



## Research Article

### The cost and revenue analysis of transactions through live sheep value chain in Sudan

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#### ABSTRACT

Present study was conducted to examine the cost and revenues along the live sheep value chain in Sudan besides the determination of marketing indicators and value addition for the sheep as economic performance among the main actors of the chain covering the locations of Elkhwei, Elnhud locality in West Kordofan state and Omdurman locality in Khartoum state. The data were collected through a field survey conducted during July- September 2018 using questionnaires, stratified random sampling representing the live sheep value chain actors of producers, wholesalers, retailers, processors, and exporters with a total sample size of 300 respondents. The study was following the descriptive statistics methods. The results showed that the producers, exporters, and processors bear the major cost in the live sheep value chain compared to retailers and wholesalers. The cost items of transporting, loading, and veterinary care were the major cost items after the certificate of origin and feed items for they comprised the main value activities performed along the chain of exporters. Also, the revenues of live sheep marketing increase along the value chain to reach its highest value for exporters. That is the same for the marketing indicators "GMM, NMM, and GPM as they increase along with the value chain actors. The producers' share in the sheep marketing value chain in Sudan owns 29% of the sheep market and the sheep (MER) in Sudan is considered as very good registering 71%. Exporters get the most value of sheep marketing as a commodity moving along the value chain reaching 67% compared to value-added for the other factors.

**Keywords:** Sheep market, value chain and cost analysis.

#### INTRODUCTION

Sudan is not quite different from its counterparts' African countries in terms of the prevailing livestock production systems of Pastoralism (nomadic and transhumant), Agro-pastoralism, Intensive Dairy Farming, and Peri-Urban systems (Salla, 2017). Sheep is one of the prominent animals reared in such systems and mainly through traditional producers who depend on natural pasture to raise their animals (Elrasheed et al., 2010).

There is little strategic production of sheep for marketing except for some sales targeted to the export market by small producers (Dirani, 2007). Animals in Sudan are not managed for high off-take, or to maximize their value for meat production. Among other obstacles to be overcome is a weakness (Elrasheed et al., 2010) of market infrastructure, animal health, extension system, and lack of market management

activities reflected in the uncontrolled entry of livestock to markets and the absence of marketing information, such as registration and pricing.

Most of the sheep producers sell their sheep during the rainy, immediately before the winter season (Ibrahim et al., 2016). As it is well known that the main source of price variability is mainly due to the prevailing climatic conditions that are unpredictable. The fluctuating droughts have catastrophic impacts on livestock activities, mainly among the small herders which led to the sale of a part of the flock at low price (Alary et al., 2009).

Sheep marketing channels in Sudan depend on the flow of livestock producers to the final consumer. The marketing channel in Sudan is very long due to the remoteness of producing areas from consumption centers, where the chain is characterized by many intermediate stages, with transaction costs being taken

up mostly by intermediary traders and brokers. Most of trading is done by private treaty, with the exception of large numbers of sheep intended for export which are sold by private auction at primary, secondary or terminal markets. Resale in the same market on the same day is common practice (Gornas, N. and El Hussein, 2012).

Value chain analysis rests on a segmentation of the different activities and mapping of interactions that may generate costs or value in the production and sale of a product or service (Webber and Labaste, 2009). Also, the cost and margin analysis are very important sets of methods and tools for the analysis of value chains, value-chain actors, and markets (Donovan et al., 2016). It is very important to conduct an appropriate analysis of profitability for different people at different points along the value chain, including transaction costs between people and points (FAO, 2012). Moreover, Value chain analysis quantifies the costs and margins associated with each event in the chain between the farm gate and the consumer. In the case of international trade in livestock, the consumer is considered to be the importer in the country of destination. Value added is the difference between the gross value of outputs and the value of inputs used by a sector or industry (Clarke et al., 2006).

In this method, the livestock-specific food price chains represent the complete vary of individuals and organizations and their coordinated value-adding activities, that create it doable to supply and remodel eutherian merchandise that are sold-out to final consumers in a very manner that's profitable right along the chain. It absolutely considers the interaction between its parts and therefore the physical, social, and economic facultative surroundings. (FAO, 2012; FAO, 2019). efficient selling channels and coordinated provide chains scale back dealings prices among totally different actors on the availability chain (Gebremedhin and Tesfaye, 2015).

