

Analysis of the Sweet Potato Value Chain in Ghana; Linkages, Pathways, Governance and Constraints

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ABSTRACT

This study was aimed at examining the various relationships and product pathways of the sweet potato value chain and constraints of actors along the sweet potato value chain in Ghana. Data were collected from both primary and secondary sources with primary data forming the core of the study. A total of Three Hundred and Eighty (380) respondents were interviewed comprising 200 producer respondents, 100 traders and 80 processors. Value chain mapping and governance approach was done to establish the linkages and relationships among actors along the value chain and the produce pathways. The Kendall's coefficient of concordance was used to analyze the various constraints by actors. The study results revealed that, the main actors along the sweet potato value chain are input suppliers, producers, collectors, wholesalers, retailers, processors and consumers. The sweet potato value chain was found to be buyer-driven and governed by collectors. The chain was also found to be weak in terms of integration and access to market information. Producers were constrained with high cost of chemical inputs, poor road network to farms and high cost of labour during the production process whilst low commodity price, poor road network and long market distance were their critical marketing challenges. Traders also identified high transport cost, inadequate storage facilities and high post-harvest losses as the most critical constraints to their sweet potato business. Limited working capital, limited access to credit and high perishability of produce were identified as the most constraining factors at the processor level. Therefore, policies and strategies aimed at improving the shelf life of the crop, enhance coordination and enhanced access to credit is recommended by the study.

KEY WORDS: Actors, Buyer-driven, Chronbach's alpha, Integration, Kendall's coefficient of concordance, Value chain map

1.1 INTRODUCTION

In Ghana, agriculture employs more than 50 percent of the economic active population and contributes more than 30 percent to export receipts and 22 percent of Gross Domestic Product (GDP) (GSS, 2013). Within food crop production, diverse crop enterprises are managed in order to improve food security and household income generation. Major among such enterprise are cereals and grains followed by Root and tuber (R&T) crops (Babaleye, 2005). Root and tuber crops consumption form between 16 and 31% of per capita daily calorie intake in Ghana (GSS, 2005). The main roots and tuber crops in Ghana are cassava, yam, cocoyam and sweet potato. Sweet potato has seen minimal work on value chain development. However, the crop holds the position as one of the main food security crops in Africa due to its resistance to drought, flexible planting, harvest cycle and tolerance of low-quality soils. Due to the crop's versatility and adaptability, it is ranked as a universal crop and seventh most important food crop next to wheat, rice, maize, potato, barley, and cassava since it contains a substantial source of carbohydrate, carotene and vital vitamins (CIP, 2000; FAO, 2002). The consumption of the crop is mainly in the fresh form by either frying, boiling or roasting; the vegetative parts (vines) are mostly fed to livestock predominantly in areas such as central Kenya where zero grazing management systems particularly in small scale dairying is well established. They may also be utilized by young calves as starter feed and partial milk replacer (Orodho *et al.*, 1995). Notable production areas and sweet potato supply centers in Ghana are Eastern, Central, Northern, Upper East, and Volta Regions; the later three regions coincide with the country's poverty map. The sweet potato value chain in Ghana comprises many actors interlinked by different governance structures which expose them to various constraints. Addressing constraints of sweet potato production as well as physical, facilitating and exchange functions of marketing thus promises improvements in poverty and food security. Sweet potato is a food security crop which contributes not only to calorie intake but employment creation, income and poverty alleviation in production and distribution centers. A number of actors are involved in the production of the crop in some Southern and Northern Regions of Ghana. Due to its short gestation period, it can be

cultivated three times in a calendar year by farmers serving as a constant and stable source of income for them. The marketing and distribution as well as processing of sweet potato have generated employment to many households especially women, and livelihoods to such households largely depend on the crop. Nutritionally, the crop is known to be a well-balanced major plant food with a good proportion of protein and calories, whilst complemented largely by substantial quantities of vitamins, especially vitamin C, minerals, and trace elements. Because of the correct balance between protein and calories, it is regarded as a start-up food for growing children (Berga *et al.*, 1993). Whilst potentially sweet potato is regarded as being widely versatile in its uses, substantial constraints of production and marketing have caused the sector to remain considerably sluggish in terms of productivity and value chain development. Thiele *et al.* (2009) assert that significant issues confronting the sweet potato value chain are; limited access to quality planting materials and other production inputs, limited market for the crop as it competes with other prominent roots and tuber crops like yam, high perishability of the crop is also seen as the main issues which has made the development of the crop's value chain sluggish. The crop potentially can be cropped at least three times yearly. However, heavy dependence on rains rather than irrigation has made the crop seasonal reducing its cropping potential. Also, limited coordination among value chain actors has made the value chain of sweet potato less developed. The foregone discussion is indicative that sweet potato value chain is one bedeviled with many constraints whereas research effort has been very low. The constraints coupled with the linkages, pathways, roles and governance structure of the value chain if not critically examined can hamper the effective role of the sweet potato value chain in providing alternative livelihoods for the households who are dependent on it. The study therefore seeks to carry out and thorough analysis of the sweet potato value chain, linkages and governance structure and finally enumerate the various constraints along the chain in order to address them appropriately.

