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Effect of Transaction Costs on Current Milk Marketing Structure in Uasin Gishu and Nandi North Districts in Kenya

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Abstract

The improvement of milk production is a key issue in Kenya since the country relies heavily on agriculture for economic growth. However, there is inadequate empirical evidence on the extent to which transaction costs constraint or prevent access to information and markets, especially for small-scale dairy farmers. This paper highlights the factors determining the milk marketing structure based on a study to assess marketing constraints faced by small-scale dairy farmers in Nandi North and Uasin Gishu districts. A combination of multi-stage, simple random and systematic random sampling methods was used to select the study district and small scale dairy farmers, where 270 respondents were interviewed using structured questionnaires and interview guides. An analysis of the milk marketing structure in the area showed that farmers facing considerable transactions costs were likely to sell surplus milk to their neighbours and hawkers rather than to milk processors, milk bars and farmer cooperatives. The study concluded that accessibility to formal market outlets is limited by considerable farm-to-market distance, poor infrastructure, inadequate transportation, and constraints of acquiring knowledge about milk prices, searching for buyers, negotiating, bargaining and monitoring milk contracts. It is recommended that due consideration be given to the development of a better physical and institutional infrastructure which would effectively link these producer areas to markets and improve market knowledge by providing relevant market information and farming skills

Keywords: Effect, Transaction Costs, Current Milk Marketing Structure, Uasin Gishu District, Nandi North District, Kenya

1. Introduction

It is now widely accepted that the costs of arranging exchange may reduce or even prevent exchanges from occurring and give rise to institutions and organizations to offset their negative impacts. The nature of milk and its derivatives partly explains the transactions costs associated with dairying. As a highly perishable and bulky product, milk requires rapid transportation to consumption centres and processing at relatively high cost (Delgado *et al.*, 1999).

In Eastern Africa, empirical evidence on the nature and importance of transaction costs in dairying is scarce. As a result, the few studies that have addressed the issue have tended to infer the magnitude of transaction costs incurred from indirect evidence of lack of commercialization. Indirect, as such evidence may be, suggests that both small and large scale dairy producers face high transaction costs, though at different levels, and that these influence production and marketing behaviour in a manner detrimental to efficiency and equity (Staal *et al,* 1997).

1.1 Transaction Costs and Milk Market Development in East Africa

The nature of milk and its derivatives partly explains the transaction costs associated with dairying. As a highly perishable and bulky product, milk requires rapid transportation to consumption centres and processing at relatively high cost (Delgado 1999).

In a study on small-holder dairying under transaction costs in East Africa (Kenya and Ethiopia), Staal *et al,* (1996) show the role of transaction costs in smallholder dairy marketing. According to their findings, transaction costs in East Africa dairy are high as evidenced by the low percentage of milk production that is commercialized in Kenya and Ethiopia, compared to that in developed countries. Transaction costs increase with distance, most likely faster than transportation costs alone, due to the increased cost of information and risk of dairy product spoilage before a buyer is found. Staal *et al.* (1997) also suggest that the role of organizations of collective action (such as processing parastatals, cooperatives, "self-help" groups) in reducing transaction costs is a recurring theme in small-holder dairy development in East Africa. When effectively managed, such organizations reduce

transaction costs for both the producers and buyers of dairy products. This reduction in costs is typically due to economies of scale in collection and transportation and also because organizations reduce the need for information about widely dispersed and small-scale buyers and sellers. Therefore, research on household and sub-section models that better integrate both existing transaction costs, but including the institutions and contracts that govern individual transactions, would be beneficial in a broader sense (Staal *et al.,* 1997). Evidence of declining transaction costs have also been observed by Ensminger (1992) among the Orma people of Eastern Kenya. Trade, increases as transaction costs of trade decline, thus affording better terms of trade, in part as a consequence of the spread of common institutional structures among both the Orma and their trading partners. The new institutions take the form of both conversion to Islam and state-imposed institution such as county regulated weights and measures, improvements in roads and telecommunications, and improved security.

In Eastern Africa, empirical evidence on the nature and importance of transaction costs in dairying is scarce. As a result, the few studies that have addressed the issue have tended to unfix the magnitude of transaction costs incurred from indirect evidence of lack of commercialization. Indirect, as such evidence may be, suggests that both small and large scale dairy producers face high transaction costs, though at different levels, and that these influence production and marketing behaviour in a manner detrimental to efficiency and equity (Staal *et al,* 1997).

