cheating by traders. The findings show that all the actors (100%) weighed their maize into 50kg mini bags with standards weighing scales approved by the Ghana Standards Authority (GSA) before selling. The traders usually filled the sacks without weighing them, which sometimes can give them up to 120kg instead of 100kg. This results in increasing the profit of the trader to the detriment of the smallholder poor farmer. Hence, weighing as part of the product and functional upgrading processes in the value chain is to the advantage of the smallholder farmer.

Labelling of Produce

Similarly from Table 2, all the farmers (100%) labelled their maize bags for easy identification as part of the product upgrading. Labelling is done to ensure that the bags can be traced back to the owner in case of any irregularities detected (see Figure 1). It is a way of preventing farmers from adding foreign materials such as stones to their maize to increase the weight. Thus under situations where the buyers do not get the content expected, they could easily get the exact farmer from whom they bought that produce and make clarifications. This also motivates the farmers to do the right thing since they know that the buyers would return to buy from them if they maintain standards.

Market Compliance

With regards to market compliance, 96.7% of the respondents indicated that they were able to comply with the market requirements. Only 3.3% could not comply with the market requirements due to weather failure and simply because the market requirements themselves are not static, hence the difficulty is that regular market examination must be conducted.

Those who complied with the requirements revealed that, they earned higher profits. Therefore, it can be deduced that farmers who complied with the market

requirements are more likely to ensure mutual satisfaction and benefits among the actors. This is in agreement with Shepherd (2007) who asserted that potato farmers in Uganda understood and complied with the workings of the market. In this case the farmers had to grow new varieties, change production practices to influence potato size and moisture content, stagger planting dates and grow at different altitudes in order to ensure year-round availability.

Market Requirements for Maize

A market oriented farmer would have to be aware of the various market requirements and produce commodities that are demanded in order to be competitive. Farmers need to identify possible markets and their requirements before they even begin to produce. Carefully going by the market requirements would surely pay off in any economic activity. Market information, especially on product quality, volumes and varieties are very useful if farmers are to maximise their incomes. Farmers were probed to find out what they thought or knew about market requirements of maize products by SFMC and their partners. They were asked to choose from a list of market requirements they were aware of. Their responses were then ranked using Kendall's Coefficient of Concordance. From the findings, cleanliness, grain size and colour of maize were ranked as 1st, 2nd and 3rd respectively. Moisture content of the maize and the variety of maize planted had the least ranks of 4th and 5th respectively.

Cleanliness was ranked first because no consumer is ready to buy maize with impurities. It is also important because if the grains are bad, then the price of the maize would be negatively affected, which goes to affect the producer. In recent times where people are very cautious of their health, and for that matter the food they eat, it is obvious that nobody would like to buy spoiled maize or maize mixed with impurities such as stones. Especially in the case of maize where there are many producers and sellers, consumers would definitely choose the best among several options.

Size of the grains was ranked the 2nd most important requirement buyers are looking for. This is so because the size of the grain is an important determinant of the quality of maize. Big grains show that the maize received sufficient moisture, nutrients and also, an indication that the maize is properly matured. Not only that, but it is an essential indicator buyers use to determine the type of maize species they are buying.

The 3rd most important requirement that consumers were looking for in the maize was the colour. White maize varieties are demanded more by consumers and food vendors than the yellow varieties. The demand for the yellow maize is coming mainly from the poultry industry. During the FGD, it was revealed that maize farmers in the study area were into the production of white maize because its price was higher and sold faster than the yellow maize in the open market. The FGD confirmed that cleanliness, grain size and colour of the grains were the main market requirements for SMFC.

The moisture content of the maize was ranked fourth by the farmers as a market requirement by the consumers. According to these farmers, they were asked to dry their maize below 14% moisture level before storage. This is to minimize losses due to storage pests and to maintain grain quality. The variety of maize planted by the farmers was ranked last as a market requirement by SFMC. During the FGD, it was revealed that most of the farmers did not even know the exact variety they cultivated. All they knew was the colour of the grain; either white or yellow.