1.2 Value chain governance

Kaplinsky and Morris (2000) refer to governance the role of coordination and identifying dynamic profitable opportunities and assigning roles to key players. Value chains entail repeating linkages through actor interactions. In ensuring governance among actors along a value chain, chain managers are to ensure that these relationships are reflective of their organization rather than some randomness of those events. The conception of value chain governance stems from a requirement to set a product and process through adequate logistic standards which then impact an action from either the downstream or upstream of the chain.

The terms coordination and governance tend to have been used in a synonymous manner in the literature particularly in the 1980s. Williamson (1985) conceptualized governance to mean the set of institutional organizations in which involves some transaction. Gereffi's *et al.* (2005) used the term governance to mean coordination which he defined as meaning the vertical organization of activities and functions of actors in work on Global Commodity Chains. Williamson (2002) stressed that the gradual shift from spot trade to contract ordering of goods and services leads to the reconceptualization of the firm not being a production function (mainly for the production activities) but as a governance structure. This improves the quality of standards for the benefit of industrial coordination which is mainly seen in the agri-food chains where commodities are perishable and frequently change form as it progresses towards its target consumer. Also, the network theory stipulates that, relationships are not only shaped by economic considerations; other concepts like trust, reputation and power also have a key impact on the structure and duration of inter-firm relationships (Uzzi 1997). Since the 1990s, social capital theory has become an important branch within the network approach. Network relations may enhance the "social capital" of a company, by making it feasible to get easier access to information, technical know-how and financial support (Coleman 1990; Burt 1997) and by encouraging knowledge transfer between network partners (Humphrey and Schmitz 2002), thereby reducing transaction costs and improving access to markets (Gulati, 1998). Firms/companies would therefore select the governance form that minimizes transaction costs, under conditions of bounded rationality and opportunistic behavior of partners. The trust that is existent between firms makes it possible for an industry to have several coordination forms. Kaplinsky and Morris (2000) classified value chains based on whether the said chain exhibits a market oriented (buyer-driven) or a produce oriented (producer-driven) governance structures or setting: Buyer-driven chains are usually associated with labor intensive industries, and so it is more important for international development and agriculture. In such industries, the lead role in coordination in terms of products specification and volume is determined by buyers. This is particularly the case for crops whose shelf life is short.

2.0 MATERIALS AND METHODS

2.1 Sampling Method and Data

The study was conducted in the West Mamprusi and Fanteakwa districts of the Northern and Eastern regions of Ghana respectively due to its their prominence when it comes to the production of the target commodity (sweet

potato). Also, these areas have seen some interventions when it comes to root and tubers crops utilization (processing) into different forms by RTIP/RTIMP initiatives. Four (4) communities were selected from each of the districts by the use of a simple random sampling technique. Farmers in the selected communities were then selected by way of simple random sampling approach using the village farmers list from the AEAs and the random number table approach which tends to reduce selection biases significantly. Markets and communities selected for trader and processor respondents were purposively selected with areas of high concentration of the targets (processors and traders) given highest priority. A combination of accidental and snowballing techniques was used to select marketers/traders and processors based on referrals from initial subjects due to the difficulty in getting a sampling frame at these actors. With this, respondents were interviewed as and when they were identified and willing to participate in the survey. A sample size of one hundred (100) farmers, fifty (50) traders and forty (40) processors were selected from each of the districts (West Mamprusi and Fanteakwa) making a total of Three Hundred and Eighty (380) respondents. Primary data formed the core of the data used in this study.

2.2 Data Analysis

A combination of value chain map and the governance structure were used to analyze the sweet potato value chain. Mapping value chain helps to get a better understanding of connections between actors and processes and interdependency between actors and processes in a value chain. A value chain map allows one to depict all activities, actors, and relationships among segments of the chain, and the interactions between producers and intermediaries. This exercise was carried out in qualitative and quantitative terms through graphs presenting the various chain actors, their linkages and all the operations of the chain from production level through the to the consumer. Within the concept of value chain, governance defines the structure of relationships and coordination mechanisms that exist among chain actors. Constraints faced by actors along the sweet potato value were also analyzed using the Kendall’s Coefficient of Concordance (W). Kendall’s coefficient of concordance (W) The Kendall’s Coefficient of Concordance was estimated as follows;

$$W = \frac{12(T - T^3)}{m^2 - (n^3 - n)} \tag{1}$$

Where;

T= Sum of ranks for each constraints been ranked

m= Number of respondents passing judgment on the constraints

n= Number of rankings

Then test of significance of the Kendall’s Coefficient of Concordance is given by:

$$z = 0.15 \log e((m - 1)w)(1 - w)^{-1} \tag{2}$$

The Kendall’s Concordance is hypothesized as;

H₀= There is no agreement among the rankings of the constraint

H₁= There is agreement among the rankings of the constraint

The test of significance of the Kendall’s Concordance was done using the chi-square (χ²) statistic which is computed using the formula;

$$\chi^2 = p(n - 1)W \tag{3}$$

Where;

n= Sample size; p=number of constraints; W= Kendall’s Coefficient of Concordance

After the various constraints and the agreements have been elicited, the Cronbach’s Alpha was used as an estimator of the internal consistency and reliability of psychometric scores for a sample of respondents for a five (5) point Likert scale helped in removing constraints that were not in-line (consistent) or measuring the same construct with the general outlook of constraints. The theoretical form of the Cronbach’s Alpha is shown below;

$$\alpha = \frac{N}{N - 1} \left[1 - \frac{\sum_{i=1}^n \sigma_{Y_i}^2}{\sigma_X^2} \right] \tag{4}$$

α= Coefficient that indicates the reliability of constraints.