The role and potential effects of transaction costs on the structure, production and marketing in Eastern African Countries can be illustrated using data from recent survey of dairy cooperatives in central province, Kenya and of dairy producers in Addis Ababa Peri-Urban area, Ethiopia. Data from the two countries show that only a small portion of domestic dairy production is marketed. In Ethiopia, which has significant per capita milk production, only 5% of estimated national production was commercialized in the early 1990s. In Kenya, the African country with the largest number of small-holder dairy producers selling milk off-farm, estimates of commercialization in 1990 ranges from 45% to 48% (Akwabi-Ameyaw, 1997).

In Ethiopia, most milk and dairy marketing occurs through the informal sector. Almost 88% of all urban milk is supplied as raw milk through the informal market, largely by small-scale producers. Few large farms or collective marketing organizations exist, so that production and marketing costs reflect the dispersed and small-scale nature of the dairy sector. The parastatal collection system, Dairy Development Enterprise (DDE) which acts as a buyer of the last resort, handles only 12% of urban milk supply and pays the lowest average prices (Delgado, 1999).

Thus, direct sales by producers, individual and institutional consumers, by-passing the dairy parastatal and private middlemen, constitute the bulk of milk sales in Addis Ababa milk shed. In this environment, both producers and consumers of dairy products appear to put a premium on contracting, with only a small number of clients/suppliers, suggesting that transactions costs are especially high in open milk markets.

There is, however, considerable variation in the importance of marketing outlets depending on the scale of production and on the location (proximity to urban markets). Consistent with this, the sources of average dairy and dairy related revenues and costs differ between small and large producers and between urban and peri-urban producers of the same size. Since different producers face different levels of transaction costs, depending on asset (capital intensity) and information levels, season, location, they respond to these differential costs with differential sales strategies.

As a general rule, transaction costs increase with distance due to the increased costs of information and risk of dairy product spoilage before a buyer is found. Thus farmers located farther away from Addis-Ababa have significantly less attractive options for disposing of their milk. Average revenue per ton of milk in the survey was remarkably similar across producer types. But the unit cost for large urban producers was much lower than for other types of producers, especially with respect to feed costs. Low credit availability, combined with the capital-intensive nature of large-scale dairying partially explain the predominance of small-scale production (Nicholson, 1997). Overall, small-holder dairy producers in Addis-Ababa milk shed appear to generally face higher transaction costs than large producers. The prices received by producers decrease with distance and appear to vary considerably depending on the size of sales and the flexibility of contractual relationships between producer and consumer. Smaller producers receive lower pieces than larger producers in some marketing channels (Deborah & Berhanu, 1991).

In terms of organizations of collective action, Kenya's experience with the Kenya Cooperative Creameries (KCC) as a buyer of last resort seems to indicate that fully fledged processing company like KCC can lower transaction costs during the initial phase of smallholder dairy development. Indeed, KCC initially served to

reduce transaction costs through pooling risk, lowering collection and search costs, making input available to farmers and rendering milk supplies more reliable (Omore *et al,* 1999). In recent years, however, severely compromised by pan-seasonal and pan-territorial pricing policies adopted for political reasons, milk prices paid by KCC to co-operatives and producers have failed to keep pace with increases in input prices, and payments for milk supplied have been delayed, exposing producers to higher risks and irregular cash flow (Staal *et al.,* 1998). In 1992, the Kenya Government liberalized the dairy industry, revoking the KCC's monopoly on urban milk sales. This resulted in the rapid development of a variety of "self help" groups and dairy co-operatives that largely emerged in response to the continued delays in milk payments by the KCC. These groups began to explore alternative market outlets, but only in regions where transportation and other transaction costs permitted. In avoiding KCC payment delays, however, those co-operatives had to contend with considerable uncertainty and high transaction costs, of searching for market outlets, screening trade partners, bargaining, monitoring contractual agreements with customers (Staal *et al,* 2001).

1.2 Cooperative as Catalysts of Milk Production and Marketing

A common form of collective action to address access problems of this type is a participatory, farmer-led co-operative that handles input purchasing and distribution and output marketing, and usually offer some form of bulking or processing. Farmers gain the benefit of assured supplier of the right inputs at the right time. Often these include credit against output deliveries and an assured market for the output at a price that is not always known in advance but is applied equally to all farmers in a given location and time period.

