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~~832~~ VALUE CHAIN ANALYSIS OF SMALLHOLDER SNAP BEAN PRODUCTION IN KIRINYAGA COUNTY, KENYA

Odero D.O[1], Mburu J.[1], Ackello-Ogutu C.[1], Nderitu J.H [2]

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[1] Department of Agricultural Economics, University of Nairobi, P.O Box 29053-00625, Nairobi. Kenya

[2] Department of Plant Science and Crop Protection, University of Nairobi, P.O Box 29053-00625, Nairobi. Kenya & Deputy Vice-Chancellor, Research and Innovations, Mt. Kenya University. Thika. Kenya

ABSTRACT

The paper aims to analyze the snap bean value chain and assess the competitiveness of small farmers and how the value-added benefits are shared by various participants of the value chain in Kirinyaga County, Kenya. We find that farmers had the lowest share of value added among the chain participants. For instance, in channel 1 the value-added share of small scale farmers was 15.6%, brokers 16.3%, processors had the highest share at 37.6% and retailers at 30.5%. Despite this, the small farmers were still competitive and that the entire chain was profitable in all the four channels that were analyzed. Shorter chains where brokers were excluded provided farmers higher benefits than longer chains. The mean value added for the chain actors were significantly different in all the four channels. Multiple comparisons test showed that all means, except between farmers and brokers, were different. The study recommends for policy interventions that seek to reduce the number of market intermediaries if commodity market chains have to be more beneficial to small farmers.

Keywords: Snap beans, Value chain analysis, Value chain actors, Value added, Competitiveness

1. INTRODUCTION

Snap beans, also known as French beans or Green beans, are of growing importance in the socio-economic systems and livelihoods in Kenya. Much of snap beans in Kenya are mainly grown by small scale farmers, purely for export as a source of family income (Monda *et al.*, 2003; Okello *et al.*, 2007). These are farmers who own between 0.5-5.0 acres of land (Ndegwa et al., 2010). Snap beans account for 60% of all vegetable exports and 21% of horticultural exports (Nderitu *et al.*, 2007).

Although the crop is mainly grown for export in Kenya, there is growing popularity in domestic consumption particularly in the urban centers (voor den Dag, 2003; MOA, 2008). The main varieties grown in Kenya for either fresh market or processing include Paulista, Monel, Amy, Impala, Samantha, Teresa, Alexandra and Julia (Ndegwa et al., 2010). The seeds are mainly imported from Europe (ASARECA, 2010).

Identification of agriculture as the driver to economic growth and development particularly in Sub-Saharan Africa has dominated debate in recent years. In Kenya, the Agriculture Sector Development Strategy (ASDS, 2010) points out the need to increasing agriculture productivity, commercialization and competitiveness of agricultural commodities and enterprise by improving market access for small farmers through better supply chain management. Van der Meer (2006) portends that value chains are of growing importance particularly for perishable products that target top-end retailers such as snap beans. Although value chains are spreading rapidly in both more and less developed countries, the share of small scale farmers in developing countries affected by them is still small (Van der Meer, 2006). This exclusion puts especially African small producers in a disadvantage position that cannot allow them to reap from value chain benefits, including high quality that command better prices, reduction of costs through higher efficiency, reduced transaction costs, improved supply of fresh products, improved access to production and market information (Van der Meer, 2006).

Value chain can be defined as the full range of activities that are required to make a product or service (Kaplinsky and Morris, 2001). The value chain therefore incorporates all the activities including input sourcing, production, transformation, marketing all the way up to final consumption and disposal after use. Competitiveness can be defined in terms of costs, quality, dependability and flexibility of production and supply. Farm level competitiveness in this study refers to cost reduction and, hence higher profitability for a given output level. A farm is competitive if, at prevailing prices for its products and inputs, it can generate sufficient profits to maintain its existence. Products of high quality attract higher price in the market. Competitiveness also increases with dependability and flexibility of production and supply.

Despite results indicating that trade in snap beans in Kenya is highly profitable (Kamau, 2000), little is known about the smallholder competitiveness of snap bean production, and the distribution of the costs and value-added benefits between the chain participants. Information on the most costly items within each respective chain level is also scarce. The overall objective of the study was, therefore, to map out the snap bean value chain and assess the competitiveness of smallholder production, taking the case of Kirinyaga County.

Knowledge about value chains of snap beans will enhance direct communication between end buyers and producers which can be a powerful tool in helping snap bean producers to understand the implications of competitiveness as a way of ensuring continued penetration of the national and international markets. The results will be used by exporters, researchers and government officials in formulating policies which will enhance competitiveness of Kenya's smallholder snap beans growers.

