



The Influence of Socio-Economic Characteristics on Commercialization of Smallholder Dairy Value Chain Development in Uasin Gishu County, Kenya

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Abstract: Livelihoods of many rural households in developing economies majorly depend on smallholder farming activities. Smallholder dairy farming is the single largest component of agriculture in Kenya. Uasin Gishu County is the leading milk producer in Kenya with subsistence, semi-commercialized and commercialized farmers constituting 70%, 20% and 10% respectively. Smallholder dairy farming in Kenya grows at 4.1% per annum compared to 1.2% for agriculture as a whole. Commercializing smallholder dairy value chain is important in providing pathway out of poverty and for sustainable rural development. Commercialization of smallholder dairy value chain development is variable and is not yet high enough to enable producers benefit from increased income and stimulate rural development. This may be influenced by Socio-economic characteristics of the smallholder producers. The objective of this paper is to examine the influence of socio-economic characteristics on commercialization of smallholder dairy value chain development. Social survey research design was used to obtain both secondary and primary data. A sample size of 384 smallholder dairy producers was studied out of a population of 50,457 respondents. Data analysis procedures used includes: mean, standard deviation, Pearson correlation coefficient, Spearman's rank correlation coefficient and multiple regressions. The study results show that socio-economic characteristics of smallholder dairy producers have significant influence on commercialization of smallholder dairy value chain development.

Keywords: Commercialization, Smallholder Dairy Producers, Smallholder Dairy Value Chain Development, Socio-Economic Characteristics, Uasin Gishu County

1. Introduction

Smallholder farming is paramount to livelihoods of many rural households in developing economies. Majority of the population in Africa (over 70%) lives in the rural areas. Over 75% of the poor are rural smallholder farmers who primarily depend on agriculture for their livelihoods (Govere et al., 1999; Pingali, 1997; Zhou et al., 2013). Dairy farming in Kenya is the single largest component of agriculture. It grows at 4.1% per annum compared to 1.2% for agriculture as a whole (IFAD, 2006; GoK, 2008; GOK, 2010a; GoK, 2013b). Furthermore, it accounts for 3.5% of

the total gross domestic product (GDP) and 14% of agricultural GDP (GoK, 2010a; GoK, 2013b). Moreover, dairy farming is dominated by smallholder producers (80%) and produce about 80% of total milk production and 70% of the total milk marketed in the Kenya (IFAD, 2006; GoK, 2010a). Kenya National Dairy Master Plan (GoK, 2010a) which is consistent with the Agricultural Sector development Strategy (ASDS), 2010-2020 (GoK, 2010b) and the Kenya Vision 2030 (GoK, 2007) aims to transform the prevalent subsistence smallholder dairy farming to competitive, commercial and sustainable dairy value chain that will lead to economic growth, poverty alleviation, wealth creation and employment. Commercializing

smallholder dairy farming is an indispensable pathway towards sustainable rural development for most developing countries relying on the dairy sector as an important pathway out of rural poverty (Von Braun, 1994; Pingali and Rosegrant, 1995; GoK, 2010a; GoK, 2013a; Tefera *et al.*, 2010; Ele *et al.*, 2013). Poulton *et al.*, 2008 defines agricultural commercialization as an agricultural transformation process in which farmers shift from mainly consumption-oriented subsistence production towards market- and profit-oriented production systems. The main purpose of subsistence system is to produce to maintain household food self-sufficiency by using mainly non-traded and household generated inputs. The semi-commercial system is focused towards generation of marketable surplus and maintaining household food security by using both traded and non-traded farm inputs. In commercial system, profit maximization is the main motive of the entrepreneur and inputs are predominantly obtained from markets (Ele *et al.*, 2013; Hall, 2005). Commercialization of smallholder dairy value chain development usually takes a long transformation process from subsistence to semi-commercial and then to fully commercialized dairy farming (Pingali and Rosegrant, 1995; Omitiet *et al.*, 2006; Jaleta *et al.*, 2009; GoK., 2010a; Agwuet *et al.*, 2013; Agwuet *et al.*, 2012).

The smallholder dairy producers in Uasin Gishu County are categorized in the commercialization process as: 70% are subsistence, 20% are semi-commercialized and 10% are commercialized (GoK, 2013a). This indicates that the commercialization of smallholder dairy value chain development is variable and is not yet high enough to enable producers benefit from increased income and stimulate rural development (Ele, *et al.* 2013; Ele, *et al.* 2012; GoK, 2010a; GoK, 2013a). This may be influenced by socio-economic characteristics. The Country and the Uasin Gishu County also have huge untapped potential for commercial-orientation of smallholder dairy value chain development (GoK, 2010a; GoK, 2013a).

