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Full Length Research Paper

Characterization of crop production and marketing to improve food security in Arsi Zone, Ethiopia

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Crop production provides food and feed; the community generates income from it to cover household expenses and savings. To improve the productivity of the sector, identification of crop production and marketing constraints in Arsi Zone is important to enhance crop production as intended in the Growth and Transformation Plan. This article aims to characterize the crop production, marketing systems and constraints so as to set proper development plans to improve food security in the future. A study was conducted in six randomly selected Peasant Associations from two randomly selected districts among 26 districts in the zone. A total of 120 farm households were selected for the study. The information collected from them was analyzed by descriptive statistics with the help of SPSS computer software. On average, farmers owned 2.645 ha of land, although there were variations from 0.25 and 9.25 ha. Barley, wheat, faba bean and field pea were the major crops, grown by 87.5, 75.8, 74.2 and 34.2% of the respondents respectively. Farmers used the crops produced mainly for family consumption and marketing. December to May was the peak period in which farmers sold their crop grains. District market was the main market where farmers sold their crops. Improving the timely availability of production inputs and improving credit access to farmers are important to enhance crop productivity and food security in the area. Strengthening service-providing institutions and bringing them into function through the provision of required facilities are crucial points which need consideration in the future.

Key words: Crop production, marketing, crop production constraints, food security, Ethiopia.

INTRODUCTION

Most crop production in Ethiopia comes from the peasant sector, whose production technologies are primarily traditional (CSA, 2011). Production and productivity under such traditional systems, however, have been considerably low, due mainly to the inherently low productivity of the crop varieties used, declines in soil fertility, and the effects of crop pests (Firdu and Tsedeke, 2007). But, contrary to this, much increase of crop production in the past decade has been observed due to increase in area cultivated in the country (Alemayehu et al., 2010); however, to what extent the area cultivated can continue to expand remains an important question. It seems that in the highland areas, expansion of cultivated area will have to come almost exclusively from reduction in pasture land.

According to neoclassical economic theory, the development of favorable marketing institutions, trade and specialization are crucial for successful agricultural business.

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In line with this, Ethiopian government in recent years has engaged in the establishment of basic development infrastructure (roads, schools, farmer training centers, health centers, and so on) in the whole country emphasizing rural parts, even though farmers are still weakly connected to factor and product markets both domestically and internationally. Only 30% of Ethiopian agricultural output is marketed (Bernard et al., 2006, as cited in Tesfalem, 2008). Better integrating such farmers into factor and product markets is part of the overall development endeavor.

Ethiopian economy has been largely based on agriculture for many past years and some years (5-10) in the future according to Growth and Transformation Plan (GTP) (MoFED, 2010). In transforming agriculture-based economy to one that is industry-based, the agricultural sector should be strengthened including the crop production sector. The country set strategy to increase crop production two-fold, as indicated in the GTP. In doing so, the driving force of the sector, the subsistence farmers, should be supported and accessed to development institutions which are fully equipped with facilities to serve the smallholders closely to enhance their productivity to attain the targets of GTP.

In order to improve crop production and productivity in the zone as well in the country, the rural service-providing institutions need to be strengthened and in line with this the status and situation of the institutions have to be known. Understanding the crop production and marketing constraints of the area is fundamental to improve the crop production and improve the smallholders' livelihoods in general. Hence, the study was designed to characterize the crop production and marketing systems in the Arsi zone and to assess constraints of crop production and marketing systems in the zone.

METHODOLOGY

Description of Arsi Zone

The survey was conducted in Arsi zone located in Oromia Regional State in the South Eastern part of Ethiopia in 2012. It shares boundaries with West Arsi, East Shewa, Bale and West Hararge Zones. Assela, the capital town of the zone, is located 175 km from Finfinne or Addis Ababa on the Finfinne-Adama-Bale Robe main road, 75 km south of Adama.

Arsi zone has four agro-climatic zones, differing mainly in altitude, whose great variation in temperature provides wide opportunities for the production of different types of crop. It is dominantly characterized by moderately cool (about 40%) followed by cool (about 34%) annual temperature. Cool/cold type of thermal zone is found in the highland areas of Chilalo, Bada, Gugu, and Enkolo and Kaka Mountains. The category of moderately warm temperature is found in the lowland areas of Gololcha, Amigna, Seru and Merti districts. It is also found in the Wabi Shabele river valleys and Awash Gorges according to the report of zone BoA and Natural Water Resource Development. The mean annual temperature of the zone is between 20 to 25°C in the lowlands and 10 to 15°C in the central highlands. However, there is a slight variation of temperature by months. February to May are the hottest months while October to January are the coldest months.

The main agricultural feature of the zone is a mixed farming system in which crop production and livestock husbandry complement each other. Crop residues mainly straw used as feed for livestock. On the other hand, the wastes from livestock used in form of compost for fertilizing the soil and livestock supply draught power during land preparation and threshing. The major food crops produced in the Arsi zone are cereals, pulses, oil seeds and others. Among cereals barley and wheat are the pre-dominant and among pulses horse beans and field peas are grown widely.

The zone has high potentialities for livestock rearing. Cattle, draught animals, small ruminants and poultry are the dominant livestock species, which contributing largely to the livelihoods of the community of the area (Messay et al., 2012). Local cattle are the pre-dominant breeds reared in the area; however, improved breeds are being substituted, due to reduced grazing and pasture lands. Improved breeds are productive than local once if properly managed. Keeping few improved breeds on smaller plots than many local breeds is being preferred by the smallholders because of reduction of grazing lands and pastures.

Sampling procedures

Multi-stage sampling techniques were employed for the data collection. Specifically, the study was conducted in Lemu-bilbilo and Munesa districts which were selected randomly at the first stage among 26 districts in Arsi zone. In the second stage, all accessible Peasant Associations (PAs) were listed and three PAs, namely Bokoji Negeso, Chiba Mikael, and Qoma Katare were also selected randomly from the accessible PAs in Lemu-bilbilo. Similarly Chefa, Gumguma and Choba were the PAs selected randomly among accessible PAs in Munesa district. From Munesa district, 14.2, 15.8 and 19.2% of the respondents were selected randomly from Chefa, Gumguma and Choba PAs respectively (Table 1). The number of the respondents involved in the study from each selected PAs was determined in accordance with population as shown in Table 1.

Data analysis

With respect to the expected output of the study, the quantitative data obtained were analyzed using descriptive statistics. Qualitative data collected during the study were used to interpret and conceptually generalize the findings and used to ensure the validity of the results from descriptive statistics. For quantitative data, descriptive statistics were employed, and all findings were combined to give meaningful picture and reliable information. SPSS software was used to analyze descriptive statistics. Means, percentages (shares), ranges, t-tests and χ^2-tests were the main descriptive statistics used in the analysis of quantitative data collected through the formal survey.

RESULTS AND DISCUSSION

Socio-economic characteristics

In the survey areas, the age of respondents (household heads) varied from 20 to 86; the duration of their farming experience and the time they had lived in the area varied from 1 to 63 years and from 10 to 75 years respectively. The overall means of age, farming experience and years lived in the area were 48, 23, and 43 years respectively. The mean ages of respondents in Lemubilbilo and

Table 1. Peasant associations and the proportions of the respondents.