1.2 Literature review

Literature on value chains has highlighted its importance in addressing several policy and production issues. van Melle et al. (2007) noted that in Kenya, chains which were initially started by smallholder producers have been replaced by large farms, mostly under direct control of the export companies. It should be noted, however, that the small farmers need to be linked to the value chains for them to realize the value chain benefits.

While analyzing the value chain of fruits and vegetables in India, Reddy et al. (2010) noted that as whole farmers linked to the value chains receive a higher share of gross value than other stakeholders and that they also received higher prices for each of the vegetables considered during the study. The study concluded that vendors play an important role in the value chain by reducing information gap between farmers and retailers when accorded proper training. Their finding underscores the need to enhance capacity building for brokers in relaying market and production information to the farmers whom they link with exporters. A study carried out in 2003 by FAO in Kenya went further to emphasize that improvement in the key areas in each stage of mango value chain such as capacity building, credit acquisition, infrastructure development and setting up of collective bargaining bodies for farmers are necessary if competitiveness has to be restored and gains realized across value chain participants. A study by Kumar and Kapur (2010) in Orissa, India, on the other hand assessed the flow of coconut from farmers through different intermediaries to the consumers by computing prices and marketing margins at the different stages of the chain in order to reflect the value addition through various participants of the chain. Though value addition was not evident, the study found that both vendors and aggregators were still able to earn profit and hence continue the business.

Support to farmers in terms of credit and training still remain key challenges in enabling farmers to grow and produce quality crops. A study on rice value chain in Kenya by Emongor et al.

(2009) found that intensive use of production inputs is required at the farm level but that most rice farmers were not using them optimally because of high costs. The study concluded that credit support was a felt need in order for the farmers to carry out timely operations in their fields. They went further to recommend that institutions involved in service provision should be strengthened to improve availability and distribution of production inputs and timely information to farmers.

A study by voor den Dag (2003) found that farmers were better off dealing directly with exporters rather than through middlemen as this channel offered them more benefits in the value chain such as higher prices, credit acquisition, a contract, ability to negotiate prices and also assurance on the place of sale. Okello et al. (2007) on the other hand showed that smallholders have been filtered out of the supply chain by food safety standards that have made them uncompetitive, although through collective action they have been able to mitigate some of the constraints arising from imposition of these standards. The study was concerned with comparing production costs of compliant and non-compliant farmers with respect to adherence to international food safety standards. While these studies attempted to look at the French beans chain from Kenya, both studies were largely export oriented and qualitative in approach. They failed to give detailed quantitative analyses of the snap beans value chain actors from production to consumption and how these compare in terms of costs and value added benefits.

2. RESEARCH METHODOLOGY

2.1. Study site and data

This study was conducted in Kirinyaga County in Central Kenya, which leads in the production of snap beans for export market in Kenya since late 1970s (Kariuki *et al*., 2006). It is about 170km to the north-east of Nairobi around the Mt Kenya highlands. Kirinyaga County is located between latitude $0^o1'$ and $0^o40'$ South and longitudes 37^o and 38^o East. The research was conducted through household survey. Primary data was collected from the selected respondents using semi-structured questionnaire. The study used baseline data which had been collected earlier in 2010 through the DrivLIC project. Multistage sampling procedure was used to identify the sample group for primary data collection. The first stage involved purposeful selection of the main export vegetable growing administrative locations in the study area. Lists of all smallholder households in locations producing and exporting vegetables were developed with the help of village elders and frontline extension staff of the Ministry of Agriculture. 139 farmers, 10 brokers, 5 transporters, 5 supermarket stores, 10 local vendors, 2 processors, 100 consumers and 5 exporters were interviewed. Separate questionnaires were developed for each category.

2.2 Data analysis

The VCA software from FAO was used for financial analysis to assess the competitiveness of snap beans in the study area. The software helps build step by step quantitative database of each of the value chain stages, thus allowing individual analysis of each chain participant. Analysis of variance (ANOVA) was independently conducted for every channel to determine if there were differences in means of the value added between the actors in respective channels and if those differences are significant. ANOVA was chosen for the analysis since it allows for comparisons between three or more groups (Green, 2000). Multiple comparisons were done using the Tukey post-hoc test to show which groups differ from each other. Since the ANOVA test assumes equal variances between groups, Levene's Test of Homogeneity of Variance was used to test the hypothesis of equal variances between the value-added for the different actors in each channel.