Arising from all mentioned above, the study went through the live sheep value chain in Sudan to study the cost and revenues of the chain actors as well as the marketing indicators and the value addition of the major chain actors of producers, retailers, wholesalers, processors, and exports of sheep.

## MATERIALS AND METHODS

This study was conducted to examine the cost and revenues along the live sheep value chain in Sudan beside determination of marketing indicators and value addition for the sheep as economic performance among the main actors of the chain covering the locations of Elkhwei, Elnhud locality in West Kordofan state and Omdurman locality in Khartoum state. The data were collected through a field survey conducted during July-

September 2018 using questionnaires, group discussions, and interviewing targeting stratified random sampling representing the live sheep value chain actors of producers, wholesalers, retailers, processors, and exporters with a total sample size of 300 respondents.

The study determines the cost, revenues, marketing indicators which were estimated following the approved methods as cited by (Duguma et al., 2012) and indicated below:

Net Marketing Margin = Gross Marketing Margin – Total Cost

Gross Marketing Margin = Selling Price – Buying Price

Total cost = Standard Marketing Cost + Transaction Costs

To estimate value addition of sheep production, trading, and processing in order to be acquainted with the sheep marketing performance descriptive statistics was used. The collected data were analyzed using Microsoft Excel version 3. 2013, and Statistical Package for the Social Sciences Program SPSS (IBM 2010) version 19.

## RESULTS AND DISCUSSION

The average total costs of sheep production using traditional methods were found to be 1355.2 SDG/head (one US\$= 70.00 Sudanese pound SDG), which can be considered as reasonable compared with modern systems of production (Table 1). While the modern systems characterized by their close location to big cities/towns and compensate its high production costs. The major cost item of sheep production was loading, contributing substantially about 38.09 % each to the total production costs. The labor cost occupied the second position, contributing about 14.63 % to the total costs. This is to a greater extent inconsistent with the work of Duguma et al., (2012) about the sheep value chain in Oromia of Ethiopia where it was found that the feeding costs are the major factors for sheep producers followed by trekking cost. Likewise, the study of Ashenafi et al., (2013) in which the major cost of production for farmers who are the producers is feed cost followed by the vet service cost.

Although producers depend on natural pasture to feed their animals during the rainy and somehow in winter seasons and resort to purchased feeds during summer and under poor environmental conditions still animals feed counted for more than 6.62% of the total costs and that would suggest the fact even with the abundant nature of pasture ecological circumstances push producers to opt to commercial feed for their animals during the season of scarcity. Veterinary care and medicine added significantly to the total costs of 14.63% as producers/traders usually rely on commercial medicines and veterinary care.

Producers believes that the best age for selling sheep is 8 months age (*gadaa*) because animals of this age fetch

have high prices. The majority of the sheep producers, therefore, keep their animals to reach this age without due consideration to cost factors and pasture carrying capacity. In contrast, Elrasheed, et al., (2010) found that the optimum quantity of sheep sales at age 2-2.5 year (*raba*), as well as its composition, is very much more towards younger ages of both males and females. The overall result is additional costs incurred in the production of sheep being kept for extended periods of time.

Another major cost factor of sheep production was the cost of transportation means, contributing substantially about 13.12% each to the total production costs. The cost of transportation/h hoof cost occupied the second position, contributing about 0.811% to the total costs.

**Table 1.** Total cost of Sheep Production (SDG/head/year)

Cost involved on different factors	Mean	%
Cost of nutrition	89.78	6.62
Cost of water	102.11	7.53
Cost of labor	198.37	14.63
Cost of veterinary care	169.77	14.63
Cost of trans. on hoof	11.00	0.811
Cost of trans. /means	177.92	13.12
Cost of loading	516.25	38.09
Cost of unloading	70.00	5.16
Cost of search for selling sheep	20.00	1.47
<b>Total</b>	<b>1355.2</b>	<b>100.00</b>

Source: Survey result, 2019 - in Season 2018; SDG: Sudanese pound.