Peasant associations (PAs)	Frequency	Percent
Bokoji Negeso	22	18.3
Chiba Mikael	19	15.8
Qoma Ketare	20	16.7
Cheffa	17	14.2
Gumguma	19	15.8
Choba	23	19.2
Total	120	100.0

Munesa were 46.33 and 49.80 years respectively. The respondents mean farming experiences in Lemubilbilo and Munesa were 24.87 and 30.67 years respectively, whereas the years lived in the areas by the respondents were 38.85 and 46.35 years respectively (Table 2).

In regard to age, a t-test showed the absence of a statistically significant difference between the respondents in the two districts. However, there is a statistically significant difference at the 5% probability level between the two districts with regard to years lived in the areas by the respondents, and another at the 1% probability level between their farming experiences.

Occupation

Crop and livestock farming is the main occupation for more than 89% of the respondents and household chores are also the main activities for about 5% respondents. The majority of farm households in the study districts practiced both crop production and livestock rearing as a mixed farming system. While crop production is practiced together with livestock husbandry, one supports the other in a variety of ways. Residues from crop production serve mainly as feed for the livestock, and the manure is used as crop fertilizer.

In addition to their main occupation, the respondents are practicing a range of activities in order to diversify their sources of income and enhance their livelihoods. Crop and livestock farming, salaried employment, self-employment on farms, casual work on other farms, off-farm casual work, herding and household chores were the secondary occupations of 5, 3.3, 6.7, 3.3, 2.5 and 5.8% of the respondents respectively.

Among 113 respondents involved in the study, crop and livestock farming and household chores were the main occupations for more than 94 and 5% of them respectively (Table 3). Crop and livestock farming was the main occupation for 90.6 and 98.3% of the respondents in Lemubilbilo and Munesa districts respectively (Table 3). The chi-square test shows the presence of significant mean differences between the two districts in referring to the respondents' main occupation statistically.

Walling and roofing materials of main resident house

The walling and roofing materials of the main resident house indicate the living standards of the household. The house of wealthy households is constructed by bricks, stone and iron sheet where as small grass thatched and wooden (timber) mud plastered house belongs to the resource poor households. Wooden mud plastered and earth were the main walling materials of main resident house in rural areas in the past years; however, significant changes are in place currently. Similarly, grass thatching was the common roofing material in many rural parts of Ethiopia.

Wood plastered with mud is main walling material of the main resident house for more than 96% in the study districts. Similarly, for 52 and 41% of respondents, grass thatch and iron sheet are the roofing materials of the main resident houses of the respondents. The result of a chi-square test shows that there is a statistically significant mean difference between the two districts with regard to the walling materials used to construct the main resident house in the areas by the respondents at the 5% probability level and between the roofing materials at the 1% probability level (Table 4). Furthermore, the result indicates the variation in living standards among rural households in Arsi zone.

Land holding

Farmers in the study areas owned land for farming, even though they also accessed land through renting and sharing with other farmers in addition to their own when there is a periodic shortage. Older and resource poor farmers rent out land to youth and wealthier farmers. More than 99% of the respondent farmers owned 2.645 ha on average, varying from 0.25 to 9.25 ha. About 98 and 63% of the respondents allocate 1.77 and 0.76 ha of their own land for cultivation and fallow respectively on average. Among the respondents who used their own land for fallowing, 63 and 37% were Lemubilbilo and Munesa farmers respectively. Fallowing is practised mainly to restore soil fertility and to reduce the incidence of grass weeds, and in the fallowing year the land is used for grazing.

In case of land shortage and based on their capability (finance to cover production cost and oxen ownership), farmers in the study areas accessed land through renting in and sharing in. In contrary to this, due to financial problem and lack of oxen for ploughing, some farmers rented out (0.488ha) and shared out (0.825 ha) some of their land (Table 5).

Land allocation

Barley, wheat, faba bean and field pea are the major

Table 2. Respondents' socio-economic characteristics variables.

Statistic	Age of respondent		Farming experience		Years lived in the area	
	Lemubilbilo	Munessa	Lemubilbilo	Munessa	Lemubilbilo	Munessa
N	60	60	60	60	60	60
Mean	46.33	49.80	24.87	30.67	38.85	46.35
Std. Dev.	11.96	13.87	11.99	14.68	14.12	15.15
t-value	-1.467^{NS}		-2.371**		-2.806***	
P-value	0.147		0.019		0.006	

Source: Analysis of own survey data, January 2013: NS= non-significant, ** significant at less than 5% level of significance, *** Significant at less than 1% level of significance

Table 3. Main occupations, by district.

Main occupation	Lemu-bilbilo		Munesa		Combined		χ^2-value	p-value
	No.	%	No.	%	No.	%		
Crop and livestock farming	48	90.6	59	98.3	107	94.7	5.591**	0.061
Household chores	5	9.4	1	1.7	6	5.3		
Total	53	100.0	60	100.0	113	100.0		

Source: Survey data, January, 2013; ** Significant at less than 5% level of significance.

Table 4. Walling and roofing materials, by district.

Walling and roofing materials	Lemubilbilo		Munesa		Combined		χ^2-value	p-value
	No.	%	No.	%	No.	%		
Earth	4	6.7	0	0	4	3.3	4.138**	0.042
Wooden	56	93.3	60	100	116	96.7		
Total	60	100	60	100	120	100		
Grass thatch	25	41.7	37	61.7	62	51.7	11.506***	0.003
Iron sheet	26	43.3	23	38.3	49	40.8		
Grass thatch and iron sheet	9	15	0	0	9	7.5		
Total	60	100	60	100	120	100		

Table 5. Mean land tenure in the 2012 cropping year.

Land ownership	Mean (ha)	Cultivated land (ha)	Fallow land (ha)	Rented out (ha)	Shared out (ha)
Own	2.645 (99.2)	1.77 (98.3)	0.76 (63.3)	0.488 (8.3)	0.825 (7.5)
Rented in	1.00 (44.2)	0.85 (40.0)	1.17 (7.5)		
Shared in	3.00 (29.2)	0.70 (28.3)	0.67 (2.5)		

Numbers in parentheses are the percentages of the respondents.

crops, grown by 87.5, 75.8, 74.2, and 34.2% of the respondents, who allocate 0.87, 0.57, 0.37 and 0.33 ha of own land to the crops respectively. Farmers rent in land to cultivate crops besides their own land and farmers more than 34% rent in land to wheat and barley among the respondents included in the study. In the study area, more than 87% of the respondent farmers allocate more own land to barley production than other crops (Table 6). However, more land is allocated for crop production, farmers use land for pasture, fallowing and non-agricultural uses in the study area. On average, farmers of the area allocate more than one plot for specific crop or grow a specific crop on different plots located at different places, which indicates a high level of land fragmentation.

Table 6. Land allocation to crops.

Crops	Own			Rented in			No. of plots
	No.	%	Mean (ha)	No.	%	Mean (ha)	
Tef	11	9.2	0.22	1	0.8	0.5	1.08
Wheat	91	75.8	0.57	41	34.2	0.44	2.17
Barley	105	87.5	0.87	41	34.2	0.58	1.38
Faba bean	89	74.2	0.37	21	17.5	0.56	1.22
Field pea	41	34.2	0.33	9	7.5	0.44	1.10
Linseed	38	31.7	0.37	16	13.3	0.38	1.36
Maize	33	27.5	0.25	6	5	0.21	1.22
Land for other crops	12	10	0.65	4	3.3	0.75	1.67
Land for pasture and tree crops	41	34.2	0.56	1	0.8	1.00	1.74
Fallow farmland	46	38.3	0.76	8	6.7	1.47	2.40
Land for non-agricultural uses	24	20	0.71	2	1.7	2.63	2.00

Table 7. Crop production and utilization (averages per household) (N=120).