The null (H_o) and the alternative (H_1) hypotheses for the ANOVA analysis were stated as;

H_o: The mean value added for the actors are equal, and

H_1: At least one of the means of the actors is not equal to the others

2.3 Analytical framework

Competitiveness was analyzed using value chain analysis (VCA) framework (Kaplinsky and Morris, 2001). Value chain is the full range of activities that are required to make a product or service. The value chain therefore incorporates all the activities including input sourcing,

production, transformation, marketing all the way up to final consumption and disposal after use. Value adding practices and returns realized in every stage by respective chain participants were explored. Following Kirimi et al. (2011), farm level competitiveness was measured by comparing value added and the costs involved at each stage of the value chain. Competitiveness was demonstrated in profitability of individual chain participants (FIAS, 2007).

2.3.1 Calculation of value-added

To compute the value-added all costs and sales for the various stages were measured as well as the underlying product and input prices. Actual market prices were used for financial analysis.

Thus according to guides from UNIDO (2009), the following were calculated;

1. Value Added (VA);
   VA is the difference between the value of output of a product ***i*** (Y_i) and the value of intermediate inputs (II_i) used in the productive activities and represents the value-added by an individual actor ***j*** during the accounting period. The intermediate inputs are those factors of production that are totally transformed or consumed during the accounting period and are not available for use during the next period.
   $VA_{ij} = Y_{ij} - II_{ij}$…….....(1)

2. Net Value Added (NVA);
   The difference between Value Added (VA) and Depreciation (DP) for product ***i*** from individual agent ***j.*** However, in this study depreciation was assumed to be zero.
   $NVA_{ij} = VA_{ij} - DP_{ij}$……...(2)

3. Gross Profit (GP);
   This measures the difference between VA and expenditure on labour, taxes, and interest charges. The GP measures the returns to cultivation after labour costs, taxes and interest charges have been deducted.
   $GP_{ij} = VA_{ij} - (wages_{ij} + interests_{ij} + rents_{ij} + taxes_{ij})$…….(3)

4. Overall value-added;
   The overall value-added was computed as
   $TVA_{chain} = Y_{chain} – II_{chain} = \sum VA_{agents}$.....(4)

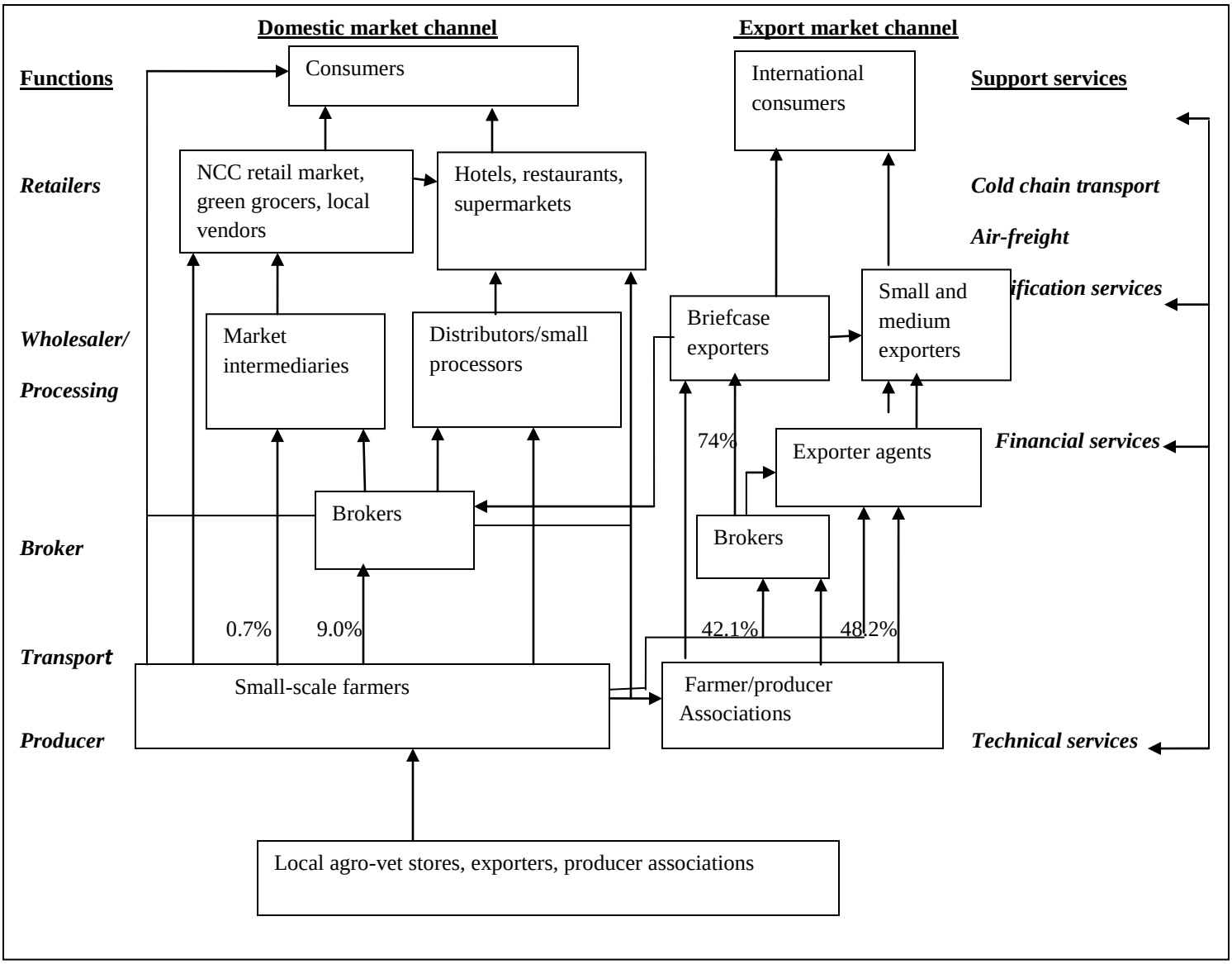
From these it was possible to identify the share of value-added contributed by each stage of the value chain. Since price varied widely among actors, the average buying and selling price were calculated for various value chain participants.