The household commercialization index (HCI) measures the extent to which household production is oriented towards the commercialization. It ranges from zero to 100%. A value of zero signifies a totally subsistence oriented producer. The closer the index is to 100%, the higher the degree of commercialization (Nmadu, *et al.* 2012; Muhammad-Lawal, *et al.* 2014). HCI was applied in this study in measuring the dependent variable. This study used dairy milk production and dairy milk sales in measuring HCI of the households of smallholder dairy producers. The studies (Pingali and Rosegrant, 1995; Jaleta *et al.*, 2009; Zhou *et al.*, 2013; Poulton *et al.*, 2008; Muhammad-Lawal *et al.*, 2014) provides scale of commercialization (HCI) as: 0% - 30%: subsistence oriented farmer; 31% - 65%: Semi-commercialized farmers; 66% - 100%: Commercialized farmers.

$$HCI = \left[\frac{\text{Gross value of milk sales per household per month}}{\text{Gross value of total milk production per household per month}} \right] \times 100$$

2. Methodology

2.1. Area of Study

Uasin Gishu County is situated in the former Rift Valley Province with a total area of 3,327.8 Km². It extends between longitude 34° 50' and 35° 37' east and 0° 03' and 0° 55' north. It is made up of six Sub-Counties namely: Soy; Turbo; Kapsaret; Kesses; Ainabkoi and Moiben (GoK, 2013a). The county is the leading milk producing county in Kenya with three (3) categories of dairy producers namely: subsistence (70%), semi-commercialized (20%) and commercialized (10%) (GoK, 2013a; GoK, 2013c). The County therefore, is mainly characterized by subsistence oriented smallholder dairy producers.

2.2. Research Design and Method of Data Analysis

This paper used cross-sectional research design. Methods of data analysis includes: Descriptive statistics namely mean and standard deviation; inferential statistics namely; correlations and regression namely Pearson, spearman's rho and multiple regression respectively. The model below was used to examine the dependence structure between random variables:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \epsilon.$$

(Mugenda and Mugenda, (2003))

Where: Y = Average HCI (Dependent variable).

Xi-n = socio-economic characteristics (Independent variables)

β_0 = Constant or Point of intercept on Y axis

β_1 -n = Regression coefficients.

ϵ = Residual term or the error

The degree of commercialization of smallholder dairy value chain development was measured using Household Commercialization Index (HCI) given by the formula below:

3. Results and Discussions

3.1. Commercialization of Smallholder Dairy Value Chain Development

The socio-economic characteristics of the smallholder dairy producers, their influence on the commercialization of smallholder dairy value chain development were analyzed using descriptive, correlation, regression statistics and HCI indices and results are as shown in table-1; table-2; table-3 and table-4 respectively.

3.2. Socio-Economic Characteristics

The descriptive results of Socio-Economic Characteristics shown in table- 1 are discussed as below:

The proportions of respondents as per their being member

of farmer organization/institution are as follows: 67.2% of respondents were reported as being members of farmer organizations, whereas 32.8% were not members of any farmer organization. This shows that most of the respondents (67.2%) were members of various farmer organizations. As per their size of land under pasture/fodder, the proportions of respondents are as follows: 13% of the respondents had no land set aside for pasture/fodder, 18.2% had land of 0.01-0.50 Ha for pasture/fodder, 50.8% had 0.6-2.5 Ha, 12.8% had 2.6-7 Ha whereas 5.2% had above 7.0 Ha for pasture/fodder. This indicates that most of the producers (50.8%) had 0.6-2.50 Ha for pasture/fodder. 82% of the respondents had land under pasture/fodder of 2.50 Ha and below.

The distribution of respondents as per their experience in dairy farming are as follows: 6.5% of the respondents had experience of 1-4 years, 13.0% had experience of 5-8 years, 29.7% had experience of 9-12 years, 39.1% had experience of 13-17 years, 5.2% had experience of 16-20 years, whereas 6.5% had experience of above 20 years. This shows that most of the respondents (39.1%) had experience of 13-17 years. 68.8% of the respondents had experience of 9-17 years. The results of proportions of respondents as per their other farming enterprises are as shown: 27.3% of the respondents had mixed farming, 7.8% had cash crops, 14.3% had food crops, 20.6% had poultry farming, 18.2% had goat rearing and 11.8% had no other farming apart from dairy farming. This indicates that most of the respondents were mixed farmers in the study area.

The proportions of respondents as per their number of dairy cows on farm are as follows: 58.6% of the respondents had on farm between 1 and 3 dairy cows, 29.7% had between 4 and 6 cows, 9.1% had between 7 and 9 cows whereas 2.6% had 10 and above dairy cows on the farm. This shows that most of the respondents were smallholder dairy producers having between 1 and 3 cows on their farms. 88.3% of the respondents had 1-6 cows on their farms. The results of distribution of respondents as per their other occupation are: 29.7% did not have any other occupation, 54.7% had off-farm employment while 15.6% were retired. Thus, half of the respondents (54.7%) had off-farm employment or source of income from off-farm.

