Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.5, No.16, 2015

A Value Chain Analysis of Tabasco Chillies Grown by Smallholder Farmers in Nyanga District, Zimbabwe

Simbarashe Tatsvarei [1*], Kingstone Mujeyi [2], Ephias M. Mugari[3], Tendai Maparara[4]

1. Marondera College of Agricultural Science and Technology, University of Zimbabwe, Box 35, Marondera, Zimbabwe
2. Department of Agricultural Economics and Extension, University of Zimbabwe, Box MP167, Harare, Zimbabwe
3. Department of Biological Sciences, University of Botswana, P. Bag UB0022, Botswana
4. Department of Agricultural Economics and Development, P. Bag 9055, Midlands State University, Zimbabwe

Abstract
This paper traces tabasco chillies value chain through characterization, distribution of value added and determining the contribution of the crop to total farm income. Data were collected using a questionnaire at all the value chain stages analyzed. Gross margin analysis, domestic value added (DVA) and shipment value (SV) were used to analyse the data. Mapping shows that the value chain is dualized. Tabasco mash pathway has DVA/tonne as follows; farm level (US$342), semi-processing (US$343), packaging and exported tabasco mash (US$1077) and SV were US$386, US$605 and US$1205 respectively. For the dried chillies pathway, DVA/tonne was US$342 at farm level and US$426 for packaging and export while the SV were US$386 and US$511 respectively. Greatest value addition is coming from transport and export of tabasco mash, followed by packaging and export of dried chillies, farm production and semi-processing adding the least. The crop contributed 39% to farm household income.
Keywords: Tabasco chillies, Zimbabwe, value chain analysis, income analysis

1. Introduction

Participation in global value chains is viewed as an effective way of reducing poverty among smallholder farmers (World Bank, 2008). In pursuance of developmental efforts to improve rural incomes of smallholder farmers in Nyanga District of Manicaland, Zimbabwe, tabasco chillies (chilli pepper) was introduced as an alternative cash crop with potential to reduce rural poverty (IRC, 2012). The farmers are producing the crop under contract where they are provided with farming inputs on credit to produce the crop under irrigation, whose marketing is also conducted on a contractual basis. The product is semi-processed and shipped to the United States of America (USA), where it is further processed to sauce and sold to the rest of the world (IRC, 2012).

Tabasco chillies have proven to be up to ten times more valuable than maize; requiring fewer natural resources than maize to produce; and they do not exhaust soil nutrients to the same extent as maize (Crowley, 2009). An average smallholder farmer can obtain yields equivalent to 6,000kg per ha, generating revenue of US$1,050 annually, compared to average of US$380 for maize. Yields of chilli peppers from the same piece of land is very high and so with only a small plot of land a farmer can make significant revenues (Crowley, 2009). However, very little is known about this crop in Zimbabwe, especially in the smallholder sector. It is thus imperative to trace the crop's value chain to highlight on the benefits of this crop, especially to smallholder farmers. Higher returns for farmers imply more disposable cash and hence the ability to meet household food and non-food requirements, agricultural inputs demands, education, health and durable goods requirements.

The overall objective of the study is to analyze the tabasco chillies value chain, identifying opportunities and constraints so as to recommend appropriate actions that stakeholders along the chain need to take. The study traces how tabasco chillies produced in Nyanga District enter the value chain, and what returns accrue to participating actors, including farmers. Specifically, the research seeks to:

i. Characterise tabasco chillies value chain through mapping and analysis of governance structures and opportunities for upgrading;
ii. Analyze the distribution of revenues and margins and value added among the actors; and
iii. Analyze the contribution of tabasco chillies production to income at the farm level and how that impacts on value chain participation and decision making.

2. Economics of Tabasco Chillies Production

Tabasco chillies are grown in hot, humid conditions and in well drained soils that hold enough moisture to keep the plants in production. Chillies are an environmentally friendly crop requiring limited water, pest control and fertilization. The tabasco farming cycle lasts nearly one year. Labor is a major cost in production of chillies and its availability is critical since in most cases family labor cannot sustain the operations. In smallholder farming, productivity is about 5mt/ha fresh weight compared to 18mt/ha in large scale commercial and an average of

23mt/ha globally (Levin, 2010). The price of fresh tabasco chillies is US$0.50/kg while that of dried chillies is US$2/kg. The processing step involves grinding the chillies with small amounts of salt into chilli mash. The mash is stored in drums for an 8-week period. This allows the gassiest stage of the fermentation process to conclude. For export to McIlhenny Company for the production of Tabasco sauce, chilli mash is decanted from drums into sealed *export bladders*, containing 22,000 kilograms of mash (Crowley, 2009). Shipment is made through Durban to USA where McIlhenny Company is located. Shipping time is between 10–12 weeks from farm gate to warehouse (Crowley, 2009). International free on board (FOB) prices average US$1,200 per tonne, while the cost, insurance and freight (CIF) USA prices of chillies is about US$2,500 per tonne (Crowley, 2009). Freight is thus a major cost in the Tabasco chillies value chain.

