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Profits and Efficiency along Pearl Millet Market Chain: A Value Addition Approach

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Abstract
Pearl millet is the most commonly used millet around the world. However, in Kenya, little information exists concerning the distributional implication of pearl millet market structure, market channel efficiency and its determinants. As a result, the characteristics of pearl millet value chain have remained scanty in the literature. This paper characterizes Kenya's pearl millet value chain focusing on its structure, functions and trade within the production areas (Mbeere district) and the final markets (Nairobi) of Kenya. Data was obtained from 255 market actors (120 producers, 2 rural agents/ brokers, 25 traders, 8 processors and 100 consumers) between August-September 2012 and analysis done using value addition approach and a multiple regression models. Evidence showed that high returns to participation accrued to processors compared to producers and traders despite their limited functions. Transport costs, border taxes and commission charges were major components of marketing cost. Pearl millet market channel efficiency was positively influenced by level of education and whether an actor undertook value addition activities before selling positively influenced.
Keywords: Mbeere district, Market channel efficiency, Final markets, pearl millet

INTRODUCTION

Pearl millet is the most commonly used millet as animal feed, grain and forage around the world. Findings indicate that broilers fed on pearl millet are heavier with better feed conversion rate than those fed on maize. In the industrial sector, pearl millet is a major ingredient in fuel and ethanol production with a 30 percent greater fermentation and Distillers Dried Grains with Soluble (DDGS) co-products with high protein and fat content than maize (Gulia *et al.,* 2007). In a household food basket, pearl millet is an important ingredient for children, elderly and convalescents residing in arid and semi-arid lands of East and Central Africa (ECA).

Compared to maize and potatoes, pearl millet performs well under hot and dry climatic conditions (200-600 mm annual rainfall) common in the ECA region. However, its productivity has stagnated at 200-800kg/ha against the global potential of 1,500-3,000kg/ha (KARI, 2007). And as a result, local production has not meet consumers' preference in terms of convenience, color, taste and long shelf life making pearl millet producers to be classified as poor with limited alternative to food, feed and fodder needs.

In terms of marketing, a simplified marketing structure in which farmers sell to traders who in turn sell to final consumers or processors exists. Because of this simplicity, accusations and counter accusations are a commonplace among pearl millet market actors. For instance, farmers grumble with inadequate market access in terms of low and uncompetitive grain prices which usually collapse during harvesting times, trader exploitation, poor developed and fragmented marketing channels with weak value chains, exploitation by middlemen and mistrust amongst market actors causing low returns. Traders complain of low volumes produced by farmers resulting in high assembly costs, in adequate all year round grain supply, high cleaning costs, poor quality grains, low access to credit, lags in policy frameworks and limited market information. Discussions with processors have confirmed that they have lost contact with traders and producers and have resorted to imports from Uganda and Tanzania to supplement locally produced grains in making premium products. This means that a larger percentage (more than 1,560 tons per annum) of pearl millet grains traverse miles and between different actors with limited or no contacts (Baba *et al.*, 2009). Its consumers, on the other hand, are regarded as less fortunate due to its association with low income households.

In Tanzania and India, Rohrbach, (2004) and Gulia *et al.,* (2007) respectively describe pearl millet markets as poorly developed with fragmented marketing channels and weak value chains with high assembly and processing costs thereby lowering actors' income and overall sub-sector competitiveness. The problem of limited market access has been associated with inefficiencies along a market chain due to limited resources necessary in helping actors meet quality standards and formal market specifications. Also, dearth of trust between actors and lack of formal contractual arrangements which have acted as impediment to actors' investment in the market for quality improvement, hygiene and respect to standards (Africa 2000 network, 2007). For a market to be efficient and profitable, however, strengthening of farmers marketing and processing capacities, collective action, marketing experience are necessary. As noted by Minten (1999), better access to market information can have a positive effect on output markets, information flows and producer prices. Although past literature evidence the potential of a well-coordinated market in improving actors' income levels and adequate functioning of markets (Stigler, 1961), accusation and counter accusations might be the root cause of inefficiencies along pearl millet

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market chains.

Tapping the intended benefits requires excellent knowledge of market structure and channel efficiency. Nevertheless, little information exists concerning the distributional implication of pearl millet market structure, market channel efficiency and its determinants in Kenya. As a result, the characteristics of pearl millet market value chain have remained scanty in the literature. This study fills this knowledge gap by analyzing the efficiency and performance of pearl millet markets in terms of market margins and costs. Specifically, the aim of this paper is to characterize Kenya's pearl millet market value chain focusing on its structure and trade within the production areas (Mbeere district) and the final markets (Nairobi) of Kenya. Understanding market channel efficiency provides relevant information concerning operational mechanism of pearl millet markets and thus a basis of reducing marketing inefficiencies along chain. In addition, information concerning agricultural market margins and costs provide excellent evaluation criteria for input-output market performance thus complimenting the ever increasing literature on transaction cost analysis.

METHODOLOGY

Study area

This study was undertaken in Mbeere district (production areas) and Nairobi city (final market) due to the presence of numerous market actors. In this study, Mbeere district and Nairobi city markets were purposively selected as production areas and the final markets, respectively based on our baseline information and past literature citing them as major production and consumption areas respectively. The district lies between latitude $0^0 45'$N and $0^0 52'$N; longitude $37^0 35'$E and $37^0 40'$E with an altitude range of 500-1200m above sea level on Tana River basin (GoK, 2005). The district experience unreliable annual rainfall with most parts receiving less than 750mm annually and an average temperature between 20-30^{0}C with March as the hottest month. The unreliability of rainfall increases major crop failures especially for maize. Nairobi city, on the other hand, is the fastest growing city in sub-Saharan Africa in the last 30-40 years. The city boasts of 3.1 million people with a growth rate of 4.7-4.8% per annum. This population is projected to be 5 million by 2020 thus providing ready market for agricultural products like pearl millet grains (Omwenga, 2011).