According to the table (2) above, the average total costs of sheep retailing and wholesaling were found to be 288.94SDG/head and 360.81SDG/head consecutively (one US\$ = 70.00 SDG), the difference in the costs can be attributed to the fact that sheep retailing address small numbers of head adding to the shorter time of keeping the animal before being marketed compared to wholesaling as it appears in the cost of nutrition where it is 52.74 SDG for retailers and it is 65.28 SDG for wholesaler even that the percentage of nutrition cost incurred by both is the same (18%). Also, this explanation is supported by the marked difference in the cost of transporting and loading between retailers and wholesalers, 21.57 SDG and 5.28 SDG for retailers and 26.50SDG and 22.70SDG for wholesalers. The major cost factor of sheep retailing and wholesaling was nutrition, contributing substantially about 18.25 % and 18.09% consecutively to the total production costs. The labor cost occupied the second position for retailing contributing which was about 15.56 % to the total costs. This is partially consistent with the work of Legese and Fadiga, (2014), where the major cost of large-scale sheep trader is the hired labor and the services of water and electricity and this may support the fact that the time of keeping the purchased animal

before being marketed is short compared to other actors in the sheep value chain. For wholesalers, the cost of veterinary care occupied the second contributing about 13.63 % to the total costs. This can be attributed to the fact that retailers have to feed their animals with purchased fodder before selling as the sheep left the pasture by then and entered the market chain, this would be the same case for wholesaler but for the larger number of their flock's veterinary attention exceed the cost of nutrition.

**Table 2.** Cost of Sheep Wholesalers and Retailers in SDG/head

Cost involved factors	Retailers		Wholesalers	
	Mean	%	Mean	%
Cost of nutrition	52.74	18.25	65.28	18.09
Cost of water	42.86	14.83	32.76	9.08
Cost of labor	50.94	17.62	46.00	12.75
Cost of veterinary care	44.98	15.56	49.18	13.63
Cost of trans./hoof	7.63	2.64	23.41	6.48
Cost of trans. /means	21.57	7.46	26.50	7.34
Cost of loading	5.28	1.82	22.70	6.29
Cost of unloading	1.96	0.67	8.62	2.38
Taxes	8.30	2.87	12.52	3.47
Fees	10.70	3.70	13.14	3.64
Brokers	17.50	6.05	14.04	3.89
Zakat	13.73	4.75	20.96	5.81
Insurance	4.75	1.64	25.7	7.12
Other fees	6.00	2.07	0	0
<b>Total</b>	<b>288.94</b>	<b>100.00</b>	<b>360.81</b>	<b>100.00</b>

Source: Survey result, 2019 - in Season 2018; SDG: Sudanese pound.

The average total costs of sheep processing stakeholders were found to be SDG 790.96/head, with new cost factor of sacrifice labor as the major one of processing that accounts for 15.79% of the total cost (Table 3), as the sheep entered the processing chain where sacrifice would add an appreciable value to the sheep as a commodity the thing that may justify the seriousness of this factor. Also, there were other relevant cost factors such as water and electricity that came in the second position and with sacrifice comprised the main factors for processing stakeholder. This is partially consistent with Legese and Fadiga, (2014) showing that labor is the main cost factor of processing that accounts for 51.5% of the total processing cost, and the packaging comes at the second position. Feed cost in the same way considered as main factor coming at the third position and accounted for 14.26% of the processing total cost. For animals in one



stage of processing should be alive particularly during purchase, transporting, and waiting for slaughter and this may justify the feed cost item.

**Table 3.** Cost of Sheep Processing Stakeholders in SDG/head

Cost involved on different factors	Mean	%
Cost of feed	112.84	14.26
Cost of water	43.16	5.45
Cost of sacrifice labors	124.96	15.79
Cost of sacrifice packing	46.36	5.86
Cost of transportation	92.32	11.67
Cost of loading	32.80	4.14
Cost of unloading	11.48	1.45
Cost of storage	3.40	0.43
Cost of disposal waste	25.04	3.16
Cost of water and electricity	115.48	14.59
The other costs sacrifice	10.00	1.26
Taxes	94.48	11.94
Fees	22.24	2.81
Brokers	23.00	2.90
Zakat	33.40	4.22
Insurance	0	0
Other fees	0	0
<b>Total</b>	<b>790.96</b>	<b>100.00</b>

Source: Survey result, 2019 - in Season 2018; SDG: Sudanese pound.

