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Research Article

COMPARATIVE CHAIN PERFORMANCE ANALYSIS: GOAT *(Capra hircus)* SUPPLY CHAIN IN NORTHWESTERN LEYTE

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This study carries out snowball sampling technique to document supply chain map and determine its performance in terms of efficiency and responsiveness of the goat industry supply chain in Northwestern Leyte. Results revealed that there were three chains identified in the area, namely: individual farmers who market their produced goats to a terminal goat market, the two registered associations, Tabango Integrated Goat Entrepreneurs and Raisers (TIGER) and Villaba Association of Goat Entrepreneurs (VILLAGE). Detailed supply chain mapping shows that goats from the farmers' point are brought to different places such as Cebu, Eastern Samar, Hinunangan Southern Leyte and Palompon, Leyte. Supply chain in the associations is generally simple, as it only constitutes direct seller-buyer market, while auction-market driven is a distinct configuration. Goat trading formally takes place once a week in the identified terminal market which were participated by processors, assembler-traders and end consumers. A simple supply and demand analysis revealed that there is a lack of the volume requirements by institutional and contract buyers, indicating an unmet demand and shortage of supply. This unmet demand opens a door of opportunity for goat production intensification in the area. Although profit margins were generated, logistical issues suggest production inefficiencies along the supply chain. Hence, this baseline information on goat supply chain provides empirical evidence on the need for improvement in the production to

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consumption in order to enhance the productivity of the goat industry in Northwestern Leyte, Philippines.

Keywords**:** supply chain map, chain performance analysis, association-driven, auction-market driven

1. INTRODUCTION

Goat production has played a vital role in rural areas, as these animals can easily adapt to different and ever-changing environmental conditions. Goats (*Capra hircus*) require simple management and low-cost production inputs, as well as transform feed into high-quality foods such as meat and milk (Castel et al., 2010; Alcedo et al., 2015; Domínguez et al., 2018; Tajonar et al., 2022). Data from the Food and Agriculture Organization (FAO) in a 2015-2020 average showed that the production share of goat meat is mostly produced in Asia (73.2%), followed by Africa (22.4%), the Americas (2.2%), Europe (1.7%), and Oceania (0.5%), with China being the main goat meat producer at more than 2.3 million tons (FAOSTAT, 2022. In addition, goat whole-fresh milk is mainly produced in Asia (59.9%), followed by Europe (14.5%), Africa (21.7%), and the Americas (3.9%), with India as the main goat milk producer at 5.7 million tons (FAOSTAT, 2022).

In the Philippines, the goat industry is considered a sunrise industry dominated by backyard raisers, but slowly becoming popular among commercial investors (DOST- PCAARRD, 2016). Though this industry is backyard dominated, its contribution to the socio-economic status of rural folks, and the Philippine economy as a whole, was evident in the past years (Alcedo et al., 2015). In fact, the total goat production in the country in 2021 was now estimated at 73.04 thousand metric tons, liveweight, which was 1.8 percent higher compared to the previous year's output of 71.72 thousand metric tons, liveweight, with Cebu province as the highest production recorded at 6.38 s metric tons or 8.7 percent of the country's total goat production (PSA, 2022). However, of the total goat population, backyard farms accounted for 98.8 percent of the total stocks. The remaining 1.2 percent comprised the inventory for commercial farms (PSA, 2022).

Goats are the most prolific domesticated ruminants (HVAP, 2011) and is considered the cleanest among all other kinds of meat, and raising it either for backyard farming or for commercial scale is cheaper and easier to manage than the other ruminant livestock animals (Cosadio et al., 2011). Goat production was mainly driven by the sustained demand for chevon for its continuously gained

popularity of having lower total fat, saturated fat, calories and cholesterol than the traditional meats such as pork, beef and chicken (Porciuncula and Padilla, 2017). Moreover, goats provide a lot of beneficial things to all the key players involved in the production to consumption, and hence, it is very important to trace, understand and manage its supply chains efficiently from upstream to downstream (Hastang et al., 2020). Supply chain analysis aims to utilize and capitalize on strengths, improve weaknesses, search and benefit from opportunities, and mitigate threats in the supply chains (Brown and Aranas, 2011). The supply chain management seeks to achieve specific gains such as reduction of product losses in transportation and storage, increase in sales, foster dissemination of technology and advanced techniques, provision of capital and knowledge among the chain partners, better information about the flow of products, markets and technologies, greater transparency in the supply chain, accurate tracking and tracing of product flows, better control of product safety and quality and large investments and risks are shared among partners in the chain (Vivanco-Aranda et al., 2010; Nasiru et al., 2013; Okewu and Iheanacho, 2015).

The Northwestern part of Leyte has been identified as one of the leading producers of goat in Eastern Visayas due to its topography, climate and abundance of forages and grasses eaten by goats. In fact, most of its populace are usually engaged in goat raising as smallholder because there is an identified terminal goat market that makes it easier for their produce to be marketed. An auction market located in the village/community (*barangay*) of Inangatan, Tabango, Leyte that takes place every Friday of the week has been identified as terminal market in which goats are one of the livestocks being traded and marketed in the area. Registered associations such as Villaba Association of Goat Entrepreneurs (VILLAGE) and Tabango Integrated Goat Entrepreneurs and Raisers (TIGER) were also identified to improve the goat industry in the area. Moreover, some individuals were also identified and qualified to bid for live goat supply that strengthens the goat industry in the area.