N= Number of components (Items)

σ_X^2 = Variance of observed total test scores for the current sample of persons

$\sigma_{Y_i}^2$ = Variance of component i for the current sample of persons

3.0 RESULTS AND DISCUSSIONS

3.1 Descriptive Analysis of Producer.

Tables 1 and 2 present demographic and summary statistics of producer respondents. About 79% were males and 21% were females. The average age of farmers from the pooled sample was 40 years. With regards to educational status of the farmers, it was realized that majority of farmers had never been to school (44.5%) followed by farmers with basic level of education (43.5%) with an average years of schooling of 8. Majority (83%) of the farmers from the study were married with an average household size of 7 people (pooled) which is an indication of additional farm labour. Majority (54%) of farmers indicated they owned their lands for sweet potato cultivation with an average farm size of about two (2) acres and above 15 years of farming experience. Output per acre was seen to have an average of 12.5 bags (1362.5kg) per acre. It was also realized from the study that, majority (53%) of farmers had access to extension services with an average extension contact of three (3) per year. Membership of FBOs was seen to be low (26%) which ultimately make group level technology transfer difficult. Record keeping was also seen to be on the low (41%) with the main reason of not keeping records by farmers being their inability of write. From the study, access to credit was found to be very low since only 12% of farmers indicated they had access. Savings habit of farmers was seen to be good since farmers reported saving about 50% of their profit.

Table 1 Demographic and socioeconomic characteristics of Producers

Variables		Fanteakwa (n=100)	West Mamprusi (n=100)	Total (N=200)	
		%	%	Freq	%
Sex	Male	71	87	158	79
	Female	29	13	42	21
Educational Level	Never been to school	26	63	89	44.5
	Basic	68	19	87	43.5
	Secondary	6	16	22	11
	Tertiary	0	2	2	1
Marital Status	Single	14	7	21	10.5
	Married	75	91	166	83
	Separated	2	0	2	1
	Widowed	9	2	11	5.5
Land Tenure Arrangement	Own land	27	80	107	53.5
	Family land	15	16	31	15.5
	Share cropping	53	0	53	26.5
	Renting	5	4	9	4.5
Access to Extension	Yes	32	74	106	53
	No	68	26	94	47
Membership of a Co-operative	Yes	0	52	52	26
	No	100	48	148	74
Record Keeping	Yes	6	35	41	20.5
	No	94	65	159	79.5
Access to Credit	Yes	14	17	31	15.5
	No	86	83	169	84.5

Source; Field survey, 2015

Table 2 Summary statistics on characteristics of Producers

Variables	Fanteakwa (n=100)		West Mamprusi (n=100)		Total (N=200)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	42.99	14.34	37.82	11.69	40.41	13.31
Years of schooling	7.48	2.62	9.1842	3.42	8.053	3.0054
Household size	5.8	2.91	8.28	4.6	7.04	4.032
Distance to farm (km)	1.6	1.076	2.584	1.97	2.092	1.65
Years of SP farming	14.36	9.17	6.6	5.45	10.48	8.47
Farm size of SP (acres)	2.2825	1.77	1.2875	0.67	1.785	1.42
Output (109kg bag)	23.095	14.52	26.02	16.31	24.55	15.47
Extension Contact	2.1481	1.026	3.1067	1.58	2.8529	1.51
Amount saved last season (GH¢)	571.5556	469.029	241.1236	190.37	407.26	394.16
Credit received last season (GH¢)	576.42	517.32	286.47	75.74	417.41	374.89
Price of SP (109kg)	93.7	12.28	65.88	11.0034	79.79	18.15
Income from SP (GH¢)	1899.8	1398.44	1274.82	645.84	1587.31	1130.74
Profit for last season (GH¢)	1310.9	1362.44	567.27	611.5	939.085	1117.33

Source; Field survey, 2015

3.2. Descriptive Analysis of Traders

Traders serve as the main link between the downstream and upstream of the value chain. Tables 3 and 4 illustrate their demographic and summary statistics. From the survey, it can be realized that majority of the traders (98%) females. It is however worth noting that, the average age of traders was 43years. About 38% of traders were wholesalers with 29% being collectors and 33% being retailers. The study revealed that, majority (61%) of sweet potato traders had never been to school with an average of 3years of schooling. Majority (51%) of traders had the main target customers for their sweet potato as fellow traders with 25% of traders targeting their produce directly to processors and 24% targeting consumers. It was realized from the survey that the main point of sale for sweet potato was the main district markets with 81% of traders responded to the affirmative. From the survey, it was realized that 48% traded in only sweet potato whilst majority (52%) of traders indicating they traded in other root and tuber crops. The survey further revealed that, majority (72%) of traders were not members of any trader association. Generally, access to price information was seen from the survey as high since majority (56%) of the traders had access to price information and handled about 9 bags (981kg) per week.

