

Determinants of Access and Participation of Smallholder Farmers in Dairy Input and Output Markets in Tanzania: A Case Study of Rungwe District

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Abstract

The study was carried out in four divisions of Rungwe District of the Southern Highlands of Tanzania to investigate the effect of market access on market orientation of smallholder dairy farmers. Multistage and simple random sampling techniques were employed in selecting 120 dairy farmers in villages across four divisions of Rungwe District. Both descriptive and quantitative techniques were used in data analysis. The results revealed that more than 79% of the farmers had experience of more than 5 years in dairying and owned an average of three heads of dairy cattle including one milking cow. Market access as measured by travel time and frequency of milk sales had respectively, a significant ($P < 0.01$) and highly significant ($P < 0.001$) influence on volume of milk sold per household. The amount of milk consumed per household was a highly significant indicator of farmers' failure to participate in dairy markets. On average, each household consumed an average of 2.7 litres of milk in excess of WHO recommended daily intake due to poor access to fresh milk markets with a range 1.2 – 6.0 litres/hh across the four divisions. Level of input use demand was strongly and negatively influenced by the price of the input and distance to market. Lack of information and access to extension services also limited farmers' participation in dairy input and output markets. The findings from this study suggest that participation in dairy market depended on access to both in-put and output markets and years of experience in dairying.

Key words: Dairy input-output Markets, Smallholder farmers, Participation, Tanzania

Introduction

Since independence in 1961, the government of Tanzania has implemented several dairy development programmes that aimed at increasing and attaining self-sufficiency in milk supply and improve human nutrition. These programmes included the establishment of livestock research centres, importation of exotic breeds and crossbreeding, establishment of parastatal dairy farms and processing plants and dissemination of farm level dairy management services and technologies (Mpiri, 1990; Mtumwa and Mwashia, 1995; Das and Msechu, 1997). The

Southern Highland regions of Iringa and Mbeya have benefited from several decades of smallholder dairy development programmes financed by the Swiss Government and the Tanzania government from 1978 to 2002 (Bachman, 2004; Van Weperen, et al., 2003). However, these efforts lacked emphasis on market development, which resulted in failure in increasing dairy productivity. As a result, Tanzania continues to be a net importer of dairy products; per capita consumption of 39 litres is still low and the welfare of dairy smallholders

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has not improved (Van Weperen, 1999; Mdoe and Kurwijila, 1989; Mdoe *et al.*, 2000).

The significance of market orientation of the dairy sector stems from the persistently notable gap between the supply of dairy products and the ever-increasing demand due to human population increase in the urban areas. In addition, prices for milk products are increasing due to a combination of demand supply gap and rising consumer incomes (Mullins, 1995). While the growing demand and increasing prices represent new market opportunities for smallholder producers, there are however, some serious constraints which limit farmers from taking advantage of these opportunities (Mdoe *et al.*, 2000).

Small-scale milk producers face many hidden costs that make it difficult for them to gain access to market and productive assets (Holloway and Ehui, 2002, Hau and van Oppen, 2002). Amongst these are high marketing cost for liquid milk, thinness of market for liquid milk and the risk associated with marketing of a highly perishable produce. Hence milk prices fluctuate spatially and seasonally (Mdoe, 1993; Maganga, 1995; World bank, 2000). On the other hand market access of both input and output seems to have a great influence on the dairy performance and profitability (Holloway and Ehui, 2002).

While lack of market for fresh milk is a common complaint of farmers in Tanzania the extent to which access to input and output markets influences profitability and the market orientation of smallholder farmers in Tanzania is not very clear. This study was therefore carried out to investigate the effect of input-output market access on market orientation of smallholder farmers in Southern Highlands of Tanzania.