Types and Sources of Market Information for Farmers

Market information is vital if farmers must succeed in the production. Most of the smallholder farmers in Northern Region are not aware of available markets due to information gap. In this study, farmers' perceptions on market information were sought. Table 2 shows that 89.9% of the farmers had information on market price and the remaining 10.1% of the farmers had information regarding the quality of the produce. During the FGD, farmers emphasized that the availability of maize and

market price were some of the main market information types available to them. The sources of market information identified were SFMC, PAS, , other farmers, traders, NGOs and the local media. However, government policy, especially on current fertilizer subsidy and supply conditions, could also be vital information, but this was not mentioned.

Regarding the price offered by SFMC, 66.7% indicated that the price was fair. Upon further interrogation, it was discovered that those who said the price was fair were actually happy with the fact that they sold and received payment in bulk from SFMC. In previous years they were selling in bits and therefore, receiving payments on piecemeal. On the other hand, those who noted that the prices were not fair attributed it to high cost of production. However, they were quick to point out that the price was better than what was being offered in the open market.

The limited knowledge of farmers on information is likely to affect their ability to meet consumer demands. However, the information types identified were relevant for the growth and expansion of their businesses.

Certification of Farmers' Produce

With respect to certification, none of the respondents said they were aware of any certification standards and therefore they could not certify their produce. Meanwhile, all of them indicated that they sold their maize without their buyers requiring any certification. The lack of awareness on certification standards by the maize value chain participation farmers could be attributed to the fact that the value chain facilitating organizations laid more emphasis on yield improvement and relationship building than certification. This concentration on yield may not offer farmers the opportunity to be up-to date with certification requirements and benefits.

Value Chain Upgrading by the Intervention Agencies

The value chain intervention agencies have been instrumental in the value chain upgrading processes. They provide services such as training and extension, information, financial and research services to the participation farmers in the chain. Most of the trainings which were given on land preparation, planting, fertilizer application, crop management, harvesting and post-harvest handling were meant to upgrade the value chain in terms of processes and products. They also facilitated farmers and FBOs' access to financial services, markets and building their capacity in a bid to improve their productivity (GAP) and entrepreneurial skills as well as their incomes. Improvement of the entrepreneurial skills of farmers would lead to value chain upgrading in terms of functions. The intervention agencies also supplied the farmers with inputs such as scales, tarpaulins, jute bags, free transportation, storage facilities and payments of bonuses to the farmers when profits are realised. The potential benefits of these activities by the intervention agencies are a reduction of production costs and enhance capital investments in the maize sector.

Factors Influencing Farmers' Participation in the ACDEP/PAS Maize Value Chain

Table 3 shows the factors that influence farmers' participation in the ACDEP/PAS maize value chain intervention. It shows that the age, marital status, farm size and perception of farmers on the ability of ACDEP/PAS membership to enhance market access significantly influenced farmers' participation. All the significant variables had positive effects on participation in ACDEP/PAS maize value chain. Education and phone ownership were however insignificant.

The positive marginal effect of the age variable means that the older farmers had a higher probability of participating in the intervention than the younger farmers. This meets the *a priori* expectation of the researcher, since the older farmers may have gained more experience in farming and could foresee the potential gains in participating in the intervention. Similarly, in the community context, the elderly have higher community status and therefore are able to access intervention such as this. This finding is supported by Martey et al (2014) who also found age of household head to significantly

influence farmers' willingness to participate in multi-stakeholder platform by smallholder farmers in Northern Ghana. On the other hand, one would have thought that younger farmers are more innovative and venturous and so they should have had a higher probability of participating. However, the findings showed otherwise.

Farmers with larger farms also had a higher probability of participating in the ACDEP/PAS maize value chain than those with smaller farms. In most cases, farmers who cultivate on a relatively large scale are able to go into these kinds of interventions. This is because the interventions come with additional cost that the smallholder farmers are unable to bear. Rationally, the smaller farm farmers would opt for their usual (old) ways of doing this, as opposed to their large-scale counterparts, who by virtue of their size are more innovative.