Using trained enumerators, data was collected from 255 markets actors (120 producers, 2 community agents/brokers, 25 traders and 100 consumers, 8 processors) using a structured questionnaire. To compliment information and provide more insights in situations where respondents did not provide elaborate answers, a focused group discussion was organized with traders, brokers/community agents and processors. A semi structured questionnaire covering source of pearl millet grain, distance to nearby market, selling and buying price, seasonal variation in prices, description of sales, source of market information, form in which pearl millet grain was sold among others was used.

Analytical framework: Value addition approach

In this study, a value addition approach was used (Tallec and Bockel, 2005). The application of this approach was based on the assumption that it correctly captures the definition of a value chain as proposed by Kaplinsky and Morris (2003). In this way, it contributes to rural - mainstream market linkages and thus aiding in strategic linkages development. In addition, it improves strategic learning processes by treating enterprises as an integrated chain rather than autonomous entities. This approach involved determining the amount of value added by each chain actor and consequently the total value added. Value added by an actor is the difference between the value of output and inputs and thus a measure of profit at every node of the chain. Based on the above definitions, the amount of value added was calculated as below (equation 1) depending on the point of the chain or whether the actor is a farmer, trade, broker or processor.

$$VA_a = P_a Q_a - \sum_{i=1}^{i=n} MC_a \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where VA_a is the value added or profit earned by an actor *a*, P_a is the price of pearl millet sold by an actor *a*, Q_a quantity of pearl millet sold by an actor *a*, MC_a is the marketing cost incurred by an actor *a*. Examples of marketing costs include packaging costs, chemicals, transport and communication incurred during market research. After calculating the value added a given marketing node[1], a decision is made based on the value obtained. For example, a bigger value added (VA) represent a more efficient chain.

Marketing efficiency

A marketing efficiency is a ratio of value addition to marketing costs at a given node. Marketing efficiency is therefore the ratio of total value added to total marketing costs (Sreenivasa *et al*., 2007).

$$\text{Marketing efficiency index (ME)} = \frac{VA}{MC} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

A negative value indicates higher marketing costs compared to value added and thus a loss along the chain and

[1] Marketing node – any point in the marketing chain where pearl millet exchange or transformation took place

vice versa. This means that a higher value was preferred for chain efficiency.

To determine factors affecting to pearl millet profits at traders node, a multiple regression analysis was used. The choice of this model and socio-economic factors as explanatory variables with priori expected signs in parameter estimates were consistent with other authors (see Shively *et al.,* 2010). In this model, a dependent variable was per unit marketing margin.

Mathematically, the regression equation may be written as below (Equation 3)

$$y_i = \beta x_i + \varepsilon_i \text{ ……..……..} (3)$$

Where y_i represent per unit marketing margin expressed in KES per bag; x_i is the vector of explanatory variable for every respondent; β is the vector to be estimated including constant term and ε_i is the error term which is assumed to be independent and normally distributed with a mean of 0 and a constant variance. It was hypothesized that per unit marketing costs expressed in KES per bag will be affected by; educational level of the actor, whether an actor is involved in any processing/value addition activity, experience in marketing measured in terms of number of years she has been in pearl millet marketing, age of the market actor and whether an actor have access to credit or other source of income.

The final implicit model can be presented as shown below;

$$Y_i = \beta_0 + \beta_1 Procg + \beta_2 Ag + \beta_3 ExpMktg + \beta_4 CredAc + \beta_5 Educ + \varepsilon_i \text{…….} (4)$$

We hypothesized a positive correlation between educational level, age and credit access and marketing margin but a neutral correlation between experiences and whether a marketer undertakes any processing before sales (table 1). To ensure correct model specification in line with model assumptions, a heteroskedasticity checks and multi-collinearity tests were undertaken.

Table 1: Nature and a priori expected signs of regression analysis of the determinants of retail marketing margin

Variable	Description	Expected sign
Processing (Procg)	Whether a household undertakes processing before sales or otherwise	+/-
Age of respondent (Ag)	Years	+
Experience in marketing (ExpMktg)	The number of years in selling pearl millet	+/-
Credit access (CredAc)	Do a trader have access to credit services	+
Educational level (Educ)	Number of years in school	+

RESULTS AND DISCUSSION

Socio-economic profile of pearl millet market actors

Socio-economic features are usually assumed to be strong especially in marketing of agricultural products. These features offer an in-depth understanding about actors' behaviour and their roles in the development of markets. In this study, level of education, mean age in years, gender and employment status of pearl millet market actors were analyzed (Table 1).

In terms of education, majority of the producers (52.5 percent) were having primary school education; 26.7 percent were with secondary education while only 12.5 percent were considered as illiterate. For traders, 56 percent had primary school education while 44 percent had secondary school education while 52 percent of consumers were in primary school while 32 percent possess secondary education. On average, there was a low level of education amongst the producers and this implies that producers may not be in a position to capture the benefits associated with pearl millet marketing as they may be disadvantaged during bargaining process (Table 1). This implies that educational level was not a barrier to pearl millet market actors although studies have shown that higher education might help actors in price bargaining.

