Economic Analysis of the Milk Supply Chain in Swaziland

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Abstract
The Dairy industry in Swaziland is made of several of actors where small holder farmers are the main producers. A majority of the farmers sell their milk to informal markets rather than the formal market due to high prices offered by informal market. The study analysed the performance of the milk supply chain in Swaziland. A descriptive quantitative research design was used in the study and data were collected by personal interviews using structured questionnaires. The data were collected from 93 farmers, 16 retailers and 1 processor. Data were analysed using descriptive statistics and Gross margins. There were 73.1% male farmers and 50.5% had between 8 and 14 years of formal education. The channel that involved the processor had high marketing margins of E8.13, while the one involving cooperatives and shops had E4.00 and E3.00 respectively. There is a need for improving extension service, encourage cooperatives and improve the price of milk offered by the processor to enhance profitability of milk farmers.
Keywords: Marketing margins, marketing channels, milk supply chain, Parmalat, producer's share

1. Introduction
The economic efficiency and success of a dairy plant largely depends on the effective management of operations like acquisition of milk from the producer, processing and distribution of dairy products. An efficient marketing system is one, which minimizes the cost of marketing services. In addition to that, consumers should be provided with quality dairy products at a reasonable price. Thus, marketing of dairy products is an imperative component of dairy development and has drawn attention of planners, policymakers, researchers and trading communities (Rangasamy & Dhaka, 2008).

The dairy industry in Swaziland is made up of a number of actors that include milk producers (small, medium and large scale), processor, distributors, retailers, as well as consumers. All these actors are regulated by the Swaziland Government mainly through the Swaziland Dairy Board which is a regulatory and statutory agent of government (Dlamini, 2012). The Swaziland Dairy Board is a public enterprise wholly owned by the Swaziland Government. It was established in 1971 under the Dairy Act No. 28 of 1968. As provided in the Act, the Board's primary function is to develop and regulate the industry. The Board's role is to complement the government's efforts through the provision of a supportive socioeconomic environment for the development of the dairy industry aimed at achieving food security, poverty reduction, investment promotion, job creation and export promotion (Swaziland Dairy Board, 2010).

Parmalat took over the processing plant from the SDB in 1999. Parmalat is the only formal market to which dairy farmers could sell their milk. Parmalat buys process and distributes milk. SDB on the other hand develops and regulate the dairy industry by providing extension services to the dairy farmers and regulating the imports and exports of dairy products (Malima, 2005; Mavuso, 2010). Parmalat Swaziland receives raw milk from farmers around Swaziland through a tight scrutiny of the microbial culture and also imports from her sister companies in South Africa. Blue Cow distributors are the major distributor for dairy products in the country, while Emalangeni Foods are importers of dairy products from South Africa including Clover as well as Dairy Belle dairy products. Larger retailers like Spar and Pick and Pay as well as Shoprite do also import some dairy products from South Africa (Dlamini, 2012).

Most locally produced milk is sold fresh and as sour-milk in the informal market, which offers more high prices than the formal one. Only 32% is sold to the milk processors who constitute the formal market (CBS, 2010). According to SDB (2012) Swaziland has 444 dairy farmers and it was stated that there are only 11 farmers who supply the processing plant. The question is what is makes the other farmers sell elsewhere other than the formal market? Therefore, the main aim of the paper was to economically analyse the milk supply chain in Swaziland.

2. Objectives of the study
The general objective of this study was to analyse the milk supply chain in Swaziland. Specifically, the study sought to identify the marketing channels that milk producers use to sell their milk and also determine the marketing margins within the milk supply chain.

3. Supply Chain Performance

Market performance refers to the impact of structure and conduct on prices, costs, and volume of output (Pomeroy & Trinidad, 1995). The performance of a supply chain is defined by supply chain profitability, and has only one source of revenue, which is the consumer (Chopra &Meindl, 2001). According to Jema (2008) the two approaches, which can be used to measure marketing performance, are: marketing margin and the analysis of market channel efficiency. Several studies have analysed the marketing margins for different types of commodities to examine the performance of agricultural products marketing. The studies include those of Xaba and Masuku (2012), Anand (1979) and Birachi (2006). Jema (2008) argued that even though variations in the margin over time might be attributable to marginal marketing costs under perfect computation, additional factors such as seasonality, technological changes, and sales volume may also explain the variations in the margins.