Extension is sometimes part of the services provided, typically at higher levels (and quality) than state extension services. Co-operatives, by providing bulking and bargaining services increase outlet market access and help farmers avoid the hazards of being encountered with a perishable product with no rural demand. In short, participatory co-operatives are very helpful in overcoming access barriers to assets, information, services and indeed to the market within which small-holders wish to produce high value items. Like contract farming producer – co-operatives can offer processors/marketers the advantage of an assured supply of the commodity at known intervals at a fixed price and controlled quality. They can also provide the option of making collateralized loans to farmers. For processors or marketers, such arrangements eliminate the principal-agent issues faced by collectives and out grower schemes in monitoring effort by the individual producer, providing better relations with local communities than large-scale farms, avoiding the expense and risk of investing in such enterprises, sharing production risk with the farmer and helping ensure that farmers provide produce of a consistent quality (Groch 1994; Delgado, 1999). Producer co-operatives, however, are unlike contract farming schemes with respect to negotiations among different partners. If the issue in contract farming revolves around the power of farmers to negotiate with processors in producer cooperatives, the issue in the co-operatives themselves is the power of members, collectively, to hold management accountable.

Producer co-operatives in Africa have had a generally unhappy history because of difficulties in holding management accountable to the members (moral hazard) leading to inappropriate political activities on financial irregularities in management and also due to the over-ambitious investment in scale and enterprise beyond management's capability. The degree of moral hazard seems to be greater if co-operatives are generally in their orientations rather than created for specific purposes, such as farmer-run local milk marketing co-operatives in Uganda and Kenya (De Janury *et al,* 1993; Akwabi – Ameyaw, 1997; Staal *et al,* 1997). In Ethiopia, however, the perception exists that there may be enormous potential for their role, in consent with production innovations as market precipitators (Niehilson, 1997).

1.3 Importance of understanding Transaction Costs and Marketing Structure

Nandi North and Uasin Gishu dairy farmers, like those in the rest of the country, can sell their surplus milk either in formal or informal channels. Informal channels include selling milk at the farm gate, to their neighbours or hawkers who visit the farmers. Formal channels include selling milk to cooperative societies, milk bars in town, and to milk processors. There are various patent benefits associated with selling milk formally rather than informally, such as higher milk prices, regular monthly incomes, and ability to obtain substantial credit. Despite clear advantages of selling milk via formal channels, it has been observed that a large proportion of dairy farmers in Uasin Gishu and Nandi North sell milk through informal channels. This paper hypothesizes that one of the explanations for this situation could be that the farmers selling milk informally could be facing huge transaction costs associated with selling milk in more formal channels. This is because one of the major problems arising is the cost of arranging exchange that may reduce or even prevent exchanges from occurring. Transaction costs include the costs of searching for and screening trading partners, bargaining with potential trading partners to reach an agreement, and transferring (transporting, processing, packaging and securing title) the exchanged products, monitoring the agreement to see that its conditions are fulfilled and enforcing the exchange agreement

(Kiriro, 2001). Hence, it is necessary to examine whether or not transaction costs could be preventing some farmers from selling milk in formal channels. Little is known about the effect of transaction costs on marketing of milk by the rural poor, their predisposition towards exchange, and the institutional framework that may impact on these costs. Given the necessary data, there is enormous scope for empirical inquiry around these themes and the use of modern techniques to derive sound policy conclusions.

Dairy farmers in Kenya produce milk under three main production systems: grazing, semi-zero grazing, and zero grazing systems (Karanja, 2003; Lanyasunya *et al*., 2006; Staal *et al.,* 1998). These three systems have been noted to produce different volumes of milk per cow. Since milk is a highly perishable and bulky product, it implies that when its quantity increases, it also results in an increase in variable transaction costs associated with its marketing. In addition, for farmers to obtain good returns from selling their milk they must elevate the quantity of milk produced by their animals. This paper also hypothesizes that if farmers could sell more of their milk (because they are producing more), they could help reduce some of their transaction costs, such as those of transportation, by buying some means of transport, for example, motorcycles, tractors and trucks. Thus, it is crucial to investigate the socio-economic factors responsible for production of little amounts of milk in Kenya.

In summary, understanding the raw milk market structure in relation to transaction costs and the nature of the constraints limiting dairy production is a key policy issue which calls for in-depth research in this area, if the livelihood of small scale farmers in the area is to be improved. This paper, therefore, examines covariates representing factors affecting production, consumption and marketable surplus in order to establish the extent to which they influence milk marketing. The raw milk market structure was also established in order to understand the market opportunities available to small scale farmers.