Table 2: A summary of the respondents' socio-economic characteristics within Mbeere district

		Percentage Distribution		
Variables		**Farmers**	**Traders**	**Consumers**
Mean age (Years)		52.4 (15.94)*	41.56 (11.26)*	45.42 (11.74)*
Education level (Years of schooling)	Illiterate	12.5	-	5
	Primary	58.9	44	52
	Secondary	-	56	31
	Tertiary	26.6	-	9
	University	1.67	-	3
Gender	Male	62.5	-	61
	Female	37.5	100	39
Employment status	Full time	-	72	18
	Part time	-	24	21
	Unemployed	-	-	55
	Housekeeper	-	-	4
	Retired	-	-	2

*Values in the parenthesis indicates standard deviation

The number of years a person takes in performing any marketing function directly influences his/her marketing experience and thus his profit levels. Therefore, the more experience a marketer is, the higher his understanding of a marketing system, conditions and prices trends. From the study, the average mean ages for producers, trader and consumers was 52.40; 41.56 and 45.42 years respectively (Table 2). This implies that majority of the actors were dynamic youths within the economically active age bracket of 21-50 years and thus they were able to take risks associated with marketing. Therefore, these actors could make a meaningful impact in the promotion of agricultural production and marketing when adequately motivated with training and credit facilities.

The result further revealed that 62.5 percent of producers were males and this reaffirms earlier research findings that farming in the area was a male dominated activity (Table 2). In addition, it shows that most households were male headed partly as a result of HIV/AIDS menace in the area. However, pearl millet marketing was mainly dominated by women (100 percent) partly due to the local tradition linking women to cooking and light farm activities like marketing, harvesting and processing.

The results further confirmed that pearl millet producers were wholly engaged in farming; traders (72 percent) were involved in pearl millet marketing on full time business (table 2). However, most consumers (55 percent) were unemployed, 21 percent were employed on part time basis while 18 percent were on full time employment. This implies that majority of traders were employed on full time basis in grain marketing and thus should be easily targeted for training and micro loans. Consumers, on the other hand, were unemployed and thus target marketing might require packing into smaller pieces which are affordable by these households.

SOCIAL CAPITAL AND NETWORKING

Social capital is the ability of people to work in unison in promoting collective action, cooperation and coordination. The social capital aspect of agricultural produce marketing is considered strong and producer-trader relationships are built on long term basis. However, pearl millet was an exception to such relationships because of the poor farmer-trader-processor built relationship.

From discussion with traders, there was high level of measurement cheating promoted with respect to market assurance, measurement equipment especially the use of unstandardized buying and selling containers and buying processes. The use of un-standardized *gorogoro*[1] served as a way of extorting extra profits from producers. In fact, three different *gorogoro's* with varying sizes were identified as one move from production to consumption. Tins used for buying from farm gate had an estimated measurement of 3 Kgs while those used for buying from rural agent or selling to other traders hold 2.5 Kgs while tins for selling to final consumers had an estimated volume of 2 Kgs. This implies that if a farmer sold three 90 Kgs bags measured using 40 *gorogoros'* to a retailers, he will loss 90 Kgs or KES 3600 per bag at operating price which is a significant loss.

Therefore, more training on the importance of collective action and trust building initiatives are

[1]*Gorogoro*- It is a volumetric measure of grain

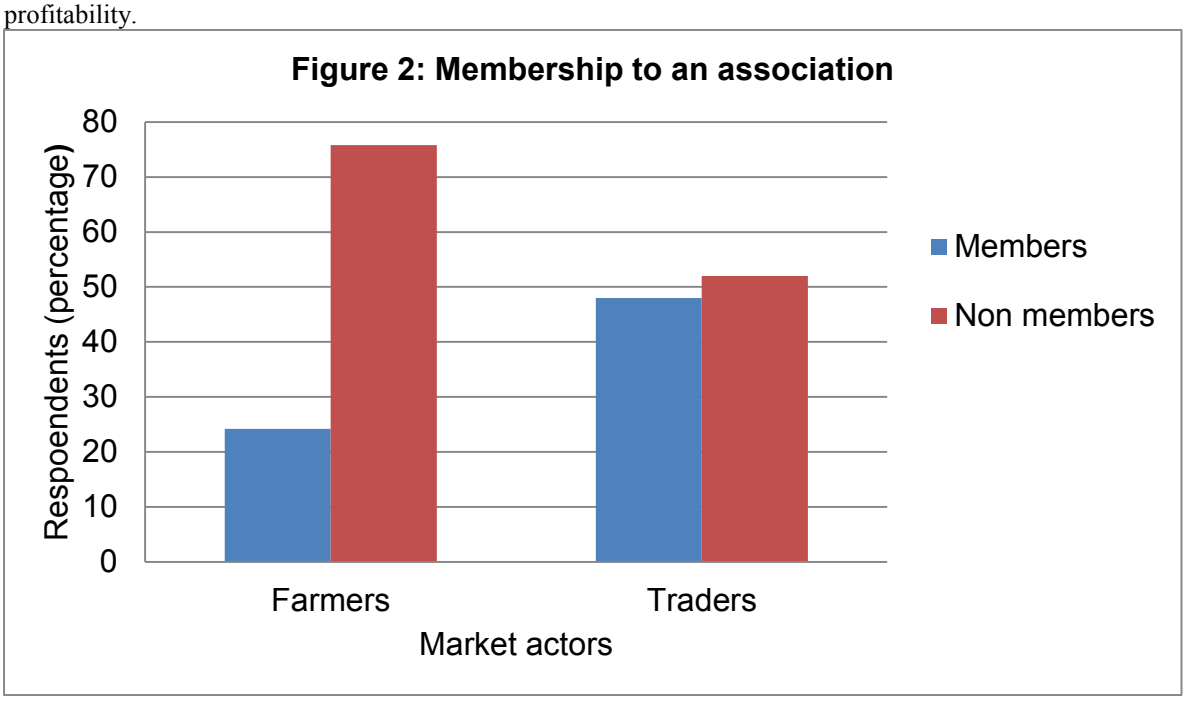
recommended. Similar observations of inaccurate measurements during buying and incidences of collusion amongst intermediaries to fix prices and limit competition were also noted by Kirimi *et al.,* (2011) amongst Kenyan maize actors. Batt, (2003) also observed an undervaluation of value added potatoes by traders to cost Vietnamese dong145 per kg due to lack of correct records and the confidentiality in reporting of market prices to conceal real profits.

