An Analysis of the Beef Production Industry and Marketing in Zambia

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Authors' contributions

This work was carried out in collaboration between both authors. Author RMS designed the study, performed the statistical analysis, the literature searches, wrote the protocol and wrote the first draft of the manuscript. Author ZG managed the analyses of the study and supervised the whole process. Both authors read and approved the final manuscript.

Original Research Article

ABSTRACT

This paper studies and provide a comprehensive and critical research by analyzing and evaluating the beef marketing channels, determine marketing efficiency, examine key social and economic factors contributing to the success and failure and establish the regional market interactions across the three agro-ecological regions in Zambia.

To achieve this, the research used both primary and secondary qualitative and quantitative data from national representative surveys by Rural Agricultural Livelihood Surveys Reports which were implemented by Indaba Agricultural Policy Research Institute, and the 2017/18 Livestock and Aquaculture Census Report by Ministry of Fisheries and Livestock, Central Statistics Office, and other relevant literature related to this study. A questionnaire was used in primary data collection through snowball sampling technique, physically asking, and observing cattle farmers, abattoirs, wholesalers, processing companies and various players or actors in the beef market. Thereafter, intermediation theory was applied to develop a conceptual framework, transaction cost analysis was used to understand how and why different supply channels develop, and finally market performance was determined by analyzing the level of marketing margins.

It was found that there are two major channels (Channel A and Channel B used by small-scale and commercial scale farmers respectively) which have channel subdivisions and several social and

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economic factors influence the farmers choice of marketing channel as well as influence consumer choices. Channel A was dominated by intermediaries while channel B be was vertically integrated. It was determined that all beef channels in Zambia were efficient and three major consumer types were observed and the regional market interactions showed that region I supplies both II and III, region II supplies III while region III is more of a consumer region.

This study will help to fully understand cattle producers marketing channel selection, consumer choice of market and product quality, regional market interactions and develops recommendations making available valuable information to farmers, beef traders, companies, and policy makers thereby has the potential to improving beef trade and markets in Zambia.

1. INTRODUCTION

The agricultural sector remains the key to meeting and enhancing nutritional and household food security needs, income generation, employment creation, and poverty reduction in Zambia [1]. It is and will remain an engine of growth of the economy for several years to come. Agriculture contributes between 18 - 20% to Zambia's Gross Domestic Product and more than 50% of the population depend on it for their livelihoods. The sector employs almost 67% of the labour force and still remains the major income source for rural women who constitute 65% of the total rural population (Nat Agri Policy 2004).

Most of small-scale farmers are engaged in low-productive subsistence agriculture characterized by lack of access to agricultural inputs, technology, and access to markets, as well as a low level of education and skills. Over the past decade, the rainfall pattern has been erratic with high incidences of droughts in most parts of the country, especially the southern half of the country and this has driven a lot of poor farmers to rely on livestock for their livelihood as a major source of income. This is because the livestock sector has continued to perform fairly well despite the drought situation [2].

In Zambia, according to the Livestock and aquaculture Census Report, it is estimated that 1,638,423 households were involved in Livestock-raising accounting for 72.2% of the total agricultural households in the country. Of these, 347,031 households and 1047 establishment raised an estimated 3,714,667 cattle around the country as well as other forms of livestock as indicated in Table 1 [2]. For many years, beef has been one of the most important sources of protein produced and consumed in most parts of the country and world at large. Each day, households go to their favourite store to buy meat for their families. At every celebration, party or event, meat is one of the must serve source of protein provided and is widely consumed by majority of people world over. Among the major sources of proteins are beef, chicken, pork, goat meat, fish, and a wide variety of processed meat [3].

Policies and developmental efforts in livestock production have mainly bordered on increasing research in livestock by the creation of livestock development centres around the country which have been promoting sustainable ways of raising livestock to ensure good quality beef and disease-free animals are raised. There has also been livestock restocking programmes carried out with a view of improving the breeds. Small-scale farmers mostly raise local breeds while commercial farmers raise fast growing imported or exotic breeds. Local breeds have slow growth rate and relatively poor meat quality while exotic breeds easily catch diseases and face eye problems during hot seasons. The effort has been to create breeds that can offer both disease resistance and fast growth coupled with good and high-grade meat quality. So far, this effort has been yielding results as there are considerable improvements and several locally improved crosses are being reared by both commercial and small-scale farmers.

Predominantly, agriculture has remained a private sector driven activity in Zambia, and this includes farming, supply of inputs and marketing [4] whereas the government formulates policies, guidelines, and provides extension services. In Zambia, limitations to increased ruminant production are lack of adequate marketing infrastructure such as low-price incentives, limited disease control, insufficient livestock

research, lack of adequate extension services and poor animal husbandry practices. However, the efficiency along the marketing channels ensures there is satisfaction of both famers and consumers on extreme ends and all the players in between.

Beef generally moves from farm to table along different channels that exist within the country. Major producers of cattle can be categorized into small-scale and commercial farmers. From these sources, beef then moves through different marketing channels and finally reach the consumer who are at the end of the channels. Further, the livestock supply chain in Zambia is characterized by intermediaries such as brokers, agents, beef traders, abattoirs, wholesalers, butcheries, local authorities and the department of livestock and fisheries. For the beef market to be highly competitive locally and abroad, it is important for the identification, development and improvement of efficient livestock marketing and distribution chain, identifying marketing problems that the farmers are currently experiencing and possible niche markets in Zambia which can reduce high transaction costs, improve market infrastructure and access to around the country. Establishing an efficient marketing system is very important to the producer, market players and consumers as it is most likely to benefit both farmers and consumers as this ensures that information is available and transaction costs are kept minimal. In the study area, the evidence gathered shows limited information with regards to economic distribution among actors, structural characteristics of market actors, regional market dynamics and efficiency of distribution throughout the country.

