

Margins and Efficiency Analysis of Watermelon marketing in Rural Northern Ghana

Michael Tuffour¹ & Michael Tia Dokurugu¹

¹*Department of Business Economics Presbyterian University College, Ghana.*

Abstract: *This study seeks to analyse the margins and efficiency of watermelon marketing in the West Mamprusi District of the Northern Region of Ghana. The research was conducted with a sample of 100 respondents consisting of 50 farmers, 35 retailers and 15 wholesalers. The study employed descriptive statistics, the deconstructed marketing margins and the marketing efficiency analysis. In relation to the structure of the market the study finds that three different market channels exist simultaneously in the chain. Again the results indicate that farmers achieved a profit margin of 45.42% per annum, wholesalers recorded a profit margin of 79.93% per annum and retailers had a profit margin of 89.83%. It is obvious that retailers achieve the highest incentives in the chain and at the highest efficiency. The study recommends that policies that focus to maximize the benefits in the chain should be promoted in the industry.*

Keywords: *Watermelon, Efficiency, Marketing Margins, Profit Margins, Ghana.*

I. Introduction

Huh et al. (2008) noted that Watermelon (*Citrullus lanatus*) is an extensively cultivated crop and also the most consumed cucurbit in the world. It is an important anti-oxidant which helps in the reduction of asthma attacks. It contains rich amounts of beta carotene and vitamin C which help in the reduction of arthritis. It also helps in the cleansing of the kidney and prevents in the cholesterol formation which reduces heart diseases (Varmudy, 2012). In addition, the trading and consumption of the crop is vital to livelihood and entrenchment of food security in some parts of South Africa (Dovie et al., 2003). In Ghana, Trevor (2008) noted that it is a crop which serves as an important source of revenue to farmers especially in times of unfavourable weather conditions since it is able to withstand harsh weather conditions as compared to other crops. Goreta et al. (2005) asserted that about 6.8% of the total area in the world devoted to vegetable production is dedicated to watermelon. Although it is an indigenous African crop, Africa hardly registers its presence in global production; with countries like China, Turkey, Iran and Mexico dominating in world production (Varmudy, 2012).

In spite of its importance globally, watermelon has its peculiarities and challenges in its marketing in different parts of the world. In Kentucky, USA, fresh watermelons are marketed at farms and road side auctions, retail and wholesale markets (University of Kentucky, 2010). In Oklahoma, the marketing of water melon involves shipping of the fruits to other states, sale at farms and roadside stands and the use of brokers (Robert et al., 1996). In India, the marketing of water melon is confronted with issues like problem of transportation, the use of numerous agents and mobile traders and lack of an organized marketing system among others (Varmudy, 2012).

Food and Agriculture Organisation (2011) asserted that like other agricultural goods in many African countries; fruits (which watermelon is part) usually rot in farms due to either poor or unavailable transport facilities. Adegeye and Dittoh (1985) were of the view that high transport cost accounted for a larger percentage of the total cost in the marketing of water melon especially in rural areas in Africa. Ebiwei (2013) also noted that high transport risk, the small sizes of watermelon which also do not attract good prices, high level of perishability and the irregularity of its supply are among some of the major challenges of water melon marketing in Bayelsa State, Nigeria.

University of Georgia (2000) and Ajewole and Folayan (2008) noted that the production of watermelon or any agricultural commodity basically depends on its profitability. Ebiwei (2013) asserted that marketing and profitability depends on its marketing efficiency; which implies marketing efficiency is very important in agricultural production. Marketing efficiency according to Adegeye and Dittoh (1985) is the movement of crops and livestock from the producers to consumers at the lowest possible cost which is consistent with the provision of the services consumers' desire.

One of the major indicators of marketing efficiency according to Adegeye and Dittoh (1985) is marketing margins, though factors like consumer prices, availability of physical marketing facilities and market competition are essential. According to Adegeye and Dittoh (1985), marketing margin is the difference between the price paid to the first seller and the price paid by the final buyer. Sudan Integrated Food Security Information for Action (SIFSIA) (2011) also defined marketing margin as the difference between the price paid by consumers and that obtained by producers. Shepherd (1993) noted that the percentage of the final weighted

average selling price at each stage of the marketing chain is marketing margin. Adegeye and Dittoh (1985) noted marketing margins can be expressed either in cash or as a percentage of retail cost. They added marketing margins indicate the relative cost of marketing at a particular time. Abbott and Makeham (1990) expressed marketing margins as the difference between price and re – sale price of a commodity. It could be inferred that higher levels of profits are reflected by high marketing margins.