Globally, the demand for Tabasco chillies is about 20,000 tonnes of mash annually. Africa produces about 3-4% of this total requirement. Countries producing this crop in Africa are Zambia, Swaziland, Mozambique and Zimbabwe (Levin, 2010). The other countries are Guatemala, Honduras, Nicaragua, Panama, Colombia, Peru and Ecuador in addition to the USA. Globally, there are 2,000 to 3,000 farmers involved in production of this crop. Production of tabasco chillies in Zimbabwe started in 2002 and was on the decline until the stabilization of the economy following the introduction of multicurrency system in 2009.

3. Theoretical Framework

Value chain studies do not have a single unifying theoretical framework, and its practitioners have borrowed from different theories and methodologies (Trienekens, 2011). These theoretical frameworks have ranged from institutional to new institutional economics. Scientific disciplines that add to the development of value chain theory can be grouped into five streams with different perspectives on inter-actors relationships; global value chain (GVC) analysis, supply chain management theory, transaction cost theory, social network theory and new institutional economics (Jraisat, 2011).

Based on literature, value chain is characterized by its network structure, its governance form, bargaining power, value added and its distribution and upgrading options. From the supply chain management and network theory, the network structure of the value chain can be outlined. The theories of supply chain management, transaction cost and value chain enable us to draw value added production. From value chain theory, network theory and new institutional economics we draw the governance and bargaining position of value chain actors, and related distribution of value added (Trienekens, 2011). Firms in value chains are linked in a variety of sourcing and contracting relationships, referred to as forms of governance. The governance of value chains can be classified into five categories; markets, modular, relational, captive and hierarchy value chains (Gereffi, 2005).

Not many studies have been conducted to analyze smallholder value chains in Zimbabwe, especially of a quantitative nature. One such study was by Jaure et al (2008), who analyzed value chains in the vegetable sub-sector in Zimbabwe using Porter's model. The study findings were that there are many players in input supply; marketing is dominated by informal players with formal urban markets controlling less than 40% of total supply. About 75% of exported vegetables were sourced within a 100km radius of Harare. The study recommended the creation of market linkages to open up more domestic and regional markets for the smallholder farmers as well as promoting processing for value addition.

4. Empirical Methods

For calculation of sample size at farm level, the population was considered as all the farmers who are involved in the tabasco chillies value chain in Nyanga District. The total number of farmers who are involved in the tabasco chillies value chain is 170. In order to calculate the sample size, the following formula was used (Wegner, 2003).

$$\boldsymbol{n} = \frac{\boldsymbol{X^2 * N * P * (1-P)}}{\boldsymbol{[ME^2 * (N-1)] + [X^2 * P * (1-P)]}} \quad (1)$$

Where:

n = Sample size
X^2 = Chi-square for the specified confidence level at 1 degree of freedom
N = Population Size
P = Population proportion (assumed at 0.5)
ME = desired Margin of Error (expressed as a proportion).

Considering a population of 170 and the required margin of error and significance level, a sample of size of 119 was generated. Simple random sampling was used to identify the farmers for interviewing. A household questionnaire was used to collect data from the farmers. Data collected was on household demographic characteristics, farm enterprise production, gross and net margins as well as perceptions on tabasco chillies value chain. Another questionnaire was sent to Better Agriculture as the other chain actor involved within the country. Only those value chain activities in Zimbabwe were analyzed, and not those outside the country. This is due primarily to budgetary constraints and unavailability of adequate data for those actors outside the country.

(i) Gross Margin Analysis

A gross margin is simply an estimate or a budget of the income and costs associated with a specific crop or activity in a farming business. Gross margin analysis (GMA) is used to determine which crops are more profitable than others and normally expressed as $/ha. A gross margin is calculated using the following formula:

$$Gross\ margin = gross\ income - variable\ costs \quad (2)$$

(ii) Domestic Value Added (DVA) and Shipment Value (SV)

According to this analytical framework, total costs are measured in terms of Domestic Value Added (DVA) and Shipment Value (SV), which constitute the main value chain indicators as follows (Tchale and Keyser, 2010):

$$\boldsymbol{Domestic\ Value\ Added\ (DVA)} = Domestic\ costs\ and\ markups + Official\ duties\ and\ taxes + Unofficial\ charges\ and\ extra\ costs \quad (3)$$

$$\boldsymbol{Shipment\ Value\ (SV)} = \text{Domestic Value Added (DVA)} + Foreign\ components \quad (4)$$

The interest is in the composition of DVA as a leverage point for enhanced sector performance. DVA include legitimate business costs and mark-ups, official customs duties and taxes, and any number of unofficial payments and bribes that sometimes have to be made to facilitate a particular operation. DVA and SV are measured according to equations (3) and (4) on a per tonne basis at each stage of the value chain for the following products or services (Tchale and Keyser, 2010).