Also, it would be noticed that the veterinary care cost item disappeared in this stage of sheep processing even it was one of the major factors in the previous stages of production, retailing, and wholesaling and can be attributed to the fact that all veterinary care measures are a prerequisite for sheep transfer along the chain to the processing as crucial quality value as well as an animal would be ready for processing that entails a shorter time of waiting compared to other previous stages. Besides, the fact of the processed animal quality requires freedom of the output product from veterinary drug residues to make it valid for marketing and consumption.

The average total costs of sheep exporter were found to be 913.89 SDG /head (Table 4), as they are the terminal chain of the sheep value chain and it is markedly noticed that the cost factor of the certificate of origin occupied the major position as it accounts for 36.06 % of the total cost and that may be attributed to procedures costs for eligibility as being exporters as well as estimation arise upon the foreign currency rate. this has brought about the marked difference between the factor of certificate of origin and other factors where the cost of feed was the near one to it with 84.20 SDG/head as the animals have a period of time waiting before being shipped to their final destination across the Red Sea. It can be noticed from table (4), the cost items of transporting on hoof; by means, loading, and

veterinary care are the major cost items after the certificate of origin and feed items for they comprised the main value activities performed along the chain of exporters.

**Table 4.** Cost of Sheep Exporters in SDG/head

Cost involved on different factors	Mean	%
Cost of feed	84.20	9.21
Cost of water	22.60	2.47
Cost of labors	46.44	5.08
Cost of vet	70.2	7.68
Cost of packing	-	-
Cost of trans. on hoof	67.50	7.38
Cost of trans.by means	60.88	6.66
Cost of loading	47.88	5.24
Cost of unloading	13.52	1.48
Cost of remain sheep in Port until loading	22.68	2.48
Taxes	18.68	2.04
Fees	22.96	2.51
Brokers	15.84	1.73
Zakat	21.00	2.30
Insurance	20.00	2.18
Veterinary quarantine	32.24	3.52
Standards	17.67	1.93
Certificate of origin	329.60	36.06
<b>Total</b>	<b>913.89</b>	<b>100.00</b>

Source: Survey result, 2019 - in Season 2018; SDG: Sudanese pound.

**Table 5.** The Total Revenues of The Sheep Value Chain Actors, in Season 2018, SDG/head/year

Indicators	Price	Quantity	Total Revenues
Producers	1680	35	58800
Retailers	2411.5	203	489,534.5
Wholesalers	2330.5	1636.2	3,813,210
Processors	2685.8	5735.44	15,404,244.75
Exporters	805	50468	40,576,272

Source: Survey result, 2019 - in Season 2018; SDG: Sudanese pound.

According to Table 5., value chain of sheep, marketing starts from producers that provide sheep to the primary markets at the average of 35 heads sold at 1680 SDG with total revenues of 58800 SDG for each sold batch of sheep.

Retailers and wholesalers represent the medium actors in the sheep marketing value chain assembling sheep brought by the producers with quantities of 203 heads and 1636 heads consecutively to sold at 2411.5 SDG and 2330.5 SDG. As it can be observed that the trading size of wholesalers is bigger than retailers with total revenues of 3,813,210 SDG for wholesalers and 489,534.5 SDG for retailers. Processors occupy an outstanding position in the sheep value chain as they trade on quantities amount to 5735 heads that processed to sold at a price of 2685.8 SDG with total revenues of 15,404,244.75 SDG. Exporters represent the endpoint

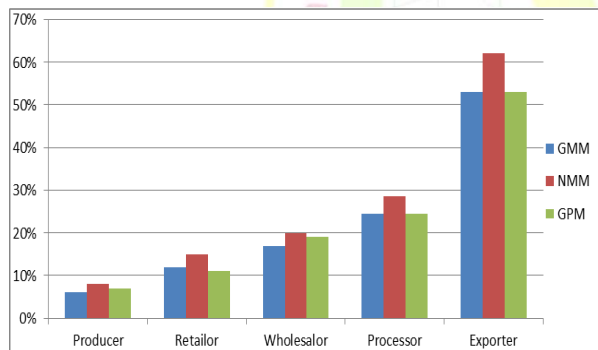
in the sheep value chain as they trade on quantities amount to 50468 heads that to be sold at the price of 805 SDG with total revenues of 40,576,272 SDG.