The results of housing type are as follows: 15.4% of the respondents had grass thatched house, 56.3% had semi-permanent house and 28.3% had permanent house. This indicates that most of the respondents (56.3%) had semi-permanent houses. 84.6% of the respondents had generally good housing types (semi and permanent housing types). The distribution of respondents as per their farm size are as follows: 43% of the respondents had farm size of between 0.1 and 0.5 Ha, 11.7% had farm size of between 0.6 and 1.0 Ha, 19.5% had farm size of between 1.1 and 2.5 Ha, 14.0% had farm size of between 2.6 and 4.0 Ha, 6.5% had farm size of between 4.1 and 7.0 Ha, whereas 5.3% had farm size of above 7.0 Ha. This means that most of the respondents (43%) had farm size of between 1.1 and 0.5 Ha. 88.2% of the respondents had farm sizes of 4.0Ha and below. The proportions of respondents as per their household size are as

follows: 22.6% had between 1 and 4 household size; 65.6% of the respondents had household size of between 5 and 8, and 11.8% had household size of between 9 and 12. This indicates that most of the respondents (65.6%) had household size of between 5 and 8. 88.2% had household size of between 1 and 8 giving an average household size of 5. The proportion results of respondents as per their Sub-Counties are: 14.6% of the respondents were from Soy Sub-County, 16.9% were from Turbo Sub-County, 24.2% were from Kesses Sub-County, 9.9% were from Kapsaret Sub-County, 15.6% were from Moiben Sub-County, whereas 18.8% were from Ainabkoi Sub-County. This shows that the respondents came from all the six Sub-Counties of Uasin Gishu County with the highest coming from Kesses Sub-County (24.2%).

Table 1. Respondents' Socio-Economic characteristics.

Member of farmers' organizations/institutions:			
Member of farmers' organizations/institutions:	Frequency	Valid Percent	Cumulative Percent
Yes	258	67.2	67.2
No	126	32.8	100
Total	384	100	
Size of land under pasture/fodder in ha:			
Size of land under pasture/fodder in Ha:	Frequency	Valid percent	Cumulative percent
0	50	13	13
0.01-0.50	70	18.2	31.2
0.6-2.50	195	50.8	82
2.60-7.0	49	12.8	94.8
Above 7.0	20	5.2	100
Total	384	100	
Dairy farming experience of house hold head in years			
Dairy farming experience of house hold head in years:	Frequency	Valid Percent	Cumulative Percent
1-4	25	6.5	6.5
5-8	50	13	19.5
9-12	114	29.7	49.2
13 – 17	150	39.1	88.3
16 – 20	20	5.2	93.5
Above 20 years	25	6.5	100
Total	384	100	
Other farming enterprises:			
Other farming enterprises:	Frequency	Valid percent	Cumulative percent
Mixed farming	105	27.3	27.3
Cash crops	30	7.8	35.1
Food crops	55	14.3	49.4
Poultry	79	20.6	70
Goat rearing	70	18.2	88.2
None	45	11.8	100
Total	384	100	
Number of dairy cows on farm:			
Number of dairy cows on farm:	Frequency	Valid percent	Cumulative percent
1-3	225	58.6	58.6
4-6	114	29.7	88.3
7-9	35	9.1	97.4
10 and above	10	2.6	100
Total	384	100	
Other occupation of household head:			
Other occupation of household head:	Frequency	Valid percent	Cumulative Percent
None	114	29.7	29.7
Employed off-farm	210	54.7	70.3
Retired	60	15.6	100

Member of farmers' organizations/institutions:			
Member of farmers' organizations/institutions:	Frequency	Valid Percent	Cumulative Percent
Total	384	100	
Housing Type of household:			
Housing Type of household:	Frequency	Valid Percent	Cumulative Percent
grass thatched house	59	15.4	15.4
semi-permanent house	216	56.3	71.7
permanent house	109	28.3	100
Total	384	100	
Farm size Ha:			
Farm size Ha:	Frequency	Valid percent	Cumulative percent
0.1-0.5	165	43	43
0.6-1.0	45	11.7	54.7
1.1-2.5	75	19.5	74.2
2.6-4.0	54	14	88.2
4.1-7.0	25	6.5	94.7
Above 7.0	20	5.3	100
Total	384	100	
Household size:			
Household size:	Frequency	Valid percent	Cumulative percent
1-4	87	22.6	22.6
5-8	252	65.6	88.2
9-12	45	11.8	100
Total	384	100	
Sub-County of the producers:			
Sub-County of the respondents:	Frequency	Valid percent	Cumulative percent
Soy	56	14.6	14.6
Turbo	65	16.9	31.5
Kesses	93	24.2	55.7
Kapsaret	38	9.9	65.6
Moiben	60	15.6	81.2
Ainabkoi	72	18.8	100
Total	384	100	