According to Ramakumar (2001) marketing efficiency is essentially the degree of market performance. It is defined as having the following two major components: (i) the effectiveness with which a marketing service would be performed and (ii) the effect on the costs and the method of performing the service on production and consumption. According to Rangasamy and Dhaka (2008) a number of parameters like marketing costs, marketing margins and marketing efficiency depend on the structure of milk and milk products market. Supply chain performance emphasises the relationships between partners in the supply chain, integrating activities from the supplier to the customer while adding value, maximising profitability through efficiency, and achieving satisfaction (Sayuti, 2011). Effective supply chain management calls for an understanding of each factor affecting the supply chain. Decision drivers directly affect the supply chain strategic choice. These decision drivers include integration, collaborative relationships, information technology, production facilities, inventory decisions, sourcing decisions, location decisions, transportation and pricing (Ambe, 2012).

Marketing costs and margins of a particular commodity reflect the efficiency of a system to a great extent. The analysis of marketing costs and margins of dairy plants would help in reducing the unwarranted costs in marketing of dairy products (Rangasamy & Dhaka 2008). According to Ghorbani (2008), marketing margins are important indices in the evaluation of supply chain performance. Marketing margins are also calculated at different points along the supply chain and then compared with consumer price. Ghorbani (2008) defined it as the difference between price or value and he argued that it is a component of commodity price that the farmer does not get. Marketing costs and marketing margins are the comparison of prices along the supply chain at the same time. It is calculated in relation to the price paid by the consumer and expressed in percentage (Teka, 2009). Several authors (Smith, 1992; Kindeya, 2010) used the selling price and the cost price whereby the difference is expressed as a percentage of the other. They used the values to calculate the farmers share percentage, total margin percentage and mark up margin percentage. Xaba and Masuku, (2012) evaluated supply chain performance of vegetables using marketing channel performance and marketing margins. The marketing channel involves a series of intermediaries through which vegetables pass from producers to consumers.

A wide margin means usually high prices to consumers and low prices to producers. The marketing margin in an imperfect market is likely to be higher than that in a competitive market because of the expected abnormal profit. Marketing margins can also be high, even in competitive market due to high real market cost (Wolday, 1994). Ghorbani (2008) and Kindeya, (2010) stated that the overall marketing margin is simply the difference between the farm gate price and the price received at retail sale. It is important to sort out the producers' share in the consumers' price and to know the shares of different actors.

Abbott and Makeham (1981) defined marketing efficiency as the movement of goods from producers to consumers at the lowest cost consistent with the provision of the service that consumers desire and are able to pay for. The two approaches to measure marketing performance are marketing margins and the analysis of market channel efficiency. The existing channels can be analysed according to price and service provided. A producer can choose between the channels available, including selling directly to a retailer or consumer. Another option is to sell the entire output through intermediaries. Empirical evidence by (Abebe, 2009; Xaba & Masuku, 2012) showed that the largest producer's share was obtained through direct sale to consumers. This was because the producers used to obtain attractive prices and a higher share of the consumer price. On the other hand channels that had a long chain had high marketing margins while the producer's share is the lowest.