The aim of this paper is to study and provide a comprehensive and critical research by analysing and evaluating the beef marketing channels in Zambia. We seek to establish the existing beef marketing channels, type of cattle produced, amount and quality desirable, how sales fluctuate at different times of the year, factors contributing to the success and failure, analyse the channels across agro-ecological region and develop recommendations for the different beef marketing channels that exist in Zambia. By so doing, the study will make available valuable information to farmers, beef traders, companies, and the government thereby has the potential to improving beef trade and markets in Zambia.

2. LITERATURE REVIEW

2.1 Agriculture

In Africa, Zambia is known to have one of the best surface and underground water resources comprised of rivers, lakes, and dams. With the vastness of resource endowment in terms of land, labour, and water that the country possesses, Zambia has huge potential to grow agricultural production. The total land area is about 75 million hectares (752,000 square Km), of which 58% (42 million hectares) is classified as medium to high potential for agricultural production. The rainfall averages between 800 mm to 1400mm annually making it suitable to produce a broad range of crops, fish, and livestock. However, it is estimated that only 14% of total agricultural land is currently being utilized.

Agriculture offers the greatest potential for generating growth and increasing employment and incomes. Smallholder farming represents a large potential resource for increased agricultural production and poverty reduction. (Nat Agri Policy 2004 – 2015) [5].

2.2 Livestock Sector

Livestock production systems in Zambia follows the dual structure of agriculture, comprising a large traditional sector and a small commercial sector. Small-scale cattle production plays an important role in rural farming households by providing employment, and contributing to draft power and manure for crop production [6]. It is however viewed as a major store of value by most small-scale farmers [7]. The livestock processing business is dominated by large commercial farms which produce a range of products such as meat, poultry products, dairy products, leather products, and animal feed. They also have a large marketing network in Zambia and franchise with supermarkets within and abroad.

Mostly, cattle are found in the drier open woodland parts of the country mainly the Tonga plateau, the Kafue Flats, and the floodplain of the upper Zambezi. Cattle in the traditional farming systems often do not enter the commercial market, which is supplied mainly commercial farms, found in central and southern parts of the country [8].

Table 1. Number of Livestock by type and province

Province	Cattle	Goats	Sheep	Pigs
Central	835,620	588,692	29,923	102,330
Copperbelt	93,429	166,503	14,175	112,303
Eastern	601,921	359,247	30,524	306,527
Luapula	12,386	166,675	1,977	21,130
Lusaka	172,760	337,677	17,941	92,847
Muchinga	85,162	159,698	3,755	67,357
North	48,530	215,520	3,781	53,250
North-western	98,672	230,760	5,515	52,597
Southern	1,315,238	1,290,856	62,586	181,783
Western	450,949	69,062	310	92,635
Zambia	3,714,667	3,558,614	170,485	1,082,765

Source: Livestock and Aquaculture Census Report

2.2.1 Animal husbandry practices

Among small-scale farmers, the most practiced animal husbandry systems are village resident cattle herding system where cattle is herded in or around the village and transhumance cattle herding system where cattle herders keep moving between the village and floodplains in search of greener pastures [6,9]. The latter is mostly practiced in the southern and western provinces of Zambia and usually by the farmers who keep large herds because they solely rely on pasture for nutrition and seldomly use any food supplements for their animals. Commercial farmers on the other hand use the paddock system where animals are kept in paddocks and are rotated every month or two to new ones. They supplement with hay baled either from improved grass grown on farms or crop residues especially wheat and sunflower during the drier periods when green nutritious grass is unavailable.

2.2.2 Disease control

Small-scale farmers use communal dip tanks at a fee or knap sack sprayers to dip their animals as prevention against ticks and tick bone diseases. About 56% of them follow a regular vaccination programme and 36% only respond to treat their animals when they show signs of sickness. These animals are usually in contact with others from different herds and as a result, an outbreak of diseases in an area such as corridor disease (locally popularly known as "denkete") usually wipe out animals in an area causing grave loses to the farmers.

The commercial farmers mostly follow a regular dipping, vaccination, and treatment programme of their herd and most of them own their own dip

tanks and have crash pens for animal handling. Their animals are kept within the confines of their farms and rarely encounter other herds while practicing strict biosecurity measures on their establishments.

The common diseases that affects cattle in Zambia are foot and mouth disease (FMD), east coast fever (ECF), anthrax, Contagious Bovine Pleura Pneumonia (CBPP), haemorrhagic septicaemia (HS), Black Quarter (BQ), corrido disease among others with an estimated mortality rate of 12.7% and 2% for small-scale and commercial farmers respectively [3,5,9]. Control of diseases is of great importance as it has over the past years affected cattle trade especially inter-provincial and regional trade due to livestock movement bans enforced by the ministry of livestock and fisheries.

2.2.3 Cattle breeds

There are various breeds of cattle kept in Zambia. Local breeds like Angoni, Barotse, Tonga, and Baila are the most common and various crosses among these breeds are popular among small-scale farmers across the country, while a small section of small scale farmers have crossed with exotic species via bulls or rarely artificial insemination [10,7]. These animals have developed adaptations to the local harsh environmental conditions such as high temperature, tropical diseases and drought. The Angoni cattle are found in Eastern province of Zambia bordering between Malawi and Mozambique and are believed to have descended from the Zebu cattle brought in by the Ngoni people when they came to Zambia from the South [11]. The Barotse cattle are found in the western part of Zambia in the Barotse plains and is believed to have developed from the cross

between the Sanga cattle and Zebu. Whereas the Baila is dominantly found in the Southern province among the Ila speaking people and is believed to be from crossings of the Barotse and the Tonga breeds. The Tonga breed is known to have its origins from the Sanga. It's found in southern part of Zambia and is very similar to the Mashona of Zimbabwe [11,12,13].

Exotic breeds are mostly kept by commercial farmers who dominantly are found along the line of rail. These farmers keep specially bred livestock on their private farms which are usually large-scale commercial farms with large herd sizes and practice high levels of management. On farm feed production is done to provide supplement for high productivity. Some of the large farms are engaged into processing of the products, carry out planned breeding programmes by both natural and artificial insemination [14].