2. Materials and Methods

The study was conducted in Nandi North and Uasin Gishu Districts, situated in the western part of the Rift Valley Province of Kenya. The two districts are situated at an altitude that ranges from 1300 to 2200 metres above sea level. The districts are endowed with an abundant resource base in terms of arable and fertile soils, water and forestry. The area is classified as being of medium to high potential. The districts' fertile soil has considerable potential for livestock, food and cash crop production. The soil types and distribution vary according to the parent rock from which they were formed but most parts of the districts have predominantly deep soils with high organic matters.

This study employed a descriptive survey research design that enabled it collect requisite information about dairying variables, as they existed within the population. The target population was all the farmers living in Nandi North and Uasin Gishu Districts, who carry out dairy farming and produced marketable milk surplus, that is, farmers who sold at least some of the milk they produced. Multi-stage technique used to divide the research area into progressively smaller units from which respondents were sampled to be employed in the study. Based on the list of dairy farmers in the two districts used in the study, there were proportionately about 55% of farmers from Nandi North and 45% of farmers from Uasin Gishu. Proportionately, about 153 farmers and 125 farmers were randomly selected from Nandi North and Uasin Gishu districts respectively.

Primary data was collected mainly through administration of pre-tested structured questionnaire in the field. From the secondary sources, data such as districts' milk production, country's milk output and consumption patterns, yield per cow, human population size, number of dairy farmers, cattle population, producer and consumer prices as well as types of major milk markets and co-operative societies in the study area were obtained. Secondary data was used to provide background and supplementary information on milk production and markets in the study area. The secondary sources were subjected to general content analysis and provided updates and theoretical insights into the aspects which were studied. A lot of information was sourced from the Dairy Board records and manuals.

Descriptive statistics were used to analyse and present the data. The effect of transaction costs on the current milk marketing structure in the study area was analysed using a variety of statistical methods. Chi-square (χ^2) tests of independence (association) were used to determine if significant relationships existed between two or more variables. For example, whether or not the amount of milk a farmer produced was related to the production system he or she used. The χ^2 test was appropriate in this case because the variables were merely counts or proportions.

Two means (belonging to two groups, say, the milk revenue in Nandi North and Uasin Gishu districts) were compared using Student's t-test, when the assumptions of the t-test such as normality and equality of variance

were met. Several means were compared using a one-way Analysis of Variance (ANOVA), so long as the data was sufficiently normal and the variance homogenous. In case of several dependent interval variables, MANOVA (multiple Analysis of Variance), implemented using the GLM (General Linear Model) was used if the assumptions of MANOVA (similar to those of ANOVA) were sufficiently met.

All the above tests were two-tailed. Significant levels were measured at 95% confidence level with significant differences recorded at $p < .05$.

3. Results and Discussion

3.1 Channels used to Market the Milk

Farmers in the study area used five main channels to market their milk. These were: selling at the gate/neighbours, selling to hawkers, selling to milk bars or vendors in town, selling to milk processors/dairy board and, lastly, selling to small farmer cooperative societies that processed the milk and later sold to shops and wholesalers. These same channels have been found to be used to market milk in other parts of the country (Karanja, 2003; Lanyasunya *et al.,* 2006; Staal *et al.,* 1998). Because the contracts between farmers and buyers of their milk are often unwritten and based on trust and conviviality in the first two channels of milk marketing, they are described as informal channels compared to the last three methods where contract making is more structured.

More farmers in both districts (slightly over 50%) sold their milk in informal channels compared to formal channels. This shows that informal channels are still prominent in milk marketing. This reflects the trends found in other studies (Karanja, 2003; Staal *et al.,* 1996). However, the market share of informal channels in the study was lower than the 76% found by (Karanja, 2003), which might suggest a reduction in prominence of informal marketing channels.

3.2 Milk Prices in Different Marketing Channels

To test whether or not milk prices offered in different marketing channels were significantly different, an ANOVA was conducted, and found to be significant, $F(4, 265), 1746.9, p < .05$. The mean milk prices are shown in Table 1.