Despite its importance, the contribution of goat industry to the people's nutrition, livelihood and local economy is a bit underestimated (FFTC, 2008). This is largely because goat production is considered as small scale, and goat products seldom enter a formal marketing system. In fact, the marketing system of goats in the Philippines is as varied as the areas and location of goat farms (Jamandre et al., 2011). Jamandre et al. (2011) indicated that direct buying, wholesaling and retailing through auction markets and abattoirs, and trading through middlemen

are the most common marketing systems of goat in the Philippines. Furthermore, buying and selling prices are largely based on weight and size of goat.

Despite the importance of the goat industry, limited studies have been conducted from production to marketing. Undoubtedly, small scale goat production can augment livelihood and potentially uplift people out of poverty. It is important that policy makers intensify its efforts in enhancing agricultural productivity as means of easing out poverty and inequality in the region (Seriño, 2014). Marketing of goats has received limited attention and support. And so, its market conduct is still varied and there are only limited markets of goats. The Northwestern Leyte has been able to identify goat terminal market, which is very beneficial for goat farmers in the study area for their produce to be marketed. Goat farmers in Northwestern Leyte generally have two types, individual farmers who traded their animals in the said goat terminal market, which somehow makes marketing easy for them. But pricing may be the issue. The other types of goat raisers in the study area are those farmer-members of an association, who somehow haven't had a hard time in trading their goats, for there is a ready-market for them through their association, and pricing may not be an issue since farmer-members are being kept updated.

With this situation, there is a need to look closely on the marketing aspect of goats in the area for the benefit of all the participants. And since its identification of the terminal market, there had been no study conducted in the area to determine the overall responsiveness of the market area to potential buyers and traders. Hence, this study aims to determine the overall operation and performance of the goat market between the association-driven and auction market-driven supply chain in Northwestern Leyte. Specifically, this study has the following objectives: (i) develop supply chain maps for goats showing the activities and services, the key players involved, the product flow, as well as information and payments; (ii) determine the live goat supply chain performance of the association-driven and auction market-driven in terms of flexibility and overall responsiveness; (iii) identify areas for improvement and draw policy recommendations for the goat industry in Northwest Leyte that will bring the entire industry to a higher level of competitiveness and profitability.

2. METHODOLOGY

The study was conducted in the Northwestern part of the province of Leyte (Figure 1) involving goat key informants (KI): farmers, traders, and end

consumers. Information with regards to the relevant market was gathered for the identification of the starting point of tracing the supply chain between association-driven and auction market-driven.

Figure 1. Goat-producing municipalities in Northwestern Leyte (Source: Google Maps, 2022)

Data Collection

Following the Channel-Master Model framework, primary data gathering was done through personal interviews with key informant (KI) respondents using a snowball sampling technique. Starting from the identified industry champions, upstream as well as downstream tracing of the entire chain were done for each of the three major supply chains.

Further, industry publications and other relevant secondary information were also obtained from various government agencies such as the Department of Agriculture (DA), Philippine Statistics Authority (PSA), and other agencies. Moreover, participant observation technique was also done through observation on the activities performed by the farmers and traders in the market area.

Data Gathering Procedure

Supply chain mapping was done using the conventions of the six (6) key questions for supply chain analysis, namely; (1) Who are the key customers and

what are their product requirements?; (2) Who are the key players and what are their respective roles?; (3) What are the activities and services provided at each step in the supply chains?; (4) How do product, information and money flow through the supply chain?; (5) What are the critical logistic issues?; and (6) What are the external influences?.

The distribution of key informant respondents was influenced by the industry champions in a certain area. Starting from upstream level of interview, variation of number of farmer respondents in every barangay in the study area were identified through the associations' membership and individual goat raisers who participate in marketing and trading business in an auction market. Then from farmer's level, identified farmer-trader was traced for the next upstream level of interview. Finally, the actual consumer being interviewed as the downstream level to locate the existing supply chain in the study area.

Analytical Procedure

Descriptive analysis was used in the study. Mapping of key actors and markets was also conducted. Issues and concerns were documented through key informant interviews and results were presented in graphical format. Supply chain performance was analyzed using supply chain surplus estimation approach across the major players in the goat industry. Profitability analysis was used to compare several market options for the goat raisers. Secondary data of the goat industry covering the period 2010-2016 on production, slaughtering and market pricing information were retrieved from the Philippine Statistics Authority (PSA).

3. RESULTS AND DISCUSSION

Goat Supply Chain Mapping and Analysis

The analysis of the goat supply chain presents the key costumers and product requirements, the key players involved, activities and services, product information, logistic issues, and external influences. The entire goat industry supply chain in Northwestern Leyte is configured in terms of two general types of farmers: the association-driven and auction market-driven farmer. In the same aspect, Staal (2015) considered two alternative models that is similar to this study – household and enterprise models - of livestock production and marketing systems to avoid ambiguity in understanding the complex marketing and supply chain management. On the other hand, other livestock such as swine and poultry

in the in the Western Leyte have four alternative marketing channels available (Rola-Rubzen et al., 2002).