The most common beef breeds kept in Zambia are Brahman, Boran, Sussex, Gelbvieh, Hereford, Angus, Simmental, Red Sindhi etc. The dairy breeds are the Friesian, Guernsey, Jersey, and the dual-purpose Simmental were introduced via semen importation. These breeds are being improved through use of semen and natural service by bulls [14].

2.2.4 Importance of cattle

Cattle are an important resource and poses several roles in socio-economic development. For example, cattle are sometimes used as dowry and may be sold to raise cash to pay the school fees of family members [15].

Among small-scale farmers, cattle are kept for draft power for use in cultivation of crops [7],

followed by cattle being the source of income, source of transport in form of ox-carts [9], source of milk, symbol of status in the village, source of meat, manure for fertilising crop farms [13], and as payment of dowry during marriages. In addition, since their domestication, cattle have played a major role in various cultures by participating in fighting games, racing and religious ceremonies [14].

The husbandry of cattle requires a more organized management than the keeping of other livestock, which has contribution to the complexity and stratification of early agricultural societies.

2.3 Agricultural Product Marketing

About 80 million litres of milk and 40 thousand metric tons of beef, 434 metric tons of mutton and 3,972 metric tons of goat meat are produced annually by commercial and small-scale farmers. Some meat, especially beef, is exported to regional markets (neighbouring countries). Eggs, meat and butter are normally exported to the regional market, while game trophies and crocodile meat are exported to the European Union and countries such as the United Arab Emirates [14]. Zambia has great potential to become a breadbasket in Southern Africa, owing to its vast fertile land and abundant water resources, however, of the 58% of land suitable for agricultural production, only 14% is under cultivation. Small-scale farm production in Zambia is often not sufficient to cover basic household nutritional needs and, even if farmers do produce a surplus that can be sold, they find it difficult to market their produce due to poor market linkages. As a result, agriculture is not seen as a profitable enterprise among the youth

Table 2. Cattle distribution by provinces in Zambia

Province	Cattle population small-scale farmers	Cattle population Establishments	Cattle farmers	Poverty indices
Central	743,595	92,025	50,462	69.50
Copperbelt	74,628	18,801	7,589	68.00
Eastern	597,149	4,772	104,989	84.30
Luapula	10,789	1,597	1,868	78.50
Lusaka	147,574	25,186	13,436	58.40
Muchinga	81,829	3,333	10,132	83.10
Northern	47,841	689	10,126	81.80
North-western	95,484	3,188	11,777	74.70
Southern	1,225,090	90,148	104,677	75.80
Western	450,116	833	31,974	83.30
National	3,474,095	240,572	347,031	78.80

Source: Author (Data from 2017/18 Livestock and Aquaculture Report)

and with limited employment alternatives in rural areas, many migrate to urban areas in search for opportunities and better living conditions. Exploring the exiting marketing conditions and value addition along the chain of production and supply can increase the incomes and living conditions in rural areas [3].

2.4 Distribution Channels and Marketing Efficiency

Beef is produced by the farmers and reaches the table of the consumers via various means available. These means through which a farmers (small or commercial scale) gets their beef or beef products to consumers, who in turn pay for the goods and services, is referred to as distribution or marketing channel. The channels are dynamic from place to place. Some can be short, others long, while others can be complex with intermediaries or vertically integrated with one company performing almost everything from production to sales. All this is to make sure products are delivered. However, in the process of delivering these products, transaction costs are incurred which determine whether or not the market is efficient. An efficient marketing system is fundamental for steady prices to producers, which are necessary incentives for increased production and supply of goods and services [16,17]. By marketing efficiency, we mean the realisation of maximum output in terms of money and or output of beef and beef products with minimum resources. The length of the channel, number of intermediaries, level of integration do not necessarily indicate the best and lucrative channel to the producer. It is important, therefore, for the farmer to know, understand, and compare the costs, sales volume and profits expected from alternative channels of distribution available as this is a determinant of survivability and growth of firms [18,6,19].

3. THE BEEF MARKETING CHAIN AND THEIR CHARACTERISTICS

The country's agriculture and food industry has been on the move and as such transforming. The Zambian beef market is currently segmented between standard beef produced by smallholder farmers under generally low intensity production system, and choice beef produced primarily by commercial farmers and fattened in feedlots [7]. There are two major kinds of producers of beef, the small-scale farmers, and commercial farmers and these make the two broad marketing

channels that have been identified through which cattle is sold from the producer to the consumers namely channel A and channel B as shown in Fig. 1 below. Each of these channels has various sub-channels. Channel A is used by small-scale cattle farmers and cattle herders to sale their cattle while channel B is mostly used by commercial farmers. It should be noted that trade also takes place between commercial farmers and small-scale farmers. In each of these channels, various players are involved in various agribusinesses before the product finally reaches the market.

The consumers in the Zambian market are categorised into low-class, middle-class, and high-class consumers. Low class consumers comprise the poor who do not usually have stable jobs, and middle-class consumers are mostly made up of civil servants and those with some stable jobs, while the high or upper-class consumers is comprised of various executives, businessmen and well to do households. The lower and partly the middle class will choose their choice of beef depending on the price while the upper class chooses based on quality and cut preferences.

3.1 Channel A

Small-scale cattle farmers and villagers keep between one to hundreds of animals on their farms and mostly in villages using traditional land. They rely on communal grazing land for pasture usually in plains and dambos, near rivers and valleys. Such places are usually in remote areas far from the road networks and social amenities. Traditionally in Zambia, most small-scale farmers keep animals as a symbol of wealth and sale only when need arises such as school fees, funerals, and other pressing family needs. Suffice to note that one of the underlying factors is that majority small-scale farmers do not have registered companies or farms.

Due to remoteness of most small-scale farmers, marketing and selling of their animals' faces a huge challenge. As a result, middlemen or village cattle traders exist. These usually collect animals from a wider geographical location and bring them to one location which can easily be accessible by buyers from the cities. These buyers usually comprise abattoirs, butcheries, wholesalers, and individual traders who are contacted every time these village collectors amass reasonable numbers. Some farmers and villagers with information and near the roads and markets would prefer to deal directly with the

buyers but those from far areas have no option and usually these don't have much information and have no means of transportation.