Constraints faced by the actors in the ACDEP/PAS maize value chain

The first category of challenges is those faced by the farmers, followed by the processors and then the input dealers.

Constraints of the Farmers

The challenges were ranked on a scale of 1 – 12, with 1 being the most important and 12 the least important challenge.

Among the challenges were lack of credit, inadequate tractor/ labour, high cost of inputs, high cost of transportation and inadequate market information. The rest are as indicated in Table 4.

It was observed that almost all the farmers ranked credit as the number one challenge confronting them in the efficient functioning of the ACDEP/NRGP/PAS value chain intervention. In Shepherd's (2006 cited in Sualihu, 2012) study, lack of capacity building and financial credit prevented smallholder farmers in Kenya from participating in global value chains because they lacked the means by which to certify their produce as required by the European markets. Credit to finance inputs and

Consistent with the *a priori* expectation was the positive estimated marginal effect of the perception variable-'ACDEP enhances market access'; implying that farmers who perceived that participation in the ACDEP intervention would enhance market access had a higher probability of participating in the intervention. Generally, the aim of the ACDEP/PAS is to provide automatic access to market for the maize farmers. Therefore it is not surprising that the probability of participation was greater for farmers who had this perception.

Marital status was also found to have a positive influence on participation; implying that the married farmers had a higher probability of participating than the single farmers. Usually, married farmers share responsibilities with their spouses, thereby making them more risk lovers than their single counterparts.

Validation of Hypothesis

The null hypothesis was that there was no agreement among the ranking by the respondents and the alternate hypothesis was that there was agreement. The estimated W was 0.619, chi-square statistics as 816.465 with 11 degrees of freedom and asymptotic significance of 0.000. The chi-square critical obtained from the chi-square table was 19.675 at 5% level of significance. The asymptotic significant value of 0.000 means that the null hypothesis should be rejected in favour of the alternate hypothesis. Thus the estimated W of 0.619 indicates that there is 61.9% agreement among the rankings of the challenges.

capital investment is a main cause for low productivity in the agricultural sector. While many financial institutions and some NGOs have made considerable efforts to provide affordable credit to farmers, the conditions for borrowing, which include the high interest rates charged by these institutions and the need for collaterals make it almost impossible for the farmers to access the credit. It was revealed during the FGD that many of the respondents did not acquire credit because they were afraid that they might be unable to pay back. The

farmers also complained of the cumbersome procedures they had to go through in order to access credit from Bonzali Rural Bank (BRB) and the Agricultural Development Bank (ADB).

For example an interview with officials of the BRB and ADB (the main financial institutions that support the farmers) revealed that farmers are entitled to seasonal loans which are payable after the farmer harvests in that particular year. Farmers who are eligible for the credit must have at least five acres of their land under the crop for which they are applying the credit. In addition, the applicant must be in groups, provide a land title deed in their name, a search certificate from the lands office, pass port size photographs and a photocopy of the national identification card. The applicant will then be required to pick an application form, pay loan application fee, conveyance fee and commitment fee which were 1.5% of the approved amount. The loan is given at an interest rate of 15% per year in the case of ADB. The applicant is given 75% of the money and 25% is held for harvesting. However, if the applicant feels that they need the money for other urgent needs such as control of pests or top dressing, they can make a written request and will be paid the 25%. The strict requirements and cumbersome nature of the procedures has meant that many of the farmers have been reluctant to access loans. There is the need to take a second look at these requirements and procedures, especially the collateral.

The second limiting constraint faced by the smallholder maize farmers in the ACDEP/PAS maize value chain is the high cost of inputs. Maize farmers cannot acquire enough inputs such as certified seeds, fertilizers, herbicides, tarpaulins, weighing scales due to the high cost involved. This results in low yields, poor quality of grains and low prices of produce. The farmers intimated that not only was the subsidised fertilizer expensive, it was not readily available throughout the season because they are given on quota basis. This finding is consistent with that of Tahidu (2010) which showed that high cost of inputs was a limiting constraint faced by smallholder soybean farmers in the supply chain in Northern Ghana. He stressed that most soybean farmers in the region could not acquire inputs and equipment such as improved seeds and tarpaulins due to the high cost involved.