Crop type	Mean output produced (kg per household)		Consumption (kg)			Mean output sold (kg per household)		
	n_1	Mean	n_2	Mean	$n_2/n_{1(\%)}$	n_3	Mean	$n_3/n_{1\ (\%)}$
Wheat	95	1273.45	95	336.06	100	68	962.50	72
Barley	115	2892.08	115	464.83	100	62	1562.10	54
Faba bean	96	567.84	93	126.68	97	66	309.02	69
Field pea	38	451.67	32	97.52	84	32	334.37	84
Linseed	37	438.51	5	51.00	14	35	381.58	95
Maize	34	741.10	23	263.91	68	11	413.63	32

Crop production trends

As indicated in the figure, farmers obtain the highest yields from barley; wheat is the next important crop, which gave better yield and competing with barley until 2009. Next to barley and wheat, faba bean is an important cash crop that shows a yield increase from 5 to about 10qt[1] since 2009. Farmers in the study areas produced crops primarily for family consumption and sale to earn cash to cover family expenditure. In general, farmers have obtained higher yields from the major crops in recent five years since 2009 (Figure 1) due to the utilization of improved agricultural technologies according to explanations of the respondents. Due to land scarcity among the farmers, specifically young ones, previously grazing, pasture and forest lands have entered into crop cultivation in recent years. Farmers started farming on hill sides and even on mountain tops in the Arsi zone as well in other parts of the country. Although this has increased production, it will have a high impact on the environment.

Crop production and utilization (averages per household)

Barley and wheat are the dominant food crops produced and utilized by a large number of farmers for consumption and sales (Table 7). Households of the study area used significant amounts of produced crops for seed, and for in-kind payment for land and labor.

As also reported by Alemayehu et al. (2010), farmers use crops produced mainly for both family consumption and marketing. For different crops, the amounts sold and consumed varies across households, and depend on family size, quantity produced, crop type and market demand. For instance, among 37 farmers who produced linseed, only 5 (14%) farmers used it for consumption, and about 35 (94.5%) used the crop for marketing; more than 87% of the linseed produced was sold (Table 7).

If the produced crops are not sufficient, households cope mainly through purchases and food aid or gifts received. Only about 17, 23, 7 and 7% of the respondents bought wheat, barley, faba bean and maize in 2010 to cope with the crop shortage of that year. An insignificant number of the respondents received wheat and barley by food aids/gifts (Table 11).

Marketing of crops

The demand and supply of agricultural produce varies from time to time, leading to fluctuations of price over

time. Nowadays, the participation of many actors makes agricultural marketing complex than in previous periods, when market actors and intermediaries were fewer. The increase of market actors and intermediaries could be interlinked with the increasing population and the benefits fetched from grain trading. The farmers sell their crops to different buyers such as farmer groups, farmers' unions, rural assemblers, brokers and rural grain traders; the potential buyers of the crops are urban grain traders and consumers, and other farmers in the study areas (Table 8). Urban grain traders and consumers were the potential market actors purchased wheat from more than 20 and 14% respondent farmers respectively. Similarly, more than 24 and 10% of farmers sold barley for urban grain traders and consumers respectively as depicted in Table 8.

Farmers' trust in traders

Respondent farmers replied differently to the trust statement provided, as shown in Table 9. In order to improve the smallholder farmers living conditions, market actors like traders should buy the product of farmers at a reasonable price at least compensating their costs of production. On the other hand, market crop price could vary overtime and the farmers' access to the correct market information varies among market actors. The correct market price that traders pay to the farmers' product and the return they fetch from it indicates the levels of farmers' trust in traders. Accordingly, farmers indicated their level of trust in traders according to the statement says "most traders can be trusted". Out of 120 respondents, more than 48% were indifferent or farmers were in between to trust or not to trust, 30% disagreed and about 16% agreed with the statement (Table 9). The Likert scale result was 2.84 which is near to 3 (in-different), which indicates the level of farmers trust on traders.

In crop marketing, where the farmers sell the crop or market type is another important determinant that facilitate agricultural marketing. For farmers, selling crop grain at farm gates and village markets reduces ups and downs of travelling far distances and saves much time to accomplish other agricultural or development tasks if just and fair prices are paid. Farmers in the study area sold their crop produce at farm gate, village market and the main district market (Table 10). Main or district market is the place where many farmers sold the crops in the study area. Some farmers sold crops at village markets, and few of them did so at farm gates (Table 9) to rural grain traders or to other village farmers who took the grains to the district market or to secondary markets. Bokoji is the main or district market of Lemubilbilo, and Kersa is the main market of Munesa district. Among 120 respondent farmers, 44.2, 50.0, 42.5, 20.8 and 24.2% sold wheat, barley, faba bean, field pea and linseed respectively at their respective district markets, as depicted in Table 9.

With regard to market type, it is crucial to consider the distance to the nearest village and main markets. Among the respondents, there were farmers who are 12 km from their nearest village market; the average distance was 4.81 km. Similarly, farmers in the study areas on average could travel 6.87 km to reach the main respective district markets which could consume more than one hour in average for a single trip (Table 12). The study result also shows the presence of farmers who travelled up to 24 km (needs 3 h) to arrive at the district main market.

To evaluate the living standards of a society in a given area, considering modes of transport is important. Farmers transport the crops to the village markets or district markets mainly by donkey; however, some farmers used oxen/ horse carts. About 53, 50 and 46% of the respondents used donkey to transport barley, wheat, and faba bean respectively to the markets.

In crop marketing, understanding the farmers' crop selling period or months is also an indispensable factor like market type, market actors, transport mode and market distance. Farmers' crop selling period could be influenced by a variety of factors such as personal, social, economic and cultural ones. As indicated in Figure 2, higher percentages of farmers sold the crop commodities between November and May. January, February and March were the peak crop selling months in the study areas during the survey year in 2012. November and December are harvesting months in study areas. However, the crop selling months vary from year to year and from farmer to farmer depending on the level of production and crop prices in the market; generally many farmers sell major proportion of crops from December to May (Figure 2).

Access to market information and means of access

Access to market information before deciding to sell their crop commodities helps the farmers to make decisions whether to sell or not, and to sell at a fair market price. Among the 120 farmers in this study, 73.3, 75.8, 65, 45 and 23.3% sold wheat, barley, faba bean, field pea and maize respectively in the survey year. Out of the respondents who sold these crops, some were unable to access market information before deciding to sell their crops (Table 11).

Some days before selling, observation of the market and discussion with other village farmers and relatives were the major means of accessing to market information for the farmers in the study area. According to the farmers' explanation, some farmers also have access to market information through telephone discussion with traders and farmers of in other areas. Cell phones are playing a great role in accessing market information.

Food security and coping mechanisms

Crop production of Arsi zone mainly comes from the

Table 8. Buyers of crops in the study areas.

Crop type	Farmer group		Farmer union/ cooperatives		Consumer or other farmer		Rural assembler		Broker/ middle men		Rural grain trader		Urban grain trader	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Wheat	3	2.5	0	0	17	14.2	3	2.5	3	2.5	15	12.5	25	20.8
Barley	1	0.8	9	7.5	13	10.8	1	0.8	1	0.8	12	10	29	24.2
Faba bean	1	0.8	1	0.8	18	15.0	2	1.7	3	2.5	10	8.3	25	20.8
Field pea	2	1.7	2	1.7	10	8.3	2	1.7	1	0.8	7	5.8	9	7.5
Linseed	0	0	0	0	5	4.2	0	0	2	1.7	4	3.3	26	21.7
Maize	0	0	0	0	3	2.5	1	0.8	0	0	5	4.2	1	0.8

Table 9. Level of farmers' trust on traders.

