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Research Article

Value Chain Analysis for Tomato Production and Marketing in Khartoum State, Sudan

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Abstract

This study considered a value chain analysis of tomato production and its related activities, conducted in Khartoum state, to perform financial analysis for the whole chain to assess the value added and profit margin distribution among the different actors. The primary data for the study was collected through structured questionnaires for 365 respondents which included farmers (100), Intermediate (25), wholesalers (60), retailers (90) and consumer (90). The secondary data were collected from the Federal Ministry of Agriculture and Forests and Ministry of Agriculture and Animal Wealth, Khartoum State. The main objective was to look at the costs, returns and profit distributed along the chain by each actor. The analytical tools employed included financial value chain analysis, share rate analysis and descriptive statistics. The degree of value addition was 53% at primary processor in stage of farmer, 21.7% added in stage of middlemen, wholesalers added 10.2% and retailers added 15.1%. The highest percentage of total profit was get by retailer (52.1), while the farmer got the lowest one (8.8), however, the middleman and wholesaler extremely got equal percentages of total profits (19.2) and (19.9), respectively. The study recommended that the decision makers should take up initiatives for strengthening of the tomato value chain by establishing processing units in the production belts as well as improving credit services can enhance income generated from tomato marketing through increasing production and reducing dependence on middlemen.

Keyword: Marketing; Production; Share profit; Tomato value chain; Value added

Introduction

Tomato is one of the most important popular vegetable in Sudan. It is a rich source of minerals, vitamins and organic acids, widely accepted and commonly used in a variety of dishes as raw, cooked or processed products more than any other vegetable. Recently, in Khartoum state the tomato cultivated area has increased, but still the crop is mainly grown by small farmers. Farmers are interested in tomato production more than any other vegetable for its multiple harvests, which result in high profit per unit area. Khartoum State is the one of its most important areas and has experienced massive development in the production and marketing of the tomato. The crop handling is still dominated by traditional ways except for small segments in Khartoum state where modern farms, super markets and groceries exist. Moreover, the marketing system for tomato is traditional and lacks the conventional trade linkages system. Central wholesaler markets for tomato, for example, do not exist except partially in Khartoum state. There are three central markets in Khartoum: Bahari (Shambat), Khartoum and Omdurman, which assemble tomato from different parts inside and outside of the state. Furthermore, Khartoum state ranks first in tomato consumption where the bulk of fresh marketed tomato is consumed with per capita consumption reaching 70 Kg per annum compared with 50 Kg on average in the Northern state Ahmed [1].

Agricultural Value Chain Actors

The value chain describes the full range of activities that firms, and workers perform to bring a product from its beginning to end use and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer. The activities that comprise a value chain can be contained within a single firm or divided among different firms Gereffi [2]. The agricultural value chain in general is composed of actors involved in tomato production, trading, transporting, retailing and processing. This study examined value chain including the linkages and

relationships between actors especially the relation between the farmers and middleman, producers, transporters, wholesalers, retailers and consumers as well as the whole range of activities required to produce tomato from farm to final market.

Producers/Farmers

A farmer defined as person who takes a responsibility and makes a decision.

The middlemen/Commotion agent

A middleman is the person who gathers various quantities of produce from different producers and sells them to large-scale traders, processors, retailers, processors or even exporters. The middleman is specialized in marketing a product Mbeine [3]. The commissioned agent (dallali) is the link between the producer and the wholesaler/retailer/consumer. He is the only "legally" recognized seller. He looks for buyers, negotiates "appropriate" prices, sells the tomatoes, collects the money and hands it over to the farmer. For his services, he receives a commission, which is a fixed amount, on each basket of tomatoes sold Adepetu [4].

Wholesalers

They are known for purchase of large amounts of products with better financial and information capacity. They buy the product at the farm gate, from assemblers and/or road side with a larger volume than any other marketing actors does. They relatively spend their full time in wholesale buying throughout the year in and out of the district Adugna [5]. Wholesalers are mainly involved in buying vegetables from collectors and producers in larger volume than any other actors and supplying them to exporters, retailers and consumers. They also store product, usually for a maximum of three days Woldesenbet [6]. Ali [7] stated that wholesalers at different levels operating in tomato marketing concentrate the various markets purchase and play significant role in price formation at local level. They provide both price information and advance payments for selected reliable clients (producers, retailers and assemblers).