Association-driven Goat Supply Chain Map

Figure 2 describes the flow of goat routes along the association-driven/assembler-trader (AT). It is observed in the figure below that it is basically an AT-led, with a relatively shorter loop because AT is the only intermediaries along the entire supply chain length. In this setting, crossbred and upgraded types of goats were mostly the traded ones, as per their buyers' main preference. ATs were given at least three months by their regular buyers to source out the required volume with consistent physical traits. It will then be picked up by the buyers, which enables the association to save on transportation and handling costs during marketing. There are two major associations for goat supply chains operating in the area, the Tabango Integrated Goat Entrepreneurs and Raisers (TIGER) and the Villaba Association of Goat Entrepreneurs (VILLAGE). Spatial presentation in Figures 3 and 4 revealed that Northwestern Leyte is the main supply point of goats in the province and in most of the region 8.

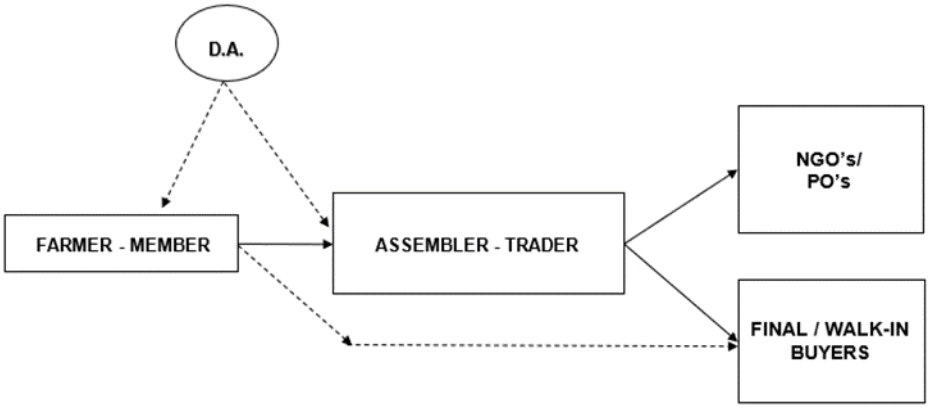

Figure 2. Supply chain map of association-driven of goat marketing in Northwestern Leyte

Note: *The solid line means that there exists a strong and dedicated relationship between actors/farmers and traders while the broken line means that the actor/farmer can choose which buyer to deliver their available supply depending on who gives them the best deal for their goats. While for the Department of Agriculture (D.A.), broken line means that somehow there is a lack of assistance by them to the industry players that may have resulted to the production and marketing problems.*

Largest buyers for the VILLAGE association-driven mainly comes from areas such as CEBU and Ormoc, City, Leyte (Figure 3). Their main buyers were institutional (for dispersal) and contract buyers (for multiplier). When the association meet the quantity required by the buyers, it will then be picked-up by the buyers, though sometimes the association will deliver the goats supply themselves, transportation costs will be reimbursed by the buyers.

For the TIGER association-driven operation, its major buyers were from Eastern Samar (contract- multiplier) and Southern Leyte (PO's-multiplier) (Figure 4). After assembling the required quantity demand, the buyers will then pick-up the goats in the association goat house. In terms of transport efficiency, TIGER association is a hassle-free market, for their buyers will be the one to get the traded animals from their area. As such, it was further noted that the flow of goat marketing supply of both associations is regularly contracted and institutionalized, which explains on why there is only a short loop of intermediaries.

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Figure 3. Spatial presentation for association-driven (VILLAGE) goat supply chain routes in Northwestern Leyte (Source: Google Maps, 2022)

Geographical locations of the VILLAGE association-driven goat supply chain map which includes the supply point and destinations of supply chain are depicted in Figure 3. There are two major routes traced namely: (1) Northwestern Leyte – Cebu; and (2) Northwestern Leyte – Ormoc City. These routes normally take a couple of hours to distribute from source to destination.

Figure 4 shows the association-driven (TIGER) goat supply chain. Its major routes of the destination of the product were as follows: (1) Northwestern Leyte – Eastern Samar and (2) Northwestern Leyte – Southern Leyte. These routes normally take a day for them to reach to their final delivery of the product.

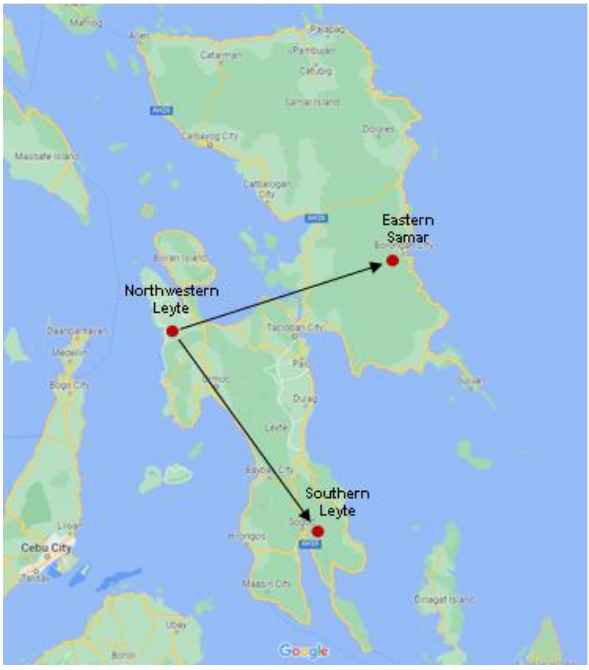

Figure 4. Spatial presentation for association-driven (TIGER) goat supply chain routes in Northwestern Leyte (Source: Google Maps, 2022)