3. RESULTS AND DISCUSSIONS

3.1 Snap beans value chain actors and their roles

Figure 1 shows the smallholder snap beans value chain map, detailing the functional levels on the left column and the support services on the far right column. The main participants in snap beans value chain were input suppliers, primary producers (smallholder farmers), transporters, traders (brokers, local vendors and green grocers, supermarket retail outlets located in urban centers and exporters), other service providers, and consumers. The value chain begins with input suppliers located at the bottom of the map who supply production inputs to producers. The resulting snap beans can be sold through the domestic market or exported. In the domestic market, smallholders can sell directly to local consumers, local vendors, brokers, or to processors, who in turn transact it further up the chain to retailers and finally to the consumers. Produce for export can be sold to small and medium exporters directly (through their field agents), or it can be sold to "briefcase" exporters through brokers. The briefcase exporters often resell their produce to the domestic market whenever they miss flight to Europe or when it is rejected by prospective importers. Export companies handled 48.2% of fresh beans, brokers 51.1% (9% sold through the domestic market and 42.1% sold to exporters) and 0.7% bought by the rest of the buyers including local traders and hoteliers. In total 90.3% of the produce was exported and 9.7% consumed locally. Figure 2 and 3 shows that exporters were the main providers of extension service and credit, respectively. Credit was mainly advanced through materials with seeds being the main form of support by exporters (Figures 4 and 5). However, farmers still need cash credit to enable them carry out timely farm operations, such as those requiring labour (Badiru, 2010), that will ultimately improve the quality of the produce. Farmers who receive credit have had higher yield, income, and improved access to farm inputs compared to non-beneficiaries (Badiru, 2010).

Figure 1: Smallholder Snap bean value chain in Kirinyaga County



3.2 Value -added by chain actors

In order to examine the competitiveness of smallholder snap beans production value added shares of the chain participants was calculated and compared with the costs incurred by each.

Value added was considered for the main domestic chain (both formal and informal) and the export chain. The formal domestic chain is the one comprising of supermarkets as retailers. Four main channels for snap beans marketing were identified thus;

i) Farmer ..... Broker ..... Processor ..... Retailer 1 ..... Consumer

(Formal domestic market)

ii) Farmer ..... Broker ..... Retailer 2 ..... Consumer

(Informal domestic market)

iii) Farmer ..... Exporter ..... Broker ..... Consumer

iv) Farmer ..... Exporter ..... Consumer

Channels (i) and (ii) are domestic channels whereas (iii) and (iv) are export channels. Results in Table 1 indicate that farmers in channel 1 had the lowest share of total value added of 15.6%, processors (37.6%), retailers who comprised of supermarket outlets had a value added share of 30.5% while brokers had 16.3%. Overall, the chain had positive value added of Kshs 164,100 indicating profitability of the entire chain.

Even though the produce that go through the informal channel earns farmers greater share of value added of 45.9% (Table 2), compared with the formal channel in Table 1, it deals mainly with rejects and is dominated by brokers whose value added share is the largest at 48%. In this channel freshness of beans was the key measure of quality and this could be evidenced from total value added created of Kshs 55,800, which is the lowest among all the four channels considered. They sold to local consumers, hotelliers and restaurants as well as children homes and served mostly low to medium income consumers. However, this channel is quite informal and dealt mainly with rejects and, quality and safety measures were not strictly observed.

