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Grape Value Chain Mapping In Dodoma Region, Tanzania

Mary Kulwijila[1*], Jeremia Makindara[2] and Henry Laswai[3]

1. Department of Economics and Statistics, University of Dodoma, P.O. Box 1208 Dodoma, TANZANIA

2. School of Agricultural Economics and Business Studies, Sokoine University of Agriculture, P.O. Box 3007, Chuo Kikuu, Morogoro, TANZANIA.

3. Department of Food Technology, Nutrition and Consumer Sciences, Sokoine University of Agriculture, P. O. Box 3006, Chuo Kikuu, Morogoro, TANZANIA

*E-mail of the corresponding author: kulwijila@ymail.com

Abstract

Understanding value chain actors, relationships, opportunities and constraints are crucial in determining the contribution of a commodity to economic development. However, one critical component that has escaped the attention of researchers is the link between these constraints with post-harvest losses of food crops along the chains. The study mapped grape value chain in Dodoma region. Specifically, the study sought to: (1) map linkages between actors, activities and flow of the product in the grape value chain and (2) analyze pre- and post-harvest constraints contributing to grape losses. A cross-sectional research design was used to collect data from 240 farmers and 30 traders which were randomly selected. Descriptive statistics, multiple responses and sub-sector analysis were used to analyze the data collected. Results indicated that the key actors in grape value chain were input suppliers, producers, processors, wholesalers, retailers and consumers. Relationship among actors was very weak because no farmers and traders associations were identified. The major constraints along the value chain that contribute to grape losses were high production and transport costs, poor extension services, limited access to marketing information, inadequate market access, lack of credit, poor knowledge on post-harvest handling, poor roads, inappropriate post-harvest technologies and spoilage of the commodity. It is concluded that, grape value chain is hampered by both pre and post-harvest constraints that greatly contribute to post-harvest losses and addressing these constraints could improve value chain and reduce the losses. The study recommends government intervention to subsidize grape inputs and infrastructure development including feeder roads, processing and storage technologies for grape actors to benefit from various activities and reduce post-harvest losses. Furthermore, the study recommends provision of extension services, credit facilities and establishment of grape board which could oversee marketing of grapes to reduce problems associated with low grape selling price to growers.

Keywords: Grape, Value chain, Mapping, Pre- and post-harvest constraints, Dodoma.

1. Introduction

Grape (*Vitis vinifera*) belonging to the *Vitaceae* family is one of the world's most important economic fruit crops (Kumar, 2010; Senthil *et al.,* 2011). It is consumed as fresh and processed into different products including wine, juice and raisins (Creasy, 2009; Mencarelli *et al.*, 2005; Buyukbay *et al.,* 2011). According to FAO (2010), approximately 71% of the world grapes production is used for wine, 27% as fresh fruits and 2% as raisins (dried fruit). On the other hand, the peel of grapes is the source of essential oil and pectin. It can also serve as a raw material for the production of cattle feed and in preparation of candies (Kumar, 2010). Raisins are rich source of sugar most of which is fructose and antioxidants. Its juice is used in cosmetics to bleach and soften skin (Creasy, 2009). Moreover, grapes are useful in fighting dyspepsia, hemorrhoids, stones in the urinary tract and bile ducts. They also activate liver functions, ease digestion, help to reduce cholesterol level of blood and eliminate uric acid (Kumar, 2010).

The major grape producing countries includes China occupying the top position 12.85% followed by Italy with 11.57% and USA with 9.24%, Spain with 9.07 % and France 8.69 % together accounting for about 51.42% of total world production (FAO, 2012). In Africa, grapes are produced in many countries, South Africa being the leading country while in Tanzania grapes are produced in Dodoma region (Mpore, 2013).

Grapes are one of the major fruit crops of economic importance in Tanzania. Grapevines are believed to be introduced in Dodoma region in 1940 by missionaries (MAFS, 2006). Since its introduction, vine cultivation has become fully adapted and contributes significantly to household income (Safari *et al.,* 2015). This is due to the fact that, grapes are considered as one of the most important cash crops, raw materials in wine industry and a

source of employment to the people living in the region. In view of the significant contributions of grape to the economic development of both rural and urban households in Dodoma, it is imperative to understand the actors, linkages, activities, product flow and constraints encountered by actors in the grape value chain.