3.3. Inferential Results

The correlation and regression analysis were used to test the research questions that socio-economic characteristics influence the commercialization of smallholder dairy value chain development. The results from the correlation, regression and HCI analyses shown in tables 2, 3 and 4 respectively are discussed as follows:

3.3.1. Correlation Results

The correlation results in table 2 below indicate as follows:

The correlation results of a Pearson correlation coefficient of 0.809 and Spearman's rho of 0.868 shows that there is a positive relationship between respondents' being members of farmer organizations and the average household commercialization index with the coefficients being highly significant at 1%. As per size of land under pasture /fodder, the correlation results of a Pearson correlation coefficient of 0.808 and Spearman's rho of 0.873 indicate that there is a positive relationship between respondents' size of land under pasture/fodder and the average household commercialization index. The coefficients are significant at 1%. The correlation results of a Pearson correlation coefficient of 0.762 and Spearman's rho of 0.846 shows that there is a positive relationship between respondents' experience in dairy

farming and the average household commercialization index with the coefficients being significant at 1%. According to the correlation results of a Pearson correlation coefficient of 0.795 and Spearman's rho of 0.866, there is positive relationship between respondents' other farming enterprises and the average household commercialization index with the coefficients being highly significant at 1%. The correlation results of a Pearson correlation coefficient of 0.692 and Spearman's rho of 0.669 indicate that there is a positive relationship between respondents' number of dairy cows on farm, and the average household commercialization index. The coefficients are highly significant at 1%.

According to correlation results above, Pearson correlation coefficient of 0.650 and Spearman's rho of 0.615 shows that there is a positive relationship between respondents' other occupation, and the average household commercialization index. The coefficients are highly significant at 1%. The correlation results of a Pearson correlation coefficient of 0.562 and Spearman's rho of 0.484 indicate that there is a positive relationship between producers housing types and the average household commercialization index with the coefficients being significant at 5%. In the case of farm size, correlation results of a Pearson correlation coefficient of -0.503 and Spearman's rho of -0.426 shows that there is a negative relationship between respondents' farm size and the average household commercialization index. The coefficients are significant at 5%. According to correlation results above, a Pearson correlation coefficient of -0.419 and Spearman's rho of -0.473 shows that there is a negative relationship between respondents' household size, and the average household commercialization index, and the coefficients being significant at 5%.

The correlation results with a Pearson correlation coefficient of 0.026 and Spearman's rho of 0.057 indicate that there is a positive relationship between respondents' Sub-County, and the average household commercialization index. The coefficients are significant at 5%.

Table 2. Correlation results.

No.	Independent Variable	Correlation Model	
		Pearson Correlation	Spearman's rho
1	Member of farmers' organizations/institution	.809**	.868**
2	Size of land under pastures/fodder (ha)	.808**	.873**
3	Experience (Years)	.762**	.846**
4	other farming enterprises	.795**	.866**
5	No. of dairy cows	.692**	.669**
6	other occupation of respondent	.650**	.615**
7	Housing type of respondent	.562*	.484*
8	Farm size (Ha)	-.503*	-.426*
9	Household size (No of persons)	-.419*	-.473*
10	Sub-County of respondent	.026*	.057*

Key to table-2: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). Sample size, N = 384. Correlation between each variable and itself = 1.00.

The correlation coefficients indicate that the household commercialization index of the respondents is significantly correlated with the independent variables. However, some correlations are more powerful statistically at 1% level of significance than the others at 5% level. Member of farmers' organizations/institutions; size of land under pastures/fodder; experience; other farming enterprises; number of dairy cows and other occupation of the respondent have correlation coefficients greater than 0.6 (+ or -) and they are significant at 99% confidence level. On the other hand, housing type of the respondent; farm size; household size and Sub-County of the respondent have relatively low Pearson coefficients of 0.562; -0.503; -0.419 and 0.026 respectively at $\alpha = 0.05$.

3.3.2. Regression Results

The regression coefficients in table 3 below show that the independent variables influence the household commercialization index (HCI) at various levels and the results are discussed as below:

Being member of farmer organization has a standardized coefficient of 0.145 meaning that being member of farmer organization has positive influence on the household commercialization index and, coefficient is highly significant at 1%. One percent changes in being member of farmer's organization causes an increase of HCI by 0.145 (14.5%). The size of land under pasture/fodder has a standardized coefficient of 0.145 meaning that size of land under pasture/fodder has positive influence on the household commercialization index with coefficient being significant at 1%. One percent changes in size of land under pasture/fodder causes an increase of HCI by 0.145 (14.5%). Experiences of the respondents in dairy farming has a standardized coefficient of 0.118 meaning that experience of respondents in dairy farming has positive influence on the household commercialization index and, coefficient is significant at 1%. One percent increases in dairy farming experience causes an increase of HCI by 0.118 (11.8%). Other farming enterprises have a standardized coefficient of 0.128 meaning that other farming enterprises have positive influence on the household commercialization index with coefficient being highly significant at 1%. One percent changes in other farming enterprise causes an increase of HCI by 0.128 (12.8%).