Methodology

Study area

Rungwe district is located in Mbeya region in the Southern Highlands of Tanzania and has an area of 2,211 km² located between longitudes 33° 20' E and 34° 00'E and latitudes 8°50'S and 9°20'S. Its altitude varies from 1,000m to 2,958m. Annual precipitation of 1700mm to 2400mm is distributed almost throughout the year except September and October. Temperature range is between -6°C and 25°C. The district has a total population of 306,380 of which 145,611 are

males and 161,659 females (URT, 2003). The area is a volcanic and mountainous plateau with numerous steep valleys and hills. It is one of the districts with high potential in dairying due to its favourable climate and the impact of several decades of dairy development activities. The district has 30,493 improved dairy cattle (Felber, 2003a). The study covered four divisions of the district, Tukuyu, Ukukwe, Pakati and Busokelo. Tukuyu town is located along the Mbeya-Kyela highway and is the main administrative and commercial centre of the study area. Ukukwe, Pakati and Busokelo divisions are located 5, 10 and 30 km from Tukuyu town. Busokelo is thus the most remote and includes Mwakaleli village which in the past had a thriving dairy co-operative society operating a milk cooling centre and some small-scale processing but has collapsed due operational problems.

Sampling and data collection

Primary data was collected from 120 smallholder dairy farmers, thirty from each division selected from villages using a multistage sampling frame. Pre-coded structured questionnaires were used to collect the data. A number of socio-economic parameters were collected from each respondent. These included household size, age, education level, gender, experience in dairying and source of start-up capital for the dairy enterprise. The information was supplemented by secondary data extracted from district headquarter reports and other documentary materials that were relevant to the study.

Access to and participation in dairy market

Households in the study area were classified according to proximity to the market and frequency of milk sale. Market access was defined by the time it took each farmer to travel to the market and the frequency of selling milk in the market (Hau and van Oppen, 2002). The measurement of time was chosen because farmers travelled mostly on foot. Farmers who spent less than 1 hour to the market were categorised as having high market access, 1-3 hours as medium and more than 3 hours as low market access.

Frequency of sale per day or per week was also taken as a measure of market access. This criterion was also used because some farmers

within the proximity of the market failed to sell their milk all the time. Therefore, farmers who sold twice a day were categorised as having high market access since these could sell both morning and evening milk most of the time. Farmers who sold once per day were categorised as having medium market access since these might have a problem with marketing either morning or evening milk. Those who sold less than 3 days/week were considered as having low market access since these have a problem of not being able to access the market on a daily basis either due to long distance to available markets or absence of daily markets. The two criteria were complimentary rather than mutually exclusive.

For market oriented dairy farmers to realise profit, they have to sell as much of the surplus milk as frequently as possible. It was assumed that, all factors being equal, high home milk consumption could be a reflection of the inability of farmers to participate fully in dairy market. Therefore proportion of milk sold to that of consumed was used as proxy to farmers' participation in milk market using the following linear regression model:

$$A = \alpha + \sum \beta_n X_n + \varepsilon_i$$

Where A = Proportion of milk sold/day or week, α = intercept, β_n = Regression coefficient explaining importance of variable X, X_n = is vector of independent variable such as:

X_1 = Distance from producer to selling point in km, X_2 = Experience in dairy business in years, X_3 = Price of milk per litre, X_4 = Level of education of respondent, X_5 = Frequency of sale per day or week, X_6 = Household size, X_7 = Age of respondent in years, X_8 = Distance from producer to town (km), X_9 = Amount of milk consumed at home in litres and ε_i = stochastic error term [$\varepsilon_i \sim N(0, \delta^2)$].

Input demand analysis

It is hypothesized that the profit the farmer gets from dairy outputs encourage him/her to invest more in the dairy enterprise leading to high demand for inputs.

Linear regression model was developed to examine the extent to which factors such as input price, distance to source of input, literacy level, access to credit, extension agent and income

derived from dairying and experience in dairy farming influence demand for inputs such as concentrates and mineral supplements which have a direct bearing on quantity of milk produced by a lactating cow.

$$Q = \beta_0 + \beta_1 BP + \beta_2 DM + \beta_3 EB + \beta_4 EL + \beta_5 EA + \beta_6 RE + \varepsilon_i$$

Where: Q = amount of concentrate given to cow per day

β_0 = intercept, β_1 - β_6 = parameters to be estimated, BP = price of input (minerals) per kg (Tsh), DM = distance from producer to input source in km, EB = experience in dairy business in years, EL = level of education, EA = access to extension agent or otherwise (dummy), RE = income from dairying (Tsh) and ε_i = stochastic error term [$\varepsilon_i \sim N(0, \delta^2)$].