From the abattoirs, wholesalers, butcheries and individuals, beef then enters the market via the sub-channels as shown in Fig. 1 below. Wholesalers and abattoirs do sale directly to consumers. However, because of distance they are unable to reach a lot of consumers. Butcheries, beef retailers and beef traders buy beef from wholesalers and abattoirs and sale large volumes to the consumers because these are located right in the cities, towns, markets, compounds, along the roads and suburbs right next to the consumers.

The meat that is sold through channel A usually is bought by the low-class and middle-class consumers. This is because besides the low quality, it's cheap and sold on the open market where buyers are usually able to negotiate the prices and close to their homes.

3.2 Channel B

This is a channel used mostly by commercial farmers. Commercial farmers keep large herds of exotic and local improved cattle on their establishments in paddocks and range land. They also buy a reasonable large number of animals from small-scale farmers. Before the animals are off-loaded to the market, they are fed on improved pastures and crop residues. Animals with good conditions are further placed in feedlots for weight gain and improved meat quality. Thereafter, the animals are sold mostly to the processing companies and sometimes to wholesalers and butcheries. Breeding animals mostly heifers are sold to other farmers both commercial and small-scale, and pedigree bulls are sold through auctions or otherwise during shows and these usually enter the export market.

The largest amount of beef in this channel passes through the processors who chop, grade, and package the beef into various cuts and quality and further distributes through supper markets, outlets and rarely through butcheries, beef retailers, beef traders and stores as shown in Fig. 1. Beef from the processing companies also enters the export market to the neighbouring and other African countries.

In this channel B, the largest number of consumers come from the middle-class and upper-class citizens. This is because the largest distribution route is via supper markets located in large shopping malls and processor outlets which are located in townships, compounds, and large markets. The quality of beef in this channel is usually good and graded where a customer buys according to preference and the prices are higher than beef in channel A.

Of major importance also is the trade that takes place between small-scale cattle farmers and commercial farmers. Small-scale farmers usually buy bulls and heifers for head improvement. On the other hand, some commercial farmers do buy local breeds mostly heifers and cross them with exotic bulls to breed locally improved breeds resistant to diseases and able to withstand the local climate while delivering good beef quality required by the targeted markets.

Apart from buying animals for breeding purposes, commercial farmers usually create collection and loading centres where small-scale farmers take their locally improved breeds and are sold at an individually negotiated live weight basis but mostly the commercial buyer offers his buying price to small-scale farmers. The animals are then loaded and transported to their establishment where, together with own animals, they are fed with improved pastures to further improve body condition and later placed in feedlots for weight gain and enhancement of meat taste and quality.

3.3 Market Interactions across Agro-ecological Regions

Zambia is divided into three agro-ecological regions. These agro-ecological regions cut across provinces and have their own distinct agricultural and climatic characteristics. Aside from that, the agro-ecological regions also have differences in cattle numbers and beef market characteristics. Table 1 above shows that the highest number of cattle in found in southern province followed by central, eastern, and western provinces respectively while the lowest numbers are on the northern half of the country.

Region I have the highest number of cattle followed by region II and lastly region III. Region I produce enough beef to meet its local demand and surplus is sold to region II and III. Beef is usually cheap and there are more abattoirs and a small number of butcheries, beef retailers and beef traders in this region. It's dominated by small-scale farmers and cattle headers whose livelihood and traditions evolve around cattle and related activities. This region is the major supplier of cattle to both region II and III.
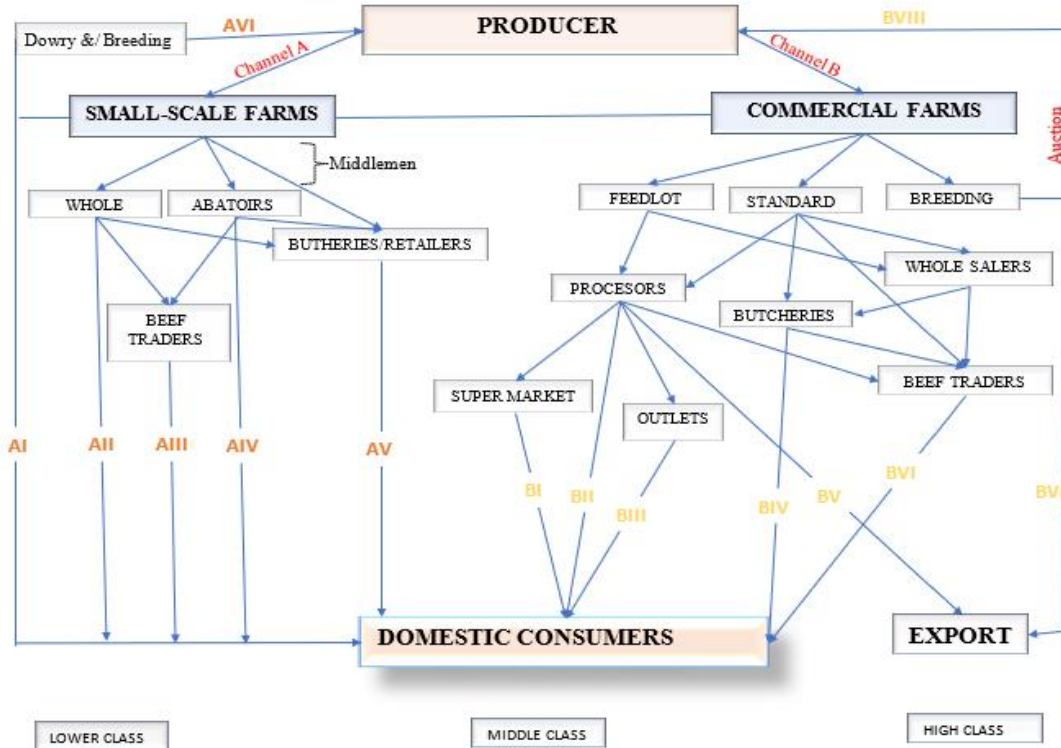
Fig. 1. Cattle marketing channels in Zambia
Source: Own Research

Region II is the central region in Zambia and this region is dominated by both commercial and small-scale farmers. The larger number of commercial cattle farmers is found in this region. The processing plants are also concentrated in region II. Beef from region I is bought by processing plants, wholesalers, butcheries, and traders and is processed and packaged in region II where it's either sold within or exported to region III.