Auction Market-driven Goat Supply Chain Map

The goat supply chain along the auction market has a distinct configuration compared to the supply chain routes along the association-driven (Figure 5). Though it was also observed that it is an AT led, other traders also interfere of the supply chain such as processor and walk-in buyers. ATs are also farmer-trader mostly belonging to an association-driven who did the canvassing

of goats for their quantity requirement for their final buyer. Of the 16 different marketing channels identified in the study conducted by Gebremedhin and Tesfaye (2015), it was found out that selling directly to consumers retained a 100 percent selling price, which rarely happens as it does rely on them having direct access to consumers. As the supply chain becomes longer and involves more transactions between different actors, farmers' share of the final price decreases (Onyango, 2013).

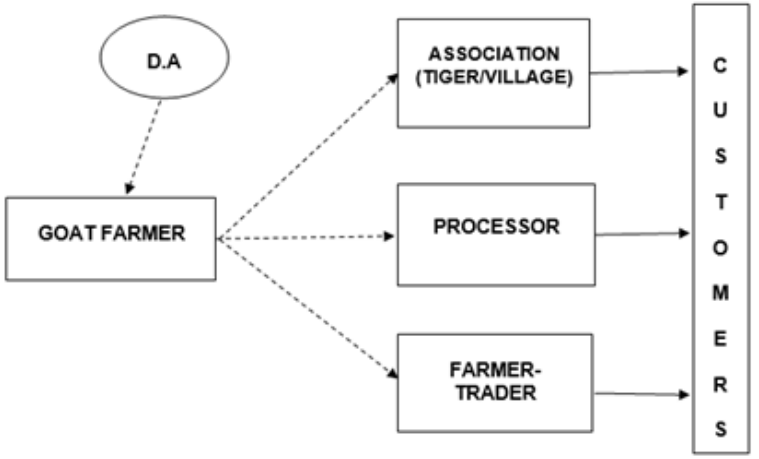

Figure 5. Supply chain map of auction market-driven of goat marketing in Northwestern Leyte

Note: *The solid line means that there exists a strong and dedicated relationship between actors/farmers and traders while the broken line means that the actor/farmer can choose which buyer to deliver their available supply depending on who gives them the best deal for their goats. While for the D.A., broken line means that somehow there is a lack of assistance by them to the industry players that may have resulted to the production and marketing problems.*

Auction Market-driven Goat Supply Chain

The geographical locations of the supply chain map along the auction market-driven depicted in Figure 6 has three major routes traced namely: (1) Tabango – Tabango; (2) Tabango – Villaba; and (3) Tabango – Palompon. These routes normally take just an hour or two to distribute from source to destination since these are just a neighbouring area from the auction market. Market systems in this setting has a distinct configuration compared to the supply chain routes along the association driven. Trading agreement in the auction market is very

different from an association-driven, as goat farmers in the area can choose on whom to deal their animals when there is a competition of pricing towards traders and processors, although rarely happens. But when there is no competition among traders, farmers get to have the lowest price the trader can offer. Hence, market efficiency between the two really differs. Gebremedhin and Tesfaye (2015) called this a loose oligopoly market structure which also violates the principle of equity between traders and farmers, as larger profit margins at the end of the chain is gained by the traders, giving them control over individual producers.

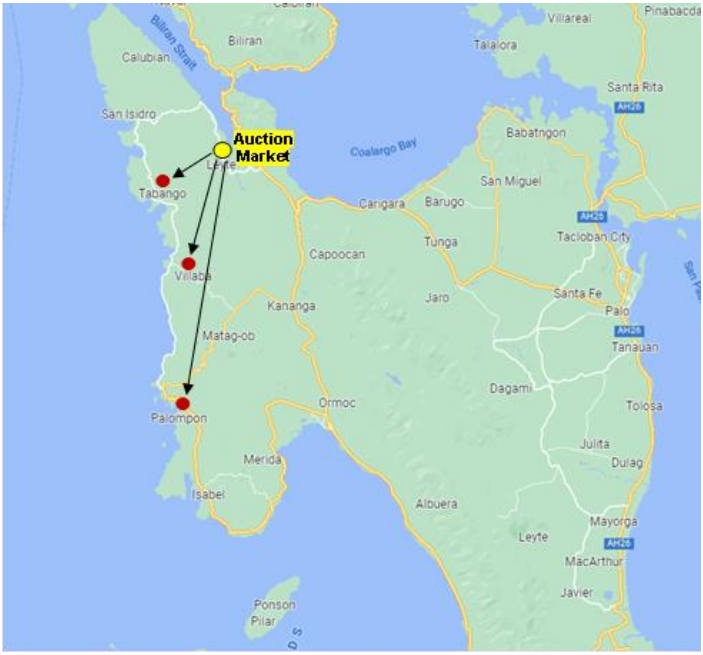

Figure 6. Spatial presentation for auction market-driven goat supply chain map in Northwestern Leyte (Source: Google Maps, 2022)

Key Customers and Product Requirements

Goats in the Northwestern part of Leyte were traded mostly in a live/raw form. Costumers for live goats were the traders, processors, retailers, contract buyers, institutional and walk-in buyers within or outside the Northwest Leyte (e.g., Palompon, Leyte, Southern Leyte, Cebu and Eastern Samar). Buyers from the two associations only takes place quarterly, and to meet the quality and quantity requirements of their buyers during marketing, the associations scouted and buy

animals at the identified terminal market every once a week, where individual farmer sells their animals.