Several studies have been conducted with respect to watermelon production in Africa, of which some focused on the economic analysis of its production based system (Adeoye et al., 2011), multi-peril insurance in its production (Economic Research Service, 1994), tradition knowledge with respect to the cultivation and uses of water melon in Mozambique (Munissee et al., 2011). Notwithstanding the studies that have been undertaken in the area of watermelon, studies in its marketing with respect to its profit and marketing margins and efficiency continuous to remain green. Though Onyemauwa (2010) studied on marketing margin and efficiency on watermelon in the Niger Delta, Nigeria, his approach was different in terms of formula, sample group (marketers) and did not factor the profit margin. This clearly indicates that there are many gaps that need to be filled in Ghana and even Africa. In Ghana, though watermelon production is relatively low, its importance and challenges (Trevor, 2008) and how efficient it is in terms of its marketing margins, profitability and economic viability have not been explored. In addition, the marketing efficiency for watermelon of the various players on the value chain is not much known. The study was therefore conducted in the West Mamprusi district of Ghana, a relatively popular community in the production of watermelon to assess the value chain of watermelon marketing in the district looking at parameters such as marketing margins, profit margins and efficiency.

II. Materials And Methods

2.1 Study Area

The study was carried out in the West Mamprusi District in the Northern Region of Ghana. The District is predominantly rural with more than 73% (with population figure of 123,397) of the population living in rural settlements while less than 27% (with population figure of 44,614) live in urban settlements. The male population is 49.41% (83,005) and female population is 50.59% (85,006). Its regional population growth rate is about 2.9%. The District is a Guinea Savannah Woodland composing of short trees of varying sizes and density which grows over a dispersed cover of perennial grass and shrubs. The District is located between longitude 0°35'W and 1°45'W and latitude 9°55'N and 10°35'N and shares boundary with the Upper East and Upper West Regions of Ghana. It has a total land area of 5013km², a vast area, with a generally undulating terrain characterized by gentle slopes and a few isolated visible outcrops and uplands; which is suitable for both crop and animal production (West Mamprusi District Assembly, 2013).

The District has a single rainy season which starts in late April with little rainfall, and which rises to its peak in the months of July and August and declines sharply until it completely halts around October. The dry season is characterized by Hamattan winds, which blow across the Sahara desert. Maximum day temperatures are recorded between March and April at 45°C while minimum night temperatures are around 12°C which is recorded in December and January. The District is drained by the White Volta and its tributaries; the Sessile and the Kulpawn rivers which are very relevant for all forms of crop and animal farming. Though there are other forms of occupations which are formal and in the private sector, the dominating occupation is farming, with farmers involved in the production of crops like beans, cowpea, groundnuts, millet, maize, rice, soya beans and watermelon (West Mamprusi District Assembly, 2013).

2.2 Data Collection Procedure

Primary data was used for the study through the use of structured questionnaires. Data was taken from all the components (farmers, wholesalers and retailers) on the value chain in water melon production and marketing. A total of one hundred (100) respondents comprising of fifty (50) farmers, ten (10) wholesalers and forty (40) retailers were selected through a stratified sampling procedure. The various samples chosen from the various strata were based on their respective population sizes. Since watermelon is mainly grown and marketed in a specific area in the district, locating the various players was quite easy. Specific proportions from the various populations were chosen from each group for the various samples. In all, farmers who were of the highest population had the highest sample size while wholesalers having the lowest population had the smallest sample size.

2.2 Method of Data Analysis

With respect to the marketing and profit margins of among the various components on the distribution chain of water melon, the Deconstructed Marketing Margins were used. The Deconstructed Marketing Margin allows for the estimation of marketing margins and profit margins. The marketing margin is computed as the difference between the cost of purchasing watermelon and the total revenue derived from the sale of watermelons. Following Abankwah et al. (2010), the formulae are specified as follows:

$$M_m = \frac{\sum_1^n [R_w - C_w]}{N} \quad (1)$$

Equation (1) shows the marketing margin M_m , which is a function of R_w , revenue, C_w , total cost of watermelon purchased or produced, and N , the sample size. Marketing margin (M_m) is basically the difference between purchasing costs and revenue derived from selling watermelon (R_w).