Region III produces a very small number of cattle which cannot meet the consumption demands. As a result, demands are met by supplies from region I and II. Most of the beef consumed here is produced in the two regions in central and southern part of the country. Fig. 2 below shows the regional beef market interactions in Zambia.

4. MATERIALS AND METHODS

This section presents and discusses the research design, population and sampling procedure, data collection method and data analysis approach used.

4.1 Data and Sampling Procedure

This research used both primary and secondary qualitative and quantitative data to determine the outcomes. We used secondary data from the set of data used in the analysis that comes from national representative surveys-2015 & 2019 Rural Agricultural Livelihood Surveys (RALS) Reports which were implemented by Indaba Agricultural Policy Research Institute (IAPRI), and the 2017/18 livestock and aquaculture census report of Ministry of Fisheries and Livestock, Central Statistics Office, and other relevant literature related to this study.

A structured questionnaire was used to collect primary data through telephone interviews, physically asking and observing cattle farmers, abattoirs, wholesalers, processing companies and various players or actors in the beef market. Snowball sampling technique [18] was applied in determining a sample and collection of relevant information in the beef market and distribution.
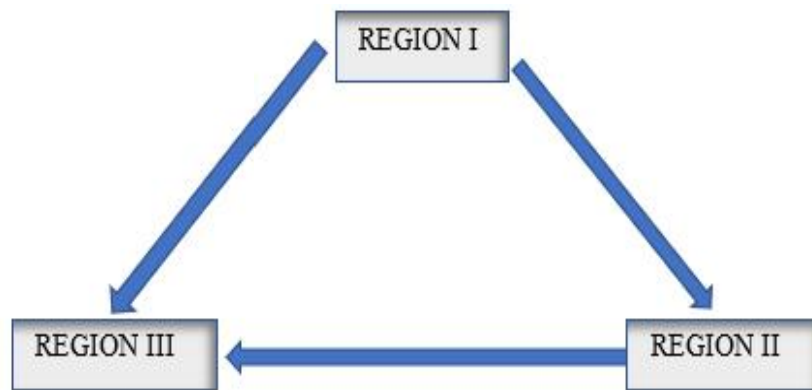
$$yu = \sum_U \frac{y_i}{N} \qquad (1)$$

Fig. 2. Regional beef market interactions
Source: Own Research

Where *U* is a population with a known or unknown number of elements *N*. If the population is represented by a graph, the elements are the vertices and the contacts are the edges between the vertices. Each element is characterized by a real-valued property *yi* which is unknown but observable if element *i* is sampled.

4.2 Data Analysis Technique

Intermediation Theory: Intermediation theory was used to develop a conceptual framework. Intermediation theory can provide a view of the food supply chain that connects producers to consumers of food products. These two ends may be directly connected by markets or alternative organizational firm structures such as vertical integration or through intermediaries (economic agents that purchase from suppliers for resale to buyers and that help buyers and sellers transact). These may be independent firms or agents. According to intermediation theory, intermediaries form when the gains from intermediated exchange exceed the gains from direct exchange [19].

Transaction cost analysis (TCA): TCA approach was used to developing insights into how and why different supply channels emerge and for understanding efficiency and competitiveness along the channel leading to producer choice of a channel. Transaction costs are simply the costs of carrying out any exchange, whether between firms in a marketplace or a transfer of resources between stages in a vertically integrated firm, when the neoclassical assumption of perfect and costless information is relaxed. Transaction costs are important because they affect the organization of economic activity or "vertical co-ordination" or "governance structure" of contractual relations and includes all the ways of harmonizing the successive vertical stages of production and marketing [20,21].

We introduced the concept of market performance which refers to the impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output. By analysing the level of marketing margins and their cost (transaction costs) components, it is possible to evaluate the impact of structure and conduct characteristics on market performance. The major indicators or measures of market performance are: net returns, marketing margins; marketing costs; producer's share; and value added and the analysis of market channel efficiency [16]. The other additional factors such as seasonality, technological changes, and sales volume may also explain the variations in the margin. Marketing margin and farmers share were selected to analyse the marketing performance and efficiency in Zambia. A marketing margin is the percentage of the final weighted averages selling price taken by each stage of the marketing chain. The total marketing margin is the difference between what the consumer pays and what the producer/farmer receives for his product. This is the difference we get between retail price and farm gate price. Calculating the total gross marketing margin (TGMM) is linked to consumer price and is written in percentage form [16].

$$TGMM = \frac{End\ buyer\ price - First\ buyer\ price}{End\ Buyer\ price} \ X\ 100 \quad (2)$$

Where, TGMM = Total Gross Marketing Margin

It is apparent that we introduce the idea of 'farmer's portion', or 'producer's gross margin' (GMMp) which is the portion of the price paid by the consumer that goes to the producer. The producer's margin is calculated as:

$$GMM_P = \frac{End\ buyer\ price - Market\ margin}{End\ buyer\ price}\ X\ 100 (3)$$

Where, GMMp = the producer's share in consumer price

The Net Marketing Margin (NMM) is the percentage of the final price earned by the intermediaries as their net income after their marketing costs are deducted.

$$NMM = \frac{Gross\ margin - marketing\ cost}{End\ Buyer\ price}\ X100\ \ (4)$$

5. RESULTS AND DISCUSSION

5.1 Factors That Affect Farmers' Choice of Marketing Channel

5.1.1 Intermediaries and vertical integration

Intermediaries have and continue to play an important role in the Zambian beef supply chain fulfilling the function of matching sellers (small-scale farmers) and buyers from different regions and within a region; performing tasks of assembling, storing, and transporting cattle; and gathering and processing information about market trends and consumer demands. The roles of intermediaries may be performed by agents acting on behalf of a vertically integrated company or by individuals taking advantages of gaps in the vertical market linkages. Small-scale farmers and cattle raising households are scattered throughout the country. Intermediaries, mostly younger men cover a wide geographical area and gather animals by foot to one designated location where buyers (butcheries, abattoirs, and individuals) can easily access, buy, and transport to urban markets. Intermediaries also have been accused of taking advantage of small-scale farmers through large margins. It should be recognized, however, that intermediaries often make it possible for a market to function and bring to life small-scale farmers market, otherwise a market would not exist. The use of intermediaries or middlemen is the major way through which small-scale farmers sale their

cattle in the Zambian beef market chain. These results are similar to the findings carried out by Chilonda [6] and Lubungu [3,7].