The key customers of goat across supply chain are particular with the animal's physical form. Important product requirements in the goat supply chain across the auction market-driven include the breed, body weight and size (Table 1). Goat traders in Pangasinan, Philippines also considered the meatiness and sex of the animal before purchasing (Orden et al., 2005). Final consumer seldom buys meat-form, due to the fact that goat slaughtering does not happen usually in the area and hence, they are the ones to slaughter the animal at home.

For the association-driven, product requirements of their buyer/s do not differ from the auction market's which include the goat breed, body weight, age and size. The same product requirements can be found in the studies of Knights et al., (2005), Afzal et al., (2011), Naanep et al., (2012), Tesfaye and Tamir (2015), Ahmad et al., (2019).

Table 1. Customers and product requirements of goat across supply chain in Northwestern Leyte

Area (North western Leyte)	Supply Chain	Customers	Destination Per Customer	Product Requirement	Average Volume Traded Per Market-Quarterly (Per Head)
Tabango	Auction Market	Trader/ Processor/ Final Consumer	Palompon, Tabango and Villaba, Leyte	Breed, Body Weight, Age, and Size	3
	Tabango Integrated Goat Entrepreneurs And Raisers	Traders/ Walk-In Buyer	Tabango and Villaba, Leyte	Breed, Body Weight, and Age	1
		NGO's/ PO's/ Institutional Buyer	So. Leyte; Eastern Samar; Cebu	Breed, Body Weight, Age, and Size	95
		Trader/ Final Consumer	Tabango and Villaba, Leyte	Breed, Body Weight, Age, and Size	3
		Trader/ Walk-In Buyer/ Final Consumer	Tabango and Villaba, Leyte	Breed, Body Weight, Age, and Size	5
		Trader/ Processor/ Final Consumer	Palompon, Tabango and Villaba, Leyte	Breed, Body Weight, Age and Size	3

continuation Table 1.

Area (North western Leyte)	Supply Chain	Customers	Destination Per Customer	Product Requirement	Average Volume Traded Per Market-Quarterly (Per Head)
Villaba	Villaba Association Of Goat Entrepreneurs (VILLAGE)	NGO's/ PO's/ Institutional Buyer	Cebu; Ormoc City; So. Leyte	Breed, Body Weight, Age and Size	307
		Trader/NGO's	Palompon, Tabango and Villaba, Leyte	Breed, Body Weight, Age and Size	7
		Trader/ Final Consumer	Palompon, Tabango and Villaba, Leyte	Breed, Body Weight, Age and Size	3
		Trader/ Walk-In Buyer/ Final Consumer	Palompon, Tabango and Villaba, Leyte	Breed, Body Weight, Age and Size	4
		Trader/ Walk-In Buyer/ Final Consumer	Palompon, Tabango and Villaba, Leyte	Breed, Body Weight, Age and Size	2
Total Volume (Liveweight)					433

Note: *Data collection and interviews were conducted in 2017.*

Basing on Table 1, it can be gleaned that auction market-driven mainly traded their goats within the locality, while association-driven has been exporting in the neighboring region and/or areas.

Key Players and Their Roles

There were several key players identified in the supply chain. These players include input suppliers, auction market, and association-driven farmers, traders, and end consumers were the major industry players of goats in the area. The main role of the suppliers was to provide necessary inputs to farmers such as breeding materials. Farmers were classified according to the number of heads they raise. For farmers raising less than fifteen heads of goats, they were classified as small-scale/individual backyard raisers, while those having more than fifteen heads of goats, with pasture area are considered large-scale/commercial farmers, which are mostly identified in the area as an association.

Goat Farmers

Auction Market-driven (Individual Farmer). They are classified as individual/backyard raisers and farmers according to the number of heads of goats they are rearing. They usually raise fifteen or below heads of goats and dispose their produce in the market area with the traders, processors and retailers. Instances of farm-gate buying will also take place among the end consumers especially during special occasions.

Association-driven (Farmer members/Assembler-traders). Association-driven of goat farmers identified in the area includes the Villaba Association of Goat Entrepreneurs (VILLAGE) and Tabango Integrated Goat Entrepreneurs and Raisers (TIGER). They market their goats in a commercial scale of marketing and they usually have regular buyers that include contract buyers within and outside the locality (Dolores, Eastern Samar, Hinunangan, Southern Leyte, Cebu and Palompon), institutional buyers like the Government agency (for dispersal purpose), processors and individual walk-in consumers within and outside the area.