4. Supply chain of milk in Swaziland

Milk in Swaziland is produced by farmers, who either sell the milk to the processing firm or sell direct to customers using informal market system. In some instances the milk is consumed within the household. The processing firm either sells to retailers who in turn sell to consumers. Figure 1, shows the supply chain of milk as it moves from producers to consumers.
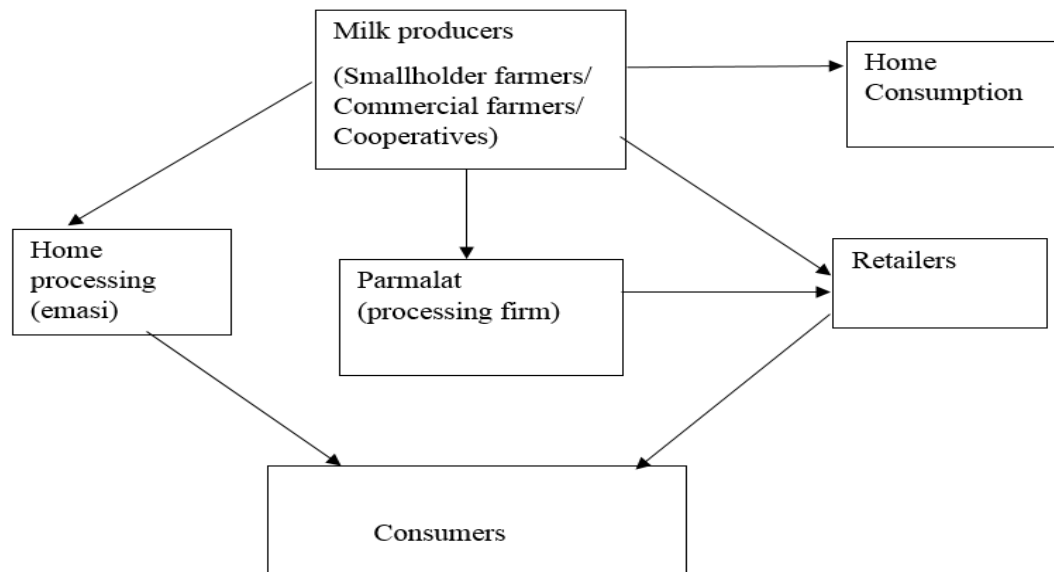
Figure 1: Milk supply chain in Swaziland
Source: Mavuso (2010)

5. Methodology

5.1 Research Design
A descriptive quantitative research design was used in the study to analyse the supply chain of milk in Swaziland.

5.2 Target Population
The target population was dairy farmers in Swaziland (N=444) dairy, processors of milk (N=1) and retailers (N=16). An up-to-date list of milk producers and traders of milk was obtained from Parmalat Swaziland and Swaziland Dairy Board.

5.3 Sampling Procedure
A two stage sampling procedure involving purposive and stratified random sampling procedure was followed to determine farmers to be included in the study. The Bartlett et al. (2001) table of determining sample size was used, hence 16 retailers, 1 processor and 93 farmers were sampled. The sample for dairy farmers were stratified and randomly selected according to the four regions of the country (Manzini, Shiselweni, Hhohho and Lubombo) to ensure that all the regions are represented.

5.4 Data collection
The study used primary data, which were collected using structured questionnaires and personal interviews. There was a questionnaire for dairy farmers focusing on identifying factors affecting milk market supply and dairy farmer's milk market participation, constraints and production costs. Retailers were interviewed on major marketing channels, marketing cost and margins, production and marketing constraints. The questionnaires were reviewed by experts in the Department of Agricultural Economics and Management to establish content and face validity.

5.6 Data Analysis
Data were analysed using descriptive statistics andquantitative methods were used to analyze the data collected.Marketing channels, gross margins and marketing margins techniques were used for measuring the supply chain performance.

6. Analytical Framework

6.1 Supply chain performance
The study used marketing channels, gross margins and marketing margins techniques to measure the supply chain performance. A series of studies have been done by different researchers (Ramakumar, 2001; Teka, 2009; Xaba & Masuku, 2012), where the performance of supply chain was analysed the marketing channels. The analysis of marketing channels involves tracing the product flow from the producer to its final destination which is the consumer.

A marketing margin is the percentage of the final weighted average selling price taken at each stage of

the marketing chain. The total marketing margin is the difference between what the consumer pays and what the producer receives for his product. In other words, it is the difference between retail price and farm-gate price (Cramers & Jensen, 1982). With a product that remains essentially unchanged during the marketing process, the difference between the price per unit at farm-gate and the price per unit when sold to the final consumer (retail price) is termed the Total Gross Margin (TGM). Various ways of presenting the same information are possible depending on the reasons for the analysis. Smith (1992) presented the information of farmers share, total gross margin and total mark-up and all was expressed in percentages.

To calculate the cost of marketing, the percentage of the total gross margin will be calculated as follows:

$$TGMM = \frac{consumer\ price - product\ price}{consumer\ price} \times 100$$

Where TGMM = Total gross marketing margin
The producer's margin is calculated as a difference:

$$GMMp = \frac{Consumer\ price - MGM}{producer\ price}$$

Where *GMMp* = Producer's gross marketing margin
        MGM = Marketing gross margin

To calculate farmer's portion or producer's gross margin (GMM$_P$) which is the portion of the price paid by the consumer that goes to the producer.

$$Producer's\ Share = \frac{producer\ price}{retail\ price} \times 100$$

6.2 Marketing Channels
According to Teka (2009) marketing channel analysis provides knowledge of the movement of goods and services from producer to consumer. Ghorbani (2008) studied the different types of marketing channels in Iran and found that some were simple, while others were complex.