Value chain is defined as the full range of activities which are required to bring a product or service from conception, through the different phases of production to final consumers (Kaplinsky and Morris, 2001). An agricultural value chain is considered as an economic unit of analysis of a particular commodity or group of related commodities that encompasses a meaningful grouping of economic activities that are linked vertically by market relationships (Getachew, 2012). Mapping of the key actors and activities is the first step in the value chain (Kaplinsky and Morris, 2001; Mmasa and Msuya, 2011; Makindara, 2012). Value chain mapping is the process of developing a visual depiction of the basic structure of the value chain (Iyabo *et al.,* 2013). In addition, value chain map illustrates the way the product flows from raw material to end markets and presents how the industry functions (McCormick and Schmitz, 2001).

There have been a number of studies on value chains mapping that have reported on linkages between actors, processes, activities and constraints of food crops value chains across the globe (e.g. Tamasese, 2009; Trienekens, 2011; Mmasa and Msuya, 2012; Makindara, 2012; Adeoye *et al.,* 2013; Mkani, 2013; Chagomoko *et al.,* 2014; Wilson and Lewis, 2015 and others). This is crucial in determining the contribution of the commodity to economic development. However, one critical component that has escaped the attention of researchers is the link between value chain activities, relationship between actors and constraints with post-harvest losses. Relatively, few empirical studies have been conducted on value chains and related constraints as the contributing factors to post-harvest losses (e.g. Patrick and Michael, 2016; Tadesse *et al.,* 2016; Humble and Reneby, 2014) and none for grapes in Tanzania. This study therefore, intends to fill this knowledge gap. The study was thus undertaken to map grape value chain and identify constraints that contribute to grape losses. Specifically, the study sought to: (1) map linkages between actors, activities and flow of the product in the grape value chain, (2) analyze pre- and post-harvest constraints that contribute to grape losses in the study area. A better understanding of how value chain constraints contribute to grape losses would help policy makers to implement appropriate measures that enhance grape value chain and post-harvest losses management.

2. Theoretical Framework

The theoretical framework in this study is based on value chain theories. According to Lazzarini *et al. (*2001), there has been extensive theory building in the field of value chains reflected in many definitions and analytical approaches. Scientific disciplines that add to the development of value chain theory are grouped into four streams with different perspectives on inter-company relationships namely global value chain analysis, supply chain management, new institutional economics and social network theory (Trienekens, 2011). Global value chain analysis focuses on the lead firm's position in value chains and its relationships with other actors and power relationships between producers in developing countries and multinational companies (Gereffi *et al.,* 2005). In developing countries, global value chain analysis focus on how actors can upgrade their activities in order to participate in global value chains and which barriers exist to entry these chains (Kaplinsky, 2000; Gibbon, 2001).

The second theoretical perspective is supply chain management which focuses on management of operations and activities in value chains (Trienekens, 2011). Supply chain management intends to maximize the value within the supply chain and to manage the costs generated from the flow of products and information in the chain in a proper way that add value for customers and other stakeholders (Chopra and Meindl, 2013). Compared to other theories, supply chain management theory focuses on improving the quality of the product, processes and to optimize distribution processes (Trienekens, 2011). Arguing the same way, Shukla and Jharkharia, (2013) emphasized that, in food sector the major concern in supply chain management is post-harvest loss reduction along the chain.

The third theoretical perspective is new institutional economics (NIE) which studies the governance/organization of transactions between companies (Trienekens, 2011). There are two branches of NIE such as transaction cost economics (TCE) and agency theory. In TCE, transactions between companies are the basic unit of analysis (Rindfleisch and Heide 1997; Williamson, 1999). Transaction costs can be defined as negotiating, monitoring and enforcement costs that have to be borne to allow an exchange between two parties to take place (Jones and Hill, 1988; Makindara, 2012). In agency theory, the focus is to determine the most efficient contract and governance structures for the principal agent relationship. The main issues in this are how to measure the performance of the parties and decide which party that will bear most of the risks According to Trienekens

(2011), new institutional economics can be used to determine which contracts or agreements that are the best for producers and value chain actors in developing countries.

The fourth theoretical field used in the framework is social network theory, where the focus is inter-relationships between social and economic interactions in value chain networks with vertical and horizontal relationships between the actors (Trienekens, 2011). In this field the belief is that economic actions are influenced by the social context in which they are embedded and that actions can be influenced by the position of actors in social networks (Gulati, 1998). Not only economic factors have impact on relationships between companies but also trust, power, mutual dependence and reputation plays a great role (Uzzi, 1997). With strong network relations the social capital can increase and transaction costs decrease as well as market access can be improved (Gulati, 1998; Trienekens, 2011).