As pearl millet grains are sourced from different producers located at different geographical locations, market actors usually incur high assembling costs and thus might contribute to this exploitation. Studies (Heide and John, 1990; Morgan and Hunt, 1994) have also confirmed that the level of relationship increases with the volume traded. In such circumstances, opportunities exist for producers to organize into groups of marketing organizations to improve on efficiency of marketing and procurement efforts. This can be achieved through collective marketing efforts.

MEMBERSHIP TO ASSOCIATION

Associations[1] facilitate agricultural market performance by developing friendship, loyalty and trust which allows members achieve economic benefits that otherwise would not be attainable. For instance, trade association are responsible for market information transmission linking source areas and final markets, provision of security and waste disposal, capturing economies of scale in reduced transaction costs through efficient dispute resolution, transport bargaining, collective labour and price negotiation and recording bad buyers in the market. In addition, they provide updates on standards, policy and news thereby acting as an early warning system its members.

For producers, associations support in accessing efficient technologies for increased yield and market access. With all these background, market actors ask to select if they were members of any association operating in their level. From the result (Figure 2), only 24.2 percent of farmers were members of a marketing association compared to 48 percent of traders. This implies that most pearl millet actors did not benefit from collective action initiatives. It is interesting to note that the long distance between the production areas and final consumption points should have motivated collective action aimed at lowering the transport cost but it this did not happen. This therefore calls for pearl millet actors trainings on the importance of collective marketing actions in order to improve on their profitability.



MARKET PERFORMANCE

An efficient marketing system minimizes the cost of a marketing process; ensures greater returns to producers while at the same time provide final consumers with quality products and at a reasonable price. In measuring market performance, marketing margin and marketing efficiency analysis were employed. Five major channels identified as below were reviewed; Channel 1 (Producer- Rural agents- Traders- small processors- Consumers); Channel 2 (Producers-Traders- Brokers- Large processors- Final consumers); Channel 3 (Producers- Rural agents-

[1] '*social structures within which cooperative arrangements between individual traders are developed and maintained'* (Smith and Luttrell, 1994)

Traders- Brokers- Large processors- Final consumers); Channel 4 (producers- rural agent- traders- final consumers) and Channel 5 (Producers- Final consumers

Marketing margin analysis

A marketing margin is the difference between consumer price and what a producer gets. Therefore, the size of a marketing margin indicates structural efficiency of a marketing system. The findings show that farmers sold a 120 kg bag of pearl millet grains at an average price of between KES[1]2,800-3,500 (USD[2] 35- 43.75) while traders sold a 100 kg bag of millet grains to brokers and large scale processors at an average price of between KES 3,360-3,960 (USD 42- 49.50). However, sales to small scale processors attracted a price range of between KES 4,860 - 6,860 (USD 85.75) per 100 kg bag while final consumers paid a price range of KES 10,000-12,000per 100 kg. It is important to note that these figures are dependent on the form of pearl millet (processed or not) and the season under review (Table 3).

Therefore, the producer's share of consumer price for a bag of pearl millet grain was 34.5, 19.4, 19.4 and 40.8 percent for channel I, II, III and IV respectively. Middlemen share of consumers' payment of 65.5 percent (channel I) and 59.2 percent (channel IV) were considered adequate based on the function they undertake in comparison to other actors along the pearl millet value chain. However, the middlemen share in consumer price within channel II and III was high partly due to overestimation of costs to conceal real profit levels. Therefore, an in depth analysis of marketing cost is necessary.

PRICE SPREAD ANALYSIS

In analyzing the price spread, estimates of cost of marketing and marketing margins were recorded. From the findings, there was large price spread within various marketing channels implying some level of exploitation of producers'. For example, the highest price spread (KES 11,600) was found in channel II while the lowest price spread (KES 4,060) was found in the IV channel (Table 3). However, when the price paid and received by an actor was considered, the highest gross marketing margin was observed in the IV channel with farm gate price constituting an estimated 41 percent of the final consumer price. The lowest return was recorded in channel III with a producer return of 19 percent. This implies that the final price of pearl millet will be more than triple as it reaches the final consumer. In general, traders, brokers and rural agents' shares of the final consumer prices were higher than producers which might be true when their marketing functions are considered. In conclusion, channel I and IV showed good potential for up scaling considering the high producer returns in comparison with other channels (Table 3).