R_w is given in the form:

$$R_w = \frac{\sum_1^n [C_w + M_w + P_m]}{N} \quad (2)$$

Where M_w is the marketing cost, and P_m is the profit margin. Substituting equation (2) into (1) results in: $M_m = \frac{\sum_1^n [P_m + M_w]}{N}$ (3)

Note: $M_w = W_w + O_w + T_w + A_w$ (4)

Where W_w is the cost of working capital, O_w , is opportunity cost of the farmer's or trader's time, T_w is transaction cost and A_w is depreciated fixed cost or rental cost. Substituting (4) into (3) results in (5), where the marketing margin is:

$$M_m = \frac{\sum_1^n [W_w + O_w + T_w + A_w + P_m]}{N} \quad (5)$$

The profit margin can be obtained by substituting (4) into (2) and making P_m the subject which gives:

$$P_m = \frac{\sum_1^n [R_w - (C_w + W_w + O_w + T_w + A_w)]}{N} \quad (6)$$

It must be noted that as Shepherd (1993) asserted, the margins were obtained by factoring in the cost of performing the different marketing functions along the marketing or distribution chain. In estimating the opportunity cost for farmers, the production of beans which is their best alternative engagement if not producing watermelon was used, while the other best alternative for middlemen which is the trading of groundnuts and mango was used.

In calculating depreciation of the fixed assets used in production, the straight line method was used. In measuring transactionary cost, the study used the criteria of Abankwah et al. (2010) and Haruna et al. (2012) which were made up of transportation cost, market tolls, handling and assembling, taxes, and 'tips'. The cost of working capital was obtained by using the cost of borrowing from financial institutions in the region which averaged 25%. The rate of working capital for the study, apart from it given a fair representation of lending rates of the financial institution in the region, also followed the criteria used by Abankwah et al. (2010) though their rate was 28%.

In assessing the economic viability of the marketing system of watermelon in the West Mamprusi District, the study used both the Returns on Capital Employed (ROCE) as used by Abankwah et al. (2010) and Hurana et al. (2012).

The ROCE is given as the ratio of profit margin to capital invested. It is given as:

$$ROCE = \frac{\sum_1^n \left[\frac{P_m}{C_i} \right]}{N} \times 100 \quad (6)$$

Where C_i , is capital invested. The capital invested comprised of working capital and depreciated fixed assets used for the production or marketing of water melon. The return on capital employed is compared with the prevailing returns on fixed deposit saving at the financial institutions. If the return on capital employed is lower than the returns on fixed deposit saving, it indicates that operations are at a sub-optimal level which is not viable; and viable, if otherwise (Abankwah et al., 2010).

In analyzing the efficiency of the marketing system of watermelon the traditional marketing efficiency criterion was used. Marketing efficiency (ME) as Abdou (2004) indicated is given in the form:

$$ME = 100 - \left[\frac{\text{Marketing Cost}}{\text{Marketing margins}} \times 100 \right]$$

According to Abdou (2004) the marketing efficiency estimates marketing margins as representing the difference between purchasing and selling prices of marketers compared to the real marketing costs. A positive sign estimates would justify application of such services, making it efficient, and a negative estimate will indicate otherwise.

III. Results And Discussion

3.1 Demographics

Table 1 indicates the demographics of 50 farmers, 35 retailers and 15 wholesalers considered in the study area. From Table 1, 100% of these farmers were males, 26.7% of the wholesalers were males while 73.3% were females whilst 100% of the retailers were females. This dominance of females in the distribution of marketing of watermelon confirms the observation made by FAO (2011), where women are concentrated in the activities of packaging and post processing of agricultural goods. For the age distribution, majority of farmers (50%) fell within the range of 30-39 years and this promotes labour use efficiency since majority of this labour force are active. Also, 60% of the wholesalers are within the age of 49 and 60 years. The range between 20 and 29 years has the highest percentage (58%) for retailers which mean more of the youth are into retailing of watermelon for a living. Table 1 further indicates that 16% of the farmers, 26.7% of the wholesalers and 42.9% of the retailers had basic education, 4% of the farmers, 20% of wholesalers and 17.1% of the retailers had Secondary, Vocational or Technical education while those who had no education were as follows; 80% as farmers, 53.3% as wholesalers and 40% as retailers. The findings depict the general assertion the level of education among farmers especially and also traders of agricultural foods continue to be low in rural Ghana and Africa (Weir, 1999; Naamwintome and Bagson, 2013). This implies that farmers especially are bereft of the use of the modern and efficient farming practices in their various enterprises.