Traders

They are the ones who bring the product from the farmer's node to the final buyers. They are an important actor in the flow of the product. Accordingly, the margins they gain from market transaction is due to their experience and skills over any other type of buyer or seller, as they are good at evaluating product quality attributes of the animal. They may have been called as culprit for manipulating the product price by an additional amount, but they still helped in making the product reached to the end consumers' hand in the safest and easiest way possible.

End Consumers

They're the ones who utilizes the product when reach at hand in the downstream level. They are the last segment in tracing the supply chain. Consumers that were identified in the terminal market consist of food stalls which they used in their menu, and households for consumption and special occasions.

Activities/Processes Across Supply Chain

The flow of goat in the supply chain started from the farmers to the end consumers by which various activities and processes were performed. And in determining its supply chain mapping, the important thing to do is to understand

the activities that occur in each of the relevant actors (Kresnawati, 2013). Goats were produced by farmers in auction market and association-driven and moved into the buyers through marketing, which was categorized into traders, retailers, processors, contract and institutional buyers and end consumers. At the farmers' expense, main activities were done including the stock acquisition, breeding method, production system, care and management, housing, feeding, labor and disease control. Most of these activities were still locked-in traditional practice especially the farmers in an auction market-driven where technology and new methods are not yet practiced.

Table 2. Production activities performed by 30 key informants of goat farmers in Northwestern Leyte.

Production Activities	Auction market	Tiger	Village
	Labor Requirement- Average Cost (Php)		
Labor:			
Feeding/Pasturing	0	7,500	2,800 (200/day/14 days)
Cleaning the fence	0	(150/day/50 days)	
Weeding	0	11,250	
Replanting	0	7,500	
Housing Materials:			
Roofing, Walling, Flooring	1,500	141,956.33	10,000
Material Inputs:			
Breed stock	5,000	50,000	60,000
Lighting	30		50
Mineral supplementation	10	12,000	1,500
Water for drinking	5		20
Concentrate supplementation	0		150
Pest and disease control	75	57,700	200
Care and Management:			
Grooming and hoof trimming	0	50	66.66
Assist the doe when kidding	0	50	66.66
Lead kid to suckle colostrum	0	50	66.66
Segregation of animals for sale (feeding and managing them)	0	0	250
Slaughtering and/or meat processing	0	300	0
Others: Rope	100	200	500
Total:	*6,720.00	*288,556.33	*75,410.98

Note: * - *Auction market- per head; TIGER- per 100 heads; VILLAGE- per 25 heads*
Data collection and interviews were conducted in 2017.

Product, Information and Money Flows Across the Chain

Product flow encompasses the actual liveweight quantity/volume of goats flowing along the supply chain. It is determined by the total production traded per marketing. Results showed that the volume of heads of goats desired by final buyer (e.g., people's organizations (POs) or nongovernment organization (NGOs) are not usually met/satisfied (Table 3). In the association, animals were assembled according to the quantity requirements of their buyers. It would then be pick-up by the buyer at the associations' point. Supply chains in the association is relatively simpler and cost-efficient due to this marketing system. While individual farmers generally sell their produce to traders and end consumers at the terminal market every once a week, and it would inevitably incur them additional cost for transportation and food allowance. Moreover, it was found out that about 413 heads of live goats are traded quarterly across supply chains in Northwestern Leyte, which somehow often lacks the required quantity of the buyer at around 457 heads. Table 3 further shows that more than 50 percent of the traded supplies for goats came from an association farmer.

Table 3. Quantity of goats actually traded across supply chain in Northwestern Leyte

Area (Northwestern Leyte)	Supply chain champions	Actual quantity of goats traded (liveweight/quarter)	Desired quantity of goats ordered (liveweight/quarter)
Tabango	Person 1	90	150
	Person 2	2	--
	Person 3	5	--
	Person 4	2	--
Villaba	Person 5	307	307
	Person 6	2	--
	Person 7	2	--
	Person 8	3	--
Total Volume Actually Traded		413	457
Estimated Annual Volume (heads/year)		1,652	1,828

Note: *Data collection and interviews were conducted in 2017.*

Payment flows along the chain

Payment procurement is on cash-to-cash basis or cash on delivery (COD), especially between the goat raisers, traders/processors and end consumers. Cash advance and/or credit on consignment basis is also possible as in the case of the

associations-contract/institutional buyers trading due to their long-standing business transactions and their mutual trust (Table 4). Across supply chains, the product pass through at least two intermediaries before reaching to the final consumer, though sometimes it directly passes to the final consumer (direct buying). Traders in the chain gets the margin of at least 40 percent net. Although sex, age and size of the animals were considered in procuring, goat pricing is always determined by the breed of an animal. For better market price, product must be at least a crossbreed or upgraded.

Table 4. Mode of payment and trading agreement observed across 44 goat supply chains in Northwestern Leyte.

Supply Chain Players	Ave. Payment		Trading Agreement	
	Buying Price (Php/head)	% Loss/ Mortality	Mode/ Terms of Payment	Other Trading Agreements
Farmer	1,200.00	0	COD	None
Farmer-trader	1,500.00	0	COD	Provide cash advance
Processor	1,500.00	0	COD	None
PO's/NGO's End buyers	5,000.00	0	COD	Provide cash advance/consignment

Note: *COD means cash on delivery.*
Data collection and interviews were conducted in 2017.