Most traders can be trusted	Strongly disagree (1)	Disagree (2)	Indifferent (3)	Agree (4)	Strongly agree (5)	Total
Frequency	4	36	58	19	3	120
Percent	3.33	30.00	48.33	15.83	2.50	100.00
Scale * Frequency	4	72	174	76	15	341

Weighted mean= 341 ÷120=2.84.

Table 10. Farmers selling crops, by market types and crop sold.

Crops	Farm gate		Village market		Main/ District market	
	No.	%	No.	%	No.	%
Wheat	4	3.3	10	8.3	53	44.2
Barley	1	0.8	5	4.2	60	50.0
Faba bean	2	1.7	8	6.7	51	42.5
Field pea	1	0.8	8	6.7	25	20.8
Linseed	0	0	8	6.7	29	24.2
Maize	0	0	2	1.7	9	7.5

traditional farming system based on animal power and rain-fed peasant sector; a limited amount comes from state farms. The peasant sector accounted for about 96.45% of the total cultivated land in the Zone, and 96.2% of the total crop production. The zone is considered as food self-sufficient zone. However, there are households having food insecurity problems, whose severity varies from year to year depending on rainfall, and from district to district, because all districts are not equally vulnerable to drought.

Among the 120 farm households included in the

Table 11. Proportion of farmers selling crops and their levels of access to market information, by crop type.

Crop type	Proportion of farmers selling the crop		Access to market information before deciding to sell the crops			
			Accessed		Not accessed	
	N	%	N	%	N	%
Wheat	88	73.3	79	89.77	9	10.33
Barley	91	75.8	84	92.31	7	7.69
Faba bean	78	65.0	72	92.31	6	7.69
Field pea	54	45.0	47	87.04	7	12.96
Maize	28	23.3	22	78.57	6	21.43

Table 12. Proportion of farmers and amount of crops bought.

Crops	Amount bought (kg)				Amount of food aid or gifts received (kg)			
	N	%	Mean	Sta. dev.	N	%	Mean	Sta. dev.
Wheat	20	16.7	147.5	108.2	2	1.67	80	28.3
Barley	27	22.5	241.6	275.6	1	0.83	300	
Faba bean	8	6.7	46.88	8.84	0			
Field pea	1	0.83	50		0			
Linseed	7	5.83	63.57	104.27	0			
Maize	8	6.7	219.88	205.56	0			

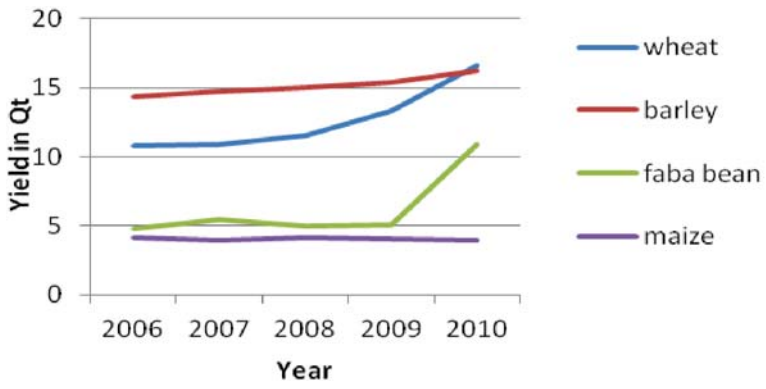

Figure 1. Major crop production trends (Yield in qt.).

study, only a few faced a shortage of food crops for consumption in 2011.Wheat and barley sustained the livelihoods of millions of people residence in highlands of the study areas. These crops were the main food crops consumed almost daily in different forms such *as injera, bread, ganfo and kinche.* Farmers in the study area utilize their crops both for consumption and marketing. About 16.7 and 22.5% of the respondent farmers bought wheat and barley respectively in 2011 due to the shortage of the crops (Table 12). Faba bean, field pea, linseed and maize were the crops cultivated by a few farmers on smaller plots in the study area as indicated in Table 7 above. These crops were consumed proportionately in smaller quantities compared to wheat and barley, and the majority of the farmers used these crops for marketing. Among the sampled farmers, only a few of them bought faba bean, field pea, linseed and maize to overcome their shortage (Table 12). Even though the quantities of food aid/gifts from government and non-government bodies are unknown, an insignificant number of households received wheat and barley as food aid or gifts from relatives, neighbors or friends.

As indicated in many reports, 'food security is defined as physical and economic access by all people at all times to sufficient food to meet their dietary requirements for a reproductive and healthy life'. By this definition, even though some households in the study area faced a food shortage in some periods of the year, they may not

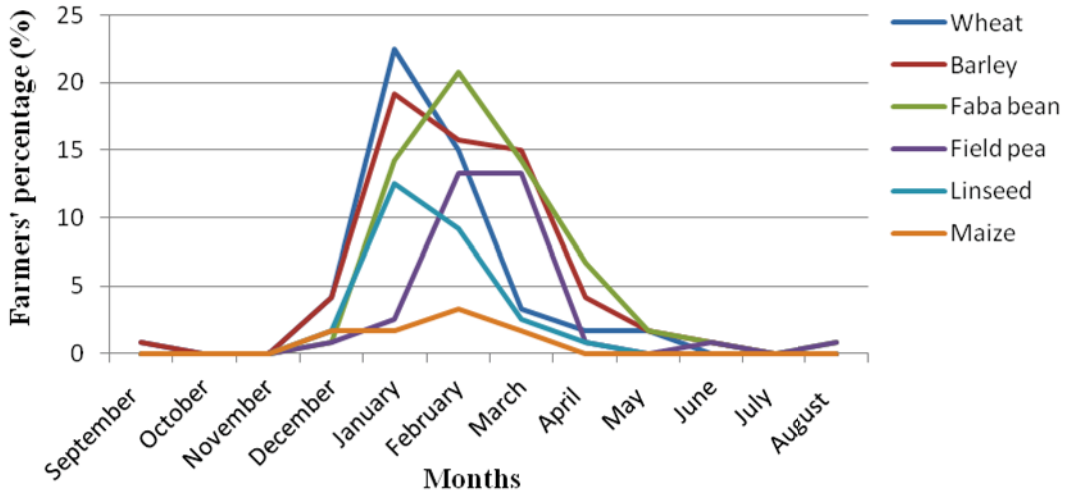

Figure 2. Patterns of crop selling months and farmers' proportion.

Table 13. Average Distance of the nearest institutions from farmer's home.

Distance to the nearest	N	Minimum	Maximum	Mean	Std. Dev.
Village market (km)	91	.001	12.000	4.80847	2.694861
Main market (km)	118	.30	24.00	6.8742	5.59383
Source of seed (km)	120	.001	18.000	4.52643	2.841906
Source of fertilizer (km)	119	.001	21.000	4.53085	2.975629
Source of farm chemicals (km)	110	.001	18.000	5.14228	3.736420
Farmer cooperative (km)	118	.001	12.000	4.29397	2.565329
Agricultural extension DA office (km)	119	.001	11.000	2.82329	1.952660

have been food-insecure, because adequate food crops were available and they could access to these food crops.