In addition to the concepts presented above, a number of similar and over-lapping concepts have been developed which focus on specific subsectors as the main unit of analysis (Holtzman, 2002). Subsector analysis has been applied widely in the analysis of agricultural commodity chains (Boomgard *et al.,* 1992). A subsector is defined as a vertically linked chain of production, marketing and transformation activities that move an agricultural commodity from the field to final distribution to consumers. Values are added as commodities move and are productively transformed across subsector stages. This approach pays more attention to firms that actively coordinate marketing systems, such as producer's, wholesale traders, processors and exporters. Key firms in any of these industries can serve as channel lead who play a large role in organizing a subsector, structuring exchange relationships, and using their strategic market power within the subsector to bring about positive changes that lead to improved system performance (Holtzman, 2002). Key concepts of the value chain approach are almost identically used in subsector analysis (Holtzman, 2002). Today, sub-sector analysis remains an important tool in any subsector program (Lusby, 1999). It enables program designers to get a clear grasp of what's going on between the different actors (large and small) in a particular industry. It enables them to determine what the major constraints/ opportunities are for increased growth. From this theoretical background, the subsector value chain framework is adopted to suit the aims of this study.

3. Methodology

3.1 Description of the study area

The study was conducted in Dodoma Municipality and Chamwino District of Dodoma region which is centrally positioned in Tanzania mainland. Four regions border Dodoma region. These include Arusha region to the North, Morogoro region to the East, Iringa region to the South and Singida region to the West. Much of the region is plateau rising gradually from some 830 meters in Bahi swamps to 2,000 metres above sea level in the highlands North of Kondoa. The region is ranked as the 12th largest region in Tanzania Mainland and covers an area of 41,310 square kilometres (equivalent to about 5% of the total area of Tanzania Mainland) with a population of 2,000,544 inhabitants (URT, 2012). The region was purposively selected because it is the main producer of grapes in Tanzania and the crop is a potential cash crop for the people living in the region.

3.2 Research design, Sampling procedure and Sample Size

A cross-sectional research design was used in this study. According to Babbie (1999), this design allows data to be collected at a single point in time and can be used for a descriptive study as well as for determination of relationship between variables. This design is considered to be favoured because of time and limited resource available for data collection (Casley and Kumar, 1988). The sampling units for this study were farmers, wholesalers and retailers from Dodoma Municipality and Chamwino District. Dodoma Municipality and Chamwino District were selected for the study areas using purposive sampling. Three wards from each district were purposively selected. From a list consisting of villages cultivating grapes obtained from District Agricultural Irrigation and Cooperative Officers (DAICO's) of Dodoma Municipality and Chamwino District, three villages from each district were purposively selected based on their potential in grape production. The villages selected were Mpunguzi, Mbabala and Hombolo from Dodoma Municipality and Mvumi Mission, Mvumi Makulu and Makang'wa from Chamwino district. Farmers were selected by simple random sampling method from village list of grape producers on probability proportional to size basis. A total of 246 smallholder grape farmers (123 from each district) were selected in order to have a fair discussion. The sample size was arrived at using a formula by Conchran (1974) as follows:

$$n = Z^2 \times p \times q / e^2 \quad (1)$$

Where n is the sample size; Z is 1.96 at 95% confidence level; P is the population proportion i.e. the proportion of grape producers in the area that was found to be 20%. While e is the margin of error (acceptable error) which is assumed to be 0.05 and q is a weighting variable computed as (1-P).

$$n = 1.96^2 \times 0.2 \times 0.8/0.05^2 = 245.86 \quad (2)$$

Finally, in each of the selected districts, 15 wholesalers and 15 retailers were randomly selected and interviewed. A total of 270 respondents were interviewed for the study.