Information flows along the chain

Technical information, sources of availability of goats and price were typical information flowing along the supply chain, whether there are fluctuations due to import costs/regulations, production costs, fuel price changes that affect transport of goats and available inventory (Jamandre et al., 2008). Across the supply chain level, technical information includes production, post-production, and marketing information which mostly obtained by key players from their own experiences and the trainings and seminars they have been attended which also helped them a lot in the management activities (Table 5). Capacity building activities have been highlighted as one of the mechanisms small-scale farmers can update their skills and management towards agricultural production (Mcdougall et al., 2019; Giles et al., 2019; Diacamos et al., 2021). Additionally, consulting technicians were also hired for their animal management practices. On the other hand, price information was sourced from prevailing market price, co-farmers and buyers (e.g., local traders, processors) through direct communication and was discovered through comparison or canvass (Abamo et al., 2011).

Internal Logistics Issues and Influences Across the Goat Supply Chain

The internal logistics issues and influences at the farmer's level are the following: poor breed type/quality, low marketable yield, lack of knowledge/technical know-how, lack of working capital, incidence of diseases (*e.g.*, foot and mouth, worms/internal parasites, viral orfs), and farmer's resistance of adoption to new technologies and practices (Figure 7).

Table 5. Flow of technical information along the goat supply chain in Northwestern Leyte

	Supply Chain Players			
Ways of Assessment	Farmer	Farmer-trader	Processor	PO's/NGO's/ End buyers
Kind of Information				
Production Information	Own experience; co-farmers; seminars and trainings	--	--	--
Post-Production Information	Own experience; co-farmers; seminars and trainings	Post-production activities	--	--
Marketing Information	Own experience; co-farmers; seminars and trainings	--	--	--
Sources of Information				
Production Information	Own experience; co-farmers; seminars and trainings	--	--	--
Post-Production Information	Own experience; co-farmers; seminars and trainings	--	--	--
Marketing Information	Own experience; co-farmers; seminars and trainings	--	--	--
Basis for Validation				
Production Information	--	--	--	--
Post-Production Information	Some have been consulting technicians	--	--	--
Marketing Information	--	--	--	--

Note: *-- means no data available.*
Data collection and interviews were conducted in 2017.

The same issues were found out in the studies of Staal (2015) in his small ruminant livestock production and marketing systems; Gebremedhin and Tesfaye (2015) in their live goats market chain analysis; Porciuncula and Padilla (2017) in their fresh goat meat supply chain study in Central Luzon, Philippines, Manalili

et al. (2020) in their dairy goat farm profiling in the Philippines and Barua et al. (2021) in their study on the sustainable value chain approach for livestock-based livelihood in Bangladesh.

Figure 7. Internal logistics issues and influences

External Issues and Influences

External issues put out a strong influence on the overall performance of goat production in the supply chain. Figure 8 summarizes the main issues and concerns mentioned by the kay actors and players of the supply chain. The common issues and concerns were the following: poor farm-to-market roads, unstable weather conditions, high transport costs, and insufficient support from the government in terms of financial and technical assistance. Policy makers may design interventions and relevant policies to enhance productivity and improve output growth in agriculture. (Seriño & Seriño, 2016). The poor farm-to-market road affected the market production of farmers in a way that supply is usually inadequate. Additionally, seasons and climate variability in the area may impose major constraints on the goat and other livestock market development (Hamza et al., 2014; Manalili et al., 2020). This is particularly relevant in Eastern Visayas, Philippines where farmers are facing unprecedented challenges in increasing productivity because of the occurrence of extreme weather events and changing climatic conditions (Ruales et al., 2020; Seriño et al., 2021).

Chain Performance Analysis

Strategic performance of a supply chain requires a good balance between responsiveness and efficiency that best meets the needs of the final customers (Abamo et al., 2011). To understand the supply chain performance in terms of the above parameters, we need to examine the various factors that drive the normal functioning of the chain (Chopra & Meindl, 2007). In terms of the goat industry in Northwestern Leyte, access to technical and price information, and supply sourcing are the most essential drivers of the chain system.

Figure 8. External logistics issues and influences

Transaction Costs Existing along the Goat Supply Chain in Northwestern Leyte

Transaction costs, as distinguished from production and marketing costs, are frictions brought about by using market mechanisms in moving the commodity along its supply chain, and if it will be eliminated, improvement in the efficiency of the goat supply chain could be achieved (Jamandre *et al.*, 2008). In the case of goat industry in Northwestern Leyte, transaction costs are associated with costs of facilitating sales negotiation, physical movement of goats and payment modes between each player of the chain. These includes product search cost, commission and communication, food and transportation allowance, and goodwill cost. Table 6 presents the varying costs faced by the supply chain actors. Assembler, traders and processors reported higher transaction costs as compared

to the farmers. More transaction costs are expected from the auction type market as compared to the association driven market.