Farm production: Farm gate Tabasco chillies
Semi-processing: Mashed Tabasco Chillies
Packaging and export: Export of Tabasco mash to the USA
Transport and export: Export of dried chillies to SA

Tabasco chillies can be in the fresh form, which is processed into mash or dried up after several months. In the most basic sense, there can be the difference between a recently harvested farm product with high moisture content and one that has been assembled in a warehouse and dried for several months. DVA and SV are therefore measured on a per tonne basis to take into account product form changes that can occur along the value chain and use conversion ratios to account for that (Tchale and Keyser, 2010). To calculate DVA and SV, the study relied on an excel template developed by the World Bank for calculation of DVA and SV. This template contains embedded formulas structured in such a way the inputting of data enables calculation of aforementioned measures. The template uses conversion ratios to trace the change in product form along the value chain. The DVA and SV are then used to show the contribution of each value chain activity to the total value. The paper assumed that the end products are tabasco mash and dried chillies at the level of export consignee. SPSS package was used to analyze data collected at farm level.

5. Results and Discussions

5.1 Mapping, Governance and Upgrading Activities

Figure 1 overleaf shows the value chain map for tabasco chillies grown from Nyanga District. The tabasco chillies value chain governance can be classified as being relational. This is because the degree of power asymmetry and explicit coordination is not strong as farmers do not have any direct contact with the lead firm. Farmers in this value chain have a low bargaining power as they depend on Better Agriculture for input supply and sell of produce. This is aggravated by the fact that farmers are not organised into marketing groups since farmers sign individual contracts. However, the fact that the contract specifies a guaranteed price implies that their position in the value chain is stable. The value chain uses formal coordination channels as there are explicit contractual arrangements at each level of actor engagements, from input suppliers to retailers.

The tabasco chillies value chain is also characterised by informal rules and regulations. In Zimbabwe actors in the value chain rely solely on commercial norms determined by Mcllheny Company. Formal rules and regulations that may reflect on the commercial norms are those that relates to standards and quality of agricultural produce imported into the USA and SA. All other value chain actors have only one source of information except the farmer. The farmer has three sources of information and these are IRC, Better Agriculture and Agritex. IRC is the link between the farmers and all outside assistance. Better agriculture handles all issues to do with inputs provision and produce sales. Agritex handles all extension services related to production and quality. Mcllheny Company ensures *ownership* of the value chain by supplying seed used in the production of the crop, its patent of tabasco sauce brand and contractual supply agreement with Better Agriculture as well as specifications of product quality and standards. The Elephant Company ensures *ownership* of the value chain through owning Better Agriculture.

