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The Influence of State of Road and Ownership of Means of Transport to Smallholder Dairy Farmers' Choice of Milk Marketing Outlet in Kipkaren Division of Nandi County in Kenya

Fredrick Odhiambo Ajwang[1*] and Catherine Ng'endo Munyua[2]

[1]Development Policy and Practice Research Group, Open University, United Kingdom.
[2]Department of Applied Community, Development Studies, Egerton University, Kenya.

Authors' contributions

This work was carried out in collaboration between both authors. Author FOA designed the study and wrote the protocol while author CNM supervised the work. Authors FOA and CNM managed data collection and statistical analysis of the data. Author FOA wrote the first draft of the manuscript while author CNM managed the literature searches and edited the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

This paper examines the determinants of smallholder dairy farmers' choice of milk marketing outlet using data from smallholder farmers in Kipkaren division of Nandi County in Kenya. Two main objectives were explored including the effect of the state of roads infrastructure and the ownership of means of milk transport to the market on the farmers' choice of milk marketing outlet. The result shows that the state of the roads and the ownership of means of transport determined the farmers' choice of milk marketing outlet in the division.

**Corresponding author: E-mail: Fredrick.ajwang@open.ac.uk;*

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1. BACKGROUND INFORMATION

The dairy industry is one of the most developed sub-sectors in Kenya's agricultural industry representing between 6-8% of gross domestic product (GDP) and supporting over 1 million smallholder dairy farmers' households [1]. Notwithstanding, 50% of the smallholder dairy farmers rely on daily milk sales as a source of income making the sector important for poverty eradication in Kenya [2]. After many years of marketing monopoly by the government owned Kenya Cooperative Creameries (KCC), the sector was liberalized in 1992 bringing about increased competition in milk marketing [3].

After liberalization, the number of milk processing firms increased to about 42 in 1999 and in addition, new intermediaries such as brokers, agents, milk bars, and itinerant traders entered the industry [4]. However, the liberalization itself did not provide the needed efficiency in milk marketing especially for the smallholder dairy producers who had to contend with new constraints for marketing especially in distance markets. The liberalization and entry of other marketing participants led to competition and decline of KCC with its eventual collapse in 1999. As a result of the collapse of KCC, the informal[1] milk marketing grew tremendously and became the preferred marketing outlet for the smallholder dairy farmers. A 2009 analysis of the milk supply chain shows that 42% of the milk is often sold directly to customers by the milk farmers, 32% is sold to informal market participants who also buy 6% from cooperatives to bring the total milk handled by them to 38% while the rest is sold to processors and cooperatives [4]. The preference to informal markets has been linked to marketing transaction costs, for instance transport costs, associated with formal markets which impede market participation because they impose added cost to the market [5]. This paper therefore seeks to contribute to the literature of smallholder dairy milk marketing in Kenya. The paper assesses the factors that influence smallholder dairy farmers' choice of milk marketing in Kenya. The following objective was investigated:

- The influence of the state of road and ownership of means of transport to the market on smallholder dairy farmers' choice of milk marketing outlet.

The paper is divided in to the following sections: first the paper discusses the methods that were used in the study; thereafter the results and discussion of results is presented followed by conclusion.

2. MATERIALS AND METHODS

The study was carried out in Kipkaren division in Nandi County in Kenya. The study employed survey research design which consisted of systematic and standardized collection of smallholder dairy farmers opinions through questionnaires. The sampling frame was made up of 5,300 smallholder dairy farmers owning between 1-4 dairy animals in Kipkaren division. First the sample size (n) was 185 households determined using the formula proposed by [7]:

$$\frac{n = z^2 (p \times q)}{d^2}$$

Simple random sampling procedure was then employed to select specific participants to be interviewed. To achieve this, a random number table was used to choose the households. This was done by first allocating the smallholder dairy farmers a number then using the table to draw the actual farmer to be interviewed per location in the division. The 10^{th} farmer was interviewed from the table of random numbers. The data was analysed using Statistical Package for Social Sciences (SPSS) software with the chi-square test used to determine the relationship between the independent and dependent variables. Chi-square test was used to test hypothesis at $\alpha = 0.05$ significance level. Chi-square test was chosen because of its appropriateness where data is nominal as of this case.

3. FINDINGS AND DISCUSSION

To establish the factors influencing smallholder dairy farmers' choice of milk marketing outlet, an analysis to compare the influence of different variables was conducted. The independent variables were; the state of road infrastructure and the ownership of means of transport. The

[1] *The informal milk market has been defined by [6] as market outlets without any government regulation and in most cases buys milk from farmers and sells the milk to consumers or milk processors. In most cases these market outlets are characterised by middlemen or hawkers. In contrast, formal milk markets have some form of government regulation for instance farmer cooperatives*

demographic data indicates that most of the households were made up of male-headed families between the ages of 18-57 years at 93% while the rest 7% were over 58 years. In addition, most of the respondents had some form of literacy with most of the farmers having primary or secondary education at 70% compared to farmers with college education who were 30% and those with no educational background at 1% of the respondents.