Vertical integration is prominent in channel B and comprise the agribusiness firms involved in livestock and meat marketing in Zambia. Large commercial farms have vertically integrated agribusinesses performing the tasks of intermediaries in the purchasing of cattle from both small and commercial farmers, transportation, fattening the cattle in large feedlots to improve quality and weight gain, processing the beef in their large plants to make distinct products, supply and distribution to supermarkets and own outlets and finally selling and advertisement. The large commercial farms have created brands that are popular throughout the country and others supply specific geographic locations. There is heavy capital investment in these institutions to build facilities for livestock, processing and storage. The use of supermarkets and own outlets are prominent in channel B because of vertical integration. The butcheries in most supermarkets are run by the large commercial farms. Supply through independent butcheries and wholesalers is minimal in channel B because of associated costs and large number of outlets by large firms.

5.1.2 Transaction costs

A transaction can be defined as an exchange which occurs between two stages of the production or distribution chain as the product changes in form and/or in ownership rights. The changes in transaction costs in the red meat sector alter the relative costs of different forms of economic organization in the beef & agribusiness marketing and the most transaction-cost-efficient channel to market is selected [17,21,16].

The small-scale cattle producers (channel A) usually encounter market-related constraints such as poor infrastructure, high transaction costs and lack of information coupled with diseases and parasites, lack of feed resources and poor rangeland. The adverse factors increase the cost of production along channel A relative to the price received for the product. Unfortunately, the quality of the beef in channel A also fetches low prices on the market driving the farmers further into poverty as can be seen from the high poverty index in Table 2. The presence of intermediaries or mediators in channel A tend to reduce farmers share in the price paid by

consumers and one would tend to think that farmers would adopt channel AI, however, the perishability of meat, lack of transport and cold storage facilities, and distance from the markets tends to increase the risk of losing the meat through spoilage making the farmers use mostly abattoirs in channel AIV as the major route in channel A followed by butcheries and retailers (channel AV), wholesalers (channel AII) and beef traders (channel AIII) respectively. Cattle is used as a form of payment in traditional marriages as dowry (channel AVI) payed to the brides' family as settlement for bride price or damages. This forms a very important and long- lasting tradition among most tribes in the country especially in southern, western, and eastern provinces.

The commercial scale marketing chain (channel B) has huge capital investment and is highly integrated. This integration ensures that costs are minimised within the whole system. They possess bargaining power to negotiate cattle buying price from establishments and small-scale farmers. Most times they give an offer of price per kg live weight to their advantage. The high integration of the process from production, processing, distribution, marketing, and sales all aim to reduce transaction costs and maximise profits. Most of the beef sold through this channel passes through the processing plants owned by large commercial farms and is distributed via outlets (channel BIII) and supermarkets (channel BI) as major ways with a portion of consumers buying directly from the plants (channel BII) especially government departments, hotels etc though there is no price advantage only the deferred payment terms allows for existence of this channel. Channel BV is where beef enters the export market. Standard quality beef is sometimes sold by commercial farmers to wholesale companies and butcheries Channels BVI and BIV respectively and these channels are characterised by lower intermediary market margins as seen in Table 3 below, and as a result not so many of these entities use this channel.

Auctioning is a marketing channel rarely used by farmers and dealers. It usually takes place during the agricultural and commercial show and field days. Livestock are assembled at these events and sold by public bidding to the buyer who offers the highest price per head. Such livestock is mostly bought for breeding purposes and not for beef. The major transaction costs of this channel are incurred during the breeding and raring stages and transportation to auction venues. Other breeding stock is purchased by either small-scale farmers or commercial farmers at the farm gates of commercial farms for head improvement. This channel accounts for less numbers of animals sold but at a relatively expensive price making it one of the high value channel.

5.1.3 Distance from central business areas

The average distance of most farms in Zambia to the nearest established market is 24.7 kilometres with a standard deviation of 7.9 kilometres as expressed in Table 4. It was also found that the average distance to the nearest private livestock buyers was 26.4 Km with a standard deviation of 8.6 Km. Therefore, owning personal transport is very important to conduct of business. However, only a small proportion of about 2.1% of small scale farmers own transportation facilities as shown in Table 5 [5]. As a result, they choose the services of intermediaries who handle the issue of transportation. On the other hand, all commercial farmers possess some mode of transportation that work to their advantage in the market.

5.1.4 Hard infrastructure

The state has in the recent years built a few roads that have made a lot of areas accessible that were in the past hard to reach and has eased the transportation and movement of goods and services. However, the feeder roads that connect most districts still need to be worked on. The shortage of holding facilities such as pens and loading ramps coupled with poor feeder road networks, limited availability of transport and cold storage facilities, and lack of marketing facilities imposes a serious challenge on the marketing of livestock and livestock related products.

5.1.5 Availability of information

Lack of information on prevailing production techniques and market conditions, type of product demanded, quality, quantity, price, and market opportunities are the major factors that affect the farmers along the channels A as most of them rely on information by village cattle traders. The commercial farmers in channel B usually have access to information about prevailing market conditions.

