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Structure of the Small and Medium Informal Dairy Enterprises in Olenguruone and Bahati Sub-Counties

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Abstract
This paper examines the drivers of the small and medium informal dairy enterprise engagement in Nakuru County in Kenya, specifically Olengruone and Bahati Sub-counties. A sample of 196 dairy enterprises was selected through stratified random sampling technique. The analytical approach used in evaluating the drivers in engagement in informal systems in terms of structural market entry involved combining Lorenz curve and the Gini coefficient methodologies. Results returned a Gini coefficient of 0.4295, which confirmed a significant dispersion between informal milk sales and income distribution between the traders in the county. The coefficient also depicts a competitive market with reduced problems of price collusions and shortages of milk supplies. However, the results indicated that the milk industry in Nakuru County was not efficient implying that any additional marketing services undertaken by traders reduced the output-input ratio as a negative marketing efficiency was established at 1% level of significance. Based on the findings, the study recommends that traders should be facilitated to vibrant groups through formulation of policies that strengthen and streamline informal dairy sector by restricting monopolistic tendencies to create a level playing field for all milk traders in the industry.
Keywords: Structure: Regulation: Informal: Lorenz curve: Gini coefficient: Competitive market: Marketing efficiency: Monopoly: Oligopoly
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1.0 Introduction

Dairy farming is one of the most important agricultural sub-sectors in Kenya. Itcontributes to 30 percent of the agricultural Gross Domestic Product (GDP), 40% of the total livestock GDP and 10% of the total GDP (Kenya national Bureau of Statistics, KNBS, 2018). It is a primary activity in the livestock sector and a pertinent source of livelihood to approximately 1.5 million small-holder farmers. It is the most rapidly expanding agricultural sector in Sub-Saharan Africa with more than 85% of the dairy cattle production in East Africa, with Kenya dominating the East Africa (Odero-Waitituh, 2017). Considering the overall dairy cattle population in Africa, Kenya is one of the largest milk producers in the continent with an estimation of over 5 million improved cattle (FAOSTAT, 2018). In 2017, the country produced over four million tonnes of milk of which the highest amount as reported by FAOSTAT (2018) was produced by small-scale farmers. With a population of about 46 million people, the country has been reported to consume between 50 and 150 litres of milk per capita per annum depending on the socio-economic class and location (WHO, 2015; Bosire *et al.,* 2017; Alonso *et al.,* 2018).

The dairy industry in Kenya has continued to attract more stakeholders due to the rapid increase in population, and hence, demand for milk and milk products (KNBS, 2018). Furthermore, as projected by World bank (2008), the growth in demand for dairy products in the country is expected to double in the next 20 years. This is evidenced by the upward trend that has been observed in the production of milk since independence that has been in line with the change in population as presented in Figure 1.