Table 3 Demographic and socioeconomic characteristics of Traders

Variables		Fanteakwa	West Mamprusi	Total (N=100)	
		(n=50)	(n=50)	Freq	%
Sex	Male	4	0	2	2
	Female	96	100	98	98
Age	<30	16	14	15	15
	30-60	80	76	78	78
	>60	4	10	7	7
Type of Trader	Retailers	40	26	33	33
	Wholesalers	30	46	38	38
	Collectors	30	28	29	29
Educational Level	Never Been to School	30	92	61	61
	Basic	68	8	38	38
	Secondary	2	0	1	1
Target Customer	Fellow Traders	54	48	51	51
	Processors	8	42	25	25
	Consumers	38	10	24	24
Main Point of Sale	Main District Market	74	88	81	81
	Market Within District	10	12	11	11
	Market Outside District	16	0	8	8
Trade in Other Commodities	Yes	52	44	48	48
	No	48	56	52	52
Membership of a Trader Association	Yes	42	14	28	28
	No	58	86	72	72
Awareness of SP Price Information	Yes	74	38	56	56
	No	26	62	44	44

Table 4 Summary statistics characteristics of Traders

Variables	Fanteakwa (n=50)		West Mamprusi (n=50)		Total (N=100)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	42.12	10.63	42.5	12.57	42.31	11.58
Years of schooling	5.54	4.067	0.66	2.37	3.10	4.12
Household size	5.62	1.88	6.54	3.19	6.08	2.65
Volumes of SP handled per week (109kg bag)	12.945	13.89	4.16	2.61	8.55	10.88
Minimum capital Requirement(GH¢)	1676.2	1533.89	411.6	163.61	1043.90	1257.62
Marketing cost	4188.74	4590.53	698.59	525.58	2443.664	3693.62
Unit Price(GH¢ /109kg)	130.294	26.77	67.63	10.12	97.222	37.13
Total revenue(GH¢)	4937.56	5072.10	877.65	683.029	2907.603	4138.41
Profit (GH¢/typical month)	748.82	982.021	179.058	190.35	463.939	759.75

Source; Field Survey, 2015

3.3 Descriptive Analysis of Sweet Potato Processors.

Processors in the sweet potato value chain perform the transformational role by changing the produce into different products for a more convenient utilization by consumers. The main product processed from fresh sweet potato was found to be the fried form. Processors also play a role as a major receptacle for the absorption of most of the sweet potato from traders compared to proportions channeled directly to consumers. This activity is basically performed by females as observed in the survey since all eighty (80) processors identified were female. The International Labour Organization (ILO) estimated about 61% of females in the informal sector in developing countries (ILO, 2000). The study revealed that, majority (85%) of processors were within the age category of 30 and 60 years. With regards to the level of education of processors, it can be seen from the results that majority (50%) of processors had attained basic level with eight (8) years of schooling. Also, majority (81%) of processors were into the processing of other commodities. Membership of processor association was almost non-existent since majority (67%) of processors were not members. A typical processor had about six (6) years of experience. Majority (46%) of processors indicated their reliance on retailers for fresh produce due to the convenience and/or proximity to these traders (retailers). The mode of marketing was also found to be the same across the two districts since all (100%) processors indicated their use of spot trade either for their produce or products. The source and type of capital used by processors was mainly own equity (96%) source. With regards to access to credit, majority (92.5%) of processors indicated they had limited access. Place of savings has been very critical in recent times in one's ability to access credit facilities from FIs.

Table 5 Demographic and socioeconomic characteristics of Processors

Variables		Fanteakwa (n=40)	West Mamprusi (n=40)	Total (N=80)	
		%	%	Freq	%
Age	<30	7.5	22.5	12	15
	30-60	92.5	77.5	68	85
Educational Level	Never been to school	12.5	80	37	46
	Basic	83	17.5	40	50
	Secondary	5	2.5	3	4
Processing more than one commodity	Yes	10	62.5	65	81
	No	0	37.5	15	19
Membership of a Trader Association	Yes	0	22.5	9	11
	No	100	77.5	48	89
Main Point of SP Procurement	Farm gate	10	10	8	10
	Collector	23	20	17	21
	Wholesaler	30	15	18	23
	Retailer	37	55	37	46

Source; Field Survey, 2015

Table 6 Summary Statistics of characteristics of Processors (continuous variables)

Variable	Fanteakwa (n=40)		West Mamprusi (n=40)		Total (N=80)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	38	6.51	34.40	7.67	36.2	7.30
Years of schooling	7.53	3.29	1.53	3.40	4.53	4.49
Household size	4.88	1.67	6.25	2.26	5.56	2.092
Average distance (km)	3.91	4.59	2.77	1.26	3.32	3.33
Total income from SP (GH¢)	1310.45	846.44	683.75	212.85	997.10	689.56
Years of sweet potato processing	7.15	3.94	4.33	2.27	5.74	3.49
Credit received for SP processing (GH¢)	1266.67	1342.63			1266.67	1342.63
Average processing cost /cycle (GH¢)	64.85	22.83	57.90	11.57	61.37	18.32
Average Profit/cycle (GH¢)	46.99	63.14	42.77	34.17	44.88	50.49