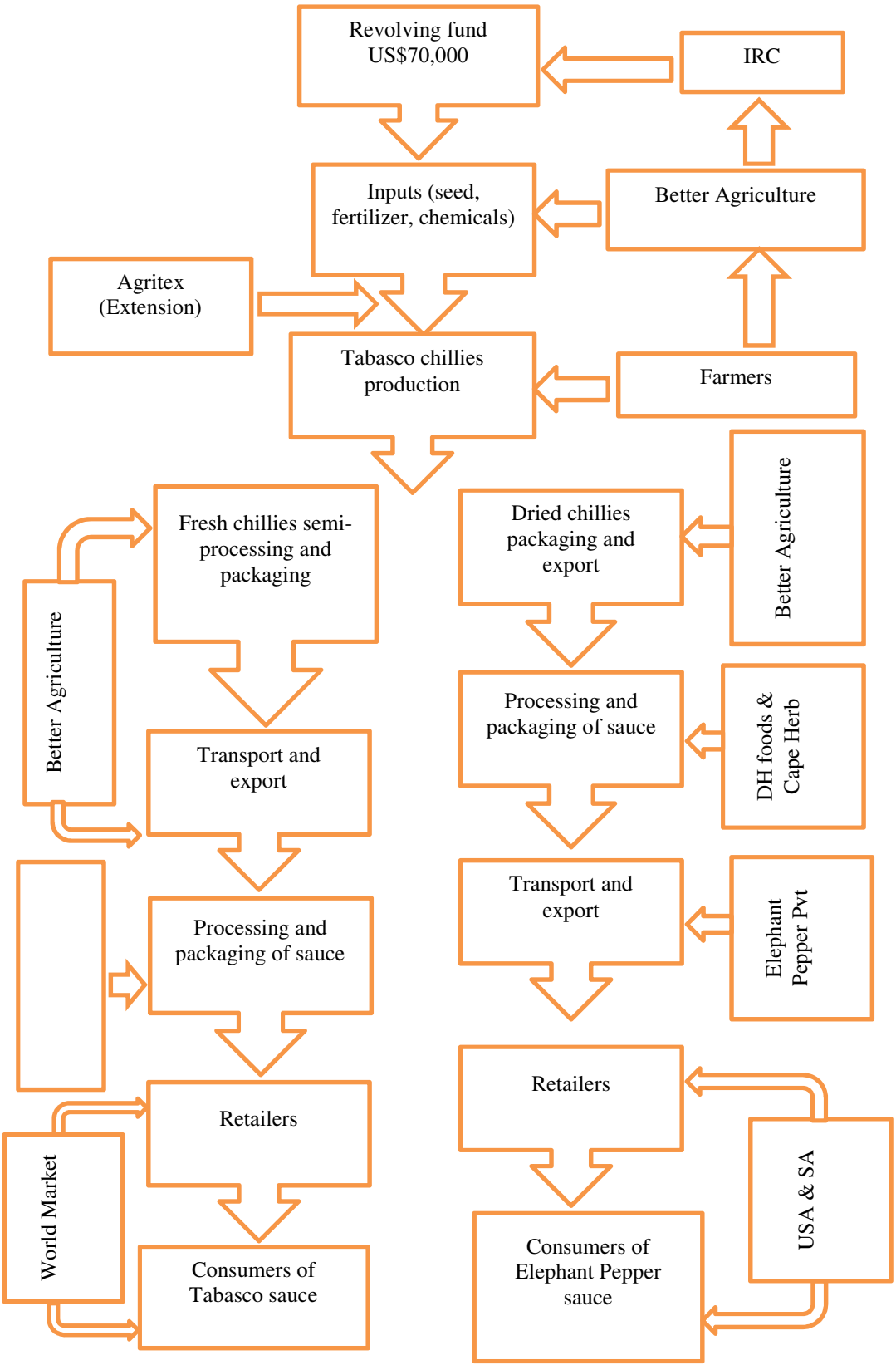

Figure 1: Tabasco chillies value chain mapping

The technology used in Tabasco chillies is not much different from that of paprika, which farmers in Nyanga were already growing, so technology upgrading was not difficult for these farmers and they even managed to apply some of the new technological knowhow like tipping to other crops such as tomatoes and paprika. Tabasco chillies production is labour intensive, allowing a greater opportunity for the poor to participate in the value chain and reduce poverty.

5.2 Analysis of DVA and SV

The tabasco chillies value chain map shows that there are two pathways, one that involves tabasco mash and the other that involves dried chillies. Analyses therefore focus on the activities undertaken from this country along these two pathways to find out the value added at each level. Table 1 begins by analysing profit and loss indicators for all the value chain activities undertaken in this country.

Table 1: Profit and loss indicators ($ per mt)

	Farm gate tabasco chillies	**Semi-processed chillies**	**Transport & export of tabasco mash**	**Packaging and export of dried chillies**
Gross revenue	500	900	1,200	700
Crop purchase	181.44	500.00	400.00	300
Other variable costs	-	12.00	28.00	87
Investment costs	205.00	93.00	16.00	78
Total costs	386.44	605	444	465
Gross margin	318.56	388.00	772.00	313
Net profit	113.56	295.00	756.00	235
Gross margin/total VC	1.76	0.76	1.80	0.81
Net profit/total costs	0.29	0.49	1.70	0.51

In terms of gross margins, the trading of tabasco mash has the greatest return, followed by the semi-processing phase, farm gate and lastly by the trading of dried tabasco chillies. The trend in net profit is the same except that trading of dried chillies comes in third position and farm level is last. This could be explained by the higher fixed costs at farm level relative to export of dried tabasco chillies. This is demonstrated by the rates of return for the given stages. The GRR shows that trading of tabasco mash has the highest value, followed by farm level, trading of dried chillies and lastly the semi-processing into tabasco mash. However analysis of NRR gives a different picture in that while trading of tabasco mash still gives the highest return, the sequence changes with trading of dried chillies being second, followed by the semi-processing phase and lastly the farm level. This implies that farm gate operations have very high overheads.

Table 2 shows the incremental value indicators for the tabasco mash pathway. DVA is highest for the trading of tabasco phase, followed by the semi-processing phase and lastly the farm gate phase. The trend is still the same for the SV for the three phases. However, of note are the high foreign costs at the semi-processing phase of the value chain. This could be a result of the machinery required in carrying out this activity as well as the high costs of special packaging materials used.