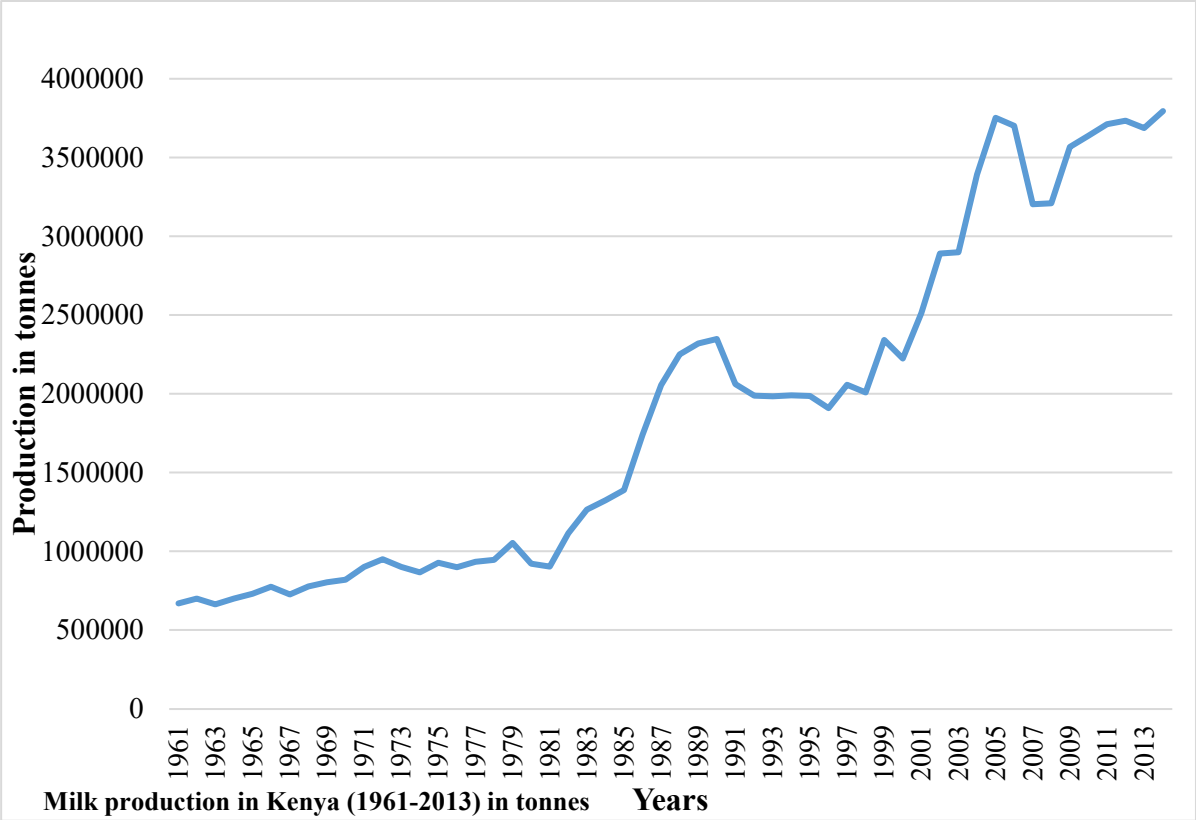

Figure 1*:* Trends in milk production in Kenya (1961-2013)
Source: FAOSTAT, 2017

With the annual milk consumption per capita currently estimated at 150 litres which is five times higher than the consumption rate in other Sub-Saharan African countries, the dairy industry has become a fundamental sector. Firstly, this is because dairy products are considered a primary food expenditure in the country owing to its nutritional value and affordability (Kaitibie, Omore, Rich & Kristjanson, 2010; FAOSTAT, 2018). Secondly, the dairy value chain has become an increasingly stable and reliable source of livelihood not only in terms of food but also income to the different stakeholders within the dairy value chain.

To meet the high demand for the dairy products in the country, milk and its products in Kenya are commercialized by the formal and the informal dairy markets (sectors). As defined by Alonso et al. (2018), a formal dairy sector is a dairy value chain that commercializes industrially processed and packed dairy products by legally registered value chain actors, while informal dairy sector as value chains commercializing dairy products that not industrially processed by both the legally licensed and unlicensed enterprises, including raw, traditionally pasteurized milk, boiled milk and other traditionally derived milk products among other milk products. The informal sector is predominated by small-scale milk producers, milk transporter traders, milk bar operators, mobile milk traders with limited infrastructure such as electricity, water, sanitation and refrigeration. Above all, as summarized by Grace (2015), the sector receives less or no support from the government and other development partners.

Albeit the inadequate support for the informal dairy sector, it accounts for approximately 86% of the milk supplies to the final consumers while the formal sector only handles 14% in Kenya (Grace, 2015; Alonso et al., 2018). Furthermore, according to the statistics by FAO (2018), the sector contributes to 70% of the jobs in Kenya generating approximately 18 employment opportunities for every 1000 litres of milk handled totaling to 40,000 jobs within the economy. On the other hand, the processing sector (formal sector) on the other hand represents a commercial system with well-developed markets and large-scale industrialized production systems (Staal *et al*., 2008). The formal sector, on the other hand, generates 13 jobs for every 1000 litres of milk handled, or a total of 15,000 jobs.

Despite the importance of the dairy sector in Kenya, it is dominated by smallholder enterprises. These enterprises produce about 70% of the milk while the large scale enterprises only account for 30% (KNBS, 2018). Consequently, most of the milk from these dairy enterprises is marketed through the informal sector, which is characterized by informal markets, subsistence, and household production (Kelly, 2011). Estimates show that 85 to 90% of milk produced is neither processed nor packaged but is bought by consumers while raw (Thorpe *et al*., 2000). According to ASDS (2010), by 2008, milk production was estimated at 5.1 billion litres which were valued

at KES 100 billion. This contribution was predominantly from the smallholder and the informal sector of dairy enterprises (Reynolds *et al*., 2004).

The smallholder dairy production faces the challenge of low productivity due to poor quality breeds of dairy cows. According to Muthui *et al*. (2014), most smallholder farmers buy low-quality heifers or culls from milk surplus zones, which translates into insufficient milk production, even under proper management conditions, (Musalia *et al*., 2007). Such animals cannot produce adequate volumes to push the smallholder farmers out of poverty. The low productivity of the dairy animals puts the dairy enterprises in a poverty trap that is characterized by cash-flow problems and high costs of production (Francesconi, 2013). Most of these farmers sell their milk through the informal channels. Since the smallholder farmers are always in need of cash, they find the local milk traders and hawkers a lucrative source of income. They do not have to wait for payment for a long period since the hawkers offer them cash for the milk. Since most of them lack value addition skills, they are left with highly perishable low-value product that they cannot sell for good returns hence inability to afford financial and professional services (Sharma *et al*., 2014).

Despite the contribution of the informal dairy enterprises to the household nutrition security and livelihoods, efforts by developing countries to adjust to global policies on food quality and safety has increasingly compelled governments in these countries to develop and implement policies that repress and criminalize the informal sector. In 2015 for example, Kenya launched a campaign to sensitize and promote the consumption of pasteurized and packaged milk in an attempt to formalize the national dairy sector. Other East African countries like Uganda and Tanzania went ahead to ban the commercialization of raw milk in 2014 and 2015 respectively. This could be traced back to the former colonial dairy policy that was largely designed to protect the interests of the large–scale settler dairy producers by essentially criminalizing the activities of the smallholder milk vendors with the then professed concerns of food quality and safety.