Tables 3 and 4 are export market channels. The value added share for farmers in the absence of brokers was higher at 18.1% in Table 3 compared to 20.2% in Table 4. In terms of costs, combined labour for farm operations was the most expensive cost for farmers, accounting for 42% of the total cost, followed by seed (18%) and fertilizer (14%). Among processor costs,

insurance accounted for the highest cost at over 5% of the total cost. On the other hand, exporter costs included overhead costs (26.4% of the total cost), labour (11.7%) and insurance (2.97%) in that order among other costs.

Table 5 shows the output of the ANOVA analysis and whether there are statistically significant differences between the means for the four market channels. The significance level is 0.000 ($p = 0.000$), which is less than 0.05, in all the four channels. The F-values are also high. Therefore, there is a statistically significant difference in the mean value-added between the value chain actors in all four channels and the null hypothesis that the mean value-added for the actors are equal, is rejected. Results of the Tukey post-hoc tests indicated in Tables 6, 7 and 8 show which of the specific means differ in each case. There is a significant difference in means between the value-added for all the value chain actors in channel 1 ($p = 0.000$). However, there were no differences between farmers and brokers ($p=0.315$) (Table 6). Levene's Test of Homogeneity of Variances indicate that the variances between the snap beans value chain actors in each of the market channels do not differ, hence allowing for the use of ANOVA in this study.

4. CONCLUSIONS AND RECOMMENDATIONS

The value chain actors were found to play roles which complement each other. Trade was dominated by lead exporters who work through field agents. Smallholder snap bean production and marketing can be enhanced if the challenges facing them along the chain are addressed. The main constraints being the high cost of inputs (labour alone constituting 42.1% of the total cost), lack of cohesion, high information asymmetry, poor infrastructure and access to credit. Support services to farmers such as credit, extension and transport remain important in improving farmers' field operations. In general, the chain was vertically integrated, but information flow was asymmetric especially between farmers and brokers, thus increasing transaction costs.

Although farmers' share of value added is the lowest in the value chain, they can get more benefit through initiating value addition processes like cleaning, trimming and packing harvested beans for the domestic market. This will ensure that the local supermarkets engage with them directly in business. Smallholder snap beans production was found to be competitive as farmers realized positive profits in the value chain. There were significant differences in the value added by the chain actors across all the channels, except between smallholder farmers and brokers. The proportion of value-added share by farmers was low, followed by brokers, then retailers while processors realized the greatest percentage of the value-added. Like other past studies, shorter chains where brokers were excluded were found to be more profitable to farmers than longer ones.

In view of the above the study recommends interventions that are necessary to support on-going research to develop sustainable varieties of snap beans seed that are locally adapted and acceptable in order to cut down on the high cost of (imported) seed and thus increase

competitiveness of smallholder producers. Despite extension services being largely provided by exporters, government efforts still remain important to empower farmers to best practices through training and information.

Access to credit is seen as a great enabler for smallholder farmers to improve their production methods and ultimately increase outputs on farms. To enhance borrowing and use of credit, governments, especially in developing countries, together with credit schemes and credit institutions should formulate education programmes to educate farmers on credit acquisition and use. In addition, development of infrastructure should be improved; especially feeder roads and cold storage facilities should be established around the production centers. This will lower the rate of post-harvest losses thus enabling farmers to present more produce of better quality for sale.

Overall, farmers should be encouraged to form marketing groups so that they can minimize the infiltration by brokers. Since shorter chains are more beneficial than longer ones, governments should have policy interventions that seek to reduce the number of intermediaries in the marketing chain, such as licensing them into legal entities. The farmers should engage in value addition practices such as cleaning, trimming and packaging their produce for the local supermarkets.

Further research is required to assess the competitiveness of snap beans production in other regions of the country and to review the factors determining the distribution of benefits and costs among the various chain actors. Since the sector has had no controls over the years, a study using private and social prices would identify any market imperfections along the value chain and highlight the country's competitiveness in snap bean trade in the region.