Table 3. Average marketing margins for different market participants for beef cattle

Market Actors	Marketing Measure	Marketing Channels													
		Channel A						Channel B							
		AI	AII	AIII	AIV	AV	AVI	BI	BII	BIII	BIV	BV	BVI	BVII	BVIII
Quantity flow Producers	Kg/Head	155	155	155	155	155	155	270	270	270	190	270	190	500	400
	Price/Kg	23	23	23	23	23	23	28	28	28	24	28	24	32	28
	Price/head	3565.0	3565.0	3565.0	3565.0	3565.0	3565.0	7560.0	7560.0	7560.0	4560.0	7560.0	4560.0	16000.0	11200.0
Abattoir/ Integration	Price/head				4805.0			14850.0	14850.0	14850.0		17550.0			
	Gross margin				1240.0			7290.0	7290.0	7290.0		9990.0			
	Marketing cost				500.0			5103.0	5103.0	5103.0		8491.5			
	Net marketing Margin				740.0			2187.0	2187.0	2187.0		1498.5			
Butcheries	Price/head					6975.0					8550.0				
	Gross margin					3410.0					3990.0				
	Marketing cost					2216.5					2394.0				
	Net marketing Margin					1193.5					1596.0				
Wholesale	Price/head		5425.0												
	Gross margin		1860.0												
	Marketing cost		837.0												
	Net marketing Margin		1023.0												
Beef Traders	Price/head			6200.0									7600.0		
	Gross margin			2635.0									3040.0		
	Marketing cost			1844.5									2280.0		
	Net marketing Margin			790.5									760.0		
	Total Gross Marketing margin %	34.3	42.5	25.8	48.9			49.1	49.1	49.1	46.7	56.9	40.0		
	net marketing Margin %	18.9	12.8	15.4	17.1			14.7	14.7	14.7	18.7	8.5	10.0		
	Producer portion	100.0	65.7	57.5	74.2	51.1	100.0	50.9	50.9	50.9	53.3	43.1	60.0	100.0	100.0

Source: Own Computation

5.1.6 Level of education

The average level of education among small-scale cattle farmers was found to be 5.9 years with a standard deviation of 0.7 years. This education level is too low for farmers to understand basic production techniques that would help them improve their herd quality and require extensive extension services for meaningful development in this sector to take place. According to Lubungu, extension education in cattle husbandry should emphasize the importance of animal nutrition, such as forage management, breeding stock management, disease outbreak, vaccinations and business skills development [7].

5.1.7 Cattle diseases

Transboundary disease outbreaks affect the inter-provincial trade of live animals. As a result, farmers are forced to restrict their sales within home provinces, which in turn severely limits their available market options. Animal health issues are barriers to trade in livestock and beef products, whilst specific diseases decrease production and increase morbidity and mortality. Musemwa also found similar results, and says that diseases such as anthrax, foot and mouth, black-leg and contagious abortion are among the most prevalent [15]. The government through the ministry of livestock and fisheries usually puts a livestock movement burns which stops the inter-provincial trade in cattle which drastically reduces the demand of cattle especially in southern Zambia and drives up the beef price in the northern part of the country which leads to higher beef prices in region III.

5.1.8 Supply Inconsistency

Small-scale farmers often keep cattle as a store of value other than money and only convert to cash when they need school fees, during sickness or in the event were death arise. Multiple ownership of cattle within families also add to the seasonal supply and price fluctuations, as multiple people have to agree to a sale that supports only specific needs. These results are consistent with the findings of Lubungu in their study Analysis of Beef Value Chain in Zambia: Challenges and Opportunities of Linking Smallholders to Markets and they found that marketing channel tends to be highly seasonal, with traders intensifying their efforts in the rural areas during the months of September and October [3]. Most small-scale farmers have limited numbers of cattle due to small herd sizes, lack of marketable livestock numbers and poor body condition of livestock. Poor condition of livestock results in farmers getting low farm gate prices especially during dry spells. On the other hand, commercial scale farmers maintain a relatively constant supply to the market and treat the rearing of cattle as a business.

5.2 Factors That Affect Customer Market Choice

5.2.1 Cost and quantity

It was observed that most customers in channel A are more concerned about the cost and quantity of beef products than they are with quality. They care less on the heath issues in the beef market so long as they get the quantity at a lower price. Nonetheless, minimum health standards must be followed as the meat is inspected by veterinary assistants in all abattoirs and a meat inspection certificate is issued.

5.2.2 Quality and quantity

The middle class and upper-class consumers who make up a bulk of channel B customers care about the quality of the beef. As a result, the producers of beef take care to ensure the quality is delivered and health guidelines are followed to meet the expectations of the customers and government regulations and guidelines.

5.2.3 Distance to market

Consumers prefer to buy their meat from facilities near to them while those with own transport usually travel to their market of choice. Abattoirs and wholesales are usually far from residential areas and as such, butcheries and beef traders fill the gap by supplying within the communities, small towns, and cities while large commercial farm outlets are doted around large communities and shopping malls around the country.

5.2.4 Brand names and advertisement

There is a section of consumers that is only attracted to brand names from big companies that have been on the market for many years. That is because these companies run extensive advertisement programmes both on television and radio as well as bill boards.

5.3 Other Factors That Influence the Beef Market

5.3.1 Size of market

Limitation in the numbers of animals that can be sold at the abattoir. Due to lack of cold storage facilities and market size limitations, cattle dealers at abattoirs are divided into groups and are given days on which they can slaughter animals to avoid over flooding the abattoir and spoilage of beef. This is one of the major reasons beef in this market is cheap because the dealers fear spoilage of beef. On average, abattoirs in Zambia can only slaughter about 12 animals per day. This shrinks the size of the market as farmers and dealers wait in line for their turn to come. The lucky ones can sale to traders from cities who slaughter and transport the carcasses to towns. Beef market in channel A are limited to the geographical location of the marketing facility. In addition, channel A is most prevalent in southern, eastern, western, and central provinces of Zambia. The rest of the country does not have abattoirs and mostly only one wholesale or processing company per province and few butcheries.