Despite all the increased efforts to develop the formal dairy processing sector, the informal small-scale dairy market has continued to extensively dominate the dairy sector in Kenya (Baker et al., 2013). Sufficient evidence abounds in literature on the pertinence of embracing and backstopping the informal dairy sector to meet the growing demand for dairy products in Kenya and all the actors whose incomes depend on this sector. With the informal sector handling 85-90% of the milk in Kenya, focus should shift to this sector since it is this sector that has many players in milk handling and marketing (Staal *et al*., 2008). As such, providing an environment for fluid milk distributors that will keep them competitive without destroying themselves in the process poses a primal challenge. The former requires attention to the market structure, while the latter involves regulation of conduct (Fowlie, Reguant & Ryan, 2016).

Since the informal dairy sector is fraught with marketing inefficiencies in terms of high transaction costs and poor market infrastructure, it is important that policies should focus on market structures available with the aim of facilitating a streamlined market that will improve the conduct and performance of the informal sector. Such policies will not only improve performance but also increase efficiency that is necessary for rapid growth of small and medium dairy enterprises growth (ADB, 2001; Sullivan, 2013). Market structure, conduct, and performance is an essential component of the dairy production system since it bridges traders and consumers hence the need to analyze it further. Therefore, this study aimed at determining the structure of the informal small and medium enterprises in Olengruone and Bahati Sub-counties in Nakuru County. With milk being a price inelastic food product in Kenya, the study also sought to establish the conduct of the actors in the informal dairy sector with regard to competitiveness of the dairy market, by establishing the level of equality in terms of the gains from the sale of milk among the informal actors in the County. Finally, the study provides recommendations on how to streamline the informal dairy market in Nakuru County and set a platform that can ensure sufficient growth for small and medium dairy enterprises can be achieved.

Methods

2.1 Study Area

Olenguruone and Bahati areas lie within Nakuru County which is one of the 47 counties of the Republic of Kenya. Nakuru borders 8 other counties and covers an area of 7,495.1 Km^2 located between Longitude 35° 28` and 35° 36` East and Latitude 0° 13` and 1° 10` South. The County's population is approximately 2,046,395 with an estimated annual population growth rate of 3.05% (KNBS, 2018). The County has a high agricultural potential (majorly mixed agriculture) where dairy farming is on significant rise. Diminishing land sizes, high demand for milk and favorable weather conditions give the impetus for dairy farming under zero grazing.

Nakuru's lowest altitude is 1,530 metres above sea level while its highest point is 3,098 metres. December, January, February, and March are the hottest months with an average of 29.3 °C while the coldest months are June and July averaging 12°C. Rainfall amount in the area ranges between 500mm to highs of 1800mm with relative humidity of 44.3%.

The study was specifically conducted in Bahati (peri-urban area) and Olenguruone (rural area) of Nakuru County because of the presence of large commercial enterprises. Bahati town has an area of 156.1Km2 with a

population of approximately 34,983 (KNBS, 2013) while Olenguruone covers 87.6 Km^2 with a population of 21,086. Both Bahati and Olenguruone predominantly grow tea as a cash crop. With climatic conditions favorable for dairy farming in the two sub-counties, the enterprise has been on an upward trend (KNBS, 2018).