The study also explored the existing milk marketing outlets in the division. The farmers interviewed sold their milk to the formal milk marketing outlets made up of KCC 2% and farmers' cooperative 63% in this case the milk chilling plant. In contrast the informal milk marketing outlets were made up of transporters 2%, brokers 3%, hawkers 29%, other farmer 0.5% and local hotels 0.5%. The result indicates majority of the smallholder farmers market their milk to the formal milk marketing outlets at 65% compared to the informal markets at 35%. The reason for this is the dominance of the farmers' milk cooperative represented by the milk chilling plant. This underlines the importance of farmers' cooperative in marketing of agricultural produce in the developing countries as has been alluded to in various literature [8,9]. The growing importance of the farmers' cooperatives has led the growth of the formal milk marketing outlets at the expense of the informal milk marketing outlets in Kenya as had been indicated earlier on. The cooperative was foremost accessible to the farmers and offered bulk marketing of the milk on behalf of the members therefore locking out middlemen often viewed as exploiting farmers. In addition, the cooperatives were offering other services such as credit facilities and farm inputs to the members which was an incentive for the farmers to join.

The milk chilling plant under study was a dairy farmers' cooperatives and through donors support (Bill Gates Foundation), the members had acquired a milk cooling machine for the purpose of reducing milk wastage among the smallholder farmers. The chilling plant was still a farmers' cooperative group, thus a formal milk outlet, however it had adopted a hybrid structure of buying milk from members and non-members. The non-members were not eligible for other services that was being offered such as credit facilities and parted with more money for transport compared to members. Consequently, 10% of the respondents indicated their flexibility in their preference of milk marketing outlet. These farmers marketed their milk to more than one outlet at a given time depending on the prevailing market price, the quantity of milk produced by their cows and the condition of the roads in the rainy season as will be discussed below.

3.1 Road Infrastructure and Choice of Milk Marketing Outlet

The hypothesis that was tested here set to determine the influence of the state of road infrastructure on smallholder dairy farmers' choice of milk marketing outlet. The hypothesis was: **The state of road infrastructure has no statistically significant influence on smallholder dairy farmers' choice of milk marketing outlet in Kipkaren division.** The chi-square test is represented in the Table 1.

From the result in Table 1, the p value (0.022) is less than 0.05 therefore the null hypothesis is rejected and the alternative is accepted implying that the state of roads within the division influenced the smallholder farmers choice of milk Marketing outlet. At the same time, the Cramer's *V* value is 0.738 indicating a strong relationship between the state of roads within the Kipkaren division and the farmers' choice of milk marketing outlet. The result shows that most feeder roads in Kipkaren division are of poor quality. The respondents were asked about the frequency of road repairs within their villages and 95% of the respondents indicated that the feeder roads in their area were repaired once in two years while 5% indicated that their feeder roads had never

Table 1. Milk marketing outlet choice with current state of road

Current state of road	Market outlet						
	Chilling plant	KCC	Transporters	Brokers	Hawkers	Other farmer	Total
Fair	39	0	0	0	15	0	54
Bad	53	2	3	4	39	1	102
Very bad	24	1	1	2	1	0	29
Total	116	3	4	6	55	1	185

χ^2 = 18.30 df = 10, p = 0.022, Cramer's V = 0.738, n=185

been repaired. This indicates that most feeder roads in Kipkaren division were in bad condition a factor made worse especially during rainy season. The poor feeder roads had negative impact in milk marketing by limiting the farmers' access to their preferred market outlet.

The important role of rural road infrastructure in agricultural production and marketing has been discussed in wide literature [10,11,9]. The roads within Kipkaren division under the study were the rural feeder roads that linked households to the local shopping centers and to the main roads leading to the nearest urban centers. The roads within the division were generally of poor condition with very few roads having bitumen surface on them. Therefore, during the rainy season between April-July the roads were generally impassable and poor in condition in the dry season due to lack of maintenance. The smallholder farmers' ability to access other markets located in urban areas were constrained because formal milk marketing outlets such as KCC and Brookside dairies, were based in urban centers a distance from Kipkaren. On the other hand, the milk chilling plant was accessible because of its locality within the division hence even when the roads were bad they were nearer to access compared to KCC. Good road infrastructure is crucial in marketing of agriculture produce and milk is no exception. Good roads facilitate fast and efficient marketing of agricultural commodities and thus farmers in Kipkaren would choose to sell their milk to hawkers and the local milk chilling plants most of the time rather than further markets like KCC found in the nearest major town.