Households of the study area used different means to cope when a food crop shortage exists. These coping mechanisms are adopted depending on how bad the crisis is, and what is available to them to manage the situation. According to the explanations of some key informants, farm households used livestock sales (specifically small ruminants), certain types of off farm employment, requesting grain loans, sales of fire wood or charcoal, reduction of crops to be marketed and reduction of consumption were some of the coping mechanisms exercised by households in the study area.

Availability of supportive institutions in the farmers' area

Gebremedhin et al. (2009) showed that the expansion of the agricultural services particularly extension had a significant impact on the intensity of input use, agricultural productivity and market participation of Ethiopian smallholders. The availability of service-providing institutions at a near distance is desirable for the farmers in order to access agricultural technologies and information. Not only availability of these institutions but also their level in facility and capacity to support farmers in the provision of required services is crucial. Even though there are farmers who are far from supportive institutions, the distances seem acceptable (Table 13). The improvements observed in the availability of supportive institutions in the farmers' area attained by the focuses given to farmers and the efforts made by the government in recent years. For instance, on average, farmers are 2.82km distant from an agricultural extension (Development Agents) office. Sources of seed, fertilizer and farm chemicals, and farmer cooperatives, are situated on average at distances of 4.53, 4.53, 5.14 and 4.30 km respectively (Table 13).

Crop production and marketing constraints

Farmers in the study areas are confronted with a variety of crop production and marketing challenges and difficulties as indicated in Table 14. Mesay and Tolosa (2011) reported rather similar wheat production constraints. The price of fertilizer and of improved seed and the

Table 14. Production and marketing constraints for selected major crops.

Constraints	Wheat		Barley		Faba bean		Linseed		Teff	
	N	%	N	%	N	N	%	N	%	N
Socio-economic										
Timely availability of improved seed	64	53.3	57	47.5	68	56.7	39	32.5	13	10.8
Price of improved seed	73	60.8	64	53.3	67	55.8	37	30.8	12	10
Quality of seed	55	45.8	53	44.2	50	41.7	31	25.8	8	6.7
Availability of credit to buy seed	45	37.5	40	33.3	37	30.8	28	23.3	10	8.3
Timely availability of fertilizer	43	35.8	50	41.7	40	33.3	13	12.5	7	5.8
Price of fertilizer	86	71.7	73	60.8	70	58.3	24	20	12	10
Availability of credit to buy fertilizer	44	36.7	36	30.0	34	28.3	18	15	4	3.3
Access to markets and information	32	26.7	31	25.8	31	25.8	23	19.2	3	2.5
Reasonable grain prices	32	26.7	37	30.8	35	29.2	20	16.7	5	4.2
Biological										
Drought	12	10.0	8	6.7	8	6.7	4	3.3	0	0
Floods	31	25.8	19	15.8	18	15.0	10	8.3	4	3.3
Pests	69	57.5	67	55.8	65	54.2	40	33.3	12	10
Diseases	67	55.8	62	51.7	78	65.0	42	35.0	12	10
Soil fertility	54	45.0	43	35.8	41	38.2	33	27.5	12	10

and the timely availability and quality of improved seed, were the main socio-economic problems reported by 71.7, 60.8, 53.3 and 45.8% of the respondent farmers respectively in wheat production. Pests and diseases, as biological/ natural wheat production constraints, were indicated by 57.5% and 55.8 farmers respectively. With regard to barley the price of fertilizer, price of improved and timely availability of improved seed were the principal socio-economic challenges reported by 60.8, 53.3 and 47.5% of farmers respectively while pests and diseases are the major biological constraints of barley, as reported by 55.8 and 51.7% of the respondents. Based on the study results, the price of fertilizer and improved seed, timely availability of improved seed and fertilizer, availability of credit to buy fertilizer and seed and access to market and agricultural information are the socio-economic crop production constraints of the farmers in the study area (Table 13). Further, pests, diseases, soil fertility and floods are important biological crop production constraints in the areas.

CONCLUSIONS AND RECOMMENDATIONS

Crop production plays a significant role in providing food and income for rural society. Wheat, barley, faba bean, field pea, and linseed are the major crops grown by most farmers through the allocation of more proportion of cultivable land. Through the utilization of improved agricultural technologies - particularly improved seeds and by increasing the extent of cropped lands, farmers in the area have obtained higher production levels since 2008. Arsi zone is considered as a food-secure region; however, some rural farm households faced food insecurity during the study period, and coped via bought grain and via food aids or gifts.

Crop marketing is a dynamic and complex phenomenon in which crop demand and supply vary from time to time, and farmers sell their grains at different markets to a great variety of market actors. Urban traders, consumers and rural traders are the main actors who bought crops from farmers in the study area. Most of the farmers sold their crop products from December to May. In recent years, village and main markets are located at relatively acceptable distances from farm households in the study areas although there

were farmers who are far from the markets.

Besides to markets, other service-providing institutions also seemed situated at acceptable distances from the farmers. Only the availability of service-providing institutions in the farmers' area without adequate facility is less satisfactory, so strengthening the institutions required facilities is more important and needs emphasis.

The high cost of fertilizer and improved seeds, timely unavailability of inputs, unavailability of credits to buy fertilizers and improved seeds, crop pests and diseases are the major socio-economic and biological problems which are significantly contributing to reduce productivity of crops in Arsi zone. Hence, improving timely availability of production inputs and improving credit accessing ways to farmers are important in the area. Furthermore, strengthening service providing institutions in the area through provision of required facilities are crucial points need to be considered in the future.

Conflict of Interest

The authors have not declared any conflict of interest.

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Managing of risks in agriculture: Benefits of conservation of forest resources in Anambra State, Nigeria

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Forest management offers a promising alternative to depletion of forest resources. Continuous degradation of the forest reserve base has major effects on other segments of the economy. This includes reduction of forest cover leading to erosion and soil degradation. This study assessed the roles of farmers in conservation of forest resources; benefits of conservation of forest resources in the area and reasons for loss of forest resources in the area. Multi-stage sampling procedure was used to select 120 respondents for the study. Data were analysed with the use of descriptive statistics. Results show that reasons for loss of forest resources in the area included: Excessive farming (M=2.8) and rapid urbanisation (M=2.0). Roles of farmers in conserving forest resources were: avoidance of illegal hunting and poaching (M=3.0), practicing continuous forestation (M=3.2) and prevention of bush burning in forest areas (M=3.3). Benefits of conservation of forest resources in the area included: Protection of forest cover (M=2.3), prevention of climate change (M=2.4) and retaining economic benefits from the forest (2.5). Hence it was recommended that there should proper planning for farming and urbanisation for conservation of forest resources in the area.

Key words: Risks, conservation, forest.

INTRODUCTION

Risks in agriculture manifest in diverse forms. Risk can be defined as exposure to variability in future outcomes (Miller et al., 2004). The key fact driving risk is that such outcomes are uncertain. The risks that farmers face result from numerous sources of change or uncertainty. Some of these are related directly to the farm business and would not exist were it not for the farm. Others are related to our involvement in a farm business as individuals (Miller et al., 2004). The economic stability of an entire rural area can be jeopardized by crises caused by different types of natural disasters and risks, from climatic events to livestock or plant diseases. Economic crises caused by the changes of market conditions may also endanger farm's viability. It is well known that forest contribute a lot to local livelihood. Forests are fundamental to food security and veritable storehouses of biological diversity and forest products, which are the mainstay of many households. These products play

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significant roles in the lives of rural people. They also reduce the vulnerability of the agricultural section to adverse natural and socio-economic factors and other risks and above all strengthen self reliance. However it is faced with degradation induced by many factors.