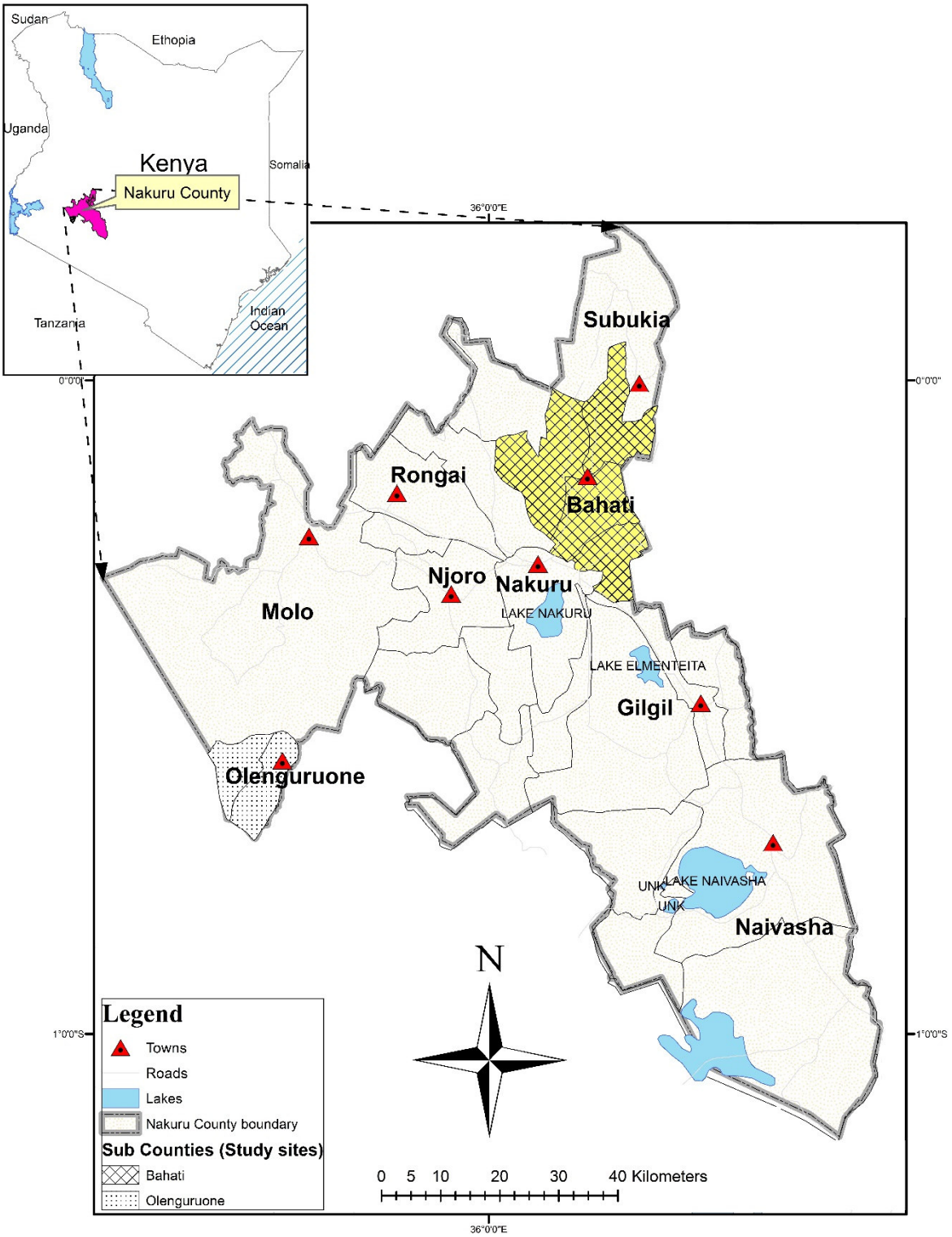

Figure 2: Area of study (Olenguruone and Bahati)
Source: World Resource Center, 2014

2.2 Research Design

To determine the structure of informal dairy enterprises, a sample of 196 informal small and medium dairy enterprise actors were randomly selected from the two sub-counties.

2.2.1 Sample size

The study adopted Groebner & Shannon (2010), formula as illustrated in equation 1.

$$n = \frac{(z^2 PQ)}{d^2} \quad \text{..... (1)}$$

Where n = is the sample size;

P =0.85 was the proportion of smallholder enterprises in Nakuru County according to IFAD data (IFAD, 2010).

d =0.05 is the level of significance that was used to eliminate 95% sampling bias.

z value= 1.96.

Q value =1- P the weighting variable.

$$\text{n} = \frac{(\text{z}^2\text{PQ})}{\text{d}^2} = \frac{((1.96)^2 \times 0.85 \times 0.15)}{0.05^2}$$
$$= \quad 196 \text{ total respondents}$$

2.3 Analytical framework

To measure the degree of market concentration/structure, concentration ratio, Gini Coefficient and Lorenz Curve were used. The Lorenz Curve was used to show the quantitative relationship between the cumulative percentages of informal small and medium milk traders against the cumulative percentage of the volume of milk sold in the markets. To compute cumulative percentages, the volume of milk sold was arranged from lowest to highest.

To further analyze the differences in performance between agri-enterprises in the urban and rural markets differences-indifferences (DiD) was used. The model is empirically represented as shown;

Observed outcome:

$$Y_{(t)} = Y_{(1(t))}D + Y_{(0(t))}(1 - D) \text{.....} \quad \text{(2)}$$

$$\alpha ATT = E\left[Y_1(3) - Y_0(3) \middle| D = 1\right]$$

Where:

(t) : period

$Y_{(0(t))}$: outcome in period t under no treatment

$Y_{(1(t))}$: outcome in period t under treatment

The empirical form of the model is given as:

$$Y = \alpha + \beta_1(treatment) + \beta_2(time) + \beta_3(treatment * time)$$

The coefficient of the treatment variable, β_1, is the estimated mean difference in Y between the treatment and control groups prior to the intervention

β_2 is the expected mean change in outcome from before to after the onset of the intervention era among the control group.

β_3 by itself is the difference-indifferences (DID) estimator. It tells us whether the expected mean change in outcome from before to after was different in the two groups.

Selling in peri-urban markets was then be considered as a treated variable; conditional on the time variable - having sold milk in both on-season and off-season of 2017. Therefore, the coefficient was determined by the combined effect of treated variable by time, that is, 'treated* time.'

The coefficient for the difference-in-difference (DID) estimators for total milk sold per day, day variable costs and day gross margin showing the participation in the peri-urban market (treatment) was then evaluated.

The concentration ratio (Gini Coefficient) was then derived from the Lorenz Curve. This helped in determining the inequity in sales distribution among the SSMVs. When a Gini Coefficient lies between 0 and 1 with values closer to 0 it indicates perfect equality of market participants while those closer to 1 indicate market inequality (Tiku *et al*., 2012). The Lorenz Curve was used to illustrate the structure of the market where a Lorenz Curve closer to the line of equality indicates equality among the market participants while the reverse is true.

3.0 RESULTS AND DISCUSSION

This section presents the discussion of the results for the study. This section presents the descriptive statistics of the socio-economic and institutional characteristics of the entrepreneurs and their dairy enterprises in the peri-urban and rural markets. This was achieved through unpaired t-test statistics for the continuous predictors and

Pearson's Chi-Square test for categorical variables. In sub-section two, the second objective was addressed by whereby the market structure and competitiveness in the dairy sector among the informal small and medium scale dairy participants were determined with a keen focus on market share and market concentration of the milk outlets in the two sub-counties. To achieve this, Lorenz curve of the milk traders was derived using the cumulative fractions of income and the number of traders. Upon which a Gini coefficient was generated to measure the level of equality in the market.