Table 3: Marketing costs, margins and price spread per channel per 120 Kgs bag of pearl millet

	Marketing channels				
Particulars	**I**	**II**	**III**	**IV**	**V**
Net producers price	3,200	2,800	3,600	2,800	4,200
Rural agent					
Buying price	3,200	-	3,600	2,800	-
Marketing margin	740	-	1180	500	-
Selling price	3,940		4,780	3,360	-
Traders					
Buying price	3,940	2,800	4,780	3,360	-
Marketing margin	1,100	1160	1200	3,500	-
Selling price	5,040	3,960	5,980	6,860	-
Brokers					
Buying price	-	3,960	5,980	-	-
Marketing margin	-	1,860	1,500	-	-
Selling price	-	5,820	7,480	-	-
Processors					
Buying price	5,040	5,820	7,480	-	-
Marketing margin	4,240	9,540	11,320	-	-
Selling price to consumers	9,280	14,400	18,800	6,860	4200
Price Spread	**6,080**	**11,600**	**15,200**	**4,060**	

Channel 1:- Producer- Rural agents- Traders- small processors- Consumers; **Channel 2:-** Producers-Traders- Brokers- Large processors- Final consumers; **Channel 3:-** Producers- Rural agents- Traders- Brokers- Large processors- Final consumers; **Channel 4:** producers- rural agent- traders- final consumers; **Channel 5:-** Producers-

[1] KES – Kenya Shillings
[2] USD – United States of America Dollar

Final consumers

PEARL MILLET MARKETING COSTS

The average marketing costs of pearl millet incurred by different actors are presented in Table 4. These costs were mainly classified into: transportation, loading and unloading, market fees and charges, commission charged by actors, weighing and stitching charges, taxes, border charges, cost of chemicals and fixed related costs.

Table 4: Transaction costs of pearl millet marketing

ITEMS OF COST	Traders	Brokers	Processors
	Marketing cost	Marketing cost	Marketing cost
Variable costs			
Purchase price/kg	23	28	35
Loading fees/bag	30	30	50
Offloading fees/bag	28	30	50
Packing materials/bag	50	50	50
Weighing and stitching/bag	30	30	-
Market fees/bag	40	40	100
Import tax charge/bag	200	200	-
Tax and bribe costs/lorry	500	500	-
Commission charges/bag	350	700	-
Transportation/bag	102	266	375
Cost of chemicals/bag	40	40	40
Average variable costs	**126.6**	**174**	**88.2**
Fixed costs			
Rent charges	3,000	40,000	45,000
Security costs	199.2	2,500	12,000
Electricity costs	150	2500	15,000
License fees	600	6000	6000
Average fixed costs	**987.3**	**12,750**	**19,500**
Total costs	**1,113.60**	**12,924**	**19,590**

Larger variations in costs were observed within pearl millet marketing chains. On average, the highest variable cost was incurred by traders (KES 126.6 per 100kgs bag) while the lowest was incurred by processors (KES 90 per bag). However, on fixed costs, processors incurred an estimated KES 19,500 month with the lowest fixed costs being incurred by traders (KES 987.3 per month). Major cost component of traders and brokers were payment of illegal taxes to police roadblocks, commission charged by local authorities for transporting of pearl millet (cess charges) and import charges at the port of entry. Major variable costs incurred by processors were in transportation estimated at KES 375 and rent charges estimated at KES 45,000 per month under fixed costs. To reduce these costs and improve on the profitability of pearl millet business, processing plants need to be located within the production areas to lower on the high rent charges.

The calculation of marketing costs as a percentage of the total marketing costs are also shown (Table 4). Result indicate that, on average, total cost varies from an estimated 1.7 percent to 75.9 percent across different pearl millet marketing levels. Amongst the diverse components of costs, fixed costs; rent and operating licenses were the highest contributors while on variable costs cereal import taxes, municipal cess and police bribes were the dominant contributors. Rent charges contributed an estimated 75.9 percent (traders); 78.4 percent (brokers) and 57.6 percent (processors) of fixed costs while transport contributed an estimated 7.6 (traders), 13.8 percent (brokers) and 52.08 percent (processors) of variable costs.

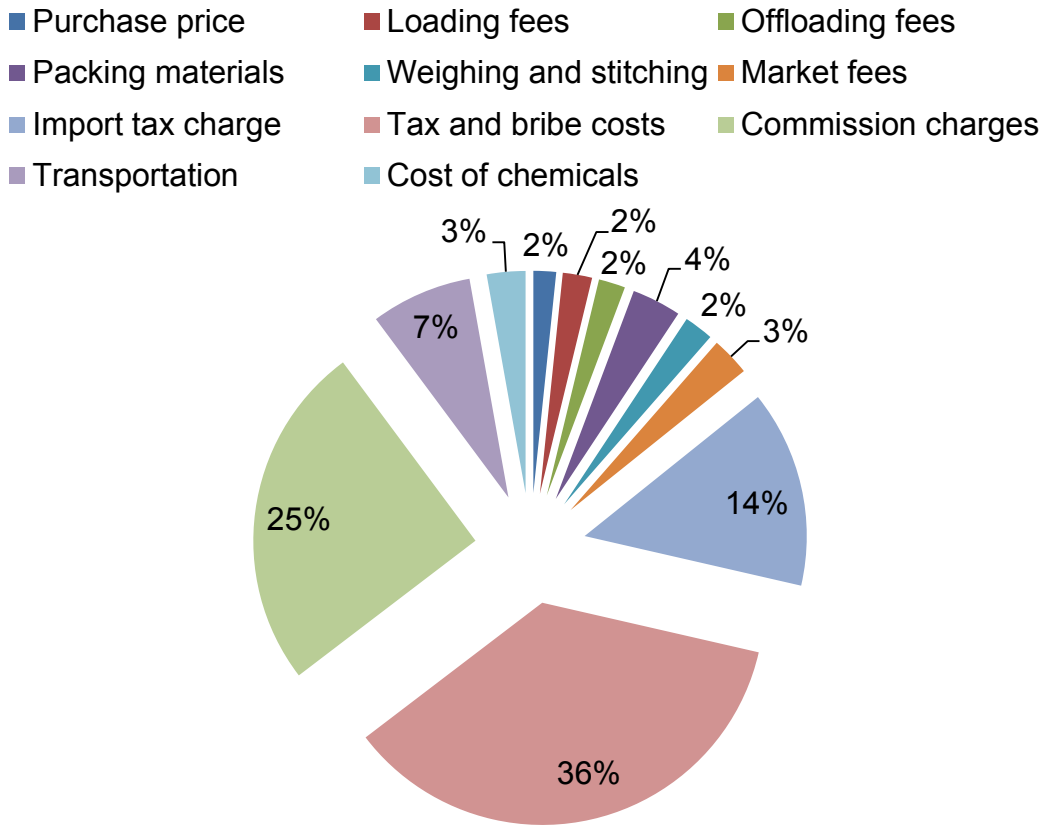
COMPOSITION OF PEARL MILLET MARKETING COSTS