Table 2: Incremental value indicators by stage

USD per MT processed raw material	**Domestic Value Added (DVA)**				Foreign Costs	**Total SV**
	Costs	Tax	Extras	**Total DVA**		
Farm level	172	170	-	**342**	44	**386**
Semi-processing and Packaging	390	(47)	-	**343**	262	**605**
Transport and Export (tabasco mash)	1,006	31	40	**1,077**	128	**1,205**

Figure 2 gives a breakdown of the composition of the SV for the traded tabasco mash, being the end product. Domestic costs and mark-ups are contributing about 38% of total SV, foreign costs at 36%, duties and tax at 17% and unofficial costs about 9%. Taxes here are contributing a significant figure due to duties paid in SA (transportation route) and the USA where the trading occurs.

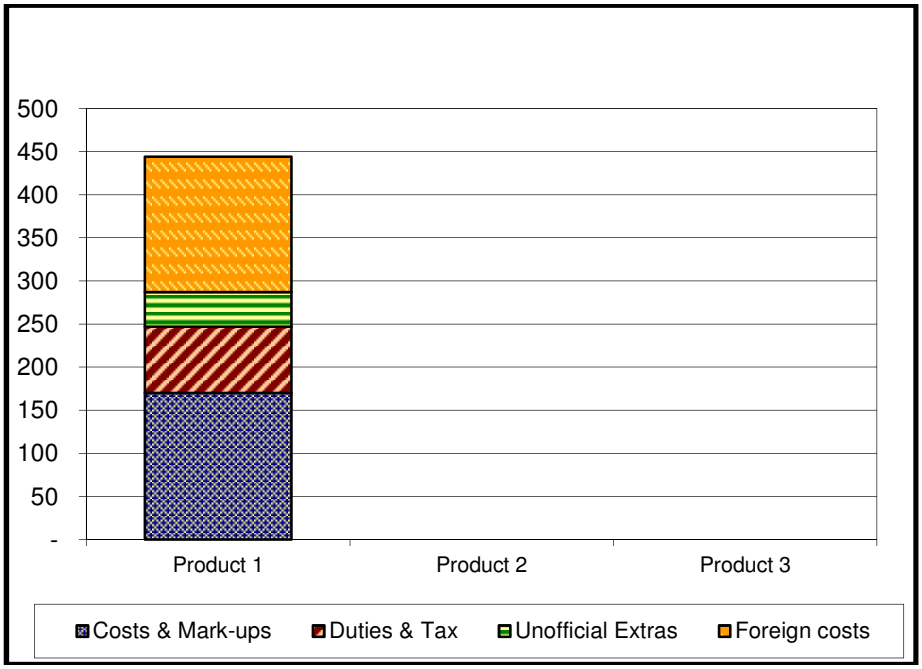

Figure 2: Composition of tabasco mash SV (USD per mt traded commodity)

Table 3 gives the composition of SV along the value chain. As shown, the greatest value is added at the transport and logistics phase, which contributes 55% of total SV. The farm level is second with 27% and semi-processing phase activity is last at 18%.

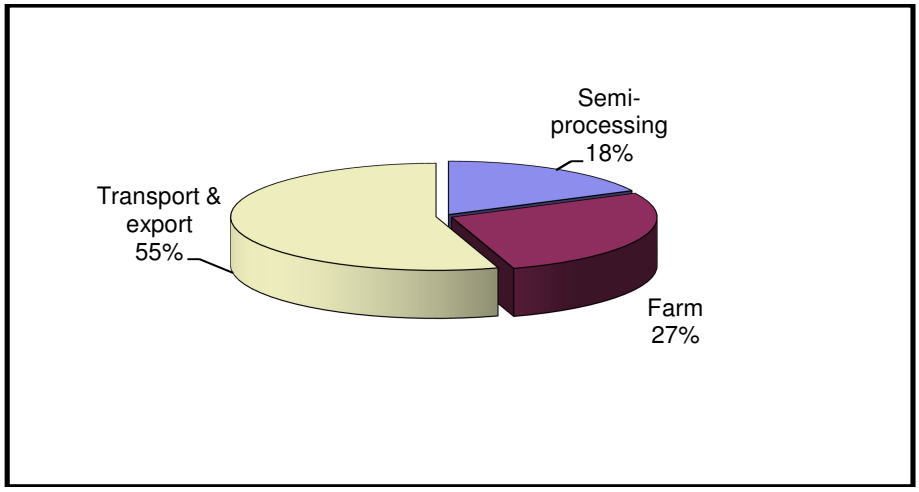

Figure 3: Composition of tabasco mash SV by value chain stage

The value chain map shows that for dried chillies, there are two sages being undertaking within the country and these are the farm level and packaging and export. These are the stages that are analysed. Table 3 shows the incremental value indicators for these stages.