7.0 Results and Discussion
7.1 Socioeconomic characteristics of sampled farmers
The results of descriptive analysis of the farmers' socioeconomic characteristics is presented in Table 1. The results indicate that 73.1 % of the farmers were males, while a small fraction of 26.9% were females. The study revealed that 49.5% of the sampled farmers were in the range of 40 to 54 years old. The youngest farmer had 26 years of age, while the eldest was 87 years old. The results further showed that 62.4% of the farmers had 5 to 9 members in their families. Mellor (1974) indicated that big family sizes are good because the members render cheap family labour to the farmer, enabling production to occur at lower cost. More than half (50.5%) of the sampled farmers had 8 to 14 years of formal education and 37% of the farmers had less than O'level education. A majority (63%) of the farmers had gone past the secondary education. Sharma (2009) stated that farmers with high level of education are expected to learn quickly new technologies than non-educated farmers and this will increase their productivity. Education enhances the skills and ability to meet food safety and quality requirements of modern channels and better utilize market information. Most of the sampled farmers raised dairy animals on part-time basis hence 65.6% of them were farming on part-time.

        The study results revealed that 88.2 % had no access to credit yet finance is important in dairy production for the purposes of veterinary medicine and feed for improved production. The findings of the study also revealed that 59.1% of the sampled farmers did not have any contact with extension worker. According to Kumar (2010) agricultural extension is a form of adult education, and can achieve results according to well-planned strategies, but the rate of change is often slow for some communities, even though it may be rapid for specific individuals. Therefore, farmers who had regular contacts with extension workers are likely to get good yields. Thus is because they had current production information. The results revealed that 72% of the sampled farmers had access to extension information, while 28% had no contact with extension workers. Market information is vital to market participation behaviour of farmers. It allows farmers to take informed decisions. On average the farming experience of respondents was 8 years and the highest monthly income was E350, 000 compared to the minimum of E490.

Table 1. Socioeconomic characteristics of sampled dairy farmers

Description	Frequency n=93	Percentage
Sex		
Females	25	26.9
Males	68	73.1
Age of the farmer		
25 - 39	7	7.5
40 - 54	46	49.5
55 - 69	35	37.6
70 - 87	5	5.7
SD=10.3		
Mean=52.7		
Min=26 Max=87		
Number of family members		
1 - 4	16	17.2
5 - 9	58	62.4
10 - 14	15	16.1
15 - 17	4	4.3
SD=3.119		
Mean=7.17		
Min=2 Max=17		
Number of years in formal education		
0 - 7	20	21.5
8 - 14	47	50.5
15 - 17	26	28
SD=4.599 Mean=11.6	Min=0 Max=23	
Status of dairy farmer		
Part-time	47	50.5
Full-time	46	49.5
Highest level education attained		
Up to primary	18	19.6
Secondary	16	17.4
O' level	28	30.4
Diploma	18	19.6
Degree	8	8.7
Post graduate	4	4.3
Farmers' access to credit		
Yes	11	11.8
No	82	88.2
Frequency of extension visits		
Zero	55	59.1
Once a year	7	7.5
Two times a year	17	18.3
Four times a year	14	15.1
Access to market information by farmers		
No	26	28.0
Yes	67	72.0
Number of years in dairy farming		
1– 8	61	65.6
9– 16	24	25.8
17-25	7	7.5
26– 31	1	1.1
SD=5.795 Mean=8.14	Min=1 Max=31	
Monthly income from dairy		
450 – 1000	7	7.5
1001 – 5000	67 .	72.1
5001 – 10000	8	8.6
10001 – 20000	4	4.3
20001 – 50000	3	3.2

50001 – 350000	4		4.3
SD=44538.23	Mean=12489.25	Min=490	Max=350000
Monthly income from wage employment			
500 – 3000	5		13.9
3500 – 9000	17		47.2
10000 – 16000	11		30.6
17000 – 36000	3		8.3
SD=6648.22	Mean=9629.72	Min=500	Max=36000