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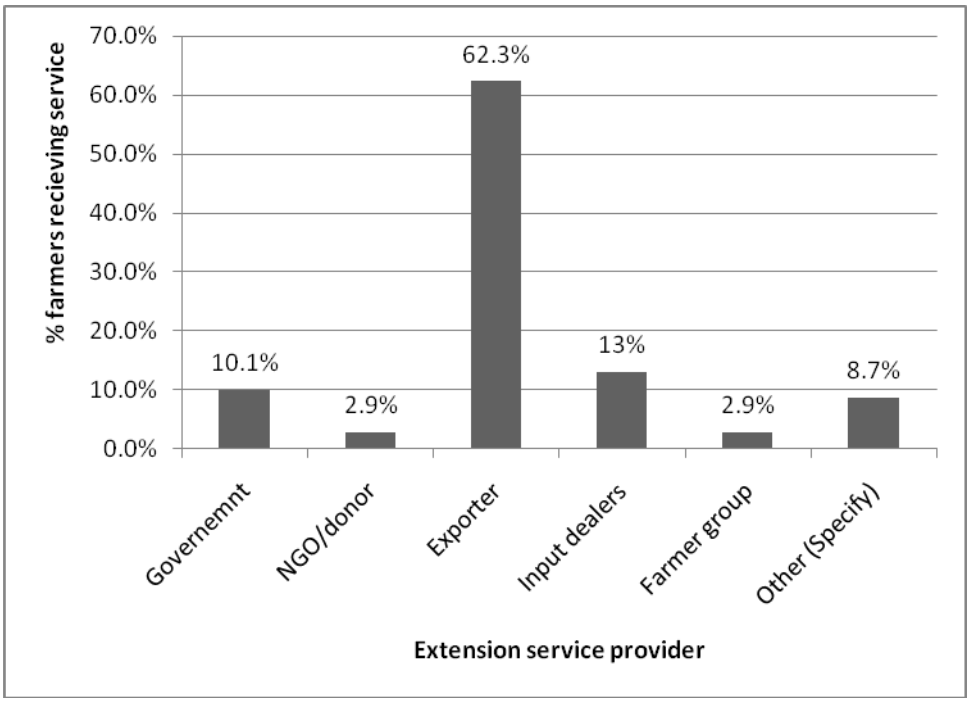
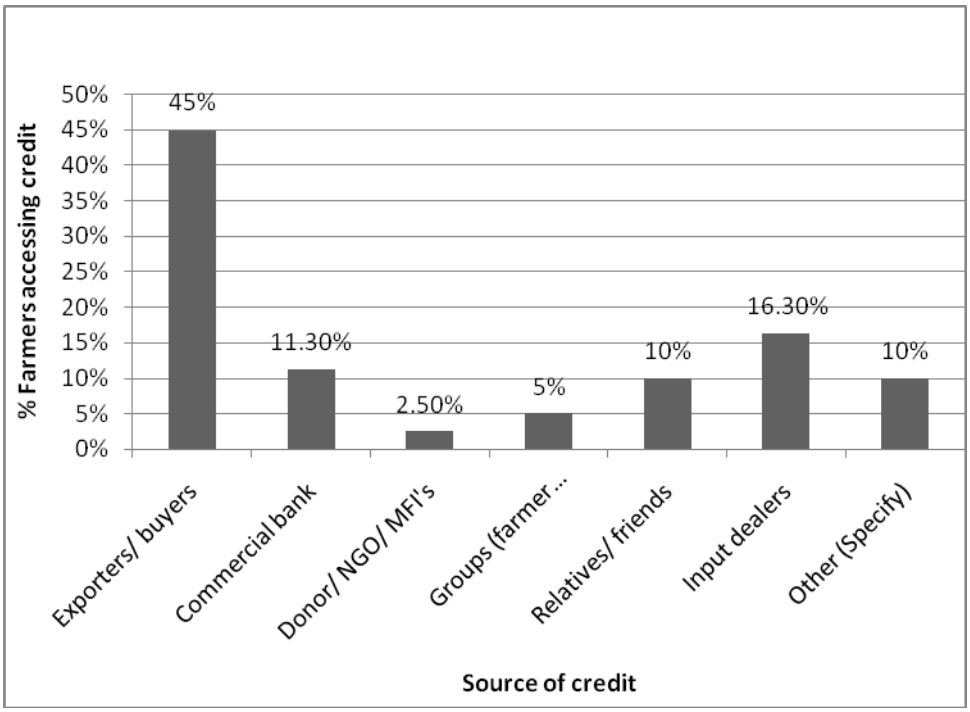
FIGURES AND TABLES OF RESULTS

Figure 2: Per cent of farmers getting snap bean extension services from various extension service providers in Kirinyaga County