3.3 Data collection

Primary data for the study were obtained from the grape farmers, wholesalers and retailers using separate pre-tested structured questionnaire. The individual household interviews were complemented with six (6) focus group interviews one in each village and 20 key informants to validate the information provided by respondents. District Agricultural Irrigation and Cooperatives Officers (DAICO), Village and Ward Extension Officers, Village Government Leaders, Research officers and Ward Executive Officers (WEO), took part in the key informant interviews. Secondary data was collected from various sources including Sokoine National Agricultural Library (SNAL), Dodoma region annual reports and web based information related to the study. The data collected from respondents included general information about the grape cultivation and marketing, inputs used and their sources, market prices for inputs, access to extension services, relationship among actors as well as associated constraints and opportunities in the chain.

3.4 Data Processing and Analysis

The collected information was summarized and processed by using Statistical Packaging for Social Science (SPSS) programmes. The data were analyzed using descriptive statistics and multiple responses. Sub-sector mapping analysis was used to map the grape value chain linkages between actors, activities and flow of the product in the value chain.

4. Results and Discussion

4.1 Value chain map of grapes in the study area

Value chain mapping is the first step in value chain analysis to visualize the flow of the product from conception to end consumer through various actors and to understand their roles and linkages (Mmasa and Msuya, 2011; Abraham, 2013). The value chain map of grapes in the study area showing how the product flows, actors, functions and supportive actors is depicted in Figure 1.

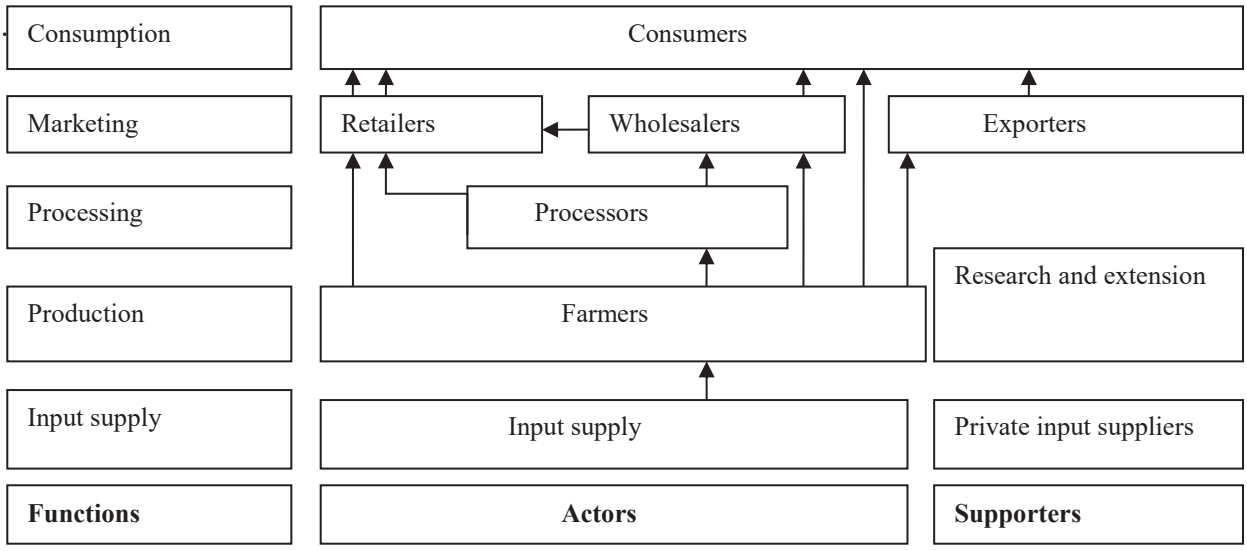

Figure 1.1: Grape value chain map

Results from figure 1 show that, the product flows sketched on the middle part of the diagram represent how the grapes reaches from producers to consumers and how the inputs reach from the input supplier to the producers. The boxes to the left of each stage of the supply chain indicate the functions performed by each actor and to the right side are supportive actors. The results of the analysis indicate that the key actor involved in grapes value chain are producers, processors, traders (wholesale and retailers), exporters and consumers. Others are input suppliers, researchers and extension officers who are supportive actors.

Input Suppliers

They provide pesticides and insecticides to farmers who use them to control grape diseases and pests. Currently private input suppliers are the main source of input supply in the study area located in the headquarters of the region. Focus group discussion revealed inaccessibility of grape inputs in the rural areas where the actual production takes place and therefore the need for the input suppliers to expand their services closer to the farms. These results concurred with the results by Hussein (2010) who found that input suppliers are situated in districts headquarters. In addition, grape farmers also participated in this stage by providing grape seed /planting materials and organic manure to other farmers which are essential inputs at the production stage.