Source; Field Survey, 2015

3.4 Value Chain Analysis

3.4.1 Value Chain Map of Sweet Potato in Ghana

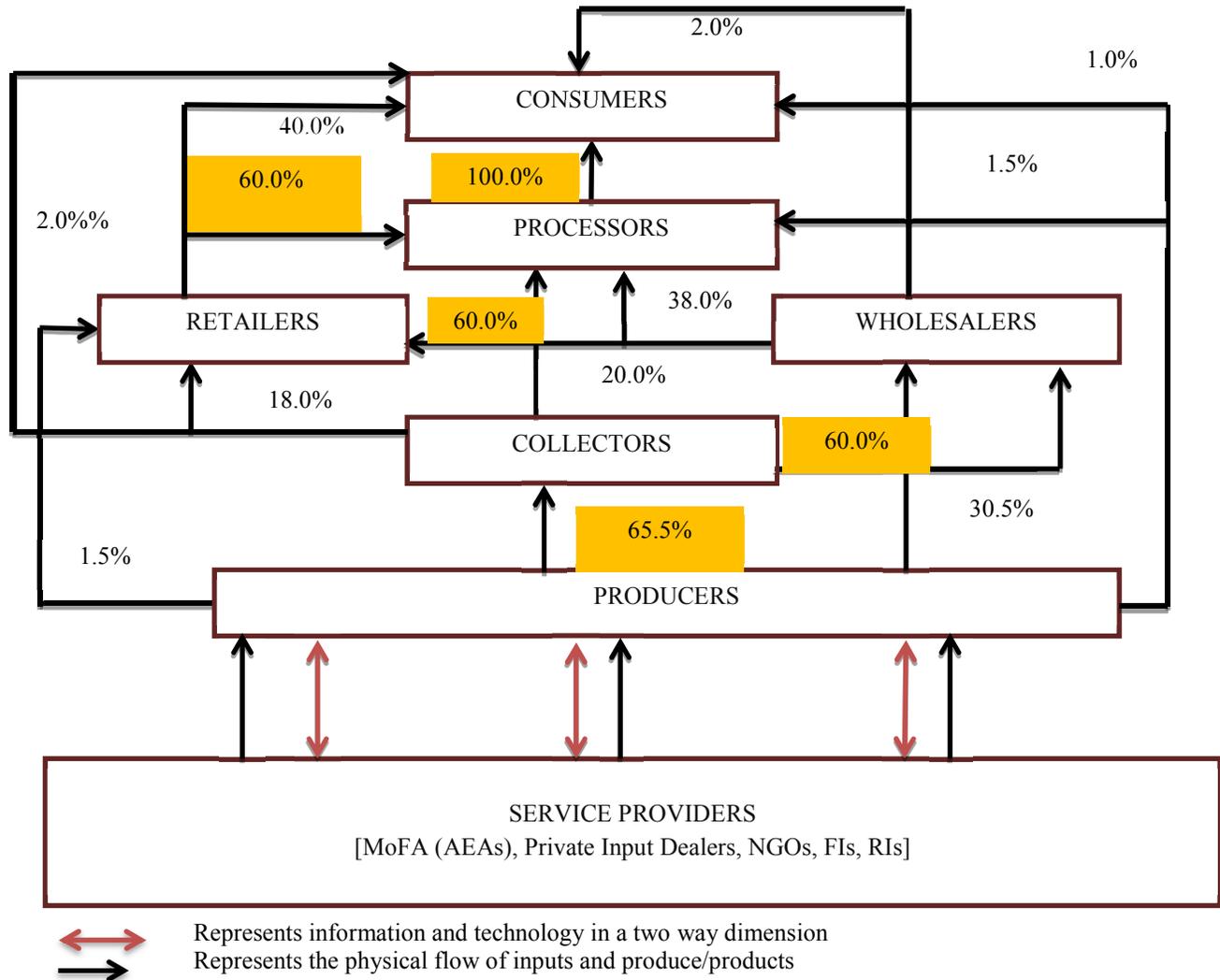
The value chain map of sweet potato in Ghana is generated from the study as depicted in Figure 1. The various actors in the value chain are depicted and the various distributional channels of the flow of sweet potato to the final consumer illustrated. From the map, it can be seen that producers mainly enjoy support services such as input supplies, financial assistance and educational programmes on innovative technology from service providers (MoFA, private input dealers, NGOs, FIs, and RIs). Information flow is mainly a two way flow where service providers receive feedback from producers on whatever service is given. Producers after production of sweet potato have a number of alternative channels to sell their produce. It was realized from the study that, majority (65.5%) of producers sold their produce to collectors who mainly buy sweet potato from the farm gate with 30.5% of producers selling to wholesalers and 1.5% selling to retailers. Only 1.5% and 1% of producers sold directly to processors and consumers respectively. Also, majority (60%) of collectors sold their produce to wholesalers, 20% selling to processors and 18% sold to retailers. Notwithstanding, 2% of collectors sold their produce directly to consumers. Wholesalers mainly sold their produce to retailers with 60% of them indicating their sale to retailers. It was also realized that whilst 38% of wholesalers sold to processors, only 2% of them sold to consumers. At the retailer level however, 60% and 40% of them sold their sweet potato to processors and consumers respectively. Finally, all processors (100%) sold their products directly to consumers in a more convenient and ready-to-eat forms.