The Large commercial farms can slaughter hundreds of animals per day which make them a very huge market for the sale of beef. They own cold storage facilities, refrigerated trucks among others which make them highly competitive and can transport beef and beef products to all parts of the country. As a result, channel B is a huge market that covers all parts of Zambia and beyond.

5.3.2 Type of breeds kept

In commercial farms, farmers maintain exotic breeding stock and improved local breeds from which offspring are selected for replacement of bulls, heifers, and the steers are sold to large scale beef processing companies. The breeds kept have a higher feed conversion ratio and attain maturity in a shorter time and has good meat quality acceptable in channel B. The small-scale farmers on the other hand keep mostly the local breeds which are smaller in size and reach maturity at relatively much longer time. The grade of the beef from these animals usually fails to enter the commercial market thereby making the farmers have no other choice but sale to the abattoirs.

5.4 Beef Market Efficiency

A lot of market considerations and key factors influencing the choice of channels of distribution are taken into account before farmers select a channel of choice [17]. In our current study, marking efficiency was measured by the producers' share, consumer price, transaction cost and other performance indicators. It can be seen from Table 3 that the portion received by the farmers in all the channels are above 50% indicating that the beef marketing channels in Zambia are efficient. Such an analysis was also used in the study Analysis of Market Structure, Conduct and Performance of Beef Cattle: The Case of Dugda District, East Shoa Zone, Oromia Regional State, Ethiopia [16]. Channel A indicates that the proportion received by the farmer is higher than that of channel B. However, in terms of actual monetary value channel B receives a higher price/kg of meat with high volume of sales, good customer reach and located in the prime areas where business is good. Despite the markets being efficient, there is need to improve the marketing efficiency especially in channel A where there are less handling facilities thereby increasing the transaction costs and reducing the marketing efficiency of the beef distribution networks. The vertical integration of channel B reduces the cost of marketing thereby making it a better channel though cannot be entered by most small scale farmers because the quality of animals and beef is of lower quality. The presence of middle men in channel A has for many years helped farmers who otherwise would face serious challenges to link with the market because of scarcity of market information, geographical limitations and many other factors as discussed above.

6. CONCLUSION AND RECOMMENDATIONS

It was found that Zambia has two major beef producers, small-scale and commercial scale farmers, and their distinct characteristics influence the choice of channel which they follow as channel A and channel B respectively. Channel A has sub-channels abattoirs channel AIV, butcheries and retailers channel AV, wholesalers' channel AII, beef traders' channel AIII and channel AVI in the order of their importance. The commercial channel B equally is sub-divided in large commercial processing channel BI, BII, BIII and BV which are the major routes followed by beef traders and butcheries channel BVI and BIV respectively.

Region I mostly have intra-provincial trade in beef as it is self-sufficient and is characterised by lower beef prices. In region II, there is an inter-mix of both the inter-provincial (supplemented by southern, eastern, and western provinces) and intra-provincial cattle trade characterised by relatively expensive beef. In this region, beef is usually packaged and comprises a larger market for commercial beef companies and many whole sale and retail beef outlets doted around the cities and towns. Furthermore, the customers are more concerned about the quality of the beef but those in compounds are more interested in quantity than quality. In region three, there are very few households that rear livestock especially cattle and mostly rely on supplies from region one and two to meet the region demands of beef. As a result, this region is characterised by high beef prices as citizens can only rely on butcheries mostly run by commercial companies for their dairy beef requirements.

The channels have various social economic factors which affect them. Channel A was found to have intermediaries to connect the sellers (farmers) and buyers. They collect cattle from wide geographical locations and bring them to a central market and act as disseminators of market information to farmers. On the other hand, channel B is a vertically integrated process with large commercial farms buying large numbers of cattle, processing, grading, packaging, marketing, distributing, and selling the beef and beef products.

The producer's choice of marketing channel to be used are affected by transaction costs, distance to market, quality and availability of infrastructure, access to market information, level of education, cattle diseases, and the ability to consistently maintain supply. There are three major categories of customers, the lower, middle, and upper class influenced by different attributes of the product such as quality vs quantity, price vs quantity, and distance to the market, brand name and advertisements.

The portion received by the farmers in all the channels are above 50% indicating that the beef marketing channels in Zambia are efficient.

It is recommended that farmers both small-scale and commercial scale should increase productivity and lower the transaction costs thereby reducing the prices for customers and increasing export quantities which has a potential to earn forex for the country.

There is need for more players to enter the small-scale farmers channel and invest in cold storage facilities which has the potential to stop wastage of beef and beef products and slightly increase the value of beef in this channel.

The need to train farmers on the right breeding stock and local breed improvement, increased investment in cattle health management, dissemination of price information, beef quality improvement, is more urgent now if small-scale farmers are to move out of poverty.

There is also a need to invest in marketing centres in order to reduce transaction costs across the country. There is need for the government, community members and stakeholders to collaborate in constructing and maintaining loading pens and cattle infrastructures which can promote livestock commercialisation among small-scale farmers and help them enter a high value and profitable marketing chain.

CONSENT

As per international standard or university standard, participant's written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIXES

The parameters appearing in both Table 2 and Table 3 are drawn from a national wide representative survey from all provinces in Zambia conducted by RAL 2015 and 2019 surveys [5,22].

Table 4. Socio-economic characteristics of producers in Zambia

Variable	Mean	Standard Deviation	Min	Max
Sales	22.1	7.2	13.6	34.1
Distance to Established Market	24.7	7.9	11.8	34.9
Distance to private livestock product buyers	26.4	8.6	15.1	36.6
Meat Consumption %	20	7.4	10.2	33.8
Livestock Income %	9.7	5.6	3.6	21

Table 5. Socio-economic characteristics of producers in Zambia

Variable	Mean	Standard Deviation	Min	Max
Household	0.3	0.2	0.1	0.75
Years of Education	5.9	0.7	4.5	7.3
Disease Control	66.6	18.3	29.8	87.3
Own Transport	2.1	1.5	0.4	6
Poverty Indices	76	8	58.4	84.3