Producers

Farmers are the major actors who perform most of the value chain functions right from farm inputs preparation on their farms or purchase of the inputs from other sources to post harvest handling and marketing. The major value chain functions that grape farmers perform include land clearing and leveling, trenching, planting, trellis system, fertilization, irrigating, weeding, pest/disease controlling, pruning, spraying, harvesting and post harvest handling. They are also responsible for the production of grape fruits and selling them to processors, traders and final consumers at their respective farms. Some of the farmers play multiple roles by supplying their grape produce directly to markets or process part of their grapes into wine and raisins.

Processors

Grapes in the study area are processed into different types of products such as wine, raisins and juices. The most popular grape products in the study area are wine. The processor buys directly from the producers in larger quantity for the purpose of processing the grapes into wine in their respective areas. Processed grape products are widely sold and accepted in the study area especially wine which is sold to wholesalers, retailers and consumers in domestic and external markets. The major wine producers buying grapes from farmers in the study area included ALKO VINTAGE (KATO) situated in Dodoma town and CETAWICO situated in Hombolo village.

Wholesalers

Wholesalers are mainly involved in buying grapes from producers in larger quantities, harvesting, packaging and transporting them to their selling place in Dodoma town near by bus stand and supplying them to retailers, consumers within the region per kilogram. They also supply to other traders in other regions within the country including Dar es Salaam, Mwanza, Arusha, Mbeya and Morogoro. They buy grapes from the surrounding areas and thus play important role in the grape value chain. Grapes are also mostly exported by Kenyan exporters who buy grapes directly from farmers. Some wholesalers also export grapes to Kenya, Uganda and Rwanda.

Retailers

Retailer's involvement in the chain includes buying of grapes directly to farmers, harvesting, packaging and transporting to regional market, displaying and selling to consumers. They also buy grapes from wholesalers and sell to consumers per kilogram or per bunch. Consumers usually buy the product from retailers as they offer according to requirement and purchasing power of the buyers. They are the last link between producers and consumers.

Consumers

Consumers are those purchasing the products for consumption. About two types of grape consumers were identified as households and restaurants. Household consumers prefer large sized grape bunches free from damage.

Supporting actors

Such actors are those who provide supportive services for the development of the crop including training, extension, research services and professional advice. District Agricultural and extension officers, Viticulture Research Institute-ARI Makutupora are main supporting actors who play a central role in the provision of such services in the study area. These results are in line with the value chain theory that actors included both direct actors who are commercially involved in the chain e.g. producers, traders, retailers and consumers; and indirect actors such as service providers (likes financial institutions and credit agents, input suppliers, business advisory services, research and development) and the government.

4.2 Sources of grape inputs by farmers

Results have shown that, majority (55%) of the farmers acquired their farmlands through purchase and by inheritance (30.4%). About 56.3% and 32.5% of the respondents made use of hired labour and both family and hired labour respectively. Results have shown further that, majority of the sample producers (76.3%) source vines from their own nurseries while 19.2% of the respondent's source vines from other farmers (Table 1). This implies that, grape farmers in Dodoma region are still growing local varieties. Therefore, Viticulture Research and Training Centre-Makutupora have a great task of ensuring that the improved grape varieties are made available to farmers to improve productivity in the region. This agrees with the findings of Mmasa and Msuya, (2012) on mapping of sweet potato value chain in Tanzania. They found that input suppliers are not vertically integrated with producers since farmers normally search seeds for planting from fellow farmers and not from recognized source/agent.

Table 1: Sources of grape inputs by farmers

Variables	Frequency	Percentage
Land acquisition		
Purchase	132	55.0
Inheritance	73	30.4
Gift/project	22	9.2
Both inheritance and purchase	13	5.4
Total	**240**	**100.0**
Sources of vine		
Own nursery	183	76.2
Purchase	57	23.8
Total	**240**	**100.0**
Sources of manure		
Own collection	55	22.9
Purchase	185	77.1
Total	**240**	**100.0**
Sources of labour		
Hired	135	56.2
Family	27	11.3
Both hired and family	78	32.5
Total	**240**	**100.0**
Sources of Pesticides		
Private dealers	240	100.0
Total	**100**	**100.0**

4.3 Access to Services, Market information and Linkages by actors

Results revealed that 74% of the farmers interviewed had not received extension services, only 26% of the respondents had received extension services in the study area (Table 2).