Similarly, inadequate tractor and labour services is hindering smallholder maize farmers in the efficient functioning of the ACDEP/PAS maize value chain intervention. Tractor services are mostly not readily available to all the farmers because they may all be tilling the land at the same time. This leads to a situation where some farmers would be farming out of the season. It was observed that, the communities in the Tamale Metropolis were the hardest hit by the problems of tractor/labour services. Tractor owners/operators would normally like to plough large tracks of land at a go and not fragmented fields. Unfortunately, the communities within the Tamale Metropolis no longer have large plots of land at one location due to sales of land to private and companies for residential and commercial development. Tractor owners/operators would therefore go to the hinterlands to plough large tracks of lands before coming back to Tamale by which time the farming season would have been over.

Furthermore, getting labour for production and postharvest activities is a problem now in the rural areas due to frequent migration of the youth to the major cities in search of jobs. An example is the 'Kayaye' menace. This situation results in high cost of labour. This is confirmed by the practices of farmers in which they resort to broadcasting maize like rice instead of planting in lines, and the high cost incurred by the maize farmers in employing labour for production and processing activities. Farmers need labour at every stage of the production and marketing process. Inadequate labour supply therefore implies poor yields and low profit margins.

The fourth most important challenge to the efficient functioning of the ACDEP/NRGP/PAS maize value chain intervention in the Northern Region is low price of maize. Even though, the actors in the chain agreed that the price being offered by SFMC is better than that of the open market, they still feel the price is not good enough, considering their cost of production these days. The study revealed that, most of the farmers only present

the maize that would cover their debt leaving the rest for home consumption and sale during the lean season. The demand and supply situation also contributes to the low prices of produce. Most of the farmers sell their produce immediately after harvest and that is the time everybody is selling. This leads to a situation where supply is more than demand, hence, the low prices.

The results agrees with that of Woldesenbet (2013) on his analysis of the maize value chain in Ethiopia in which limited access to market, low price of product, lack of storage, lack of transport, low quality of product and lack of policy framework to control the illegal Ethiopia-Somalia trade route were the major problems confronting maize producers.

The challenge ranked by respondents as the fifth highest was lack of extension service. This confirms the fact that the ratio of extension officers to farmers is still low, making communication and adoption of innovations very difficult. We found that extension services were mostly given by technical officers of the value chain intervention agencies. The MOFA extension staffs were hardly seen. In the study by Emongor et al (2009), low provision of extension and research services and low supply of irrigation water in irrigation schemes were the major constraints affecting maize farmers in Kenya.

Inadequate market information or poor communication was also an important drawback in the effective functioning of the maize value chain. Maize producers usually acquire marketing knowledge through linkages and information flow. Information flow among actors of the producer group would provide the way for the identification of market opportunities. Inadequate market information flow means that maize farmers were at a loss as to the right quantities and prices that they needed to work with. This confirms the findings of Sualihu (2012) in which over 56% of the chili pepper value chain farmers in the Tolon District and the Tamale Metropolis reported of irregular information flow among members as a challenge to the effective functioning of the chain. Sualihu (2012) stressed that lack of information flow among the actors undermined

trust which happened to be a prerequisite for successful Farmer Based Organisations (FBOs). Free flow of information among the actors would, undeniable enable them function as an organic unit, take collective decision, build trust and actions that would be binding and beneficial to them. The seventh most challenging constraint confronting the actors to the efficient functioning of the value chain is high cost of transportation. The intervention organisations indicated that the high cost of transporting farm inputs and farm produce increase the cost of production of the farmers which would have negative effects on their net income.

The eighth ranked most importance challenge facing the actors to the efficient function of the value chain is poor road network. The bad nature of the roads to the communities is affecting the smooth and timely transportation of inputs to farmers and produce from the aggregation centres, further leading to low yields.