Table 3: Incremental value indicators by stage for dried chillies

USD per MT processed raw material	**Domestic Value Added (DVA)**				Foreign Costs	**Total SV**
	Costs	Tax	Extras	**Total DVA**		
Farm level	172	170	0	342	44	386
Packaging and Export (dried Chillies)	326	67	33	426	84	511

The results again show that the incremental value being added at the packaging and export phase is higher than that at the farm level, with SV at farm level being US$386 and that of packaging and export being US$511. At the packaging and export phase, DVA contribute 83% of SV and foreign costs add 17% of SV. At the farm level, DVA contribute 88% to SV while foreign costs contribute 12%. The high taxes at the farm level relates to the

custom duties charged on the imported seed, chemicals and some fertilizers. Analysis of the dried chillies being marketed indicate that 63% of its SV is from domestic costs and mark-ups, 13% from duties and taxes, 20% from foreign costs. About 4% represent the unofficial payments made to officials involved in the value chain. Figure 4 shows these results.

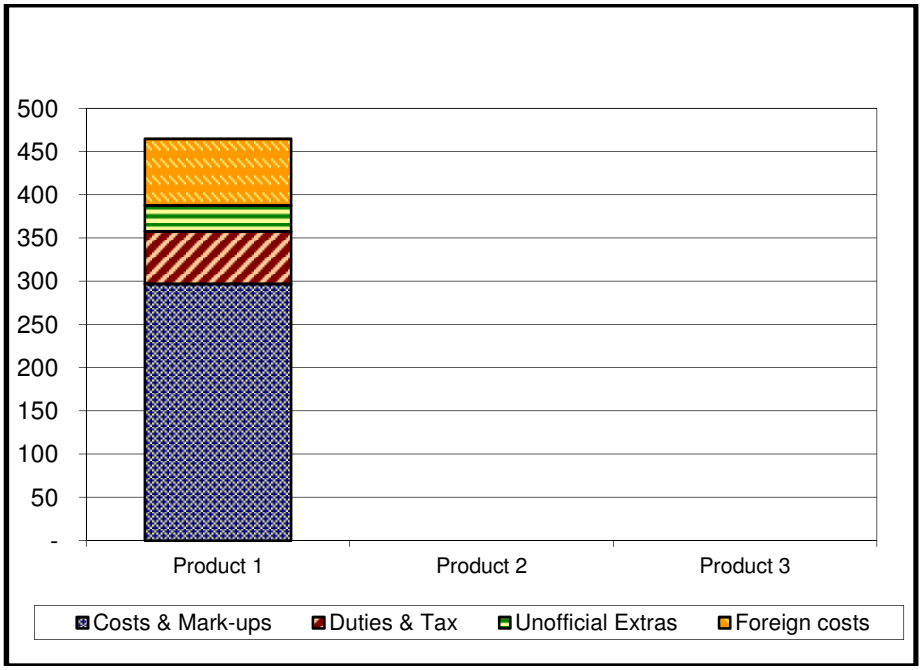

Figure 4: Composition of SV (US$ per mt dried chillies)

In terms of the overall value added, the results show that of the dried chillies traded in SA, farm level activities add 43% while packaging and export contribute 57% of the total SV as indicated in figure 5 below.

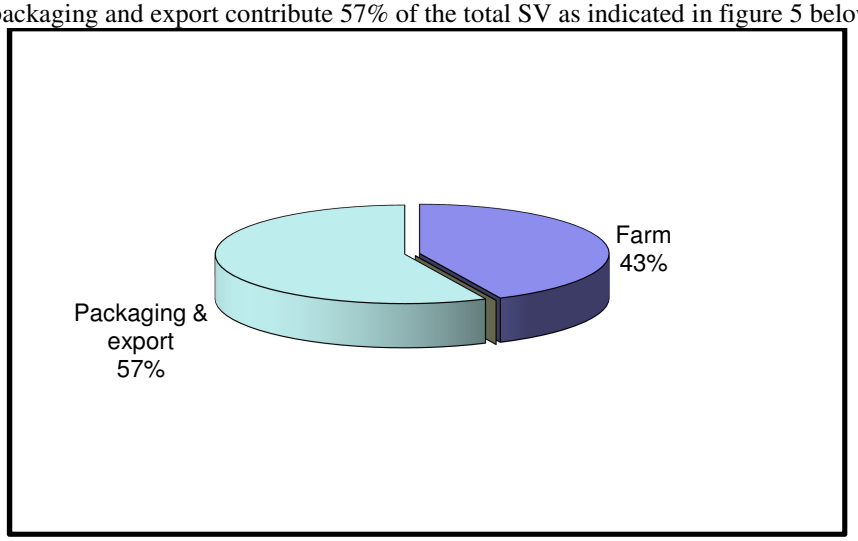

Figure 5: Build-up of final dried chillies SV by value chain stage

The overall results shows that value is added most in the logistics and organization stages of the value chains. The packaging, transport and export phases of the value chain contribute more as compared to the farm level activity. In both the tabasco mash and dried chillies pathways, farm level contribution to SV was lower than that of transport, packaging and export phases. Expectations were that these stages were supposed to contribute less in terms of SV than the farm level stage of the value chain since there is not much physical transformation of the product, but this was not so. A study by Hanyani-Mlambo (2008) for sugar beans showed that input suppliers added US$0.17, farmers added US$0.13 and wholesalers US$0.46 for each kilograms produced, implying that services contribute higher to value added that do processing stages. Again this is consistent with results from this study. NISTPAS (2005) results differ in that the greater share of value added in cassava processing was from the farm level. According to the study, famers contributed 55%, traders 13.2%, wet