Table 1: Demographic Characteristics of Respondents

Demography									
Marketing Chain		#	%						
Producers		50	50						
Wholesalers		15	35						
Retailers		35	35						
Gender		#	%						
Producers	Male	50	100						
	Female	0	0						
Wholesalers	Male	4	26.7						
	Female	11	73.3						
Retailers	Male	0	0						
	Female	15	100						
		20-29		30-39		40-49		50-59	
Age		#	%	#	%	#	%	#	%
Producers		18	36	25	50	6	12	1	2
Wholesalers		3	20	9	60	3	20	0	0
Retailers		16	58	14	31	5	11	0	0
Education		Non		Basic		Sec/Tec/Voc		Tertiary	
		#	%	#	%	#	%	#	%
Producers		40	80	8	16	2	4		
Wholesalers		8	53.3	4	26.7	3	20		
Retailers		14	40	15	42.9	6	17.1		

Source: Field Data, 2013

3.2 Marketing and Profit Margins of Watermelon among the Players

The mean marketing margins for the major players from the deconstructed marketing margins analysis were as follows; GH¢1738.80 for farmers, GH¢156,360.00 for wholesalers and GH¢5,664.10 for retailers. On the subject of marketing cost, farmers, wholesalers and retailers on the average incurred GH¢949.00, GH¢31,388.00 and GH¢576.00 respectively. Also, farmers on the average obtained a profit margin of Gh¢789.84, representing 45.42% of marketing margin per annum, wholesalers recorded an average profit margin of GH¢124980.00 representing 79.93% of the marketing margin per annum while retailers obtained an average profit margin of GH¢5088.10 per annum representing 89.83% of the marketing margin as shown in Table 3. The result of the study on the profit and marketing margins reveal that profit margins were high among the chain drivers (retailers and wholesalers). This is partly explained by the relatively higher marketing cost used by farmers with less than proportionate returns with low marketing cost. National Centre for Agricultural Economics and Policy Research (2010) study on Estimation of Marketing Efficiency of Horticultural Commodities under Different Supply Chains in India confirms the results of this studies that farmers bear a considerable marketing cost but obtain a less than proportionate returns. Again, National Centre for Agricultural Economics and Policy Research (2010) results reveal that price spread (marketing margin) is relatively very favourable to wholesalers and retailers when compared to primary producers. Similarly Abankwah et al. (2010) also realised that the profit margin of retailers on the average was more than of the wholesalers in coconut marketing. In a study of tomato supply chain in the northern region of Ghana, wholesalers and farmers obtain

the higher profit margins whiles retailers on the average obtained low marketing margins (Haruna et al., 2012) which is somehow different from the results of this study, as indicated in Table 3.

Table 3: Annual Revenue, Marketing Cost, Marketing and Profit Margins

Measure of Margins	Mean	Maximum	Minimum	SD	% of Mm
Farmers					
C _w	919.31	5980.00	236.00	88.1346	
R _w	2658.10	11600.00	0.00	2375.60	
P _m	789.84	8605.70	-2733.00	1937.65	45.42
M _c	949.00	7003.00	233.00	1024.70	54.58
M _m	1738.80	10400.00	-1146.00	2004.65	
Wholesalers					
C _w	61456.00	105000.00	11900.00	23574.80	
R _w	217820.00	343000.00	43000.00	77269.70	
P _m	124980.00	218000.00	22800.00	48252.00	79.93
M _c	31388.00	518000.00	8263.20	10814.00	20.07
M _m	156360.00	262000.00	31100.00	58117.60	
Retailers					
C _w	2868.70	7190.00	40.00	2107.08	
R _w	8532.80	75500.00	97.50	12550.60	
P _m	5088.10	70300.00	-301.50	11620.00	89.83
M _c	576.00	1080.50	359.00	202.10	10.17
M _m	5664.10	7090.00	57.50	11658.00	

Source: Field Data, 2013

IV. Economic Viability of the Marketing System

Retailers invested the lowest amount of capital with a mean value of GH¢253.714 whiles wholesalers invested the highest amount of capital which averaged GH¢3726.67 with farmers having the least averaging GH¢919.31. Wholesalers had the highest return on capital employed (RoCE) which amounted to 3797% whiles farmers recorded the lowest RoCE which averaged 86% with retailers having 1696% return on their capital invested. The findings is similar to that of Abankwah et al. (2010) where retailers had the highest average returns on capital in the marketing of coconut. The findings of the study somehow differs from the that of Haruna et al. (2012) where retailers recorded the lowest returns on capital in the marketing of tomato with wholesalers leading and farmers coming second as indicated in table 4.