The numbers of dairy cows on farm have a standardized coefficient of 0.105 meaning that number of dairy cows on farm has positive influence on the household commercialization index and, coefficient is highly significant at 1%. One percent increases in number of dairy cows on farm causes an increase of HCI by 0.105 (10.5%). Other occupation has a standardized coefficient of 0.095 meaning that other occupation has positive influence on the household commercialization index and, coefficient is highly significant at 1%. One percent increases in other occupation of the household causes an increase of HCI by 0.095 (9.5%). Housing types have a standardized coefficient of 0.070 meaning that housing types have positive influence on the household commercialization index and, coefficient is significant at 5%. One percent changes in the type of housing

towards permanent types causes an increase of HCI by 0.070 (7.0%). Farm size has a standardized coefficient of -0.031 meaning that farm size has negative influence on the household commercialization index with coefficient being significant at 5%. One percent increases in the farm size causes reduction of HCI by 0.031 (3.1%). Household size has a standardized coefficient of -0.022 meaning that household size has negative influence on the household commercialization index with coefficient being significant at 5%. One percent increases in the household size causes reduction of HCI by 0.022 (2.2%). Sub-County has a standardized coefficient of 0.008, meaning that Sub-County of the respondents has positive influence on the household commercialization index and, coefficient is significant at 5%. One percent changes in the Sub-County of the household causes an increase of HCI by 0.022 (2.2%).

Table 3. Regression results.

Independent Variables	Coefficient	Std. Error	T-ratio
Member of farmers' organizations/institution	.145**	(.136)	1.066
Size of land under pastures/fodder (ha)	.145**	(.136)	1.066
Experience (Years)	.118**	(.108)	1.093
other farming enterprises	.128**	(.076)	1.684
No. of dairy cows	.105**	(.104)	1.010
other occupation of respondent	.095**	(.193)	0.492
Housing type of respondent	.070*	(.098)	0.714
Farm size (Ha)	-.031*	(.213)	-0.146
Household size (No of persons)	-.022*	(.148)	-0.149
Sub-County of respondent	.008*	(.036)	0.222
Constant	.285	(0.633)	0.450

Coefficient is significant at the 0.01 level (2-tailed). * Coefficient is significant at the 0.05 level (2-tailed). Sample size, N = 384. R=0.902; R²=0.814; Adjusted R²= 0.760

The regression coefficients show that these independent variables (socio-economic characteristics) influence the household commercialization index. Member of farmers' organizations/institution; size of land under pasture/fodder; experience in dairy farming (Years); other farming enterprises; number of dairy cows and other occupation are positively related to HCI and coefficients are significant at 1%. Housing type and Sub-County of respondent are positively related to HCI and coefficients are significant at 5%. The coefficients of farm size and household size (No of persons) of the respondent are negatively related to HCI and significant at 5%. The R Square statistic (.814) is generally interpreted to mean that: the ten independent variables in the regression model account for 81.4 percent of the total variation in the given HCI. Thus, "the higher the R-squared statistic, the better the model fits the data". In this case, the model fits the data with a high significance.

3.3.3. Socio-Economic Characteristics and HCI Results

Furthermore, the HCI of the respondents were determined and the results are as indicated below (table-4):

According to HCI results, respondents who were members of farmers' organizations/institutions have higher

commercialization index of 66%, whereas those who were not have lower commercialization index of 28%. This means that farmer's membership to associations'/organizations increases commercialization level. Membership of associations'/organizations and groups possess the potentials of increased access to information important to production and marketing decisions. Collective action as measured by belonging to farmers' organizations strengthens farmers' bargaining and lobbying power which facilitates obtaining institutional solutions to some problems and coordination. In addition, collective action has an additional advantage of spreading fixed transaction costs. This variable impacts positively on market participation and HCI. The result is in line with that of Jones, (1996), and Matungul et al., (2001) that collective action as measured by belonging to farmers' organizations strengthens farmers' bargaining and lobbying power. Cooperation with large commercial producers also lowers transaction costs as it enhances opportunities for information sharing. The large scale commercial producers have access to services and profitable markets. This is a valuable resource that can promote market participation and increases HCI. The result is also supported by that of Ele, *et al.*, (2013) which state that membership of cooperatives had a positive sign indicating that as membership of cooperatives is increased and encouraged commercialization of households will also increase. This is also in line with Ele, (2008) where increase in membership of cooperatives increased fish production in the fresh water fishery sub-sector of the cross River Basin in Cross River State, Nigeria. According to Agwu, *et al.*, (2012), the coefficient of farmer's membership to associations was positive and significantly related to market orientation and commercialization at 1% probability level. It is also in line with previous findings of Olwande, (2010). The development of agricultural support services such as agricultural extension linking smallholders with new farm practices, and institutional arrangements such as agricultural marketing and service cooperatives which are designed to help link smallholders with input and output markets(Jaleta, *et al.*, 2009; Lerman, 2004; Govereh, *et al.*, 1999; Alene, *et al.*, 2008; IFAD, 2006) found that reducing transaction costs require arrangements that include contract farming and development of smallholder organizations to achieve continuous and reliable supply of marketed commodities. Sharp, *et al.*, (2003) found out that it is through networks that information and other resources can be transmitted, and the existence of trust facilitates co-operative behavior based around these networks.