These factors are varied and caused by many agents. The demand for welfare and social infrastructure, and high good requirement were always at the expense of the fertile forests land. The pressure by man, animals and environmental agents on forests has made the soil become quickly impoverished and unable to sustain agricultural production. These also result to unprecedented and alarming threats to biodiversity throughout the world especially forestry resources. Deforestation in the tropics accounts for up to 20% of global emissions of carbon dioxide, making it the second most important contributor to climate change after the combustion of fossil fuels and the largest source of greenhouse gas (GHG) emissions in the developing world (Houghton, 2005). Food and Agriculture Organisation's (1998) states that forest degradation takes different forms, particularly in open forest formations, deriving mainly from human activities such as overgrazing, over-exploitation (for firewood or timber), repeated fires, or due to attack by insects, diseases, plant parasites or other natural causes such as cyclones. However, forests have an important role to play in global hydrological cycles, affecting rainfall patterns and temperature regimes.

Deforestation or loss of vegetation or the selective exploittation of forests for economic or social reasons is very common in Nigeria. In most areas major losses have been recorded in vegetation, forest complexity (diversity), or in germplasm (quality). The deforestation rate in the country is about 3.5% per year, translating to a loss of 350,000 to 400,000 ha of forest land per year and recently, it was shown that forests now occupy about 923,767 km^2 or about 10 million ha (Ladipo, 2010). This is about 10% of Nigeria's forest land area and well below FAO's recommended national minimum of 25% and between 1990 and 2005 alone, the world lost 3.3% of its forests while Nigeria lost 21% (Ladipo, 2010). Also, according to Adeyoju (2001), the total forest estate which stood at 10% of the country's land area in 1996 is now less that 6%. Also, interdependence between population and environment has been endangered and broken down as problems and risks of deforestation, soil erosion, flooding and pollution increases. Hence, there is need for risk management through conservation of forest resources.

Risk management in agriculture is an essential tool for farmers to anticipate, avoid and react to shocks. An efficient risk management system for agriculture will preserve the standard of living of those who depend on farming, strengthen the viability of farm businesses, and provide an environment which supports investment in the farming sector (Miller et al., 2004). Forest management offers a promising alternative to depletion of forest resources. It involves controlled and regulated harvesting combined with silvicultural and protective measures to sustain or increase the commercial value of subsequent stands and it relies on natural regeneration of native species. Although varied in their approaches and methods, forest management systems seek to protect forest cover, ensure the reproduction of commercially important species containing economic, social and environmental benefits from the forest. It does not mean that mankind should drastically reduce or stop the consumption of forest resources. As long as mankind maintains a reasonable consumption rate and treats the forests with benign care, replenishment rate of forest resources would be higher than the consumption rate of mankind (Tai, 2004). Thus, it will be able to keep a healthy cycle [of the natural resources], prevent permanent loss of the natural resources and improve our living environment.

Forest conservation could be seen as actions taken in management of a forest that result in maintenance of the possibilities for future forest related benefits (Wollenberg et al., 2001). In principle, local people own the forest, but the management and control of forest, reserves, which cover around three quarter of forest area, is rested on the state governments (ITTO, 2005). Before the colonial era the former eastern Nigeria had successfully managed their forest resources with little or no threat to the environment. This was checked by using traditional institutions such as the family (kinship) religions, town unions, clubs, clan and kindred meetings among others. Participatory resource management is often seen as an appropriate solution to reducing resource degradation and it is generally assumed that it would ensure the equitable and sustainable use of environment resources. Through local participation, nearby communities would be engaged as stakeholders in managing the resources thus ensuring commitment to long term management goals (Chukwuone, 2007). Forest conservation world over is changing from the traditional forest management approach with technical details and absolute concentration on trees, to managing the forest in a way that ensures greater benefit flow to all stakeholders especially the forest communities (Forest Association of Nigeria, 2003). Also the UNFCCC Subsidiary Body for Scientific and Technical Advice (SBSTA) made suggestions for 'Reducing emissions from deforestation in developing countries' at the thirteenth Conference of the Parties in Bali, Indonesia in December 2007 (Saunders, et al., 2008).

Despite the existing conservation measures for management of forest resources, uncontrolled deforestation especially in eastern Nigeria, continuously leads to accelerated soil erosion and other problems. Population pressure has also aggravated gully erosion problem of Anambra State such that almost all local government areas of the state are affected through gradual removal of uniform depth of soil or gullies, which cut deep down slope.

In view of the above, the forests have been subjected to degradation, exploration, utilization and careless destruction. Also the trees in the forest within the study area are volunteer trees and consequently have considerably faced extinction and perhaps diminished in quantity and quality to such extent that it is inadequate for rural needs, hence posing environmental, biological, cultural, medical and nutritional problems. Hence, there was need to answer the following questions: What are reasons for loss of forest resources in the area? What are the roles and methods of farmers in conserving forest resources in the area? and What are the benefits of conservation of forest resources in risk reduction in the area? These questions gave rise to the objectives of the study.

Objectives

The objective of the study was to investigate the ways of managing of risks in Agriculture and ascertain benefits of conservation of forest resources in Anambra State, Nigeria. The specific objectives were to:

1. Ascertain reasons for loss of forest resources in the area;
2. Identify roles and methods of farmers in conserving forest resources in the area and
3. Ascertain benefits of conservation of forest resources in the area.

METHODOLOGY

The study was carried out in Anambra State, Nigeria. Multi-stage sampling procedure was used to select 120 respondents from existing farmers' organisation. Data were collected through the use of interview schedule. The population of the study comprised all the people engaged in forestry activities. Anambra State is made up of three senatorial zones, namely: Anambra North, Anambra Central and Anambra South with seven local government areas (LGAs) allocated to each zone (www.igbofocus.co.uk). In the first stage, Two out of the three senatorial zones were purposively selected for the study (Anambra North and Anambra South). One Local Government Area (LGA) was purposively selected from each selected zone (Awka South LGA-Anambra North Zone and Orumba South LGA- Anambra South Zone) while two communities each were also purposively selected from each LGA (Awka South LGA-Enuorji and Adabebe communities, Orumba South LGA- Umuchu and Umuomaku communities). The reason for purposive selections was because of the existence of traditional forests in those areas. A list of 40 people engaged in forestry activities was compiled in each community based on their villages and hamlets/kindred from which 30 respondents were randomly selected giving a total of 120 respondents for the study. Data were analysed with the use of descriptive statistics (percentages and mean scores).

In order to ascertain the respondents' roles and methods of conservation of forest resources, the respondents were asked to tick the roles and methods on a 5-point likert type scale of strongly agreed (SA), agreed (A), disagree (D), strongly disagree (SD) and undecided with nominal values of 5, 4, 3, 2 and 1, respectively. The respondent mean score were obtained for each response option. A cut off point of 3.0 was used to indicate the major roles and methods used by the respondents. Also, to ascertain the respondents' perception of the reasons for loss of conservation of forest resources and benefits of conservation, the respondents were asked to tick the possible reasons for loss and benefit on a 3-point Likert type scale of: major reason/major benefit (3), minor reason/minor benefit (2) and not a reason/benefit at all (1) with nominal values of 3, 2 and 1, respectively. The respondent mean score were obtained for each response option. A cut off point of 2.0 was used to indicate the major reason for loss and major benefits of conservation according to the respondents.