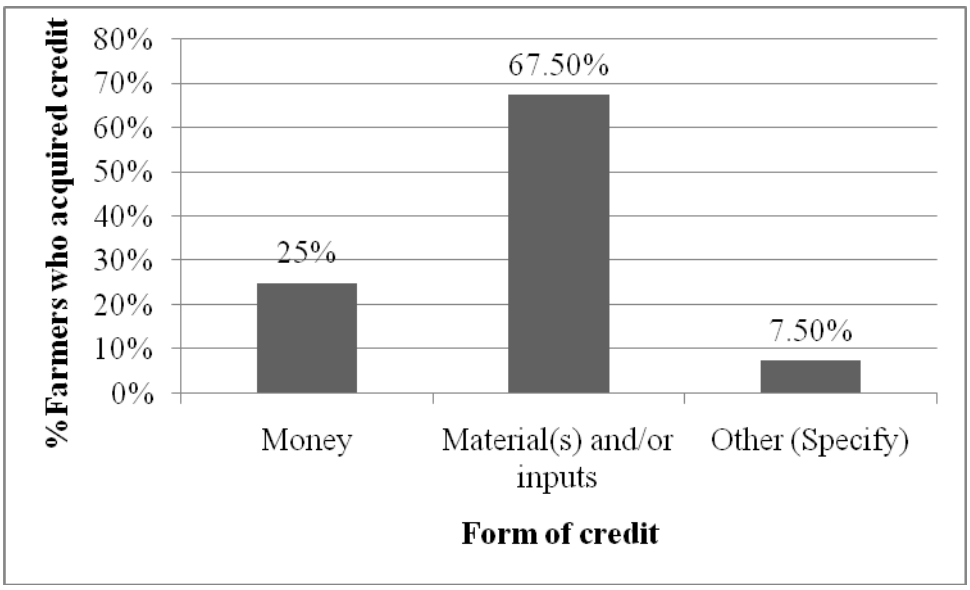
Source: Survey results, 2011

Figure 3: Per cent of farmers acquiring credit from various sources in Kirinyaga County



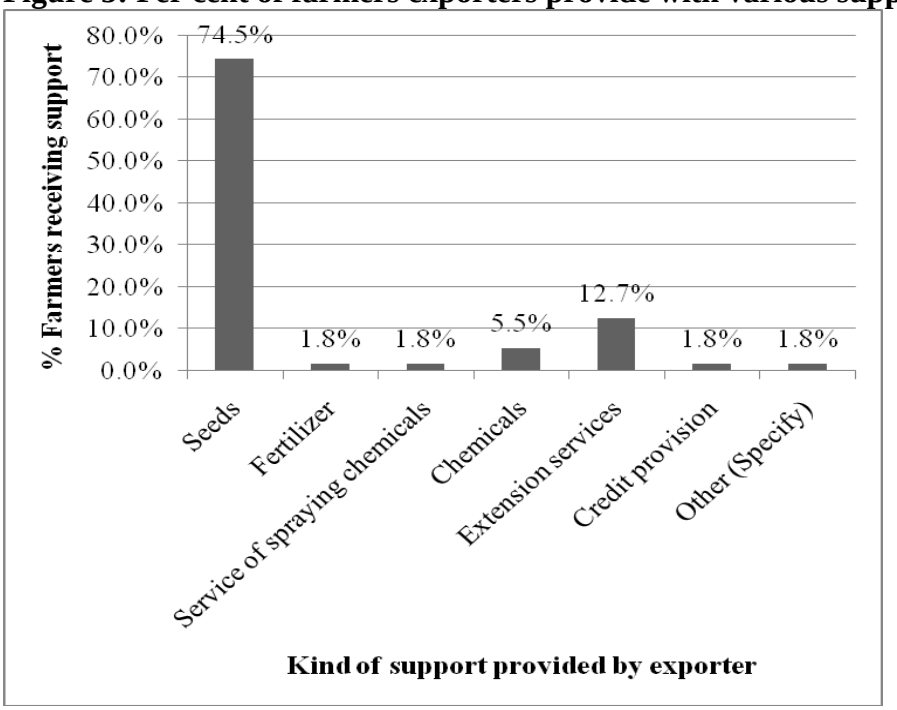
Source: Survey results, 2011

Figure 4: Forms of credit that farmers received in Kirinyaga County



Source: survey results, 2011

Figure 5: Per cent of farmers exporters provide with various support services



Source: Survey results, 2011

Table 1: Average value added per ton of snap beans per actor for channel 1

Actor	Total output in Kshs per ton	Intermediate inputs	Total Value added	Gross Profit in Kshs	% share of Value Added
Smallholder farmer	43,000	17,400	25,600	9,300	15.6
Broker	70,000	43,200	26,800	24,500	16.3
Processor	151,000	89,300	61,700	55,800	37.6
Retailer 1 (Domestic supermarkets)	201,000	151,000	50,000	50,000	30.5
TOTAL			**164,100**		**100**

*The exchange rate at the time of survey was 1USD= Kshs 81

Table 2: Average value added per ton of snap beans per actor for channel 2

Actor	Total output in Kshs per ton	Intermediate inputs	Total Value added	Gross Profit in Kshs	% share of Value Added
Smallholder farmer	43,000	17,400	25,600	9,300	45.9
Broker	70,000	43,200	26,800	24,500	48.0
Retailer 2 (grocers/ vendors)	74,000	70,600	3,400	3,400	6.1
TOTAL			**55,800**		**100**