Table 2: Access to extension services, Market information and linkages by actors

Actors	Farmers		Wholesalers		Retailers	
Variables	frequency	%	Frequency	%	Frequency	%
Access to extension						
Yes	60	26.0	-	-	-	-
No	180	74.0	-	-	-	-
Total	**240**	**100.0**	-	-	-	-
Access to credit						
Yes	10	4.2	3	20	0.0	0.0
No	230	95.8	12	80	15	100
Total	**240**	**100.0**	**15**	**100**	**15**	**100.0**
Sources of marketing information						
Hear from neighbours	199	83.2	4	26.7	5	33.4
Direct visit to market	35	14.5	6	40.0	2	13.3
Cross check with traders	6	2.3	5	33.3	8	53.3
Total	**240**	**100.0**	**15**	**100.0**	**15**	**100.0**
Relationships among actors						
	182	75.6	10	66.6	13	86.7
Very weak	22	24.4	4	26.7	2	13.3
Weak	0	0.0	1	6.7	0	0.0
strong	0	0.0	0	0.0	0	0.0
Very strong	**240**	**100.0**	**15**	**100.0**	**15**	**100.0**
Total						

This indicates that majority of farmers had never received extension services from village extension officers. The reason for this could be due to shortage of extension officers in the study and inadequate skills of the extension officers in vine cultivation and management. Hence, training of extension officers regarding vine cultivation and management by appropriate personnel is needed so that they can be able to advice farmers so as to improve grape production.

Access to information, technology and finance determines the state of success of value chain actors (Abraham, 2013). However, about 95.8% of the farmers had no access to credit. Similarly, 80% of the wholesalers and 100% of the retailers had no access to credit services. This hinders the success of the grape value chain actors. Furthermore, results in Table 2.2 show that, most farmers were getting marketing information particularly of price through hearing from fellow farmers (83.2%) and few though direct visit to markets (14.5%). Due to lack of proper marketing information, farmers are price takers since they are forced to sell their product at the price offered by traders/processors due to fear of huge post-harvest losses. This result is in agreement with that of Msuya and Mmasa (2011) who found that majority of producers sold their sweet potatoes products after hearing from their fellow friends (50.7%) or direct visit to the markets (44%).

The relationship between the value chain actors was assessed and a summary of the results is presented in Table 2.2. Results show that linkages between actors is very weak (75.6, 66.6 and 86.7%) for farmers, wholesalers and retailers respectively. This is due to the reason that, there were no association or cooperatives identified between actors, no collective bargaining that takes place on the price, no contracts between buyers and suppliers, instead informal trust based relation is the only relationship observed between buyers and suppliers. As a result, each farmer interacts individually with the trader and other buyers. This reduces farmers bargaining power and increase the incidence of post-harvest losses. According to Humble (2013), formation of cooperatives, producer associations or public- private relationships can be a way to upgrade horizontal relationships in value chains in

developing countries. Kader (2004) argued that, horizontal collaboration can contribute to decrease losses in horticultural supply chains.

4.4 Value chain constraints promoting grape losses

The constraints in the grape value chain were categorized as pre-harvest and post-harvest constraints.

4.4.1 Pre-harvest constraints

Table 2.3 shows the pre-harvest constraints encountered by farmers in the study area.

Table 3: Pre-harvest constraints encountered by grape farmers

Constraints	Frequency	Percentage[1]
High production costs	230	95.8
Fake chemicals	185	77.0
Limited access to credit	161	67.1
Poor extension services	147	62.5
Pests and diseases	132	55.0
Rain-fed production	112	46.7

([1]Total add up to more than 100 due to multiple response)

The pre-harvest constraint encountered by farmers that limit grape production and a cause to post-harvest losses were identified as high production costs, fake chemicals, limited access to credit, poor extension services, pests and diseases and rain fed production. Result shows that, about 96% of grape farmers stated high production costs as the number one constraint. This was due to high prices of inputs mainly fertilizer (organic manure) and pesticides (Table 3). High prices of these inputs resulted into limited use of agro-inputs leading into poor quality and huge post-harvest losses of grapes which affects their incomes.