The third sub-section entailed the determination of the market conduct by evaluating the practices of the different market outlets with regard to the structure of the market. To achieve this objective, paired t-test statistics and Pearson's Chi-Square tests were employed for continuous and categorical predictor variables respectively. A Fried man test was then performed to determine the critical challenges encountered by dairy traders. Finally, market performance was analyzed in two phases. The first phase was analyzed using a paired t-test to find the statistical difference in the performance of milk traders between the peri-urban and the rural markets while the second stage involved execution of a Difference in Difference (DiD) model to determine the spatial difference in performance between the suburban and rural market participants.

3.1 Socio-economic characteristics of entrepreneurs and their businesses

3.1.1 Trader characteristics

The majority of the milk traders, 62.26% (n =117) interviewed, operated in the peri-urban markets while the rest conducted their dairy businesses in the rural markets. This could allude to the high population and consumption rates in the peri-urban markets as compared to the rural markets.

Age is a proxy of experience of a trader in the marketing process of dairy products. Age is, therefore, an imperative variable in indicating the extent to which dairy traders are integrated into the market function process. The average age of milk dealers in the rural markets was lower than that of the peri-urban 50 as presented in Table 1, indicating that the peri-urban market was relatively dominated by older traders as compared to the rural markets. This could be attributed to the fact that older dealers could be endowed with sufficient resources to meet the high transaction costs involved in the peri-urban as compared to their younger counterparts. Furthermore, older dealers could have robustly established market networks compared to their counterparts. The paired t-test results indicated that the mean age of the dairy traders in the rural markets was statistically different from those of the peri-urban markets at 1% level of significance. This finding is very vital for policy formulation, and implementation as the inferences can be used for targeting a specific group of traders or formulating different sets of policies to benefit each group as compared to targeting them as a whole due to differential characteristics, and hence different needs. Despite the fact that age poses an advantage of experience rather physical participation in the dairy sector as asserted by Berem, Obare & Bett (2015), it is regarded as a limiting factor to the realization of an active economy. This is due to the fact that an aged population likely to participate less in economic activities as compared to a younger one.

Regarding the start-up capital for the dairy business starting a dairy enterprise in the rural market was expensive as compared to the peri-urban market. The startup capital; for an enterprise in the rural market (Olengruone sub-county) required an average of KES 41,811 while that for peri-urban (Bahati sub-county) the start-up capital was KES 30,158. This was, however, contrary to expectation as rural enterprises are expected to incur low rental, milk transportation and business costs payable to the county government as compared to their counterparts in the in the peri-urban markets. The t-test statistics indicated a negative and significant mean difference in the startup capital for dairy enterprise in the rural market and peri-urban market at 10% level of significance. This indicated that it was cheaper starting a dairy enterprise in the peri-urban than in the rural market. This could allude that a favorable business environment existed in the peri-urban market as compared to the rural market.

Table 1: T-test statistics for socio-economic characteristics of the traders (Continuous variables)

	Rural (74)		Peri-urban (117)		Pooled (191)			
Variable	**Average**	**Std. Dev.**	**Average**	**Std. Dev.**	**Average**	**Std. Dev.**	**t-value**	**P-value**
Age of trader (Years)	42.76	13.09	50.98	14.23	47.80	14.34	4.0127***	0.0001
Number of employees	0.50	0.71	0.64	0.77	0.59	0.75	1.2713	0.2052
Experience (years)	10.15	9.00	11.45	8.63	10.95	8.77	0.9950	0.3210
Startup capital (KES)	41,811.49	10,384.80	30,158.12	19,315.32	34,673.04	16,301.41	-1.7030*	0.0902

Note: *, ***significant at 10% and 1% level respectively

3.2 Market Structure

3.2.1 Market share of Milk outlets in Nakuru County

Table 2: Percent market share of milk outlets Nakuru County

Preferred market outlet	Frequency	Proportion	Cum.
Final consumer (own milk bar)	66	34.55	34.55
Brokers/transporters	51	26.70	61.25
Large processor	48	25.13	86.38
Other milk bar enterprise	13	6.81	93.19
Restaurants	8	4.19	97.38
School/offices/institutions	5	2.62	100.00

Note: cum = Cumulative percentage (representing the concentration ratio)

As presented in Table 2, it was clear that majority of the milk from farmers and sellers in the two markets in Olengruone and Bahati sub-counties was sold through own milk bars to the final consumers represented by 34.55% (n = 66) of the market composition. This was followed by brokers/transporters at 26.70% (n=51) then large processors at 25.13% (n= 48). On the other hand, only 9.43% (n=26) of the milk produced in the two sub-counties was delivered to the other channels including restaurants, school, offices or institutions and other milk bar enterprises. This could be attributed that milk producers and sellers were more confident in delivering their products to more specific outlets that directly dealt with milk and its associated products. This could further be associated with the mode and nature of payment associated with delivery of milk as organized outlets and milk bars are likely to have consistent and reliable payment modes unlike the restaurants, schools and institutions that could take long time to pay contrary to the traders wish to get quick cash. Premised on the nature of concentration ratio in the market, it implies that the nature of payment determines the volume of milk delivered to a particular milk outlet. Conventionally, majority of the farmers and milk sellers will prefer spot markets through which they are paid on delivery, a characteristic of the own milk bars (final consumers) and brokers or transporters. Larger processor was among the largest three outlets because their mode of payment is organized and constant either within a certain period as per the agreement signed.