Data analysis

The collected information was analysed using Statistical package for social science (SPSS, 2000). The key qualitative and quantitative analyses used in the study were gross margins and linear regression models. To assess the impact of market access on input use and overall dairy performance a partial Analysis of Variance (ANOVA) was done by studying its relationship to individual selected variables such as pasture plot size, quantity of minerals and concentrates given to cow per day, age at first calving, calving interval and total milk produced per cow/day.

Results and discussion

Socio-Economic characteristics of respondents

The social economics characteristics of respondents were similar to most of rural household setting else where in Tanzania (Msangi, 2001). About 55% of the respondents had attained at least primary education and majority consider dairying as their main source of income. The results also revealed that 49% of the dairy farmers fall in the most economically active age category ranging between 30-50 years. Furthermore, the results indicate that majority (79%) of farmers had experience of more than 5 years in dairy farming and most of them used

their own savings as the start-up capital for their dairy business. The average household size of the dairy farmers in the study area was 6 persons. This is relatively bigger compared to the an average of 4 person per household in the area reported during the 2002 population census (URT, 2003). This may be due to natural demographic dynamics of the area.

Herd size and composition

The average herd size across the four villages was three heads of cattle made up at least one milking cow and one calf. The rest were either a dry cow, a heifer and in very few cases a breeding bull. Households which did not have bulls, used bulls from bull-owning household to breed their cows. The proportion of cows in the herd is of paramount importance in dairying since it contributes directly to revenue generation of the herd. Msangi (2001) reported similar variation in dairy herd and composition within individual dairy farm household in Turiani division, Morogoro, Tanzania.

Market access and mode of transport

Table 1 shows the level of market access and the mode of transport used by sample respondents.

The results show that 14% of the farmers sold milk direct to milk vendors from their homes (i.e. zero travel distance) or transported milk to individual consumers located within an average distance of 0.6 km (43%) and to farmers' group shops (27%) located within an average of 1.1 km. The majority (95.7%) travelled on foot while only 4.3% used bicycles.

Thus about 70% of the farmers sold milk within less than one hour travel time to the market reflecting limitation imposed by the means of transport available. The reliance of on-foot transport was due to lack of access to other means of transport. Mutabazi (2002) reported the similar observation in Mbeya in which market actors in Mbeya municipality used public transport while other market actors with poor road network transported milk either on foot or used bicycles.

It is notable that market access as measured by travel time and frequency of milk sales had respectively, a significant ($P < 0.01$) and highly significant ($P < 0.001$) influence on volume of milk sold per household.

Table 1: Influence of market access on amount of milk sold by small holder dairy farmers in Rungwe district

Criteria	Variable	Classification	N	%	Average litres sold per day	F-value
1. Frequency of milk sales	2/day	High market access	30	30.9	11.4	7.349***
	1/day	Medium access	54	55.7	4.3	
	<3days/week	Low market access	13	13.4	3.4	
		Total	97	100	6.4	
2. Travel time to market	<1hr	High market access	67	61.7	8.1	5.185**
	2-3hrs	Medium access	19	20.8	2.7	
	>3hrs	Low market access	11	17.5	4.6	
		Total	97	100	6.4	
3. Mode of transport	On foot		90	95.7		
	Bicycle		4	4.3		
4. Customer type		Farmers Group shop (n=26)		Individuals (n=42)	Vendors (n=14)	Kiosks/Shop (n=15)
		%	26.8	43.3	14.4	15.5
		Distance travelled	1.1	0.6	0	2.5

Note: *** Significant at 0.1% and ** Significant at 1%

Table 2: Regression results for Determinants of milk market access in terms of proportion of milk sold per day by smallholder dairy farmers in Rungwe district