Retailers

Retailers sell small quantities of tomato products either directly to individual, household or institutional consumers. This function is undertaken by a wide range of actors, depending on the point of sale along the supply chain. These may include traders at various levels (roadside and market places), kiosk, grocer and supermarkets Ali [7]. These are known for their limited capacity of purchasing and handling products and low financial and information capacity. Beside this, these are the ultimate actors in the market chain that purchase and delivered product to consumers Adugna [5]. They are the last link between producers and consumers. They mostly buy from wholesalers and sell to urban consumers. Retailer involvement in the chain includes buying of vegetables, transport to retail shops, grading, displaying and selling to consumers. Woldesenbet [6].

Consumers

Consumers are those purchasing the products for consumption Woldesenbet [6]. This study was conducted to analyze value chain of fresh tomato, to generate important information useful to strengthen tomato value chain and provide guidelines for interventions and relationship between the different actors. Also the study try to determine tomato marketing costs, value added and profit margin distribution along the value chain that will improve tomato marketing system, as well as generate valuable information to policy makers in public and private sectors in order to take actions and make interventions to improve the market performance and provide supporting policies, which could help to improve tomato value chain in Khartoum State.

Research Method

Data collection

Primary data: The primary data are obtained using structured questionnaires for each actor (producer farmers, middlemen, wholesalers, retailers and consumers). Selected respondents were interviewed through visiting framers' fields as well as central and local markets of vegetables in Khartoum state in order to get clear understanding, observations and perceptions about the production and marketing systems in the study area. The primary data collected from housewives was to obtain consumers' data.

Secondary data: Secondary data were collected from annual reports of the Federal Ministry of Agriculture and Forests and Ministry of Agriculture and Animal Wealth, Khartoum State, Administration of Food Security, internet as well as published and un published documents from relevant institutions which are appropriate to the study.

Sampling technique

Table 1: Sample size and distribution of the actor.

Target	Information / data needed	Sample size
Producers	Inputs suppliers (seeds, fertilizer, pesticide etc.,)	100
Intermediate	Middlemen in central and local vegetables markets	25
Wholesalers	Central vegetables markets.	60
Retailers	Central and local vegetables markets.	90
Consumers	Housewives	90

In order to select a representative sample, the multistage sampling frame was used to collect data from procedures, while other actors were traced and interviewed using purposive sampling to collect the quantitative and qualitative data. The benefit of multistage sampling is to achieve desired representation and is used frequently when a complete list of all members of the population does not exist. Multistage sampling is a complex form of cluster sampling in which two or more levels of units are imbedded one in the other and it is an effective strategy because it depends on multiple randomizations. The first stage consists of constructing the clusters to sample form. In the second stage, a sample of primary units is randomly selected from each cluster (rather than using all

units contained in all selected clusters). In following stages, in each of those selected clusters, additional samples of units are selected, and so on. All ultimate units (individuals, for instance) selected at the last step of this procedure are then surveyed Mugenda [8]. The sample size and distribution among the actors showed in Table 1.

Economic analysis of the study

The "Economic Analysis" of a value chain assesses in quantitative terms the creation of "Value Added" and its distribution to the various agents involved. The Value Added is a measure of wealth created in an economic system by a production process, net of the resources consumed by the process itself. More specifically, the economic analysis allows the analyst to determine:

a) The value added created by the overall value chain.

b) The value added and margins for each economic agent at each stage of the chain.

c) The allocation of value added among production factors (capital, labour, other assets) and the public budget, through the respective distributive variables: (profits, wages, rents and taxes) Bellù [9].