3.2.2 Concentration ratio of the informal dairy enterprise

Since the dairy industry consisted of homogeneous products, that is milk and its associated value added products with relatively similar prices the industry was categorized as an oligopolistic market structure. To illustrate the extent of market control of the three largest market outlets in the dairy industry in Nakuru County and the degree to which the industry was oligopolistic, a traditional structural measure of the distribution of market participants or traders called concentration ratio was employed using the N-firm concentration technique.

In order to determine the market structure and competitiveness of the market, a concentration ratio of milk outlets in Nakuru County as presented in Figure 3 was employed in structuring the market. The results show that 3 - firm concentration ratio comprising (three biggest outlets in the market share of milk) of 86.38% was calculated and generated from the market share of the cumulative percentages of the individual market outlets as shown in Figure 3 and Table 3. Since the 5- firm concentration ratio was 97.38%. This indicated that the level of concentration of the milk market outlets in the dairy industry in the County was high implying that the market structure ranged from oligopoly to monopoly in nature since the 5 -firm concentration ratio of greater than 70%. While studying the grain market in South Sudan, Ngigi (2008), found a Gini coefficient of 0.7 and concluded that the grain market in the country was highly concentrated.

Premised on the market share of the five major milk outlets in the two markets, it was evident that the dairy industry in the County tended towards a perfectly competitive market (Sexton & Xia 2018). This meant that the milk outlets could hardly collude within their interest to control and set the milk prices. Institutions and the hotel and accommodation industry in the County controlled 2.62% of the dairy market share, indicating the role they play in providing a market for farmers and milk traders. This is crucial for policy as the inclusion of these industry in policy formulation and implementation can play a significant role in determining the amount of milk produced in the county.

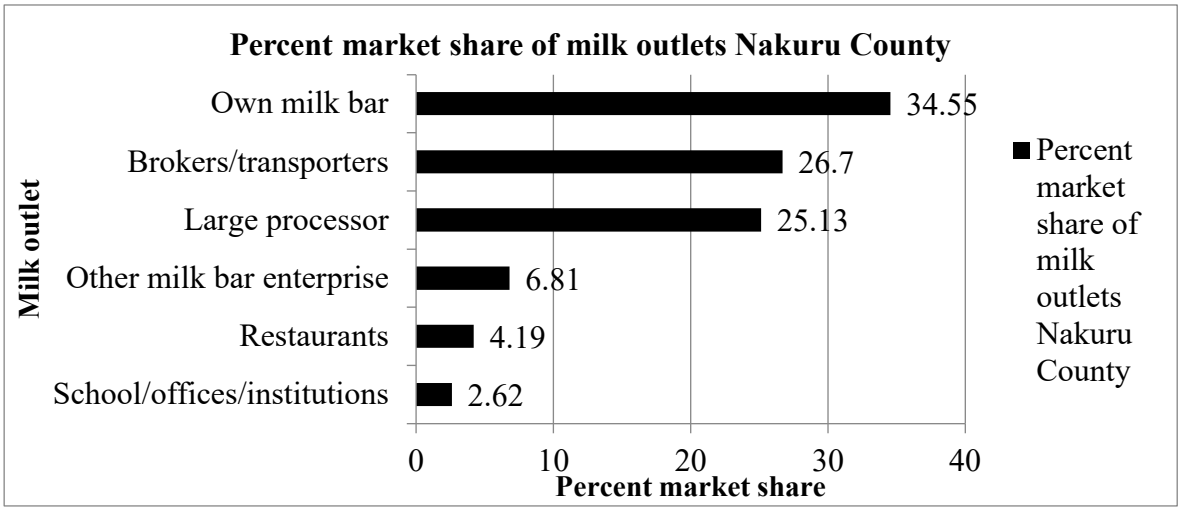

Figure 3: Market concentration ratio of milk outlets in Nakuru County

This implied that there was stiff competition in the milk market in Nakuru owing to the fact that there were few different large outlets buying relatively homogeneous products (milk and its associated value added products) at relatively the same prices. The markets generally dealt with a homogeneous product which was raw milk however there were aspects of product differentiation ranging from the packaging and presentation of the products and value addition to either boiled milk, *mursik* (fermented milk) and yoghurt. Most of the traders sold to final consumers mainly through own milk bars. The growth of milk bar outlets has made the market more competitive and milk farmers and sellers do not have to rely on the traditional outlets like milk processors, brokers or roadside selling.

The growth of milk industry in Nakuru County and the increase in the number of milk market outlets has therefore made the dairy sector in the County to be more market competitive. This is particularly the case because the milk outlets are willing to buy the products at competitive prices in the quest to attract farmers and other milk suppliers to them. As a result, this is playing to the advantage of the small and medium scale dairy farmers and other small scale milk sellers at large. As a result, the sector is likely to grow since farmers will hardly experience the problem of milk spoilage. This is because the higher the number of milk outlets, the higher the demand and this in turn affects the prices too.

Therefore, understanding the intensity of competition and the ease of entry into the dairy sector is of paramount importance particularly regarding the behavior of the market and the outcomes associated with the actions of the industry players. Additionally, it is easier to understand the segment of the dairy market share that is controlled by each milk outlet within the County. As an effect, concentration rates can assist in the analysis of the sector and hence enable organization and ease of intervention in cases where there is no order among the players or if farmers or ultimate consumers are being exploited.