Predictors	B	S.E	t-ratios	Sign.
(Constant)	0.397	0.158	2.505*	0.014
Age of respondent	-0.022	0.001	-0.236	0.814
Education level of respondent	0.057	0.020	0.638	0.525
Years in dairy business	0.164	0.003	1.643	0.104
Household size	-0.085	0.010	-0.935	0.353
Distance to selling point	-0.249	0.008	-2.584*	0.012
Distance to town	-0.086	0.002	-0.792	0.431
Frequency of sale/day or week	0.366	0.034	3.743***	0.000
Price of milk/litre	-0.053	0.001	-0.585	0.560
Milk consumed/day in litres	-0.517	0.003	-5.439***	0.000
$R^2 = 51.6\%$ Adjusted $R^2 = 45.9\%$ SE = 0.1589 F-value = 9.118***				
Note: *** Significant at 0.1%, ** Significant at 1% * Significant at 5%				

Determinants of access to input and milk market

Table 2 presents the results from estimated parameters determining access to milk market participation model. The R-square value of 51.6% shows that more than half of the variation in market participation (proportion of the amount of milk sold) is due to predictors used in the model and the remaining 48.4% variation is caused by other factors. The statistical tests of the model show that the explanatory power of the model was highly significant ($P < 0.001$).

The results show that out of the 9 parameters examined, distance to selling point and frequency of sale/day or week were significantly ($P < 0.05$), and highly significantly ($P < 0.001$) related to market access in the study

area. The fact that the distance from producer to town had an insignificant negative influence on access to milk market ($P > 0.05$) while distance to selling point had significant influence means that point of sell within the vicinity of the producers was a more important market outlet for milk than the district town. These findings support previous studies in Mali, Nigeria and Ethiopia where milk marketing was promoted by shorter distance between producers and consumers (ILCA, 1993).

Frequency of sale/day or week, which is an important indicator of market access, had highly significant ($P < 0.001$) influence on milk market participation. On the other hand milk consumption at home reduced the level of milk market participation significantly ($P < 0.001$) while a non significant

Table 3: Factors influencing demand for concentrates and minerals inputs fed to cows by smallholder farmers in Rungwe district

Predictors	B	SE	t-ratios	Significance
(Constant)	44.843	14.420	3.110***	0.003
Access to extension service	0.038	6.241	0.381	0.705
Distance to input source in km	-0.050	0.193	-0.489	0.626
Price of concentrates per kg	-0.249	0.005	-2.429*	0.018
Net return from dairying	0.492	0.000	5.081***	0.000
Access to credit facilities	0.268	8.898	2.743***	0.008
Level of education	0.021	2.357	0.207	0.836
Years in dairying	-0.250	0.264	-2.503*	0.015
$R^2 = 42.8\%$ Adjusted $R^2 = 36.6\%$ SE = 16.73 F-value = 6.847***				
*** Significance at 0.1% ** Significance at 1% * Significance at 5%				

negative effect was observed for age of respondent ($P < 0.814$ and household size ($P < 0.353$). As one increases the frequency of milk sale per day or per week automatically the amount of milk sold increases and little is left for home consumption. In the regression model, frequency of sale is the variable with the second highest departure from zero ($t = 3.743$) compared to other independent variables. This implies that the variation in milk market participation can be explained well by frequency of milk sale and amount of milk consumed. Other factors that influenced market participation positively though not statistically significant ($P > 0.05$) include level of education and years in dairy business. These findings are similar to what has been reported by Araudoba (1993), Rutamu and Uden (1998) and Elias (2003) respectively in Dodoma, Tanga and Mbeya urban, Tanzania.

Selling price had negative influence on milk market participation though not significantly ($P > 0.05$). This confirms the empirical evidence (Staal *et al.*, 1997; Felber, 2003b) that most of the farmers selling milk consider reducing market risks and lowering costs of transacting through bulking and risk sharing rather than expectation for higher prices. In the study area, it was observed that most farmers preferred to send all milk in bulk to group or private shops than selling small quantities to individual customers who pay highest market price. This is time consuming and producer would bear all the risk of loss in case of spoilage or failure to sell all the milk.