Traders

In this section, traders included both retailers and wholesalers[1] of pearl millet grains operating in the selected markets under review. From our analysis, taxes and bribes, commission charges, import taxes and transport costs contributed 36, 25, 14 and 7 percent respectively towards the final cost of pearl millet product (figure 3). In summary, more than 82 percent of pearl millet price was contributed by only four major cost elements. It is interesting to note that taxation of grains is still very high in Kenya like any other developing countries despite several programs aimed at discouraging agricultural taxation policies. Discussion with traders revealed that taxes were mainly from municipal cess, border crossing fees and government license fees while bribes were from the numerous police road blocks.

[1] People who had more than 15 bags in a designated storage facility

Figure 3:Transaction costs of traders

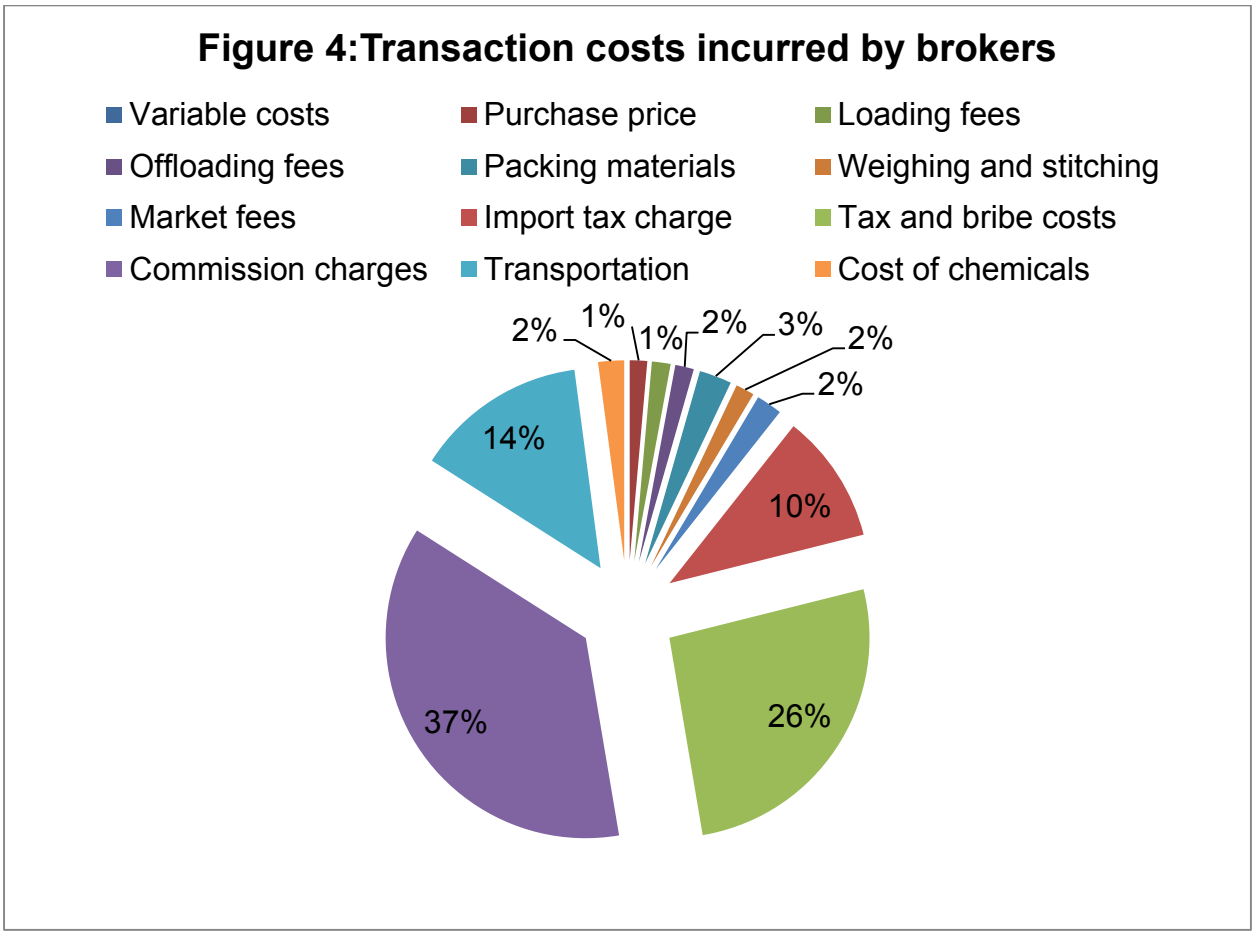


Therefore, to improve the competitiveness of pearl millet marketing, there should be attempts at reducing the level of tax and reduction of police road blocks.