The economic analysis of this study was built on tomato tin (10kg) as a unit base. According to FAO , building production and income accounts for complex sets of activities and or for a set of agents carrying out different activities (e.g., a whole value chain including producers of the primary commodity, processors, wholesalers, transporters, retailers etc), built on a per unit base (e.g., one ton of output, one hectare etc) for which basic information is more often readily available, then aggregate them Bellù [9].

Total costs (SDG/Tin): The total variable costs such as charges for land preparation, harvesting, packaging, transport, labor, grading and seed purchase (SDG/tin) were obtained from farmers and traders. In this study, the added cost of each actor represents the cost which he added to produce a tomato tin.

Unit Total Cost (SDG/Tin): It is the cost of the output (tomato tin) and the cost of intermediate inputs and calculated as a summation of the actor added costs and the selling price of the actor.

a) Percentage Added cost: It is the percentage cost of each actor attributed to the total cost of all actors: % added cost = (actor total cost) / (total cost of all actors) *100.

b) Revenue (unit price): It is the selling price of the produce. The money earned by selling the produce, plus any other income earned by selling by-products or waste KIT and IIRR [10].

c) Profits: According to KIT and IIRR [10], once we know the costs and revenues of each actor in the chain, we can calculate their financial positions. Profit is calculated by deducting variable costs from revenues.

Profit (gross income) = Revenue – costs.

d) Percentage of total Profit (profit margin): It is the percentage of the final sale price that comes as profit for the seller.

%Total Profit = ((Revenue – costs) / (Retailer unit price – Total cost of all actors)) *100.

e) Margins: A marketing margin is similar to a profit margin in that it shows the relationship between the amounts a farmer pays for a product and the amount its customers pay. However, while marketing margin is the difference between cost to the seller and the cost to the consumer, profit margin is the percentage of the final sale price that comes as profit for the seller Kimmons [11].

f) Unit Margins = the unit price of the actor - the unit price of the next actor in the chain.

g) Percentage Unit Price (SDG/Tin): The percentage of the actor selling price (SDG) obtained directly from farmers or traders and the total unit price of all actors along the chain.

% Unit Price = unit price of the actor /total unit price of the all actors.

Tomato Productions in Khartoum State

Khartoum state is considered as one of the main areas of production and consumption of vegetables in the country due to its high population growth rate (3.7%) with high income levels and increasing awareness of the nutritional value of vegetables Mohamed [12]. Tomato production is characterized by seasonality and perishability, tomatoes are grown as a winter crop (main season) in (October-November) and as an off-season crop during summer in (February) and autumn (June). During summer months (April- September) there is a relative shortage of tomato and that leads to high prices in these months, while there is abundance during the winter months. The problem of seasonality is the cause of low prices in the winter months compared to the summer months.

Tomato varieties

According to Ahmed [1] the common tomato varieties is Strain B which is a determinate Varity and a relatively small plant. The leaves do not cover the fruits well but are medium-sized and strong. The plant is resistant to high temperature and grown in the winter season and in autumn in the southern regions.

Peto 86: A well-known species in Sudan, cultivated in large areas with high temperatures compared to other varieties. These two varieties (Strain B and peto 86) are the two main varieties cultivated in Sudan, which are open pollinated and thus the seeds of these two varieties are produced by different companies, which led to a significant difference in quality and quantity of seeds and conformity to the original specifications known in terms of plant growth and quality of fruits. New varieties are also grown by the

Agricultural Research Corporation: Sennar 1 and Sennar 2, which are resistant to yellow leaf curl virus, but they are small in size. New varieties of tomatoes have also been approved by the Institute of Horticultural Export Development at the University of Gazira, the varieties are: Omdurman and the Gazira 96, which have yellow leaf curl virus resistance, and Abdullah and Somerset 98 both of which are resistant to high temperatures.