3.2.3 Determination of the Market structure using the Lorenz curve

To further illustrate the market structure, a Lorenz curve was derived using the cumulative fraction values of income and population of traders as presented in Figure 3. To measure inequality in gains from the sale of milk, in Olengruone and Bahati Sub – counties, a Lorenz curve and Gini coefficient were employed. A Lorenz curve is a cumulative curve used to examine pooled information such as sales distribution in an industry, distribution of capital, income or the distribution of capital and production among companies or organizations in a given industry (Ukav, 2017). In this study, the cumulative fraction of the population of the traders in the dairy sector was plotted on the horizontal axis against the fraction of income earned by the traders in the industry. A line of absolute equilibrium was then fitted to establish the degree of inequality encountered in the industry where the further an industry actor is from the diagonal line of inequality, the more the tendency of monopolization will be existence in the dairy industry in the two Sub-counties. Therefore, the primal aim for the Lorenz curve was to demonstrate how much the distribution of milk collection or purchase diverged from the ideal situation depicted by the equality line.

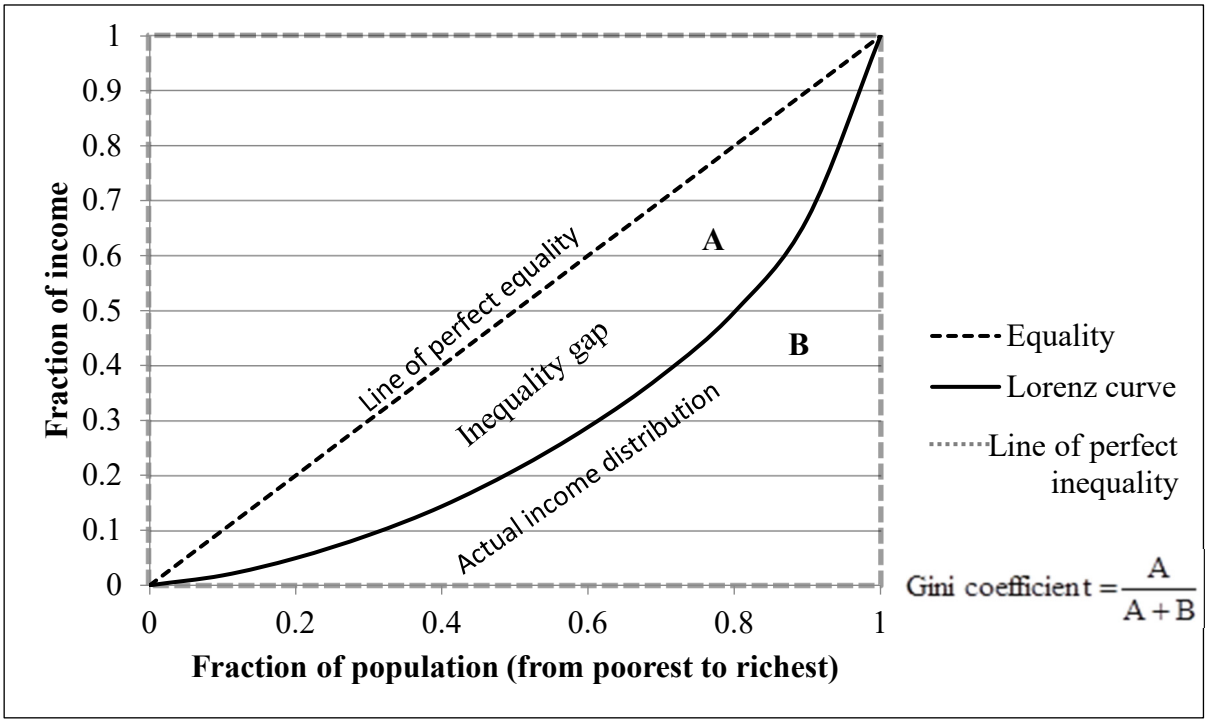

Figure 4: Lorenz curve of milk traders in Nakuru County

3.2.4 Determination of the Milk Market Share

To determine the proportional effect of the sizes of the milk outlets and the share of the market they control in the two sub-counties, a Gini coefficient was calculated from the Lorenz curve. The coefficient is used to measure the magnitude of the distribution (area) between the absolute equilibrium line and the Lorenz curve. Therefore, as the area becomes large, the effect of the evaluated milk outlets in the dairy industry increases. According to the rule of thumb, there would be perfect inequality in the market if the Gini coefficient is 1 and 0 if there is perfect competition and therefore equality within the dairy industry with the prices determined by the forces of the market, with free entry and exit into the industry (Ukav, 2017). Additionally, Tiku *et al*. (2012), , found a Gini coefficient value 0.54 and 0.65 for processors and merchants of palm oil respectively. They concluded that an oligopoly market structure existed among the marketers. Moreover, Harun *et al.* (2012) in Ghana while investigating the tomato market concentration between wholesalers and retailers found concentration ratios of 0.58 and 0.64 concluding that the Pwalungu market was highly concentrated. On the other hand, Enibe, Eze & Ugwuoke, (2018), recorded different and contrasting results while studying banana marketing in Nigeria, Anambra State as they found Gini coefficients of 0.17 and 0.21 for retailers and wholesalers respectively, indicating the existence of a competitive market.