RESULTS AND DISCUSSION

Reasons for loss of forest resources in the area

Entries in Table 1 show that the major reasons for loss of forest resources according to the respondents were excessive farming (M=2.8), insufficient economic incentives for conservation (M=2.5), inadequate resources for monitoring system (M=2.5), inadequate technical support for conservation of forest resources (M=2.3), limited government investment in forest conservation (M=2.3), illegal logging and poaching (M=2.3), burning of forest areas (M=2.2), existence of land-use and infrastructure planning (roads, new settlements) that does not take into account protected areas (M=2.1), rapid urbanization (M=2.0), climate change and global warming (M=2.0), population growth and density (M=2.0) and decreasing soil fertility (M=2.0). This implies that clearing of forest area as a result of excessive farming is the major reason for loss of forest resources among other reasons.

This is in line with Contreras-Hermosilla (2000) who stated that shifted cultivators, private and government logging companies, mining and oil and farming corporations, forest concessionaires and ranchers clear forest lands or selectively exploit forests for agricultural expansion, to subsist, formining, to obtain forest products and fuelwood, etc. Similarly, agricultural concerns clear large tracts of forest lands in Malaysia and Indonesia to establish agro-industrial plantations (Kartodiharjo and Supriono, 2000). Also according to Boon et al. (2009), the factors causing the depletion of the forests include excessive legal and illegal logging, unsustainable farming methods, annual bushfires, surface mining and infrastructural development. Underlying these deforestation driving forces are forest policy failures, unrealistic forest fee regimes, external prices of timber, weak institutional structures, and population pressures (Food and Agriculture Organisation, 2001). Government policies for forest conservation are either inactive insufficient. Powell (2009) opined that there is deficiency in comprehensive and specific policies to encourage development of forestry practices. This implies that forest resources are faced with risks and are not conserved mostly due to human activities in forest areas and in most cases, forest degradation does not show as a decrease in the area of woody vegetation but rather as a gradual reduction of

Table 1. Distribution of respondents according to reasons for loss of forest resources in the area.

Reasons	Mean (M)
Excessive farming	2.8*
Insufficient economic incentives	2.5*
Inadequate resources monitoring system	2.5*
high level of poverty among community members	2.5*
Inadequate technical support for conservation of forest resources	2.3*
Limited government investment in forest conservation	2.3*
Illegal logging and poaching	2.3*
Burning of forest areas	2.2*
Land-use and infrastructure planning (roads, new settlements) does not take into account protected areas	2.1*
Rapid urbanisation	2.0*
Climate change and global warming	2.0*
Population growth and density	2.0*
decreasing soil fertility	2.0*
Excessive harvest of resources	1.9
Insufficient training and education for forest conservation	1.9
Unpriced forest goods and services	1.9
Inadequate conservation laws	1.8
Pest and diseases	1.6
Floods	1.6
Cattle ranching and overgrazing of forest areas	1.6
Limited local people participation in management of resources	1.5
Limited awareness on need for conservation	1.3

*Major reasons for loss of forest resources in the area.

biomass, changes in species composition and soil degradation. Also, unsustainable logging prac-tices can contribute to degradation if extraction of mature trees is not accompanied with their regeneration or if the use of heavy machinery causes soil compaction or loss of productive forest area. Therefore there is need for sensitization of farmers, researchers and government on the benefits of conservation of forest resources.

Also, insufficient economic incentive for conservation is a major reason for loss of forest resources. Labor, capital and input for instance are needed for efficient forest con-servation practices. Shortage of these hinders adoption of these practices especially for different tasks in forest conservation especially seedling production, tree establishment and management. The human capacity, infrastructures and institutional supports for forest practices are usually not as well developed as for annual crop technologies (Gladwin et al., 2002). Also according to Powell (2009), lack of suitable infrastructure to sort, grade, and stabilize and add value through processing to non tree forest products (NTFPs), other specialty crops and niche production hinder the practice of forest conservation.

Roles and methods used by farmers in conserving forest resources in the area

Table 2 comprises the roles and methods use by farmers in conservation of forest resources in the area. The roles played by farmers in order to conserve forest resources in the area included: Prevention of clearing of forest area for agricultural purpose (M=3.3), prevention of bush burning in forest areas (M=3.2), provision of forest guards for forest preservation (M=3.2), imposition of fines/sanctions on illegal exploiters (M=3.2), practicing continuous forestation (M=3.2), making laws against indiscriminate felling of trees (M=3.1), involvement of local people in the conservation movement (M=3.1), making laws against clearing of forest area for settlement (M=3.0), prevention of illegal hunting or poaching (M=3.0) and prevention of grazing in the forest area (M=3.0). This implies that the most important of the major role played by the farmer is prevention of clearing of forest areas for agricultural purposes and the respondent try as much as possible to leave forest resources protected.

Also, methods used by the farmers include: adopting agro-forestry practices (M=3.1), group formation (M=3.1), use of good participatory approaches (M=3.0), involvement of local leaders (M=3.0), use of improve technologies like forestation techniques forest laws and policies (M=3.0), provision of group labour (M=3.0) and use of age grade to control exploitation of forest resour-ces (M=3.0). This finding is in line with the opinion of Dosskey et al. (2011) that farmers practice agroforestry by integrating trees into agricultural systems to aid the management of the agricultural components. According

Table 2. Distribution of respondents according to roles and methods used in conserving forest resources in the area.

Roles of farmers	Mean score (M)
Prevention of clearing of forest area for agricultural purpose	3.3*
prevention of bush burning in forest areas	3.3*
Provision of forest guards for forest preservation	3.2*
Imposition of fines/sanctions on illegal exploiters	3.2*
practicing continuous forestation	3.2*
Making laws against indiscriminate felling of trees	3.1*
Involvement of local people in the conservation movement	3.1*
Making laws against cleaning of forest area for settlement	3.0*
Prevention of illegal hunting or poaching	3.0*
Prevention of grazing in the forest area	3.0*
Making source trees sacred	2.7
Investing in forest conservation not seeing the forest as only source of generating revenue	2.4
Educating their people on the benefit of conserving forest resources	2.3
Encouragement of alternative sources of energy use other than wood	2.1
Methods used for conservation of forest resources	
Adopting agro-forestry practices	3.1*
Group formation	3.1*
Use of good Participatory approaches	3.0*
Involvement of local leaders	3.0*
Use of improve technologies like forestation techniques, forest laws and policies	3.0*
Provision of group labour	3.0*
Use of age grade to control exploitation of forest resources	3.0*
Collaborations with extension agents	2.2
Collaboration with research institutes	2.0
Engaging in trainings	2.0
Collaboration of farmers in Funding	2.0
Individual approach	2.0

to FAO (2013), when designed and implemented correctly, agroforestry combines the best practices of tree growing and agricultural systems resulting in most sustainable use of land. The trees are planted or retained as farm trees and interplant with arable crops, in close proximity to the homestead where they are protected. Also, the farmers form groups and use participatory

Benefits of conservation of forest resources

According to Boon et al. (2009), the past two decades have witnessed increased attention by the world community to the issue of conservation and a wise use of forest resources. These resources are of great importance to millions of people, especially those whose livelihoods directly depend on them. Forest resources play a key role in protecting the environment and are of tremendous importance to the sustainable development of every society. Hence the uncontrolled and unsustainable methods of harvesting natural resources being employed by forest resources exploiters, investors, government agencies, individual and community members which predispose forest to risks urgently need to be checked. The benefits of conservation of forest resources were ranked by the respondents. Means of retaining economic benefits from the forest (M=2.5) ranked first, while prevention of climate change (M=2.4), protection of forest cover (M=2.3) and improvement of employment (M=2.2) ranked second, third and fourth respectively (Table 3). Other benefits included that conservation of forest resources helps to improve employment (M=2.2), improve the local climate (M=2.0), provides source of additional income (M=2.0), improve sources of forest fruits and vegetables (M=2.0). The minor benefits include that it helps to improve constant access to medicine and herbs (M=1.9), enhances soil conservation (M=1.9),generate money invested in other projects (M=1.8), aid carbon sequestration (M=1.8), provide bio-fuel and bio-energy (M=1.8), conserve biodiversity (M=1.6); improve microclimate (M=1.6), enhance water use efficiency by erosion control(M=1.5) and enhance soil fertility (M=1.5).