Marketing channel of tomato product

Altoum [13] stated that tomato like other crops goes from the producer to the consumer through different channels. Tomato product goes from the producers either to the primary traders in the production area and then to market agent in Khartoum; or from the producers to the market agent directly in Khartoum State [14]. The market agent share in Khartoum accounts to about 5% of the total gross revenue in both cases. Tomato then passes from the market agent through different channels: (i) either directly to consumers; or (ii) to the wholesale trader, who takes a share of one free tin out of each ten tins; and then from the wholesaler to the retail traders. The retail traders put 5 SDG on each kg of tomato for sale to the consumer as a margin of revenue. Sometimes, the wholesaler sells directly to the consumers. Saeed [15] revealed that 60% of the farmers prefer to sell their product to wholesalers at central market, 30% of them prefer to sell to middlemen and only 10% prefer selling to retailers and 5% to consumers. 48.5% of wholesalers prefer to sell their tomatoes to retailers, 34.3% of them prefer to sell to middlemen and 17.2 % prefer selling directly to consumers. Middlemen purchased from two channels, one of them was wholesaler 34.3% and the other one was farmers 30%. While 5.6% of the middlemen sold their product to traders or to another middleman, 94.4% of them sell directly to consumers. In spite of that 48.5 of retailers bought tomatoes from wholesalers and 5.6% bought from middlemen, while all retailers sell directly to consumers.

Results and Discussion

Land holding, ownership and farming system

Table 2 showed that, (63%) of the land holdings was between 0.5 and 5 feddans, (27%) of farmers had 5.5 to 10 feddans while the percentage of farmers who had more than 20 feddans was only (3%). This indicates small size of the land holding generally cultivated. As for the size of the area cultivated with tomatoes, the percentage of farmers who had less than 0.5 to 1 was (32%), farmers with 0.5 to 3 feddans were (44%) and farmers who had 3.5 to 6 feddans were (12%) while the area of more than 12 feddan was only (2%), indicating that most of the tomatoes area was of small size, and this result agreed with Saeed [15]. For the farming system, (64%) of farms was rented and the partnership and ownership were only (18%). In terms of land ownership, (69%) rented from individuals or from other farmers, (8%) rented from government while (18%) were land owners and (5%) were owned by the partner. Nearly (91%) of the farmers practiced agriculture as a main occupation while (9%) had other occupation in addition to agriculture.

Table 2: Distribution of farmers by land holding and farming system in Khartoum State.

Variable	Frequency	Percentage
Land holding /fed by group		
0.5-5	63	63.0
5.5-10	27	27.0
10.5-15	4	4.0
15.5-20	3	3.0
More than 20	3	3.0
Total	100	100
Tomato area /fed		
Less than 0,5 -1	32	32.0
1.5-3	44	44.0
3.5-6	12	12.0
6.5-9	6	6.0
9.5-12	4	4.0
More than 12	2	2.0
Total	100	100
Farming system		
Owned	18	18.0
Rented	64	64.0
Shared cropping	18	18.0
Total	100	100
Land ownership		
Government	8	8.0
Private	69	69.0
Farmer's own	18	18.0
Partner's own	5	5.0
Total	100	100
Practicing farming as a main occupation		
Yes	91	91.0
No	9	9.0
Total	100	100

Types of services and services providers

The type of services provided to tomato farmers in winter season 2015/2016 and services providers included financial services, agricultural cooperative services, extension services and middlemen services.

Financial services

The government of Sudan has specialized agriculture mandate to avail finance to agriculture products; for example, the Agricultural Bank of Sudan. Farmers refrain from taking loans because they fear crop failure and not being able to repay their credits. Another reason is that the farmers have too little information about loan conditions. It was found that only (40%) of farmers received funding from different sources. (6%) received funding from the Agricultural Bank while only (2%) received funding from relatives and friends and (32%) received funding from the middlemen. The

repayment period of the finance obtained from the Agricultural Bank was 6-9 months with profit of (5%), the purpose of the funding was to obtain inputs and for harvesting the crop. While the financing received from the friends and relatives was non-profit and paid after harvesting. Also, it was found that the partner in the partnership system plays an important role in the financing, he provided production inputs, harvesting and transportation of the crop, and the end profits will be divided equally between the partner and the farmer. This result agreed with Abdalla [14] who founded that only (44%) of the vegetable farmers in the State have source of finance, mainly available for those belonging to cooperatives or through shared relationships. KIT and IIRR [10] reported that banks have few clients among farmers, who are generally considered not to be "bankable" as they have no collateral (or do not wish to use their major assets, their lands, as collateral, due to risk of losing it to the bank).