Table 3: Average value added per ton of snap beans per actor for channel 3

Actor	Total output in Kshs per ton	Intermediate inputs	Total Value added	Gross Profit in Kshs	% share of Value Added
Smallholder farmer	43,000	17,400	25,600	9,300	18.1
Broker	70,000	43,200	26,800	24,500	18.9
Exporter	187,000	97,800	89,200	76,300	63.0
TOTAL			**141,600**		**100**

Table 4: Average value added per ton of snap beans per actor for channel 4

Actor	Total output in Kshs per ton	Intermediate inputs	Total Value added	Gross Profit in Kshs	% share of Value Added
Smallholder farmer	46,000	17,400	28,600	12,300	20.2
Exporter	187,000	73,800	113,200	100,300	79.8
TOTAL			**141,800**		**100**

Table 5: ANOVA results for testing the difference of mean value-added between the snap bean value chain actors in four different market channels in Kirinyaga County

	Description	Sum of Squares	Df	Mean Square	F	Sig.
Channel 1	Farmer-Broker-Processor-Retailer 1	5087.426[a] 303.083[b] 5390.509[c]	3[a] 77[b] 80[c]	1695.809[a] 3.936[b]	430.830	0.000**
Channel 2	Farmer-Broker-Retailer 2	4408.41[a] 301.319[b] 4709.732[c]	2[a] 81[b] 83[c]	2204.207[a] 3.720[b]	592.530	0.000**
Channel 3	Farmer-Broker-Exporter	18843.521[a] 421.842[b] 19265.364[c]	2[a] 76[b] 78[c]	9421.761[a] 5.551[b]	1697.445	0.000**
Channel 4	Farmer-Exporter	33524.869[a] 381.099[b] 33905.969[c]	1[a] 78[b] 79[c]	33524.869[a] 4.886[b]	6861.568	0.000**

******Significant at $\alpha = 0.05$; [a]Between Groups; [b]Within Groups; [c]Total

Table 6: Multiple comparisons between means of value-added of actors for Channel 1

Dependent Variable: VA
Tukey HSD

(I) channel	(J) channel	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Farmer	Broker	-1.168	0.6746	0.315	-2.939	0.604
	Supermarket	-24.428(**)	0.9213	0.000	-26.847	-22.009
	Processor	-36.158(**)	1.4246	0.000	-39.899	-32.417
Broker	Farmer	1.168	0.6746	0.315	-0.604	2.939
	Supermarket	-23.260(**)	1.0867	0.000	-26.114	-20.406
	Processor	-34.990(**)	1.5368	0.000	-39.026	-30.954
Supermarket	Farmer	24.428(**)	0.9213	0.000	22.009	26.847
	Broker	23.260(**)	1.0867	0.000	20.406	26.114
	Processor	-11.730(**)	1.6599	0.000	-16.089	-7.371
Processor	Farmer	36.158(**)	1.4246	0.000	32.417	39.899
	Broker	34.990(**)	1.5368	0.000	30.954	39.026
	Supermarket	11.730(**)	1.6599	0.000	7.371	16.089

** The mean difference is significant at $\alpha = 0.05$

Table 7: Multiple comparisons between means of value-added of actors for Channel 2

Dependent Variable: VA
Tukey HSD

(I) channel	(J) channel	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Farmer	Broker	-1.168	0.6558	0.183	-2.734	0.398
	Vendor	22.182(**)	0.6558	0.000	20.616	23.748
Broker	Farmer	1.168	0.6558	0.183	-0.398	2.734
	Vendor	23.350(**)	0.8626	0.000	21.291	25.409
Vendor	Farmer	-22.182(**)	0.6558	0.000	-23.748	-20.616
	Broker	-23.350(**)	0.8626	0.000	-25.409	-21.291

** The mean difference is significant at α= 0.05

Table 8: Multiple comparisons between means of value-added of actors for Channel 3

Dependent Variable: VA

Tukey HSD

(I) channel	(J) channel	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Farmer	Broker	-1.168	0.8011	0.317	-3.083	0.747
	Exporter	-63.568(**)	1.0940	0.000	-66.183	-60.953
Broker	Farmer	1.168	0.8011	0.317	-0.747	3.083
	Exporter	-62.400(**)	1.2904	0.000	-65.485	-59.315
Exporter	Farmer	63.568(**)	1.0940	0.000	60.953	66.183
	Broker	62.400(**)	1.2904	0.000	59.315	65.485

** The mean difference is significant at α= 0.05