Table 4: Returns on Capital Employed

Parameter	Mean	Minimum	Maximum	SD
Farmers				
Capital invested	919.31	236.00	5980.00	881.346
Profit margin	789.84			
RoCE	86%			
Wholesalers				
Capital invested	3726.67	8000.00	1500.00	1800.19
Profit margin	124980.00			
RoCE	3797%			
Retailers				
Capital invested	253.714	500.00	40.00	200.81
Profit margin	5088.10			
RoCE	1696%			

Source: Field Survey, 2013

The results of the study indicate in Table 5 that farmers had a marketing efficiency value of 45.42%, wholesalers 79.93% and retailers 89.83%. This reveals that retailers recorded the lowest inefficiency level followed by wholesalers and the highest being farmers. Contrary to the findings of Haruna et al. (2012) wholesalers were the most efficient, followed by farmers with retailers been the least efficient. Similar to this study, Onyemauwa (2010) also discovered that the marketing system in the Niger Delta Area in general was not efficient; which was in the neighbourhoods of 57%.

Table 5: Marketing Efficiency for the various Players in the Market

Market Group	Farmers	Wholesalers	Retailers
Marketing Efficiency	45.42	79.93	89.83

Source: Field Survey, 2013

V. Conclusion

This study devoted attention to estimate the margins and efficiency of watermelon supply chain actors in the West Mamprusi District of northern Ghana. The findings of the study indicate that marketing of watermelon is profitable, economically viable and has positive returns on capital for both farmers and middlemen. Retailers are the most benefactors of the marketing of watermelon with the farmers being the least. In terms of marketing efficiency, retailers had the highest and farmers were the lowest though the players in general had some degree of inefficiency in marketing. The study recommends a continuous incentives to farmers of watermelon through efforts like contract farming. Also, government can generally improve the marketing of watermelon through improved road networks in the district. Also, creating the awareness of the health benefits of watermelon can stimulate the demand for the crops. In addition, government and non-government should help in the training of both farmers and middle men on the best marketing practices in order to increase their profit margins.