Application of quality chemicals is important in controlling pests and diseases infestation and hence increased productivity. However, limited use of quality chemicals is a key barrier to increasing productivity in Tanzania's grape sub-sector. About 77% of grape farmers claim use of low quality (fake chemicals) of which are unable to control pests and diseases as the second constraint limiting the quality of grapes and responsible for post-harvest losses of grapes (Table 2.3). The results are in agreement with that of Aidoo *et al.* (2014) and MoFA (2011) who claimed high production costs as the serious constraints that tomato farmers in Ghana and India are facing and a major contributor to post-harvest losses due to poor crop management resulting from high input prices.

Furthermore, lack of credit (67.1%) was reported as also the most important constraints affecting grape production and a source of grape losses (Table 3). Farmers lack funds to buy the needful inputs such as fertilizer and agro-chemicals required to increase productivity, protect grape from infections as well as improved technologies that could reduce grape losses. This result concurred with the findings of other studies including FAO (2015) and Wachira *et al.* (2014) who found that credit constraint is one of the main bottlenecks to technology adoption to reduce food losses and waste.

About 62.5% of the grape farmers complained poor extension services. This implies that, farmers still are unaware of the recommended grape vine production and post-harvest practices resulting into low yield and high post-harvest losses. Expansion of farmers training in improved agronomic and management practices, with the support of extension services as well as frequent visit of extension officers could increase productivity of the crop, adoption of new practices and technologies hence reduced loss.

Pest and diseases were also claimed by farmers as a constraint to grape production accounted for 55%. This could be due to low quality of the pesticides used by farmers as well as inappropriate use of the required amount. Moreover, most horticultural crops, and indeed their production technologies demand abundant water to express their potential. Supplemental irrigation or total irrigation is necessary for successful production of horticultural crops. However, about 47% of grape farmers complain of rain-fed production as also the constraint to their daily activity resulting into low grape yield in the area (Table 3). Rain-fed agriculture is cheaper in terms of energy requirement to supply the crop water needs as compared to irrigated agriculture, but is inefficient (URT, 2000). Development of small-scale drip irrigation systems for production of horticultural crops including grapes is a key to the success of the production system.

4.4.2 Post-harvest constraints

Post-harvest constraints encountered by grape farmers in their day-to-day activities are presented in Table 4

Table 4: Distribution of PH constraints encountered by grape farmers (N=240)

Constraints	Frequency	Percentage[1]
Unreliable market	240	100.0
Lack of post-harvest technologies	173	72.8
Low price of the produce	149	62.1
Lack of knowledge on PH handling	136	56.7
Late payment	119	49.6

Note: [1]Total adds up to more than 240 due to multiple answer (multiple response analysis)

The results show that, 100% of the farmers sampled reported unreliable market as the number one post-harvest constraint hindering the grape value chain development (Table 4). This implies low grape production and a major reason to grape losses because for the economic producer, increased production is generally a response to demand which is expressed by the availability of the market for what is being produced. The results are in agreement with Sebeko (2015) and Humble and Reneby (2014) who found that inadequate market accessibility contributed to post-harvest-losses of Et-fruit, avocado and mango in Ethiopia. In addition, Segre *et al.* (2014) claimed that, among the factors that explain losses and waste and closely linked to value chain inefficiency are missing markets which prevent the food to reach the consumers, despite being needed.

Low grape selling price was another constraint reported by 62.1% of the sampled farmers (Table 4). The price rate is the most important factor that hindered individual farmers' development. As far as marketing is concerned, the majority of the farmers are still not satisfied with the prices offered by traders and processors as compared to production costs. Low price implies that, farmers are unable to manage their vine yards hence low quality of the produce and huge post-harvest losses. This was due to lack of grape board that could facilitate market information system in the study area. Furthermore, farmers complain of late payment accounting for 49.6% (Table 4). Payment was made either on cash or credit basis depending on the buyer. When grapes were sold to traders, farmers received cash or payment was made later. However, there are some problems of trusting and farmers are risking their produce by selling it on trust because in some instances buyers could not come back to repay the farmers as it was claimed by one farmer who lost TZS 5 million in 2012/2013 season. On the other hand, when selling to processors, payment was made later depending on sugar content. Grape farmers however, are price taker as they have no control on the sugar content measurement. This also contributes to post-harvest losses of grapes because late payment hinders farmers from buying appropriate inputs at the right time and post-harvest technologies that could protect grape from damage.