Determinants of access to dairy inputs and services

The results (Table 3) from estimated input regression model show that the explanatory power of the model was significant ($P < 0.001$).

The R-square value shows that 42.8% of variation in the input demand were due to the fitted predictors and the remaining 57.2% were due to predictors not included in the model.

Estimated coefficient attached to net return from dairying had significant influence on dairy input demand ($p < 0.001$). This shows that increase in output market access increases the propensity of farmers to use inputs because market access assures them of good income returns after buying the necessary inputs. In this study net return from dairying contributes to almost half (49.2%) of the total variation in input demand.

Access to credit facilities was statistically significant ($P < 0.01$) increasing the propensity for input use due to the fact that farmers with access to credit facilities had advantage over those who had no access. The majority of the dairy farmers (96.7%) had no access to credit facilities (Table 4). Access to credit enables the farmers to use improved inputs such as commercial feed supplements and veterinary services and paying hired labour, which in turn have a direct positive impact on dairy performance. Philip (2001) reported similar findings for Turiani dairy farmers who had access to credit facilities. According to Freshwater (1989) credit facilities assist farmers in the adoption of dairy technologies by increasing farmer's capability to purchase inputs such as veterinary drugs and commercial feeds that would otherwise not be affordable to them. Currently, access to formal rural credit facilities is limited in Tanzania especially for purely agricultural enterprises. These findings support other earlier studies of Lyatuu (1994), Sirili (2001) and Felber (2003b) who reported that most of the rural dairy farmers had no access to credit facilities.

Table 4: Access to dairy support services by small holder farmers in Rungwe district(n=120).

		Ukukwe		Busokelo		Pakati		Tukuyu		Overall	
		n	%	n	%	n	%	n	%	n	%
Extension	Yes	24	80	20	66.7	10	33.3	28	93.3	82	68.3
	No	6	20	10	33.3	20	66.7	2	6.7	38	31.7
Credit	Yes	1	3.3	-	-	-	-	3	10	4	3.3
	No	29	96.7	30	100	30	100	27	90	116	96.7
Market information	Yes	4	13.3	-	-	-	-	21	70	25	20.8
	No	26	86.7	30	100	30	100	9	30	95	79.2

Price significantly ($P<0.05$) lowered demand for dairy inputs. Various researchers have reported similar observations (Mlambiti, 1999; Mugittu, 1999; Sirili, 2001). High prices depress demand for inputs as farmers economise on their use, by pursuing subsistence oriented production strategies whose returns are low. This further dampens demand for inputs, lowers incentives and returns to increased procurement and distribution by traders, which leads to higher prices. This results in an increased self-reinforcing movement towards an equilibrium featuring limited trade in high priced inputs alongside a preponderance of production systems featuring limited use of inputs, low productivity and low returns. In the absence of intervention that addresses this problem, no supply-side or demand-side pressures will succeed in reversing low performance trends observed in the study area.

Distance to input market had no significant influence on input use/demand which suggest that infrastructure, transport cost and its availability matter more than distance per se. Similarly, access to extension services did not have significant effect on input use which seems to suggest that farmers (31.7%) who indicated to have had no access to extension services or no market information (79.2%) (Table 4) may have had access to alternative sources of information such as other farmers, private veterinary services or Para-veterinarians. Farmers require periodical information on commodity prices to enable them plan production levels in advance and to negotiate for better prices. Availability of information also helps to create transparency

among all players in the market. Lack of transparency in the market (e.g. where buyers offer very low prices) discourages production and perpetuates poverty, thus constraining further development of the smallholder dairy sector. In contrast, a good flow of market information makes commodity prices competitive and results in fair distribution of benefits to producers, traders and consumers.

Conclusions

Results of the study show that a combination of available milk market outlets, means of transport and distance to selling points influenced frequency and volume of milk sales per day significantly. Higher home milk consumption and therefore low market participation were due to lack of reliable markets for fresh milk within the vicinity (less than one hour travel distance) of milk producers. Input use demand was strongly and negatively influenced by the price of the input and distance to market suggesting that distance to milk market and price of input act as barriers to entry in dairy business.

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