starch 14%, dry starch 10% and dry starch traders 7.4%. Again Keyser et al (2010) found that maize farmers were contributing 65% of SV, primary assembly was 19%, processing 1% and final marketing was 14%. Uribe (2012) also differ in results showing that tabasco value chains in Colombia, where 43% of value added correspond to farm level activity, 5% for stock-up and processing costs, 22% for packaging and storage and 30% for international logistics. The trend indicates that where the value chain is of a global nature, international logistics and organization phases tend to contribute higher value added compared to farm activity. However, if the value chain is all local, the farm level activity tends to have a higher contribution to total SV than other stages in the value chain.

The results also showed that as value is added from farmer to export, contribution of DVA increases but the contribution of foreign costs to SV increase more. This is in contrast to results obtained by Keyser and Tchale (2010) for processed cotton lint, where domestic costs accounted for 79% of SV, duties and taxes 8% and foreign costs 13%. It is evident that whether a value chain is producing a product for the export or local market has a bearing on the composition of SV per each value chain phase. Where a product is locally produced, contribution of DVA is higher and foreign costs lower, but if the product is for the export market, DVA might be high but contribution of foreign costs is substantial.

5.3 Contribution of Tabasco Chillies to Whole Farm Income

In order to calculate the contribution of tabasco chillies to whole farm enterprise, information was used from the sample concerning the sources of income. Farmers indicated that 95% of household income comes from crop sales, 4.2% from formal salary and 0.8% from petty trade. The entry point is therefore to calculate the income from crop sales, which constitute the greater part of farmer income. On average, farmers indicated that in a farming season they grow the following crops; maize, wheat, sugar beans, paprika, tabasco chillies, paprika, tomatoes and rape. Gross income in this case was calculated using total production figures. The assumption made was that consumed produce are measured at their opportunity costs, which is the price that farmers would have received if they had sold the produce at farm gate. Table 4 shows whole farm enterprise production statistics.

Table 4: Whole farm enterprise production

Crop (2011/12)	Hectares	Production (kg)	Marketed (kg)	Price ($/kg)	Gross income ($)	Yield/ha
Maize	0.521	1064.79	271.54	0.19	200.18	2,042.96
Wheat	0.113	130.12	100.00	0.50	65.06	1,151.47
Sugar beans	0.221	229.27	215.83	1.04	237.87	1,039.29
Paprika	0.177	708.00	258.69	1.20	849.60	4,004.52
Tabasco chillies (fresh)	0.201	964.80	737.64	0.50	482.40	4,797.61
Tomatoes	0.047	623.30	617.45	0.66	413.93	13,205.41
Rape	0.005	110.44	86.36	0.67	74.49	21,238.27
Total	**1.285**	**3,830.71**	**2,287.51**		**2,323.53**	

The largest arable area is planted to maize, followed by sugar beans,tabasco chillies, paprika and wheat, with tomatoes and rape having only marginal areas devoted to their production. Gross income figures shows that paprika is the highest earner, followed by tabasco chillies and tomatoes, while wheat is the least income earner. Table 5 below follows up on this further to obtain net income.

Table 5: Whole farm enterprise income analysis

Crop (2011/12)	Hectares	Gross income	Variable Costs	Gross margin	Fixed costs (10% of TVC)	Net income
Maize	0.521	200.18	192.43	7.75	19.24	-11.49
Wheat	0.113	65.06	110.75	-45.70	11.08	-56.77
Sugar beans	0.221	237.87	233.22	4.64	23.32	18.68
Paprika	0.177	849.60	569.86	279.74	56.99	222.75
Tabasco chillies	0.201	482.40	175.05	307.35	17.50	289.85
Tomatoes	0.047	413.93	178.61	235.32	17.86	217.45
Rape	0.005	74.49	5.71	68.79	0.57	68.21
Total	**1.285**	**2,414.51**	**1,465.64**	**948.87**	**146.56**	**711.32**