3.4.2 Actors and their Role in Sweet Potato Value Chain

The value chain map emphasized the involvement of diverse actors who participate directly or indirectly in the value chain of sweet potato in Ghana. According to KIT *et al.* (2006), the direct actors of a value chain are those involved in actual activities along the chain (input suppliers, producers, traders, processors and consumers) whilst the indirect actors can be said to be actors who provide financial or non-financial support services, such as credit agencies, government via MoFA, NGOs, cooperatives, researchers and extension agents. Input suppliers are involved either directly or indirectly in the supply of agricultural inputs. Private input suppliers have been acknowledged by farmers as the main source of input supply (especially fertilizer, herbicides, pesticides and farm implements). Sweet potato growing farmers also participate in this stage of the value chain particularly when it comes to sweet potato planting materials (vines) supply to fellow farmers at a fee and/or gratis. Notwithstanding, it was also observed that MoFA through its agents of technology transfer (AEAs) sometimes provide sweet potato vines in the form of vine multiplications programs. Such actors are responsible to supply agricultural inputs like improved sweet potato vines, fertilizers, herbicides, pesticides and farm implements which are essential inputs at the production stage. Sweet potato farmers/producers are the major actors who perform most of the value chain functions right from farm inputs preparation on their farms or procurement of the inputs from other sources to post harvest handling and marketing. Ploughing, planting, fertilization, irrigating, weeding, pest/disease control, harvesting and post-harvest handling are some of the major functions undertaken by sweet potato producers. Monocropping was the most practiced production system. Post-harvest handling, which includes different activities like sorting, grading, packing, storing, transportation, loading and unloading, are mostly done by the farmers themselves if they send the produce (sweet potato) to the market or traders who go to the producing centers to buy at the farm gate. Traders in the value chain are those actors who basically ensure the movement of the physical sweet

potato from the downstream of the value chain to the upstream of the chain. These traders were identified as collectors, wholesalers and retailers. Collectors are traders in assembly markets and/or farm gates who collect sweet potato from farmers in village markets and from farms for the purpose of reselling to wholesalers and retailers. They use their financial resources and their local knowledge to bulk sweet potato from the surrounding area. They play an important role and they do know areas of surplus well. Collectors are the key actors in the sweet potato value chain, responsible for trading up to 65.5% (Figure 1) of sweet potato from production areas to wholesale and retail markets. However, wholesalers are mainly involved in buying sweet potato from collectors and producers in larger volumes than any other actor and supply them to retailers, processors and consumers. The results indicate that wholesale markets are the main assembly centers for sweet potato in their respective surrounding areas where collectors from producing areas deliver the produce. They had better storage, transport and communication access than other traders. Almost all wholesalers had a warehouse in a market either self-owned or used on rental basis. Retailer involvement in the chain includes the purchase of sweet potato, transporting to retail shops, grading, displaying and selling to processors and final consumers making them the last trader link between producers and consumers. Sometimes they could also directly acquire volumes from the producers (1.5%) and collectors (18%) (Figure 1). Consumers and processors usually buy the produce from retailers as they offer according to requirement and purchasing power. With regards to processors, they are very vital due to the role in changing the physical form of the produce whilst improving the shelf life of the crop. Processors of the sweet potato value chain in Ghana were found to mainly perform two type of value addition. The first activity performed is the addition of value to the produce itself in the form of storing, packaging (produce) and transporting the produce to the processing site. The second phase of value addition includes peeling, washing, frying and packaging (product) to consumers in such convenient ready-to-eat form. Processors mainly obtained sweet potato from retailers. Also, it is worth noting that, provision of services such as training and extension, information, financial and research services are the reserve of these supporting actors who may not be directly involved in the mainstream chain. Access to information or knowledge, technology and finance determines the state of success of value chain actors (Martin *et al.*, 2007). These supporting service providers in the sweet potato value chain were seen as MoFA, private input dealers, Non-Governmental Organizations (NGOs), Financial Institutions (FIs) and Research Institutions (RIs). Although cooperative societies are present in some communities, they mainly perform a facilitating role of mobilizing farmers for such services to be provided by the aforementioned institutions.

Figure 1 Value Chain Map of Sweet Potato in Ghana.



Source; Researcher's Own sketch from Field Survey, 2015

3.4.3 Governance of the Sweet Potato Value Chain

The facilitation role of value chain is performed mainly by dominant actors. This is done mainly through the movement of the commodities and price setting mechanism. They basically set the mode of operation and rules of marketing of the chain for which every chain actor subscribe. The study results indicated that the collectors and wholesalers supported by the producers are the main value chain governors. Markets (Walewale, Agomanya, Ehiamankyene and Achiaman) are heavily dependent on collectors, and therefore the sweet potato value chain is heavy dependent on the volumes supplied to these markets. In most instances, the level of relationship among the key actors is one of a free market exchange and not coordinated since all actors market their produce by the spot trade system. As a result of the improper information flow and ultimately the minimal bargaining power, farmers are left with very little options than to set their produce at the farm level particularly due to the high perishability of the crop coupled with poor storage systems. This is in conformity with work done by Bezabih (2008) who concluded that the lack of coordination among producers increase their bargaining power of producers in the value chains of horticultural crops in Ethiopia. Actors along the sweet potato value chain mainly depend on the collectors for price fixation although final price determination has some semblance of negotiations. Vertical linkage between value chain actors was virtually non-existent due to the mistrust among the actors leading virtually to no contractual arrangement along the chain but there is horizontal linkage between traders of the same type (i.e. collectors linking

up with fellow collectors in terms procurement and transportation and so on). In some cases, failure of either producers or traders to meet predetermined conditions and commitments results in conflicts.