Selling milk at the gate or to neighbours and to hawkers earned the lowest price for the farmer. This was likely because of many farmers practicing dairying in the study area, and hence neighbours could be able to negotiate for ridiculously low prices. Hawkers are in the business of buying milk from the farmers and selling it elsewhere. Hence, to increase their profit margins, they must strive to reduce the buying price of milk from farmers. Farmers received the highest price by selling their milk to milk bars/vendors in town or to small cooperatives that processed the milk and later sold it. Milk bars could pay more because their clientele were likely to be the affluent urban dwellers. Co-operatives offered high prices because they likely enjoyed economies of scale in marketing and since they added value to the milk during processing, they sold the product at higher prices. The price paid by milk processors/dairy board was significantly lower compared to that paid by milk bars and smaller farmer cooperatives, a finding that is similar to that of (Karanja, 2003). There were two main milk processors predominant in the study area, New KCC and Brookside. New KCC offered a lower price of Kshs 20 which included a transport charge of Ksh 2 while Brookside paid a marginally higher price of Ksh 23. It is important to note that these prices were single-time estimates, and they could change in a year since they fluctuated depending on supply of milk.

3.3 Relationship between Production System and Milk Marketing Channel

Table 2 shows the relationship between the production system employed by the farmer and the milk-marketing channel used.

A significant and strong (as measured by a λ of 43%) relationship was found between the production system employed and the way the milk was marketed. Farmers in grazing systems exclusively sold their milk to neighbours and hawkers while farmers in zero and semi zero grazing systems sold their milk in more formal channels.

3.4 Returns to Dairy Production

Tables 3 and 4 show the annual milk revenues for each household in the study area under different production systems, and milk marketing channels respectively.

Annual milk sales and revenues were significantly higher in zero grazing systems, followed by semi zero grazing systems and, lastly, the grazing system. However, gross production costs were more in zero grazing system chiefly because of higher expenditures on commercial feeds. Nevertheless, the results show that dairying, especially when run as a business concern, could be a good source of income for farmers. This is so because the income margins shown in Table 3 do not include sales of the animals themselves or calves. Moreover, other than milk sales, farmers also obtained manure from the animals, milk for consumption, and some had constructed biogas plants that run on manure from the animals.

The highest milk revenues were obtained by farmers who sold their milk directly to milk bars in town. However, this was only a small proportion of farmers who had access to town for reasons of proximity or ownership of means of transport. The next highest earning channel was farmers who sold to their own milk cooperatives and milk processors. The milk co-operatives and processors paid their customer farmers through bank accounts. Thus, farmers who used this channel were assured of getting monthly income, which they could be able to plan for well. The other advantage of this channel was that farmers could obtain loans from these institutions, using their milk income as security. However, there were some disadvantages of selling milk to processors. First, some of them such as New KCC deducted Ksh 2 transportation fee for every litre of milk delivered. Secondly, some imposed quotas on the amount of milk that a farmer could deliver to them. Farmers who sold milk to hawkers and neighbours earned the least amount of revenue, partly because of the small volumes of marketed milk and the nature of the marketing channel that offered the lowest price. These channels paid farmers mostly on a weekly basis hence most of them frittered the money away as they were unable to plan well for their money. In addition, farmers could not obtain reasonable loans from these channels.

In conclusion, the best marketing channel appeared to be that of selling milk directly in town, so long as transaction costs involving transportation were reasonably low because of proximity, good roads or ownership of a motorcycle or a car, truck or tractor. The second best option appeared to be to sell milk to co-operatives or milk processors. Thus, transaction costs appeared to influence the milk marketing structure in the study area. As such, the null hypothesis that transaction costs have no effect on the milk marketing structure was rejected.

4. Conclusion and Recommendations

Three production systems, free grazing, semi zero and zero grazing systems were found to be used by dairy farmers to produce milk. Milk production was found to be highest in zero grazing systems, followed by semi-zero and lastly, free grazing. This was because the best animal husbandry practices were found in zero grazing system, followed by semi-zero grazing while the worst husbandry practices were found in free grazing. Farmers in the latter production system produce little milk and obtain low returns from the sale of milk; hence they face considerable transaction costs due the inability to invest in means of transport and non-participations in transaction costs-reducing institutions such as cooperative societies.

Because of high transaction costs, majority of farmers in the two districts were found to sell milk either to neighbours or to hawkers. However, these channels offered the lowest prices compared to prices offered by milk bars/vendors in town, small farmer cooperatives, and milk processors.

In order to compensate for missing marketing and to reduce transaction costs, farmers may develop institutions as a collective action, to provide needed services. At the national level, the state should play a key role in sustaining the regulatory framework under which market participants can operate. Marketing facilities and associations (grass root marketing organizations), combined with contract enforcement, could create a sound environment for private sector involvement in the small scale dairy sector.

Small self-sustaining groups on marketing organizations based at “grass roots” level, run for and by the participants, could address the real marketing needs of member-farmers. The state should play a pivot role in fostering such arrangements and brokering partnerships between these groups and private investors by providing a sound and secure environment for business. Formation of co-operatives, which could later turn into companies, could allow farmers to increase milk production and marketing. They could also be the engine for transforming the mostly informal dairy industry into the next level of more formal based sector.