Agricultural cooperative services

Only (32%) of the farmers participated in the cooperative farmers' associations. (30%) of them were from Wadramley Cooperative Society and (2%) from the Elkhogalab Cooperative Society, in response to the services provided by this cooperative societies, (19%) replied that they had not been offered anything and (13%) replied that the society provided rented water at (650 SDG per feddan). These cooperative societies previously provided inputs to farmers and got 1/3 of the production, but now its role is limited to rent water.

Extension services

Agricultural extension services in the country are provided by the government through the Ministry of Agriculture. In Khartoum State, the extension services are under supervision of Ministry of Agriculture and Animal Wealth. Crop yields and productivity are low compared to the potential demonstrated by good agricultural practices. Low performance is attributed to ineffective extension services. Some weaknesses in the services are; non-use of the package approach which emphasizes combining of the dissemination that includes extension messages and use of inputs; weak research – extension –farmer linkage. Also, Abdalla [14] mentioned that, the non-native farmers in intra- and peri-urban centers are usually coming with their knowledge and experience from their own living areas in spite of practicing different cropping in different ecosystems. Peri-urban farmers under cooperatives or public schemes may make use of the extension services provided by the cooperatives and public schemes especially when inputs are provided by the management. This study found that the percentage of those who received extension services was (66%) of the farmers. For the extension services of the Ministry of Agriculture and Animal Wealth, where a number of extension agents working in different areas, the ministry provides an agent housing to be located near of production areas and provides vehicle (motorcycle) for movement so that they can reach the farmers in their fields. Also, the study found that some of them used the means of social communication (whatsapp) in sending information message to the farmers or to an appointment for meeting them. However, in some areas, the farmers' contact with extension agent was very poor and the agent may be unknown as a result of transferring them from area to another one.

Financial analysis of tomato value chain

This section of the study discusses the results of financial analysis of tomato value chain in winter season 2015/2016 in Khartoum state for the different value chain actors who include farmers, middlemen, wholesalers and retailers. The financial analysis of this study was built on tomato tin (10 kg) as a unit base for the all actors. Table 3 below shows the unit total cost which represents the total cost per (tin) for each actor, amounting to 17.497, 27.080, 35.760 and 46.260 SDG, respectively. The added unit total cost explains the cost of the output (tomato tin) and the cost of intermediate inputs, as showed in Table 2, the high added unit total cost is shown in the farmer's actor and the lowest one in the wholesaler actor. On the other hand, the percentage of added cost represented the percentages cost of each actor attributed to total cost of all actors, the farmers have the highest percentage added cost while the wholesaler has the lowest one. The selling price for each actor in this chain represents the purchase price from the previous actor. The unit profit component calculated after subtracting the unit total cost from unit price, the study found that, the retailer had the highest unit profit (14.420) SDG and the highest percentage of total profit was (52.127%), while the farmers had just (8.759 %) of the percentage total profit. According to KIT & IIRR [10], this is a very common cycle in Africa in the peak season, when there is more than enough supply – some tomatoes rot before a buyer is found. So, the traders have power over the farmers, and get a higher value share.

Table 3: Tomato value chain components (SDG per tin) in winter season 2015/2016.

Tomato Value Chain Actors	Cost			Revenue	Profit		Margins
	Unit Total Cost SDG	Added Unit Total Cost SDG	% Added Cost	Unit Price SDG	Unit Profit SDG	% Total Profit	Unit Margin
Farmer	17.497	17.497	52.994	19.920	2.423	8.759	19.920
Middleman	27.080	7.160	21.686	32.400	5.320	19.231	12.480
Wholesaler	35.760	3.360	10.177	41.260	5.500	19.882	8.860
Retailer	46.260	5.000	15.144	60.680	14.420	52.127	19.420
Total		33.017	100		27.663	100	

The results showed that profit margin at farm level was (19.920) SDG, which on average was higher compared to the other marketing levels of the chain, followed by retailer (19.420) SDG. This result similar to Ngatigwa [16] on an analysis of the tomato value chain in Mvomero district, Tanzania, who found that profit margin at farm level on average, was higher compared to the other marketing levels of the chain. This was attributed to a producer at farm level having large quantities of tomatoes produced and sold hence production costs are spread over a large quantity of tomatoes sold thus reducing the unit cost of tomatoes production and transport.