This study found a Gini coefficient of 0.4295 indicating the statistical dispersion representing the milk sales and therefore, the income distribution of milk outlets in Nakuru County. The coefficient is approximately 0.4 indicating that there was 40% equality in the dairy industry in the County. This implied that there was a relatively equal distribution of income from milk between the six milk outlets reviewed in this study. This shows that despite there being many milk sellers in the market, majority of them enjoyed a fair share of the market thereby making relatively equal returns.

The coefficient is relatively low which also indicates a relatively concentrated market with few groups of milk traders. This indicates a relatively competitive milk market eliminating problems of price collusions and shortages of supplies. Since the coefficient was much closer to zero than to one, it implied that milk outlets in Olengruone and Bahati sub-counties closely exhibited features or conditions of a competitive market structure as compared to a monopoly market structure (Ukav, 2017). This implied that no single outlet had the power to control the market. Consequently, farmers and milk sellers will only sell their milk and its associated products to traders that were willing to offer them competitive prices with convenient and agreeable modes of payment. To this end, the net gains realized from the industry were primarily ascribed to the volumes of milk or its associated value added products (Fermented milk, yoghurt, ghee or boiled milk) that an individual trader had supplied within the industry in the County as presented in Table 4.

From the generated Gini coefficient, it was clear that a total of 205, 650 Kenyan shillings was generated each day from the sale of milk per day with the largest proportion of income earned from the sale of milk coming from the traders that handled between 172 to 191 litres of milk per day followed by those that handled 153-171 litres.

However, the least proportion of milk income per day was earned by the sealers who handled between the lowest unit of milk sale to 19 litres in Nakuru County. This implied that the higher the quantity of milk handled in the dairy sector, the larger the proportion of income controlled. This could be attributed to the fact that traders who buy more milk are more likely to enjoy economies of scale and therefore, reduced transportation and informational search costs associated with milk search and delivery to the final consumer. As a result, they are likely to command a higher income share in the market due to substantive milk trade.

Regarding the concentration of traders based on the volume of milk handled in a day, there was an inverse relationship between the concentration of traders and the volume of milk handled in a day. This could be ascribed to the fact that the majority of the actors in the industry were constrained by resources and therefore, unable to handle more litres of milk per day. Furthermore, smaller traders could not be in a position to have afford refrigeration facilities that are necessary in handling the excess milk in cases where the market is insufficient as compared to their counterparts. This could also be attributed to inefficient transport mechanisms used by smaller traders thereby affecting their delivery compelling them to limit the amount of milk they sale per day. However, premised on the Gini, coefficient, the control of the amount of milk in Bahati and Olengruone was not significantly different as the coefficient was relatively closer to zero than to one indicating that there was no absolute control by any trader within the dairy industry, but rather conditions for perfect competition existed in the market as depicted by a Gini coefficient of 0.4295.

Table 3: Gini coefficient of milk traders in Nakuru County

Category	Range of litres of milk sold per day	Total milk income per day	Percent of milk income	Fraction of milk income	Fraction of population	Percent of population that is richer (selling more milk)	Score	GINI
1	0-19	3660.7	1.78	0.018	0.10	0.9	0.0338	**0.4295**
2	20 to 38	6515.3	3.17	0.032	0.10	0.8	0.0539	
3	39 to 57	8597.3	4.18	0.042	0.10	0.7	0.0627	
4	58 to 76	10831.9	5.27	0.053	0.10	0.6	0.0685	
5	77 to 95	13495.5	6.56	0.066	0.10	0.5	0.0722	
6	96 to 114	16115.0	7.84	0.078	0.10	0.4	0.0705	
7	115 to 133	19115.0	9.29	0.093	0.10	0.3	0.0651	
8	134 to 152	23879.5	11.61	0.116	0.10	0.2	0.0581	
9	153 to 171	34852.5	16.95	0.169	0.10	0.1	0.0508	
10	172 to 191	68588.3	33.35	0.334	0.10	0	0.0349	
		205650.9833	**100.00**	**1.000**	**1.00**		**0.5705**	

4.0 Conclusion and Policy Implications

Based on the Gini-coefficient, the marketing structure of the informal dairy enterprise is competitive with relatively high equality among the milk traders in the county. Although the market had many traders, the majority of the traders enjoyed a fair share of the market with nearly equal returns per unit of investment. Therefore, there was no absolute control by any trader within the informal dairy industry but rather exhibited conditions of an oligopolistic market structure. The results revealed that the most preferred marketing outlet was final consumers while schools and other institutions were the least preferred outlets.

To streamline the informal sector, information asymmetry within the informal dairy market should efficiently be bridged by organizing traders into vibrant cooperatives and traders' unions. These arrangements could allow the development of horizontal and persistent network relationships instead of the existing spot markets relation that could instead enable the milk marketing agents to build a higher level of trust and interdependence which would facilitate development of contractual agreements and enterprise to enterprise relationship in the milk marketing chain. Additionally, this would restrict monopolistic tendencies in the dairy industry and therefore, create a level playing field for all the milk actors in the County.

Milk being a perishable product, the county government in collaboration with the national government should establish the necessary supportive infrastructure like good roads and cooling plants for the dairy informal sector. This would ensure that the informal milk traders deliver their milk and milk products in time. Furthermore, they would earn more from value addition.

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