7.2 Average quantities of milk sold at various markets per month.

Table 2 shows the different outlets where farmers sell their milk. The results revealed that most (36.2%) of the milk is sold to Parmalat and 35.3% sold to local customers. The farmers who sold to Parmalat were large scale farmers. Total milk produced per week by the farmers was 55818 litres per week and 54257 litres was sold, which is 97.2 % of the milk produced. The results in Table 2 revealed that 2.8% of the weekly production was used for feeding the family and calves. Only 4.3% of the total milk was sold to cooperatives by the sampled farmers.

Table 2. Milk flow to various outlets per week

Market	Average Quantity of milk (litres)	Percentage
Local customers	19705	35.3
Parmalat	20181	36.2
Shops	11970	21.4
Cooperatives	2401	4.3
Home use and calves	1561	2.8
Total milk sold	55818	100

Total sold per week =54257 litres

Percentage sales per week= 97.2

Figure 2 shows the direction of milk flow from the producer to major market demand. The figure further explains the relative importance of the milk marketing participants in terms of volume across the supply chain and their linkage. Figure 2 shows that out of all the milk produced by farmers, 37.2% is sold to Parmalat which is the major processing firm in Swaziland. Farmers also sell large volume (36.3%) of milk direct to consumers and 2.8% is used for feeding calves and home consumption, while 4.3% is sold through their cooperatives. The results further showed that 22.1% the milk produced by Parmalat is sold to retailers, and 59.3% of the milk that consumers receive come from retailers. Retailers get their supply from Parmalat (37.2%) and direct from producers.
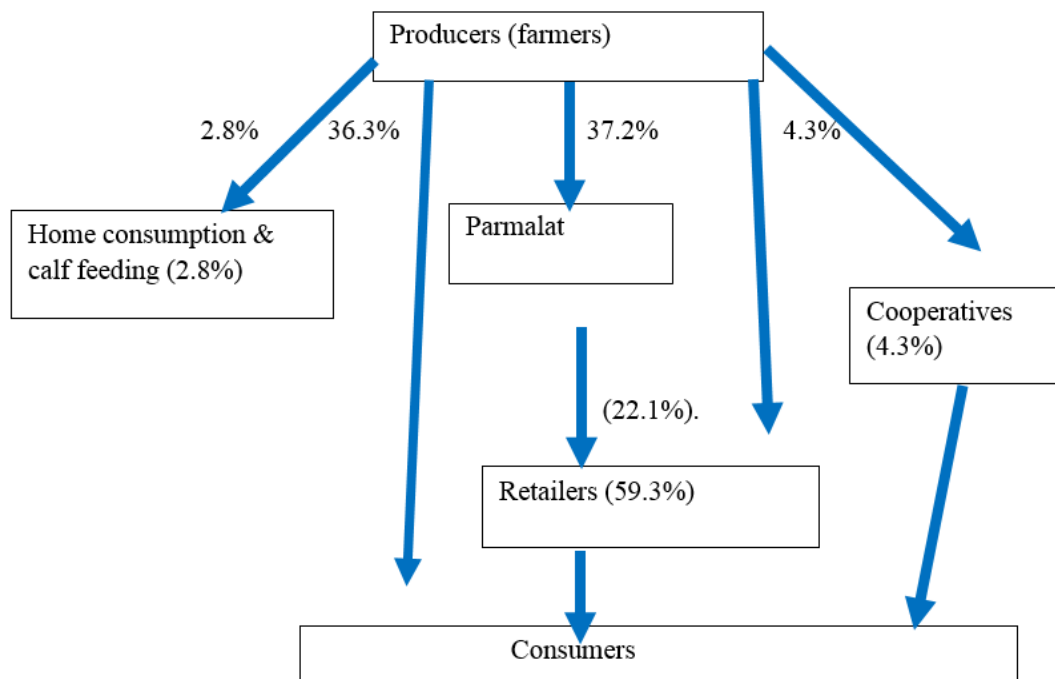
Figure 2: Milk supply flow in Swaziland