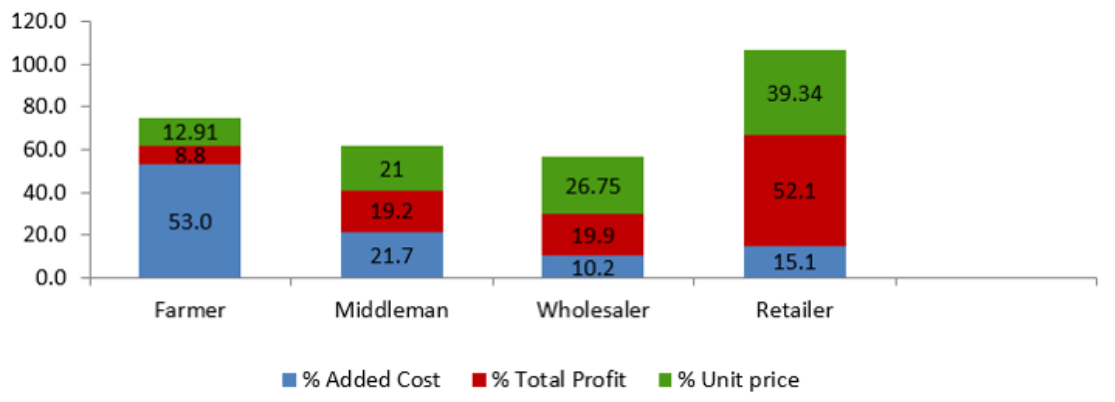

Figure 1: Tomato value chain margins for each actor.

Also, (Figure 1) below explains the relationship between the four actors including the percentage added cost, percentage of total profit and percentage of unit price. The percentage added cost for the farmer, middleman, wholesalers and retailers were 53.0, 21.7, 10.2 and 15.1 respectively. The highest one was the farmer; due to paying all operation production costs, pre-harvest and harvest costs as well as the transportation and loading costs. The second one was the middlemen who paid for the transportation cost, gate fees, handling cost, security, taxes and unloading cost. The third one was the retailers, the high added cost, is the cost of borrowed money and the last one was the wholesalers who had the lowest percentage added costs. The result disagrees with Saeed [15], who found the wholesaler added cost was higher than that of the middleman.

The highest percentage of total profit was getting by retailer (52.1), while the farmer got the lowest one (8.8), however, the middleman and wholesaler extremely got equal percentages of total profits (19.2) and (19.9), respectively. This result was due to that retailer sells at high prices compared with quantities sold. This result agreed with tomato value chain in western Kenya, where the kenyn farmers received only about a quarter of the final retail price of the tomatoes in the peak season KIT & IIRR [10]. In Sudan, this result agreed with Emam [17] and Saeed [15]. The percentage unit price for the actors: retailer, wholesaler, middleman and farmer were (39.34), (26.75), (21) and (12.91), respectively. This indicates that the retailer had the high percent to increase the unit price percentages unit price and this explains the difference between farmers' received price and consumers' price.

Conclusion

The study of financial value chain of tomato in Khartoum state showed that the highest percentage of total profit was get by retailer, while the farmer got the lowest one; therefore, any policies related of tomato in Khartoum state must protect the producer rather than retailers. A big share of farmers in consumers' price goes to retailers; this implies that, the intervention of intermediaries reduces the producer's profit share. Middlemen play a significant role in facilitating tomato sales and in distributing tomato to different traders, they also play a significant part in creating an efficient pricing system in the market through signaling critical information to other market participants.

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