The table shows the net income from farming activities at the farm level. The table shows that the average farmer earns a gross income of US$2,414.51 from using 1.3ha of land from cropping activities. It should be noted that on irrigated land, farmers can plant more than one crop on the same piece of land per agricultural season. The total variable costs are US$1,465.64 from all the enterprises involved in, giving a gross margin of

US$948.87 and a net income of US$711.32. The estimation of fixed costs as 10% of total variable costs are based on the Agritex estimates that they use in calculation of fixed costs. As was indicated in the sections above, this net income from crop production represents 95% of farm incomes. This implies that whole farm enterprise income stands at US$748.76, with US$31.45 coming from formal employment and an average of US$5.99 coming from petty trading. It can the therefore be deduced that the tabasco chillies value chain contributes about 38.7% (289.85/748.76*100) to the total whole farm enterprise income, followed by paprika and tomatoes both contributing 31%.

Tabasco chillies crop is the major contributor to household income at the farm level. Results show that on average, farmers involved in the production of the crop are earning about 39% of their income from this crop. All the other crop enterprises are contributing less to the whole household income. This means that an improvement of the income generated by the value chain will have a significant impact on the family incomes. Therefore, farmers as participants in the value chain will be particularly willing to invest their energy in the upgrading of the value chain, which may not be the case if the commodity had a minor contribution to total farm household income.

6. Conclusions

The mapping of the value chain showed that tabasco chillies follow two pathways up to the final consumer. The first involves tabasco mash, which is sold to Mcllhenny Company in the USA under contract arrangements and processed to produce tabasco sauce, an internationally branded sauce. Mcllhenny was identified as the lead firm and the governance described as relational. The lead firm maintains control of the value chain by providing the seed used in production of the crop, which it produces only in the Louisiana, USA and the patent it has to tabasco sauce. There is no direct contact of lead firm with farmers but with intermediaries. The other pathway involves the buying of dried tabasco chillies. This product is sent for processing into Elephant sauce in SA. Along this pathway, The Elephant Company was identified as the lead firm. This lead firm maintains control through its shareholding in Better Agriculture. In terms of upgrading activities, the study findings were that there is no complex upgrading since farmers adapted quickly to the tabasco chillies production as they were already producing under irrigation crops related to tabasco chillies such as paprika.

Analysis of value added was limited to activities undertaken by local chain actors, hence the final products considered were tabasco chillies mash sold to Mcllhenny in USA and dried chillies sold to The Elephant Company in SA. Analysis of profit and loss indicators showed that farmers were getting a net profit of US$113, semi-processing phase US$295, transport and export of tabasco mash US$756 and packaging and export of dried chillies being US$235 for every tonne of respective product. The net rate of return showed that tabasco mash processing had the greatest rate of return at 1.70, followed by packaging and export of dried chillies at 0.51, semi-processing 0.49 and farm level at 0.29. This shows that farmers had the least return to investment in production and Better Agriculture had the highest return. For the tabasco mash pathway, the DVA (US$ per tonne processed tabasco chillies) was as follows; farmers ($342) semi-processing and packaging ($343) and transport and export ($1,077) and the shipment value were $386, $605 and $1,205 respectively. This implies that again the greatest value addition is coming from transport and export of Tabasco mash, followed by semi-processing and farm level being the one adding the least. In terms of contribution to SV, results showed that farm contributed 27%, the semi-processing 18% and transport and export 55%.

For the dried chillies pathway, DVA was $342 at farm level and $426 for packaging and export of dried chillies while the SV were $386 and $511 respectively. Again this shows that packaging and export are contributing more than the farm level. The build-up of SV for dried chillies shows that the farm contributes 43% to total SV and packaging and export 57%, validating earlier conclusions that farm level is contributing less value added than other activities considered within the value chain. Possible explanations for this could be low productivity of the farmers, which is way below the accepted average of between 6 to 40 tonnes/ha world-wide. This has implications on domestic costs and mark-ups, leading to contribution to SV. However, it was noted that these results obtained are consistent with previous research on tabasco value chains in South America, which showed that farm level activity add least to final consumer value.

The determination of whole farm enterprise income showed that sources of income for farmer were crop production (95%), formal salary (4.2%) and petty trade (0.8). Based on these findings, the study calculated net income from crop activities. The average household produced the following crops annually; maize, wheat, sugar beans, paprika, tabasco chillies, tomatoes and rape. Since these crops are grown mainly on irrigated land, more than one crop was grown on the same piece of land per agricultural season. The results showed that the total gross margin from the crop enterprises is US$948.87 and the net income is US$711.32. Given that this contributes 95% of net income, the whole farm income was determined as US$748.76. Out of this, tabasco chillies net income is US$289.85, giving the crop a 37% contribution to total income. This is the highest contribution out of all the sources of income available to the farmer. While this figure is high, other researchers showed that contribution of a value chain crop to a farm enterprise could be as high as 90% (Van Melle at-al,

2007).

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