Another problem affecting the value chain is post-harvest losses. Post-harvest losses occur both in the field and in storage. The farmers mentioned that due to the multiple activities being carried out at the same time during harvesting, their maize plants are destroyed in the field by pests such as cob borers. They also indicated that the inability of SFMC to convey the maize at the aggregation points on time leads to attacks by storage pests.

Inadequate land was only a problem in the Tamale Metropolis but not so much in the rural communities in the Tolon District (Kpendua and Tibogunaayili). In the Tamale Metropolis farm lands are being sold to individuals and companies for development at the expense of farming. Also lack of storage facility was not considered as a major challenge because the farmers did not keep the produce in their homes but rather gathered at aggregation points for onward collection by SFMC immediately after harvest. Thus farmers did not need to keep the maize with them for so long. However, Tahidus' (2010) study reveals that, lack of storage facilities by soybeans farmers in Northern Ghana compelled them to sell at farm gate to traders at lower prices in which they

cannot even recoup the cost incurred in production.

Lack of trust was the last challenge. It was discovered during the FGD that, SFMC sometimes do not buy all the maize presented to the company, especially when the market price is lower than the agreed price and so SFMC would only take the produce meant to cover the debt of the farmers, but this allegation was denied by SFMC officials. The farmers also accused the intervention agencies of not delivering the inputs on time; a situation the farmers said was a major cause of low yields and income. In the light of this analysis, it can be concluded that the failure of the maize farmers in the ACDEP/PAS value chain intervention in the Northern Region to increase their yields and income are as a result of these performance challenges they faced.

Trading and Processing Constraints

SFMC and SAVBAN processing company Ltd also identified financial credit, low sales and lack of storage facilities as constraints affecting the progress of their businesses. For the maize value chain development in the study area to achieve its intended results, solutions need to be provided to eliminate or minimise the constraints militating against actors of the chain. These included linking actors to credit sources at low interest rates, assisting in the provision of storage facilities and processing machines and access to guaranteed markets for their produce.

Constraints to Agro-Input Dealers

The agro input dealers appeared not to have many bottlenecks like the producers, traders and processors in the maize value chain. The only mentioned constraint to the sector was inadequate access to financial credit to expand their businesses and inadequate storage facilities for their outputs. It was observed during the interview that the agro input dealers especially the smaller ones were not properly connected with the other actors of the maize value chain. This came to light when they could not produce a contract document to support their involvement in the chain. The research findings further revealed that price fluctuations, inadequate knowledge and skills of agro-input dealers, especially the small input dealers on the proper use of agro-chemicals and the management of its adverse effects on the users were some of the challenges facing the input dealers.

Constraints of the Supporting Actors

In order to ascertain the constraints faced by the maize value chain actors in the study area, the main value chain intervention organisations (ACDEP, PAS, SFMC, BRB and SAVBAN) were contacted. Their responses with respect to the challenges they faced included high cost of borrowing in an inflationary environment with high level of interest rates, lack of economies of scale in volumes of produce traded in and high transport and storage costs.

The inability and unwillingness of the maize farmers to shift to the cultivation of international market driven hybrids are some of the main constraints affecting the supporting actors in the maize value chain. The varieties of maize cultivated by these farmers are poor in quality due to its susceptibility to pest and diseases both in the field and storage. They further revealed that unfavourable climatic conditions, especially rainfall, which is unpredictable these days, were also constraints affecting the activities of the maize value chain supporting actors. This is especially the case of SFMC who have to face the bankers when farmers are unable to pay. They also reported that cost of agricultural input such as fertilizers and hybrid seeds were very high and these presented a glooming picture to the maize value chain sector, because farmers are not able to purchase and apply the required quantity to their maize and that affected their yield and loan repayment.

The study further sought the opinion of MOFA extension staff regarding challenges facing maize production among small scale farmers in the study districts. The following were some of the bottlenecks identified: the use of uncertified seed by farmers, subsistence mentality by the farmers, lack of awareness of improved agricultural practices and lack of technical knowhow.