In analyzing the sheep value chain in Sudan according to the study above in terms of Gross Marketing Margin (GMM), Net Marketing Margin (NMM), Gross Profit Margin (GPM), Producers Share (PS), and Marketing Efficient Rate (MER) for the actors, it is found that, as shown in Figure 1, Gross marketing margins increases along the value chain as it forms 6%, 12%, 17%, 24%

**Table 6.** Value Addition among Major Chain actors in SDG

Indicators	Retailer	Wholesaler	Processor	Exporter	Total value
Margin	349,917	3,812,888.28	15,403,580.4	40,575,455	60,141,841
Value added	1%	6%	26%	67%	

Source: Survey result, 2019 - in Season 2018; SDG: Sudanese pound. Moreover, producers share in the sheep marketing value chain in Sudan own 29% of the sheep market, and the sheep Marketing Efficient Rate (MER) in Sudan is considered as very good registering 71%. As it's observed in Figure 1 and Table 6, exporters get the most value of sheep as commodities moving along the value chain. So, the value added to sheep reaches 67% compared to the least value-added for retailer's chain actor of only 1% where the value-added improved a little for wholesalers to be 6% and considerably for processors making 26%.



**Fig. 1.** The marketing indicators (GMM, NMM & GPM) of the sheep value chain actors

**CONCLUSION**

Through the study of the cost of the transaction along the live sheep value chain in Sudan incurred to the actors who were determined as producers (owners/rearers), retailers, wholesalers, processors, and exports, it can be formulated that there were variation in terms of total cost and certain factors within each stage in the value chain. So, it would be concluded from the study that the producers (owners/rearers), exports, and processors bear the major cost in the live sheep value chain compared to retailers and wholesalers and this would be attributed to the nature of the economic activity in terms of some complicated practice that may add a lot to the cost of transaction mainly speaking the

and 53% for the producer, retailer, wholesaler, processor, and exporter consecutively. Whereas Net Marketing Margin (NMM) registered values of 8%, 15%, 20%, 29%, and 62 % for the producer, retailer, wholesaler, processor, and exporter consecutively. For Gross Profit Margin (GPM) as it is represented through Figure 1, it is observed that exporters score the highest margin of 53% followed by processors making 24% and wholesalers, retailers, and producers that made 19%, 11%, and 7% consecutively.

cost factors of loading and labor are the major costs for producers; the cost factors of the certificate of origin and feed are the major costs for producers for exporters and the cost items of sacrifice labor, water and electricity are the major cost for processors. Moreover, producers who depend on natural pasture to feed their animals during the rainy and somehow in winter seasons have to purchase feeds during summer and under poor environmental conditions and even with the abundant nature of pasture ecological circumstances push producers to opt to commercial feed for their animals during the season of scarcity.

The major cost factor of sheep retailing and wholesaling was nutrition. This can be attributed to the fact that retailers have to feed their animals with purchased fodder before selling as the sheep left the pasture by then and entered the market chain, this would be the same case for wholesaler. The labor cost occupied the second position for retailing and this may support the fact that the time of keeping the purchased animal before being marketed is short compared to other actors in the sheep value chain. Feed cost item is considered as main item coming at the third position of the processing total cost. For animals in one stage of processing should be alive particularly during purchase, transporting, and waiting for slaughter and this may justify the feed cost item.

The cost factors of transporting on hoof; by means of, loading and veterinary care are the major cost factors after the certificate of origin and feed factors for they comprised the main value activities performed along the chain of exporters. Also, it is very important to mention that the revenues of live sheep marketing increase along the value chain to reach its highest value for exporters. Besides, the marketing indicators of Gross Marketing Margin (GMM), Net Marketing Margin (NMM), and Gross Profit Margin (GPM) increase along the value chain actors of producer, retailer, wholesaler, processor, and exporter to reach its highest point for exports Moreover, producers share in

the sheep marketing value chain in Sudan own 29% of the sheep market and the sheep Marketing Efficient Rate (MER) in Sudan is considered as very good registering 71%. Equally important, exporters get the most value of sheep marketing as a commodity moving along the value chain. So, the value added to sheep reaches 67% compared to the value added to the other actors.

According to the above mentioned it is recommended that reducing the cost born by the producers (owners/rearers), exports, and processors in the live sheep value chain will mobilize the sheep sector and improve competitiveness in its markets in the region. Also, further studies conducted on addressing the major cost items in the live sheep trade will support the sector positively.

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