Table 6. Nature of transaction costs existing along goat supply chain in Northwestern Leyte

Supply Chain Actors/Players	Nature of Costs	Supply Chain Links		
		Auction Market	Tiger Assoc	Village Assoc
Farmers	Commission (canvasser)	5	0	0
	Communication	10	10	10
	Quality and price downgrading	25	0	0
	Goodwill costs	25	0	0
	Total	65	10	10
Assembler-trader	Product search cost	10	0	0
	Transportation	150	100	100
	Commission (canvasser)	5	0	0
	Communication	10	10	10
	Total	175	110	110
Processor	Product search cost	10	0	0
	Transportation	150	100	100
	Commission (canvasser)	5	0	0
	Communication	10	10	10
	Total	175	110	110

Note: *Data collection and interviews were conducted in 2017.*

Profitability and Efficiency across Supply Chain Links

Supply chain profitability (also known as supply chain surplus) is the difference between the revenue generated at the final customer and the overall cost transmitted across the various stages of the chain (Chopra & Meindl, 2007; Abamo et.al., 2011). The higher the margin surplus of the supply chain, the more the chance that supply chain will be successful and operational. Results show that the average profit or surplus margin for the auction market is around PhP 3,730 and the for the association driven market is relatively higher at PhP 3,970. This is based on the assumption that the revenue per goat heas is around PhP 5,000.

Across auction market supply chain, the margin of supply chain profit is between 40 to 50 percent, while association-based goat supply chain, the margin of supply chain profit/surplus is between 50 to 60 percent (Table 7). It can therefore be said that association-driven is a more effective in goat trading and marketing compared to the auction market-driven. To improve profit, one of the ways is to reduce marketing margins, which can be done through streamlining costs and/or

reducing the profits of marketing institutions (Hastang et al., 2020). On the other hand, association-driven supply chain of marketing has an efficiency level of as high as 78 percent, which may be a good rate number for the association to continue functioning, though it may be undeniable that it still needs improvement.

Table 7. Profitability and efficiency of goat supply chain in Northwestern Leyte.

Supply chain actors/players	Supply Chain Links		
	Auction Market (PhP/kg)	Tiger Assoc. (PhP/kg)	Village Assoc. (PhP/kg)
Supply Chain Revenue (Per Head)	5000.00	5000.00	5000.00
Less:			
Supply chain costs;			
Farmers:			
Production/Processing	180.00	250.00	250.00
Marketing costs	75.00	0.00	0.00
Transaction cost	65.00	10.00	10.00
Subtotal	315.00	260.00	260.00
Assembler-Traders:			
Production/Processing	250.00	250.00	250.00
Marketing costs	50.00	0.00	0.00
Transaction cost	175.00	110.00	110.00
Subtotal	460.00	360.00	360.00
Processor:			
Production/Processing	250.00	250.00	250.00
Marketing costs	50.00	50.00	50.00
Transaction cost	175.00	110.00	110.00
Subtotal	460.00	410.00	410.00
Total Supply Chain Costs	1270.00	1030.00	1030.00
Supply Chain Surplus (Profit)	3730.00	3970.00	3970.00
Potential Supply Chain Cost	855.00	800.00	800.00
Profit/Surplus Margin	3730.00	3970.00	3970.00
Supply Chain Efficiency	0.67	0.78	0.78

Note: *Data collection and interviews were conducted in 2017.*

4. CONCLUSION

This study aims to provide baseline information of the goat supply chain in Northwestern Leyte. The following major findings of the study are highlighted. Goat production remains relatively small scale and outputs are largely marketed in the local areas and neighboring islands. The presence of local organizations like the Tabango Integrated Goat Entrepreneurs and Raisers (TIGER) and the Villaba

Association of Goat Entrepreneurs (VILLAGE) are helpful in keeping local supply of goats. Results show that both associations have better goat market supply chain compared to auction market-driven. The auction market-driven has lesser share of the supply chain margin/profit over the association-driven due to the organized and functioning group of the farmer members of an association-driven compared to the auction market. Farmer members of both associations can also trade their produce in an auction market, which is very advantageous to goat raisers, for they can still sell their goats whenever the association has no contract buyers. On the other hand, the auction market has some advantages too. For small scale farmers aiming to sell at the auction market can get better price under competitive marketing system and access to information. But entering in this market will entail costs. Marketing costs was more of a burden for the auction market-driven farmers because they have to spend for transportation to bring their goats to the market area. Meanwhile goats produce of the farmer members of the association-driven market will be picked-up by their buyers from their farm. This is convenient to the farmers as long as there is presence of a good farm to market road.

Results of the study documented various issues, problems and constraints in the current goat supply chain across the Northwestern Leyte. These issues and concerns were discussed during key informant interviews. These include poor breed type/quality, low marketable yield, unstable pricing standards, lack of knowledge/technical know-how, lack of working capital, incidence of diseases (e.g. foot and mouth, worms/internal parasites, viral ORF), farmers' resistance of adoption of new management practices and poor farm-to-market roads. These are being experienced first-hand especially by the auction market farmers. Marketing of goat produce can be enhanced through the presence of a workable farm to market road. Access and mobility are enabling factors in improving the goat supply chain. Results of the study suggests that interventions from the government, non-government organizations or other concerned agency needed to strengthen goat industry in the Northwestern part of Leyte.

5. CONFLICT OF INTEREST

The authors declare no conflict of interest.

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