Generally, the sweet potato value chain is one that is characterized with a governance structure which is buyer driven with little-to-no trust between chain actors. Whilst farmers blame traders for offering very low prices for their produce, traders also blame farmers for not providing adequate produce with the right specifications. Farmers are mainly smallholders and are not very organized when it comes to marketing of their produce and do not govern the value chain. Due to the fear of recording huge post-harvest losses, producers are price takers and hardly negotiate for improved prices. The governance structure of the sweet potato value chain was observed to be similar across the two districts.

3.5 Sweet Potato Value Chain Constraints

The value chains of perishable and semi-perishable commodities like root and tuber crops including sweet potato are reported to be constrained by large post-harvest losses and inefficient value chain management among others (Kumar et al., 2011). These constraints are not just at a particular level but along the entire chain. The study therefore sought to independently identify the various constraints faced by actors along the sweet potato value chain.

3.5.1 Constraints Faced by Sweet Potato Producers

Producers in the value chain are the primary actors in the value chain who basically produce sweet potato and subsequently deliver mainly through sales to the other actors in the value chain. Table 7 presents constraints as faced at the production level. Generally, high cost of chemical inputs, poor road network, high cost of labour, limited access to credit facilities and high labour requirement were identified as the five most critical constraints that hinder the effective production of sweet potato. The most important constraint identified by farmers was the high cost of chemical inputs mainly because of the high requirement of the crop for these input particularly pesticides owing from the sweet tuberous roots of the crop which attracts a number of borers. Poor road network to farms makes it difficult for farmers to easily transport their produce from the farm to market centers which further increases the rate of post-harvest losses owing from the long duration the crop has to stay on the farm after maturity. The nature of production of the crop makes it naturally labor intensive since the land preparation methods involve either ridging or mounding whilst crop management after planting involves a lot of crop care. This coupled with the competing needs of labour in these areas makes it difficult to attract labourers to assist in these rigorous farm activities especially when the remuneration for agricultural labour is comparably low. This results in high wage charges for the very few who are able to secure the services of paid labour. Although, there was a weak agreement among the various constraints identified with a Kendall's W value of 0.107, this level of agreement was significant at the 1% level with a Chronbach's alpha of 0.677. Also, critical marketing constraints identified by farmers were low commodity price, poor road network and long market distance. Farmers were however of the view that, prices for their produce after harvest was low since the crop was highly perishable and reduces their bargaining power when traders come to procure their produce. Also, the poor road network from their farming communities to market centers coupled with the relatively long travel distance to these centers further weakens the marketing power of their produce. There was nevertheless little agreement among the marketing constraints of farmers with a Kendall's W value of 0.279 which was significant at a 1% level.

Table 7 Critical Constraints of Sweet Potato Producers

Production Constraints*	Fanteakwa (N=100)	West (N=100)	Mamprusi	Pooled(N=200)
High cost of chemical inputs	1.61	1.66		1.64
Poor road network	1.06	2.35		1.71
High cost of labour	1.59	1.89		1.74
Limited access to credit facilities	1.29	2.21		1.75
High labour requirement	1.78	1.98		1.88
High interest rate on credit	1.51	2.27		1.89
High incidence of pest and diseases	2.3	1.59		1.95
Erratic rainfall pattern	2.65	1.63		2.14
Poor/declining soil fertility	2.32	2.14		2.23
High cost of planting material	2.36	2.12		2.24

High weeds infestation	1.99	2.53	2.26
High level of losses	2.71	2.15	2.43
Limited access to extension services	1.71	3.2	2.46
Inadequate storage facilities	2.55	2.5	2.53
Unavailability of quality planting material	2.92	2.62	2.77
Limited access to chemical inputs	2.5	3.03	2.77
Limited access to land	2.64	3.6	3.12
<i>Kendall's W=0.107; Chi-square=341.171; df= 16; Sig. 0.000; Chronbach's alpha = 0.677</i>			
Marketing Constraints*	Fanteakwa (N=100)	West (N=100)	Mamprusi Pooled (N=200)
Low commodity price	1.3	1.84	1.57
Poor road network	1.1	2.21	1.66
Long market distance	1.67	2.42	2.045
Inadequate storage facility	2.26	2.31	2.29
High transport cost	2.53	2.1	2.32
Poor linkage with value chain actors	2.66	2.28	2.47
Inadequate market information	2.04	3.12	2.58
High market toll	3.31	2.93	3.12
Low commodity demand	3.63	3.74	3.69
<i>Kendall's W=0.279; Chi-square=446.473; df=8; Sig. 0.000; Chronbach's alpha = 0.484</i>			

* *Ranking scale: 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree.*
Source; Field Survey, 2015

3.5.2 Constraints Faced by Sweet Potato Traders

Table 8 presents the major constraints encountered by traders in the sweet potato value chain. From the study, it was realized that traders identified high transportation cost, inadequate storage facility, high post-harvest losses, poor road network to produce sources and limited capital as the most pressing constraints hampering effective performance of their role in the value chain. The high transport cost was mainly as a result of the long travelling distances that are usually travelled by traders to production areas coupled with the bad nature of these roads. Also, the inadequate storage facilities for the produce expose the fragile crop to high post-harvest losses which ultimately affect their profit levels. However, traders disagreed to the assertion that there was low demand for the produce. These constraints were seen to be measuring the same construct since the Chronbach's alpha value of 0.541 suggests a high level of internal consistency (54.1%). Also, the level of agreement among the constraints was seen to be a weak one since Kendall's W was estimated at 0.171. Although the level of agreement was observed as weak, it was significant at a 1% level.