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Tables

Table 1. Mean Milk Prices in Various Markets

Marketing channel	**n**	Milk price (Ksh/litre)	
		Mean	Standard error
Sell to neighbours/gate	104	15.462[a]	0.0975
Sell to hawkers	69	17.579[b]	0.0909
Sell to bars/vendors in town	22	25.500[c]	0.143
Sell to milk processors/dairy board	34	22.529[d]	0.0869
Sell to cooperatives	41	25.293[c]	0.0719
Total	270	19.204	0.250

Means with different letters in a column are significantly different at $p < .05$ by HSD. n = number of farmers

Source: Survey data, 2009

Table 2. Relationship between the Production System and Milk Marketing Channel

			Production system		
			Zero grazing	**Semi zero grazing**	**Grazing**
Where milk is sold	Neighbours/ gate	Frequency	0	18	86
		Percentage	0	19.6	58.5
	Hawkers	Frequency	3	5	61
		Percentage	9.7	5.4	41.5
	Bars/town	Frequency	20	2	0
		Percentage	64.5	2.2	0
	Processors	Frequency	3	31	0
		Percentage	9.7	33.7	0
	Cooperatives	Frequency	5	36	0
	Total	Percentage	16.1	39.1	0
		Frequency	31	92	147
		Percentage	100	100	100

χ^2, 313.23, df=8, p<.001, λ=.43, p<.05
Source: Survey data, 2009

Table 3. Annual Milk Revenues and Production System

		000's Ksh	
Variable	**Production system**	Mean	Standard error
Annual milk sales	Zero grazing	168.352[a]	14.618
	Semi zero grazing	76.297[b]	4.484
	Grazing	10.781[c]	.528
Annual feed costs	Zero grazing	21.460[a]	1.194
	Semi zero grazing	14.959[b]	1.067
	Grazing	0.183[c]	0.152
Annual labour costs	Zero grazing	15.483[a]	1.234
	Semi zero grazing	8.793[b]	.728
	Grazing	.636[c]	0.073
Annual tick control	Zero grazing	0.681[a]	0.038
	Semi zero grazing	1.247[b]	0.043
	Grazing	1.405[c]	0.044
De-worming costs	Zero grazing	0.925[a]	0.042
	Semi zero grazing	1.742[b]	0.068
	Grazing	0.650[c]	0.032
Annual milk revenue	Zero grazing	129.800[a]	12.777
	Semi zero grazing	50.035[b]	3.184
	Grazing	10.278[c]	0.493

For each variable, means with different letters are significantly different at $p < .05$ by HSD test.
Source: Survey data, 2009

Table 4. Annual Milk Revenues and Marketing Channel

		000's Ksh	
Variable	**Marketing channel**	Mean	Standard error
Annual milk sales	Neighbours	13.733[a]	1.013
	Hawkers	15.239[a]	1.682
	Milk bars	189.373[b]	17.509
	Processors	82.237[c]	5.624
	Cooperatives	106.856[d]	6.993
Annual feed costs	Neighbours	1.876[a]	0.552
	Hawkers	2.196[a]	0.762
	Milk bars	21.628[b]	1.489
	Processors	15.235[c]	1.654
	Cooperatives	17.798[c]	1.626
Annual labour costs	Neighbours	1.024[a]	0.097
	Hawkers	0.159[a]	0.086
	Milk bars	17.136[b]	1.128
	Processors	9.294[c]	0.842
	Cooperatives	13.951[d]	0.977
Annual tick control	Neighbours	1.420[a]	0.048
	Hawkers	1.314[a]	0.065
	Milk bars	0.733[b]	0.049
	Processors	1.152[a]	0.072
	Cooperatives	1.189[a]	0.076
De-worming costs	Neighbours	0.855[a]	0.066
	Hawkers	0.890[a]	0.099
	Milk bars	0.845[b]	0.046
	Processors	1.588[c]	0.113
	Cooperatives	1.743[c]	0.088
Annual milk revenue	Neighbours	10.577[a]	0.689
	Hawkers	14.584[a]	1.469
	Milk bars	149.030[b]	15.448
	Processors	54.967[c]	3.974
	Cooperatives	72.173[c]	4.911

For each variable, means with different letters are significantly different at $p < .05$ by HSD test.
Source: Survey data, 2009