The HCI results indicate that respondents who had over 7.0Ha of land under pasture/fodder have higher commercialization index of 69% and those who had no land under pasture/fodder have lower commercialization index of 26%. The other acreage of land have HCI as indicated: 0.01-0.50 Ha (27%); 0.6-2.50 Ha (28) and 2.6-7.0 Ha (29%). This means that the higher the size of land under pasture/fodder, the higher the HCI due to higher dairy productivity. This is mainly due to feeds being available for increased milk production. Feeding constitutes the largest portion of the

costs of milk production in market-oriented dairy farming.

Respondents with over 20 years of dairy farming experience have higher commercialization index of 67%, whereas those with 1-4 years dairy farming experience have lower commercialization index of 25%. The HCI of other ages are as indicated: 5-8 years (26%); 9-12 years (26%); 13-17 years (28%) and 16-20 years (44%). The result implies that as the number of years of farmers' increases, the probability of commercialization also increases. Experience has been known to lead to perfection in activities. This resultantly manifests in increased knowledge of techniques or otherwise involved in any enterprise. The results mean that increased experience of respondents in dairy farming improves their capacity in business management, access to market information and access to knowledge and technology hence higher HCI due to improved access to markets and increased productivity. Human capital comprises of education, experience, skills, capabilities of household members engaged in pursuing new opportunities that could change the household's overall living standards. The result is supported by that of (IFAD, 2006) which states that the rural poor are constrained by lack of information about markets, lack of business and negotiating experience, and lack of collective organization which can give them the power they require to interact on equal terms with others. According to World Bank, (2008), household asset holding in the form of human capital is one of the crucial elements in commercializing smallholder agriculture. The study finding is also in line with that of (Ele, *et al.*, 2013; Martey, *et al.*, 2012) which indicate the age of the household is a proxy measure of experience and availability of resources. They also confirmed that it is possible that older and more experienced households are able to take better production decisions and have greater contacts which allow trading opportunities to be discovered at lower cost than younger farmers. The results also indicated that on average a household head is married and has between 19 to 22 years of farming experience and has had at least primary school education, which indicates that they can at least read and write an important factor in the commercialization of farming. This finding is consistent with Agwu *et al.*, 2011; Agwu, *et al.*, 2012 where farming experience was also significant at 1% probability level with a positive sign. The finding is also in line with that of Nmadu, *et al.*, 2012 who found out that age of poultry farmers, marital status, educational status, number of years in poultry production, types of birds and production system increased technical efficiency and HCI.

The respondents who were with only dairy farming as an enterprise have higher commercialization index of 48% followed by those who had mixed farming (29%), whereas respondents with goat rearing as other farming enterprise have lower commercialization index of 21%. The HCI of other type of farming are as indicated: Cash crops (24%); food crops (22%) and poultry (23%). This therefore means that commercialization of smallholder dairy value chain development is associated by specialization in dairy farming.

The result is supported by that of Jaleta, *et al.*, (2009).

The HCI results indicate that respondents who had above ten (10) dairy cows on the farm have higher commercialization index of 68%, whereas those who had 1-3 cows have lower commercialization index of 28%. The other respondents with number of dairy cows have HCI as indicated below: 4-6 dairy cows (29%) and 7-9 dairy cows (43%). This is mainly due to increased milk production and economy of scale as the number of cows per respondent increases. The respondents with large herds of dairy can receive more income from sales of the animals and their products. This result is consistent with the finding of Michalickover, *et al.*, (2014) who found out that reduction in the number of cows per herd and savings in the feed consumption resulted in the lower economic efficiency of milk production in the period 2009-2012 in Slovak Republic. The finding by Otieno, *et al.*, (2014) that herd size among other factors contributes positively to efficiency also confirms the study findings. According to Berem, *et al.*, (2011), an increase of a household's Tropical Livestock Units (TLUs) by one unit reduced the probability of a household becoming chronically poor by 0.02 units in Baringo County of Kenya.