Lack of improved post-harvest technologies accounted for 72.8% of the total farmers interviewed especially processing, packaging and storage facilities resulting into post-harvest losses. The result conforms to Rugumamu (2009) who claimed lack of post-harvest technologies to contribute to post-harvest losses of crops in Tanzania. Similarly, Humble and Reneby (2014) claimed inadequate post-harvest technologies to contribute to post-harvest-losses of avocado and mango in Ethiopia. Coupled with this was lack of knowledge on post-harvest handling was also a constraint complained by (56.7%) of the farmers interviewed. This might be due to lack of post-harvest learning platforms in the study area. The results conforms to Kereth *et al.* (2013) who found that, knowledge on post-harvest handling is limited resulting into high post-harvest of fruits along the supply chain.

4.5 Constraints encountered by grape traders

The major constraints faced by traders are presented in Table 5

Table 5: Post-harvest constraints encountered by grape traders (N=30)

Constraints	Frequency	Percentage[1]
High transport costs	25	83.3
High spoilage	23	76.4
Lack of knowledge on post-harvest handling	21	70.0
Poor grape selling place	20	66.7
Lack of credit	17	56.7

Note: [1]Total adds up to more than 30 due to multiple answer (multiple response analysis)

The result reveals that the major constraints were high transportation cost accounted for 83.3% (Table 5). While farmers complain of high production costs, traders consider high transport costs as the major constraint. The high transportation cost was attributable to poor condition of roads resulting into huge post-harvest. High spoilage of grapes accounted for 76.4% was also the constraints to traders (Table 5). Spoilage being a constraint was attributed to the perishable nature of the commodity, inadequate market accessibility and low level of investment in post-harvest infrastructure mainly packaging and storage facilities. Moreover, poor knowledge on post-harvest handling (70%) was a constraint to traders resulting into post-harvest losses of grapes. Comprehensive training on how to improve product handling could be a key to improving grape quality and reduce post-harvest losses at market level. Coupled with this is poor grape selling place complained by 66.7% of the traders. The study identified that there is no specific area designed for selling grapes as a result traders especially retailers are moving with their grapes on their heads at different areas around the city searching for customers.

Lack of credit facilities was also adjudged the most constraints by the traders (56.7%). This implies low purchasing power and limited adoption of improved post-harvest technologies resulting into post-harvest losses. The result is in agreement with Honfoga *et al.* (2014) who emphasized that credit must be accessible to farmers and agricultural entrepreneurs aiming to stimulate innovation and increase smallholders' and entrepreneurs' access to post-harvest equipment.

5. Conclusion and Recommendations

The study mapped grape value chain in Dodoma to identify the actors, linkages, flow of product and constraints that promote grape losses. The key actors in grape value chain were input suppliers, producers, processors, wholesalers, retailers and consumers. Relationships among actors were very weak because no farmers and traders association identified. Grape value chain development appears to be hampered by a number of constraints that promote grape losses. Among others high production costs, inappropriate use of inputs, low grape selling price, late payment, lack of credit, lack of knowledge on proper post-harvest handling, lack of post harvest technologies, inadequate market accessibility, poor roads, high transport costs and spoilage of the commodity. Addressing these constraints would be a clear pathway for improved grape vale chain.

From the above conclusions, the following recommendations are put forward: Provision of extension services on good agronomic practices to farmers by extension officers, so that farmers can produce good quality grapes and reduce post-harvest losses. Establishment of grape board is recommended which should oversee marketing of grapes and particularly offer marketing information to growers to reduce problems associated with low grape selling price. Formation of farmers' organization or association could be of vital importance to increase relationships among actors, a way to reduce post-harvest losses and finally improve the grape value chain is also recommended.

Government in partnership with community based organizations such as SACCOS, NGOs and banks should facilitate provision of credit facilities to smallholder farmers and traders at reasonable interest rates and conditions to expand their business and buy improved post-harvest facilities. On the other hand farmers should be sensitized to make use of available credit facilities. Investment in small grape processing plants in the production area by both government and other development stakeholders is also needed to improve market accessibility and reduce post-harvest losses of grapes. In addition, government intervention to subsidize grape inputs especially pesticides and infrastructure development including feeder roads is recommended to lower production costs, transport cost and incidence of losses. Finally, intervention on building appropriate grape marketing place with storage facilities and proper ventilation by regional authorities and other development stakeholders is needed to increase grape marketability and reduce post-harvest losses.

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