CONCLUSIONS AND RECOMMENDATIONS

From the aforementioned, the ACDEP/PAS value chain has chalked some successes, in terms of helping the farmers to upgrade their products and thereby giving them relatively high prices for their produce. However, a lot more needs to be done, in terms of taking a holistic approach to removing the constraints, especially the use of collateral in credit delivery. Also, while more actors (e.g. investors in storage facilities) must be encouraged to come on board, the chain must be supported to address the challenges for an effective linkage of all the actors.

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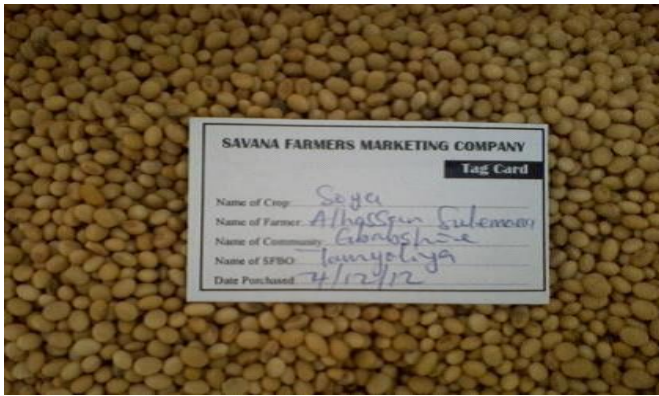
Figure 1: Farmer Identification Tag
Source: PAS (2011)

Table 1: Process upgrading of the Maize Value Chain

Methods of Upgrading	Frequency	Percentage
Type of seeds used for planting		
Certified seeds	22	18.3
Own seeds	98	81.7
Germination Test		
Yes	1	0.8
No	119	99.2
Land preparation		
Ploughing only	117	97.5
Ploughing and harrowing	3	2.5
Total bags of fertilizer/acre		
0	4	3.3
1-2	75	62.5
3	41	34.2
Planting in rows		
Yes	39	32.5
No	81	67.5
Farming Systems		
Mono culture	72	60
Mixed cropping	28	23.3
Mono cropping	20	16.7

n=120
Sources: Field Survey, January, 2014

Table 2: Product Upgrading of the Maize Value Chain

Methods of Upgrading	Frequency	Percentage
Shelling of Maize		
Sheller with tarpaulin	65	54.2
Hands and sticks	55	45.8
Weighing of maize		
Yes	120	100.0
No	0	0.0

Grading of maize		
Yes	3	2.5
No	117	97.5
Labelling of maize bags		
Yes	120	100.0
No	0	0.0
Market compliance		
Yes	116	96.7
No	4	3.3
Market information		
Price of produce	107	89.9
Quality of produce	13	10.1
Certification	0	0.0
Yes	120	100.0
No		

n=120

Sources: Field Survey, January, 2014

Table 4: Rankings of farmers' Challenges

Challenge	Sum of Score	Mean Rank	Rank Position
Inadequate tractor/ labour	416	3.45	3rd
High cost of input	314	2.63	2nd
Lack of credit	163	1.34	1st
Lack of extension serv.	884	7.38	5th
High cost of transport	920	7.68	7th
Inadequate market information	914	7.63	6th
Lack of storage facilities	1078	9.01	11th
High post-harvest losses	1019	8.51	9th
Poor road network	1009	8.44	8th
Lack of trust	1122	9.35	12th
Low price for products	466	3.87	4th
Inadequate land	1045	8.71	10th

Sample size= 120, Kendall's W = 0.619, Chi-Square = 816.465, Df =11 and Asymp. Sig. =0.000

Source: Field Survey, January, 2014

Table 3: Probit Estimation Results of the factors Influencing Farmers' Participation in ACDEP Value Chain.

Variable	Marginal effect	Standard error
Age	0.007**	0.004
Marital status	0.217*	0.123
Education	-0.014	0.010
Farm size	0.038*	0.021
Phone ownership	0.037	0.070
ACDEP enhances market access	0.425***	0.069
Chi square	17.68***	

Note: ***, ** and * means significant levels at 1%, 5% and 10% respectively

Source: Field Survey, January, 2014