Brokers

Major cost elements for brokers[1] were from commission charges (37 percent), taxes and bribes (25 percent), transport cost (14 percent) and import taxes (10 percent) respectively (figure 4). They reported that they are charged higher commission per ton by municipal council in every trip they made. In addition, they also encounter police road blocks because most of their stock they import from Tanzania and Uganda with minimal local purchase especially between the long rain harvesting. In collecting the small units of pearl millet from producers coupled with the poor states of rural roads, they incur high transport cost which directly influences their pricing and hence profitability.

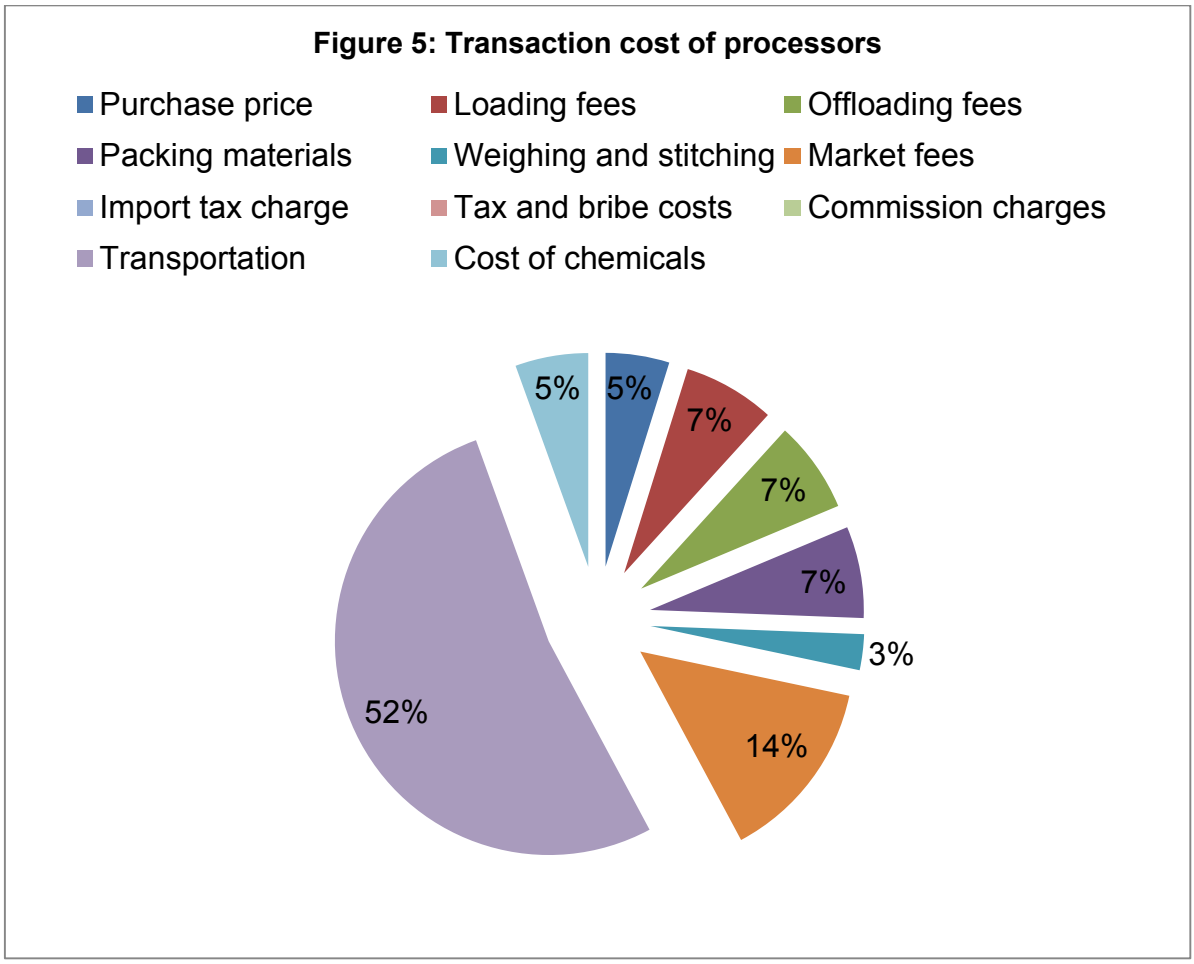
[1] people who purchase pearl millet grains from other market actors and sell to processors in bulk



To improve their profitability and overall chain efficiency, this study recommends application of mobile technologies in bulking of the small lots available from producers. As such, transport costs will be reduced. In addition, there is need for negotiation for a considerable commission to be charged on food commodities within the council which will in turn lower the price of food for consumers.

Processors

Both small and large scale processors were involved in pearl millet marketing. Most of their costs arise from transportation (52 percent), tax and bribes (14 percent), market fees, commission charges and packaging material costs averaged 7 percent respectively (figure 5).



The high transport costs might have been caused importation was common amongst large scale processors. In addition, these processors were also involved in the distribution of their products to major retail outlets. As that, they incurred double transport in an attempt to improve their profitability. They also paid an annual market fees in excess of KES 60,000 for which greatly lowered their profitability considering the low sales common with pearl millet products.