The results indicate that respondents who had other off-farm employments have higher commercialization index of 46%, whereas those who had no other occupation have lower commercialization index of 28%. The retired ones have HCI of 29%. This is mainly due to considerable re-investment of such earnings from employment off-farm in various dairy operations in the dairy value chain giving rise to increased productivity hence higher commercialization level. By implication, increasing income of the farm households will lead to an increase in the probability of commercialization among the farmers. Household income both farm and non-farm has the potentials of reducing dependency on the agricultural output and thus commercialization. The result is also in line with that of Randela, *et al.*, (2008) who found out that access to non-farm income may lead to risk reduction in household decision making. and, with it, increased propensity to undertake higher risk activities, notably selling crops or producing for the market. Agwu, *et al.*, (2013), found out that coefficient of income was significant at 5% level with positive sign Agwu, *et al.*, (2011) had opined that income leads to increase in volume or quantity traded and thus expansion of the enterprise. The significance of off-farm income suggests that, as also noted by Alene, *et al.*, (2008) that there might be considerable re-investment of such earnings in various farm operations by some cattle keepers in Kenya. Otieno, *et al.*, (2014) also found out that off-farm income contribute positively to efficiency in beef cattle production in Kenya. Berem, *et al.*, (2011) found out that involvement in off-farm income played a key role in reducing the probability of a household becoming chronically poor. This is especially true for the Counties, which falls among the ASALs of Kenya. An increase in off-farm income by one unit reduced the level of chronic poverty by 4.3 units.

The HCI results show that respondents who had permanent

housing type have higher commercialization index of 44%, whereas those who had grass thatched housing type have lower commercialization index of 20%. The respondents with semi-permanent housing have HCI of 26%. This can be due to the financial capabilities of the respondents with permanent housing types hence able to invest in dairy farming for increased dairy productivity. This then can leads higher volumes or quantities of milk in the market thus higher commercialization level.

Results of HCI show that respondents who had farm size of 0.1-0.5Ha have higher commercialization index of 57%, whereas those who had over 7.0Ha have lower commercialization index of 24%. The other farm sizes have HCI as indicated: 0.6-1.0 Ha (29%); 1.1-2.5 Ha (28%); 2.6-4.0 Ha (27%) and 4.1-7.0 Ha (26%). This inverse relationship implies that respondents with relatively large land sizes are likely to have low levels of commercialization. This is probably because increased market participation and commercialization is also a function of land productivity. It therefore implies that any initiative in the dairy industry to increase land size must be preceded with efforts to increase productivity of land currently under use. The size of land is important because transaction costs are largely fixed costs that can be spread across more output on large farms. The study result is consistent to that of Randela, *et al.*, (2008) which revealed that the existence of unexpected negative relationship between land size and level of market participation. Partial effects, computed at sample means, indicate that the probability of commercialization decreases by 2% for one hectare increase in farm size. This finding contradicts that of Ele, *et al.*, (2013), Rahut, *et al.*, (2010), and Agwu, *et al.*, (2012) that as farm size increases, the probability of commercialization of the households increases. Martey, *et al.*, (2012), had opined that farm sizes influences the level of agricultural commercialization in a study area in Ghana. Evidence from other Countries (e.g Zimbabwe) as presented by Govereh, *et al.*, (1999) indicated that in these studies household commercialization was indeed positively related to land holding size.

The HCI results indicate that respondents who had household size of 1-4 have higher commercialization index of 54%, whereas those who had household size of 9-12 have lower commercialization index of 25%. The respondents of household size of 5-8 have HCI of 28%. The negative relationship between household size and commercialization implies that household members tend to consume more than they contribute to the sales of the product. Respondents with more dependents have lower level of commercialization. Given that farmers are already subsistence in nature due to their smallholding, this result is expected. As the number of persons in the household increases, the probability of farmers' orientation towards commercialization reduces. The result is supported by that of Lapar, *et al.*, (2003) who found out that the propensity to participate into the market economy declines with numbers of household members. The finding is also confirmed by Randela, *et al.*, (2008) who found out that household size

influences the level of market participation significantly but negatively. Ele, et al., (2013) reported that household family size has a negative sign indicating that as family size increases, commercialization reduces. Agwu, *et al.*, (2012) results indicated that household size was significant at 99% probability level but with a negative sign hence also confirming the study finding. They argued that large household sizes detract households from market orientation due to its effect on increasing household domestic consumption needs. This result is in line with Enete, *et al.*, (2009) and Gebremedhin, *et al.*, (2010). The result is contradicted by that of Makhura, (2001) who reported that the size of household represents the productive and consumption unit of the household. Traditional agrarian studies show that household members represent labour resources and hence posited to be directly related to engagement in agricultural activities. Therefore, household with large household members can produce more marketable output or store it for household consumption.