References

- [1]. Abankwah, V., Aidoo, R. and Tweneboah-Koduah, B. (2010, December). Margins and Economic Viability of Fresh Coconut Marketing in the Kumasi Metropolis of Ghana. *Journal of Development and Agricultural Economics*, 2 (12), 432-440.
- [2]. Abbott, J. C. and Makeham, J. P. (1990). *Agricultural Economics and Marketing in the Tropics*. London, Intermediate Tropical Agricultural Series.: Longman Group Ltd. Intermediate Tropical Agricultural Series.
- [3]. Abdou, A. I. (2004). Modified Marketing Efficiency Criteria for Consideration in Cropping Structure Planning: A Case Study of Newly Reclaimed Land Farmers in Egypt. *Farm Management, IFMA 16 – Theme 3*, 79 - 84.
- [4]. Adegeye, A. J. and Dittoh, J.S. (1985). *Essential of Agricultural Economics*. Ibadan: Impact Publishers Nigeria Ltd.
- [5]. Adeoye I. B., Olajide-Taiwo F. B., Adebisi-Adelani O., Usman J. M. and Badmus M. A. (2011, July). Economic Analysis of Watermelon Based Production System in Oyo State, Nigeria. *ARPN Journal of Agricultural and Biological Science*, Vol.6, 54-55, 58.
- [6]. Ajewole O. C & Folayan J.A. (2008). Stochastic Frontier Analysis of Technical Efficiency in Dry Season Leaf Vegetable Production among Smallholders in Ekiti State. *Nigeria. Agricultural Journal*, 3, 252-257.
- [7]. Dovie, D.B.K; Witkowski, E.T.F; Shackleton, C.M. (2003). Direct - use value of small holder farmers production in a semi - arid Rural South African Village. *Agricultural System*, 76, 337 - 357.
- [8]. Ebiowei, K. (2013). Marketing Margin and Determinants of Net Return of Watermelon Marketing in Yenagoa Metropolis of Bayelsa State, Nigeria. *Journal of Experimental Biology and Agricultural Sciences*, 1(14), 241 - 249.
- [9]. Economic Research Service, USDA. (1994). *Watermelons: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance*. California: Federal Crop Insurance Corporation.
- [10]. Food and Agriculture Organization (FAO). (2011). *Global food losses and food waste—extent, causes and prevention*. Rome: FAO of UNO.
- [11]. Goreta, S., Perica, S., Dumicic, G., Bucan, L., & Zanic, K. (2005). Growth and Yield of Watermelon on Polyethylene Mulch with Different Spacing and Nitrogen Rates. *American Journal of Horticultural Science*, 40 (2), 366-369.
- [12]. Haruna, I, Nkegbe, P.K and Ustarz, Y. (2012). Structure, Conduct and Performance of Tomato Marketing in Ghana. *Journal of Economics and Sustainable Development*, 3(10), 156 - 163.
- [13]. Huh, Y., Solmaz, I., & Sari, N. (2008). Morphological characterization of Korean and Turkish watermelon germplasm. 1 Cucurbitaceae. Proceedings of the IXth EUCARPIA meeting on genetics and breeding of Cucurbitaceae (Pitrat M.ed.). May 21-24. Avignon, France: National Institute for Agrarian Reform (INRA).
- [14]. Munisse, P., Andersen, S.B, Jensen, B.D., and Christiansen, J.L. (2011). Diversity of landraces, agricultural practices and traditional uses of watermelon (*Citrullus lanatus*) in Mozambique. *African Journal of Plant Science*, 5(2), 75 - 86.
- [15]. Naamwintome, B.A and Bagson, E. (2013). Youth in agriculture: Prospects and challenges in the Sissala area of Ghana. *Net Journal of Agricultural Science*, 1(2), 60 - 68.
- [16]. National Centre for Agricultural Economics and Policy Research. (2010). *Estimation of Marketing Efficiency of Horticultural Commodities under Different Supply Chains in India*. New Delhi - 110012. New Delhi: National Centre for Agricultural Economics and Policy Research.
- [17]. Onyemauwa, C. (2010). Marketing Margin and Efficiency of Watermelon Marketing. *Agricultura Tropica et Subtropica*, 13(3), 196 - 201.
- [18]. Roberts, W., Damicone, J., Edelson, J., Motes, J. and Duthie, J. (1996). *Watermelon Production*. Oklahoma Cooperative Extension Service. Stillwater, Oklahoma. HLA-6236: Oklahoma State University.
- [19]. Shepherd, A.W. (1996). *A guide to Marketing Costs and how to calculate them*. Rome: Food and Agriculture Organization (FAO) of the United Nations.
- [20]. Sudan Integrated Food Security Information for Action (SIFSIA). (2011). *Price and Market-Structure Analysis for Some Selected Agricultural Commodities in Sudan: Marketing Costs and Margins*. Sudan: Food Security Technical Secretariat / Ministry of Agriculture (FSTS) FAO-SIFSIA.
- [21]. Trevor, W. (2008, February 26). <http://trevoringhana.blogspot.com/2008/02/too-much-of-good-thing.htm>. Retrieved March 13, 2014, from Trevor in Ghana.
- [22]. University of Georgia. (2000). *Commercial Watermelon Production*. Cooperative Extension Service, College of Agricultural and Environmental Sciences. Georgia: University of Georgia.
- [23]. University of Kentucky. (2010, June). *Watermelon*. Lexington: Crop Diversification and Biofuel Education Research Center, University of Kentucky.
- [24]. Varmudy, V. (2012, August). *Watermelons: Need to capture Foreign Markets*. FACTS FOR YOU, pp. 18-19.
- [25]. Weir, S. (1999). *The Effects of Education on Farmer Productivity in Rural Ethiopia*. Centre for the Study of African Economies, University of Oxford, Department of Economics. Oxford: Centre for the Study of African Economies.
- [26]. West Mamprusi District Assembly. (2013). *Official Records*. Walewale, District Planning and Coordinating Unit, West Mamprusi District Assembly: Government of Ghana.