These findings supports [8,5,9] hypothesis that poor road infrastructure increases farmers marketing transaction costs by increasing transport costs and the physical remoteness of accessing markets. In this case, the increased physical remoteness forced the smallholder farmers to market their milk to the most accessible milk outlets. The poor roads were. Therefore, a barrier to the farmers accessing their preferred market outlets outside the locality.

3.2 Means of Transport to the Market and Farmers' Choice of Milk Marketing Outlet

The study further analysed the influence of ownership of means of transport to the smallholder farmers' choice of milk marketing outlet. The hypothesis that was tested was: **The ownership of the means of milk transport to the market has no statistically significant influence on smallholder dairy farmers' choice of milk marketing outlet in Kipkaren division.** The results for the chi square test are represented in Table 2.

From the chi-square test, the p value 0.040 value is less than 0.05 thus the null hypothesis is rejected and the alternative accepted. This implied that the ownership of the means of milk transport to the market influenced the smallholder dairy farmers' choice of milk marketing outlet in Kipkaren division. The Cramer's *V* value of 0.244 indicates a weak relationship between the ownership of the means of milk transport and choice of milk market outlet. The data set indicates that 95% of the farmers owned some means of transport to the market while 5% did not own any means they used to the market. Those who did not own either hired or used their neighbors' means to transport milk to the market. About a half of the respondents, 56%; used bicycle to transport milk to the market, while the rest used other means such as pick-up truck 4%, tractor 2% and motorcycle 18% while 20% were carrying the milk physically to the market.

The ownership of means of milk transport to the market is closely related to the state of the roads described earlier on. The state of road infrastructure influenced the appropriate means of transport that farmers can use to transport their produce to the market. Most of the smallholder farmers owned bicycles because of their affordability. However, at the time of data collection motor cycles were becoming a popular means of transporting farm and non-farm

Table 2. Market choice with ownership of means of transport

Ownership of means of transport	Milk marketing outlet					
	Chilling plant	KCC	Transporters	Hawkers	Brokers	Other farmer
Yes	100	3	1	0	9	0
No	16	0	3	6	46	1
Total	116	3	4	6	55	1

χ^2 = 11.07, df= 5, p = 0.040, Cramer's V = 0.244, n= 185

produce within rural and urban Kenya. A few farmers had pick-up trucks and other had tractors which they used to transport the milk.

An efficient transport system is important to efficient agricultural marketing as most agricultural produce are often highly perishable. When transport services are infrequent and inadequate farmers will often be at a disadvantage when they attempt to sell their produce because of the high costs associated with transport. For instance, a farmer who owns a tractor can deliver all their milk to an outlet like the chilling plant because of increased accessibility. Hawkers may promise quick sales at higher value but are often not dependable due to their mobility. Evidence suggests that transport costs charges in much of Africa is higher compared to Asia and other parts of the world due to the poor road conditions in Sub-Saharan Africa [12]. A general improvement of the state of roads within the rural areas is expected to decrease travel time and lead to the emergence of a variety of transport modes which in the long run may lower transport costs [10].

Therefore, in assessing the importance of means of transport of agricultural produce, the road network in an area plays a role in determining the appropriate means of transport available and the associated costs as was the case in this study. The bicycles, though owned by most of the farmers, was not the best means of transporting milk to the market taking into consideration the state of the roads in the area. Taking everything it consideration, the ownership of a means of transport should not factor into influencing agricultural marketing. However, in the developing countries scenarios where markets are not fully developed, the infrastructure is poor and most farmers operate with minimal resources, owning a means of transport determines the accessibility of markets as in this study. Therefore, the importance of owning a means of transport is based in the ability of the farmers overcoming remoteness and accessing the preferred market outlet.

4. CONCLUSION

The result has shown that the state of road infrastructure and the ownership of means of transport determine the smallholder farmers' choice of milk marketing outlet. The state of the roads in the study area, as in most areas in rural Kenya, was in in poor condition. Road construction in Kenya is often skewed in favor of the urban roads at the expense of the rural roads. This is ironical, since Kenya's economy is dependent on agriculture as a major employer and the major source of export and therefore foreign currency. There is need, therefore, for increased investment in rural roads where the bulk of agricultural production is based. When farmers can access markets easily, it gives them the incentive to increase production. Farmers do not necessarily have to own a means of transporting for their produce especially when there is a cooperative. However, poor roads and underdevelopment of markets exacerbates the need for farmers to own a means of transport. Good rural roads is also expected to reduce wastage in agricultural produce especially during transport to the market. Therefore, there is a valid reason for the governments, in Kenya and other developing countries, to fund improvement of rural roads.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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