Marketing efficiency analysis

Our findings of pearl millet efficiency is shown below (Table 5)

Table 5: Marketing efficiency of different pearl millet marketing channels

Prices/Costs	Channel I	Channel II	Channel III	Channel IV
Value added	6,080	11,600	15,200	4,060
Cost of marketing				
Traders	1,392.60	1,392.60	1,392.60	1,392.60
Brokers	-	1,914	1,914	-
Large processors	-	940	940	-
Small processors	415	-	-	-
Total cost of marketing	**1,807.60**	**4,246.60**	**4,246.60**	**1,392.60**
Marketing Efficiency index	**3.36**	**2.70**	**3.54**	**2.90**

The findings indicates that channel III had the coefficient of marketing efficiency of 3.5 and was therefore more efficient than channel I (3.4); channel IV (2.9) while channel II was the least efficient with efficiency index of 2.7 (Table 5). Therefore, considering the margins and efficiency index, pearl millet marketing can be said to be efficiency and profitable. However, this result should be interpreted with caution as only variable costs was used in the analysis an apportioning of fixed costs per bag was not possible. However, Batt, (2003) observed an undervaluation of value added potatoes by traders to cost Vietnamese dong145 per kg as a result of lack of clear

dealing records and confidentiality in reporting of market prices amongst traders to conceal real profits.

Factors affecting pearl millet retail marketing margin

In analyzing factors affecting marketing margin received by traders, a multiple regression model was used. The result of our findings is as shown below (Table 6).

Table 6: Regression results of factors affecting retail marketing margin of pearl millet

Explanatory variables	Regression coefficient	Standard error
Age	0.004	0.061
Education level	2.086**	1.021
Experience in marketing	-0.112	0.088
Processing	-7.064*	2.006
Credit access	1.609	1.740
Constant	23.801	7.701

*Significant at 1 percent; ** significant at 10 percent: Prob.> F = 0.005; R-squared = .562; Dependent variable was the marketing margin

The value of R^2 (coefficient of determination) of 0.56 implies that 56.2 % of the variation in pearl millet marketing margin was explained by the explanatory variables like age, education, experience in marketing, processing and access to credit. The F ratio was statistically significant at 5 percent level of probability and thus reaffirms the overall significance of the parameter estimates in the model.

Results from Table 6 reveal that educational level of respondents and whether an actor undertakes any processing before selling as significant in influencing an actor's marketing margin. Education is positive and significant at 10 percent level with a coefficient of 2.085 indicating that an increase in one year of schooling increases pearl millet traders marketing margin by 2.085 per kilogram, ceteris paribus. This implies that pearl millet marketing could not be learned informally. Therefore, having better education gives excellent business dealing advantage than otherwise to value chain participants. Contrary to this, Ugwumba (2009) and Ayoola and Zever (2010) found out that educational level to negatively affect households' level of maize marketing efficiency in Nigeria. They attributed their result to the fact that in Nigeria, maize could be acquired informally by any household without necessarily having better education.

Traders were asked if they undertake processing before selling their pearl millet. Result show a negative but significant at 5 percent indicating that an increase in household engagement in processing before sales decreases retail marketing margin by 7.06 per kilogram. This implies that the cost of processing pearl millet was high and thus policies aimed at reducing the cost of processing was necessary in order to increase marketing margin. A similar finding of an inverse relationship between marketing costs and the efficiency of marketing was noted with Nigerian maize market participants (Ayoola and Zever, 2010).Contrarily, Ugwumba (2009) found a negative correlation between fresh maize marketing costs and actors' incomes form marketing.

Access to credit was positively related to pearl millet marketing margin although not significant at 5 percent level. This implies that marketers with large resources will sell more pearl millet and receive high margins compared to small marketers who are constrained by finance. A similar positive but insignificant finding was noted with Nigerian maize marketers (Ugwumba, 2009).

Although the age of the marketer was negatively correlated with the marketing margin, it was insignificant at 5% level of probability. In addition, the regression analysis showed that marketing experience had negative relationship with the marketing margin. However, it was insignificant at 5 percent level of probability.

CONCLUSION AND POLICY IMPLICATIONS

This study revealed that pearl millet marketing was dominated by women aged between 41-53 years. Producers, on the other hand, had a higher level of educational compared to these young women. Results further showed that pearl millet business was profitable despite poor coordination between producers and other chain actors. The most efficient channel was channel III (Producers- Rural agents- Traders- Brokers- Large processors- Final consumers) with a 3.54 index, while channel II (Producers-Traders- Brokers- Large processors- consumers) index of 2.70 was the least efficient. However, there was no value addition within channel IV. Brokers and traders incurred higher transport costs due to police bribes, municipal cess and import taxes. In addition, most millet actors were not members to any formal associations which might have limited their access to credit. Trader's marketing margin was positively influenced by age, educational level of an actor and access to credit but was negatively influenced by traders marketing experience and access to finance.

This study recommends for an improvement in credit access for all market actors to improve their competitiveness and purchasing power of all actors. Moreover, formation of group marketing cooperative to reduce the high transport cost thereby enhancing profit margin of millet market actors was necessary. Government should also consider reducing market fees or if it is maintained, it should be used for productive purposes like establishing of an organized marketing system, improving the status of rural roads and setting up of farmers markets to support

of agricultural production. Finally, there is need for efficient linkages of all pearl millet market actors to enhance level of trust between traders. Such policies might include formation of micro selling schemes, use of contract agreements and setting up of online marketing system to sensitize processors on the annual domestic production levels and supply sources.

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