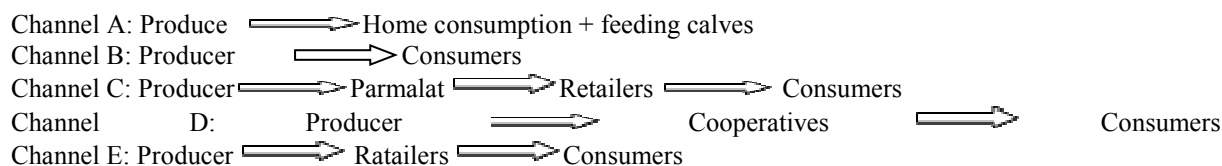### 7.3 Milk marketing channels and market margins

A marketing channel is the sequence of intermediaries through, which a product pass from farmers to consumers (Mendoza, 1995). They are the outlets or routes through which commodities move through to reach the final consumers. The analysis of marketing channels was intended to provide a systematic knowledge of the flow of the goods and services from their origin to the final destination. The outlet that farmers normally target for their marketable surplus is the local market. Figure 2 showed a summary of the channels through which milk in Swaziland is distributed identified as -The research identified for different marketing channels.

7.4 Major marketing channels

The study identified five outlets through which milk in Swaziland is distributed. Channel A and B were the shortest with only two actors while channel C was the longest. Table 3 indicates that Parmalat received 36.2% (20181 litres) per week of the milk from farmers. This channel was closely followed by the farmer to producer outlet with 35.3% (19705 litres). The results also indicated that selling direct to consumers had a larger producers' share 100% and was followed by farmer -retailer - consumer with 75% as a producers' share. The longest channel which involved farmer-Parmalat-retailer-customer recorded the highest total gross marketing margin ofE8.13. These results were in line with Kideya (2010) who stated that a wide marketing margin means that the consumer is paying more while the share of the producer is low. On the other hand the channel that included producer-retailer-consumer had a total gross marketing margin of E4.00.

Table 3. Market channels and marketing margin analysis for milk

Market actors	Marketing measures	Milk marketing channels				
		Chan A	Chan B	Chan C	Chan D	Chan E
		1561	19705	20181	11970	2401
Quantity flown per week (litres)						
Producers	Price/ litre	9.73	9.73	4.50	6.00	9.00
Coops	Price/litre	_	_	_	10.00	_
	Gross margins/litre	_	_	_	4.00	_
Shops	Price/litre	_	_	_	_	
12.00		_	_ . 3.00		Gross margins/litre	_	_
Parmalat	Price/ litre	_	_	10.55	_	_
	Gross margins/litre	_	_	6.05	_	_
Retailers	Price/litre	_	_	12.63	_	_
	Gross margins/litre	_	_	2.08	_	_
Total Gross Marketing Margin		_	_	8.13	4.00	3.00
Producers portion (%)		100	100	35.63	60	75
Rank of channels by producer's share		1	1	5	4	3

Channel A: Produce ⟹ Home consumption + feeding calves
Channel B: Producer ⟹ Consumers
Channel C: Producer ⟹ Parmalat ⟹ Retailers ⟹ Consumers
Channel D: Producer ⟹ Cooperatives ⟹ Consumers
Channel E: Producer ⟹ Ratailers ⟹ Consumers

7.0 Conclusions and Recommendations

7.1 Conclusion

Based on the findings, the study concludes that there were very few female farmers (26.9%) involved in dairy farming in Swaziland. This could be as a result of the fact that milking is seen as a man job even though most small enterprises in Swaziland are dominated by females. It was noted that the help by extension service was minimal yet their contribution could be important in uplifting the milk supply chain in Swaziland. The milk flow is among five actors namely the producer, retailer, Parmalat, cooperatives and consumers.The highest producer's share was obtained through the channel where the producer sells direct to consumers and the channel that involved 4 actors gives the least producer's share. Most producers prefer the channel with the highest farmer's share because they sell at a higher price compared to selling to Parmalat.

7.2 Recommendations

Based on the findings of the study, the following recommendations were made in order to improve production of milk in the industry, while minimizing costs.

1. The Swaziland government needs to subsidise the price of milk that Parmalat pays to the producers. This can encourage more farmers to join the formal market, hence reducing imports on milk.
2. Farmers should buy inputs as a group rather than individuals. They can do this through collective action whereby they pool their money together and share transport costs and lowering the cost of transactions

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