Table 8: Critical Constraints of Sweet Potato Traders

Constraints*	Fanteakwa (N=50)	West (N=50)	Mamprusi	Pooled (N=100)
High transport cost	1.62	1.64		1.63
Inadequate storage facility	2.32	1.8		2.06
High post-harvest losses	2.52	1.76		2.14
Poor road network to produce source	1.94	2.38		2.16
Limited working capital	2.02	2.38		2.20
Inadequate market information	2.66	1.78		2.22
Long market distances	2.36	2.14		2.25
High market toll/tax	2.42	2.24		2.33
Poor linkage with value chain actors	2.74	1.92		2.33
Low demand for commodity	3.72	4.18		3.95
<i>Kendall's W=0.171 ;Chi-square=154.13; df=8, Sig. 0.000; Chonbach's alpha = 0.541</i>				

* *Ranking scale: 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree.*
Source; Field Survey, 2015

4.5.3 Constraints Faced by Sweet Potato Processors

Table 9 presents the constraints identified by processors along the sweet potato value chain. From the study, limited working capital for business, limited access to credit, high perishability of raw materials, poor storage facilities of products and high processing cost were identified as the most critical constraints facing processors along the sweet potato value chain. This was not very surprising since working capital was mainly from equity sources with very little access to external sources. It is however worth noting that, the cost of capital even if accessed was high considering the level of risk involved in the business. There was a 0.324 level of agreement among processors in their ranking of the constraints as seen from the Kendall's W test which was significant at 1% level. The test of reliability and internal consistency conducted revealed that the constraints were internally consistent with a Chronbach's alpha value of 0.569.

Table 9 Critical Constraints of Sweet Potato Processors

Constraints*	Fanteakwa (N=40)	West (N=40)	Mamprusi	Pooled (N=80)
Limited working capital for business	1.625	1.10		1.36
Limited access to credit	1.875	1.20		1.54
High perishability of raw material	1.975	1.425		1.70
Poor storage facilities of products	2.2	1.625		1.91
High processing cost	2.8	1.20		2.00
Poor road network to produce source	2.875	2.025		2.45
High transport cost	2.875	2.10		2.49
Low product price	2.2	2.95		2.58
Inadequate storage facility	3.1	2.825		2.96
High market toll/tax	2.8	3.40		3.10
Low demand for processed product	3.75	3.45		3.60
<i>Kendall's W=0.324 ; Chi-square=284.759 ; df=11; Sig. 0.000; Chronbach's alpha = 0.569</i>				

* *Ranking scale: 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree.*
Source; Field Survey, 2015

CONCLUSION

The study revealed that, whereas there was male dominance at the production stage, there was a female dominance at the processing and marketing stages of the sweet potato value chain. Actors along the sweet potato value chain were in the economically active age bracket of between 30 and 50 years. With regards to the level of education, chain actors had generally attained basic level or had never been to school. Sweet potato produced was seen to pass through several actors (*i.e.* collectors, wholesalers, processors and retailers) with little value addition in the form of sorting/grading, cleaning, packaging, storage and transportation before reaching the end-users. These actors have the primary aim of ensuring that the produce is moved from the farm gate to the final consumer in its demanded form since they are responsible in providing the needed information in terms of consumer preference and specification to producers. The main point of the sweet potato physical transformation was performed at the processor level of the chain where apart from the basic value addition of cleaning, storing etc. it is sliced and fried to improve the convenience of consumption. This conformed to findings of Anandajayasekaram and Gebremedhim (2009) who stated that, in the perspective of agricultural value chains, value addition comes in the form of bulking, grading, cleaning, packaging, transporting, storing and processing. The absence of contract production, functional farmer co-operatives and group marketing in the value chain has made the chain buyer-driven since traders virtually dictate the price of sweet potato even though there is semblance of negotiation with producers. This was in tandem with find of Fitter and Kaplinsky (2001) who found that, the power symmetry along the coffee value chain made the chain buyer driven which was disadvantageous to the producers. This, they alluded was partly due to the better informed and institutional advantage that traders usually poses over producers. Governance in the sweet potato value chain was found to be weak since all the actors' transacted business based on spot market arrangement with uneven access to market information which leads to mistrust among trading partners. High cost of chemical inputs and low commodity (sweet potato) price were the most critical production and marketing constraints respectively at the

farmer level. Also, high transport cost and limited working capital were the most critical constraints respectively at the trader and processor levels.

Formation of actor groups along the value chain to strengthen the level of coordination and integration which will help enhance the development of the said value chain. Finally, policy interventions should be tailored towards improving access to credit and capital sources of actors since these constraints run through all the levels of the value chain.

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