The results of HCI show that respondents who came from Soy Sub-County have higher commercialization index of 48%, whereas those who came from Ainabkoi Sub-County have lower commercialization index of 26%. The respondents from other sub-Counties have HCI as indicated: Turbo (45%); Kesses (28%); Kapsaret (27%) and Moiben (29%). This means that communities living in Soy Sub-County consume less milk and sell more whereas those in Ainabkoi Sub-County produce more and consume more.

Table 4. Household commercialization index (HCI) results.

Member of farmers' organizations/institutions:			
Member of farmers' organizations/institutions:	Frequency	Valid Percent	Household commercialization index
Yes	258	67.2	66
No	126	32.8	28
Total	384	100	41.5
Size of land under pasture/fodder in Ha:			
Size of land under pasture/fodder in Ha:	Frequency	Valid percent	Household commercialization index
0	50	13	26
0.01-0.50	70	18.2	27
0.6-2.50	195	50.8	28
2.60-7.0	49	12.8	29
Above 7.0	20	5.2	69
Total	384	100	35.8
Dairy farming experience of house hold head in years:			
Dairy farming experience of house hold head in years:	Frequency	Valid Percent	Household commercialization index
1 – 4	25	6.5	25
5 – 8	50	13	26
9 – 12	114	29.7	26
13 – 17	150	39.1	28
16 – 20	20	5.2	44
Above 20 years	25	6.5	67
Total	384	100	36
Other farming enterprises:			
Other farming enterprises:	Frequency	Valid percent	Household commercialization index

Member of farmers' organizations/institutions:			
Member of farmers' organizations/institutions:	Frequency	Valid Percent	Household commercialization index
Mixed farming	105	27.3	29
Cash crops	30	7.8	24
Food crops	55	14.3	22
Poultry	79	20.6	23
Goat rearing	70	18.2	21
None	45	11.8	48
Total	384	100	27.8
Number of dairy cows on farm:			
Number of dairy cows on farm:	Frequency	Valid percent	Household commercialization index
1 – 3	225	58.6	28
4 – 6	114	29.7	29
7 – 9	35	9.1	43
10 and above	10	2.6	68
Total	384	100	42
Other occupation of household head			
Other occupation of household head:	Frequency	Valid percent	Household commercialization index
None	114	29.7	28
Employed off-farm	210	54.7	46
Retired	60	15.6	29
Total	384	100	34.3
Housing Type of household:			
Housing Type of household:	Frequency	Valid Percent	Household commercialization index
grass thatched house	59	15.4	20
semi-permanent house	216	56.3	26
permanent house	109	28.3	44
Total	384	100	30
Farm size Ha:			
Farm size Ha:	Frequency	Valid percent	Household commercialization index
0.1-0.5	165	43	57
0.6-1.0	45	11.7	29
1.1-2.5	75	19.5	28
2.6-4.0	54	14	27
4.1-7.0	25	6.5	26
Above 7.0	20	5.3	24
Total	384	100	31.8
Household size:			
Household size:	Frequency	Valid percent	Household commercialization index
1 – 4	87	22.6	54
5 – 8	252	65.6	28
9 – 12	45	11.8	25
Total	384	100	37.5
Sub-County of the respondents:			
Sub-County of the respondents:	Frequency	Valid percent	Household commercialization index
Soy	56	14.6	48
Turbo	65	16.9	45
Kesses	93	24.2	27
Kapsaret	38	9.9	28
Moiben	60	15.6	29
Ainabkoi	72	18.8	26
Total	384	100	33.8

The HCI results for the socio-economic characteristics range from 27.8% (subsistence) to 42% (semi-commercialized). This means most of the respondents are not commercialized due to their socio-economic characteristics. Hence there need to improve the socio-economic status of the smallholder dairy producers.

4. Conclusion and Recommendations

The study reveals that the socio-economic characteristics particularly Member of farmers' organizations/institution; Size of land under pastures/fodder (ha); experience (Years); other farming enterprises; number of dairy cows and other occupation of respondent have highly significant influence on commercialization of smallholder dairy value chain development. In view of the above results, the National and County Governments in conjunction with other relevant stakeholders in the dairy value chain should formulate policies and design programs and projects that: promotes specialization in dairy farming; enhance the establishment and management of pasture and fodder crops for increased dairy productivity; strengthen human capital development to for transparency and accountability; strengthen farmers' organizations so as to increase the bargaining and lobbying power; reduce wastage and transaction costs in the commercialization process. Furthermore, in the implementation of the formulated policies and the designed programs and projects transparency and accountability mechanism should be at the fore of the implementation regulatory and legal frameworks.

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