This implies that conservation of forest resources have tremendous benefits. According to Contreras-Hermosilla (2000), forests provide local and global unmarketable

Table 3. Distribution of respondents according to benefits of conservation of forest resources in the area.

Benefits	Mean	Rank
retaining economic benefits from the forest	2.5	1st
prevention of climate change	2.4	2nd
protection of forest cover	2.3	3rd
Improve employment	2.2	4th
improving the local climate	2.0	5th
Provides source of additional Income	2.0	6th
Improve sources of forest fruits and vegetables	2.0	7th
Improve constant access to medicine and herbs	1.9	8th
Enhances soil conservation	1.9	9th
Money generated from sustainable forest conservation is invested in other projects	1.8	10th
Aids in carbon sequestration	1.8	11th
Provision of bio-fuel and bio-energy	1.8	12th
Biodiversity conservation	1.6	13th
Microclimate improvement	1.6	14th
Enhancing water use efficiency by erosion control	1.5	15th
Enhance soil fertility	1.5	16th

benefits which may accrue to distant consumers and any loss of these benefits must be considered costs. For example, a slash and burn farmer does not pay for the global cost of increased carbon dioxide released into the atmosphere or for the increased costs of protecting dams downstream that result from his actions, nor for the loss of biodiversity or aesthetic resources associated with the forest he exploits (Contreras-Hermosilla, 2000). These costs are important for society as a whole and the private agent of forest decline. Forest conservation helps to prevent loss of forest resources.

CONCLUSION AND RECOMMENDATION

Forest resources are vital for existence rural communities. The study assessed the roles, methods and benefits of farmers in conservation of forest resources. Changes within a forest class, from closed to open forest, will negatively affect the stand or, in particular, lower its production capacity and constitute forest degradation. Also, forest degradation implies a major loss of forest productive capacity, even where there is little defo-restation as such. The study identified numerous benefits and means of forest conservation. It well established that forests provide varieties of food, fibre and medicine for humans as well as employment opportunities and income and also help in soil protection and erosion control. However this benefits derived from forest areas are been endangered by human exploitations and activities.
Hence it was recommended that:

1. Forest resources should be conserved as much as possible to enhance sustainable provision of benefits accruable from forest.
2. Trainings and extension services on improved forest management techniques should be provided for farmers.
3. Farmers and government should collaborate and provide adequate fund and facilities to the conservation of forest resources.
6. Appropriate government and forestry policies should be enacted to encourage conservation of forest resources.
7. Loggers and poachers should be encouraged to effectively control and minimise wastage of forest resources.

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Full Length Research Paper

Preparing agricultural product marketing for the new AEC market: A case study for improving the marketing organization for farmers in Chiang Rai Province, Thailand

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The ASEAN Economic Community (AEC) will be established in 2015 providing challenges both advantageous and otherwise to the agricultural economy of Thailand. The Marketing Organization for Farmers (MOF) intends to develop an integrative business model based on contract farming of native rice turned into a unique product. This study explored the unique agricultural product especially native rice Kiaw Ngu native glutinous rice variety (GS No. 8974) and the marketing channel of such product to prepare for the AEC market. The data of this study were collected from state organization's experts and specialists who were selected for in-depth interviews and focus group discussion in Chiang Rai Province. Moreover, the MOF chose a contract farming system to promote this rice in its supply chain. The MOF expected to create a new market for this rice in the integrated market of AEC that will be expanded domestically and overseas especially in the neighboring countries such as Laos, Myanmar, the Philippines and Malaysia.

Key words: Agricultural economics, Kiaw Ngu native glutinous rice, marketing channel, contract farming, Chiang Rai Province.

INTRODUCTION

The establishment of the ASEAN Economic Community (AEC) will promote the free flow of goods and services among ASEAN countries consisting of Thailand, Indonesia, Malaysia, the Philippines, Singapore, Brunei, Vietnam, Myanmar, Laos and Cambodia. The integration of AEC may bring both advantages and disadvantages to Thailand with such advantages as the liberalization of trade in goods and services within ASEAN, exporters/

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manufacturers in Thailand will be able to export their products to the wider market and can transfer technology within the AEC. Moreover, they can increase business activities in the ASEAN region. Also, investors may move the production from Thailand into member countries in ASEAN which offer cheaper labor costs. With regard to the disadvantages, cheaper labor costs will influence the employment of Thai labor. Laborers from Myanmar, Laos and Cambodia will migrate freely to work in Thailand more and more, which these labors will compete with Thai workforce (Department of Trade Negotiations, 2011). Moreover, the cheaper priced products will be imported into Thailand such as palm oil from Malaysia, coffee and rice from Vietnam, tea from Indonesia, and coconuts from the Philippines and Indonesia.

Cultures and food consumption patterns in the AEC member countries share a great resemblance especially rice consumption. Many member countries can produce food and agricultural products but these are not enough to supply the increasing domestic demand. Moreover, many AEC countries have the purchasing power for imported goods. Therefore, these reasons provide an opportunity for exporting agricultural products to these countries. Rice products of Thailand have been affected by many countries in ASEAN especially Vietnam but it can compete on the basis of the quality and identity of Thai rice. In 2014, the estimated volume of Thailand's rice export approximated 9.5 million tons while Vietnam's rice export approximated 6.5 million tons. However, the average price of Vietnam's rice was cheaper than that of Thailand, being 445 USD/ton and 483 USD/ton, respectively. It is predicted that in 2015 Thailand will export rice at approximately 10 million tons while Vietnam will export approximately 6.7 million tons. (Department of Foreign Trade, 2014). In 2014 (January - August), Thailand exported white rice to AEC member countries such as Singapore and Laos. Moreover, Thailand also exported glutinous rice to Malaysia, Singapore, Laos, the Philippines, Indonesia, Cambodia and Brunei worth approximately 80.2, 3.6, 2.0, 1.9, 1.1, 0.5 and 0.5 million USD, respectively (Information and Communication Technology Center, 2014).

The stiff competitions in the new AEC market will influence the preparation of public and private agencies and state enterprises in Thailand. Not only will they need to improve quality of products but also they need to create unique products and enhancing the strength of such products. Moreover, the agricultural sector of Thailand in the future should focus on the effective production, branding and quality of products (BIAE, 2013). Therefore, many organizations in Thailand, including the Marketing Organization for Farmers (MOF) must emphasize these aspects to develop the economy of the country. Moreover, Kulreangsub (2012) explained that it will be a golden opportunity to export Thailand's agricultural products into Cambodia, Myanmar, Laos and Vietnam due to the fact that these countries have a high purchasing power. In addition, these countries are expected to expand their foreign trade in the future.

The MOF is a state enterprise in Thailand that has a role to support the farmers in agricultural marketing. Therefore, it should find a golden opportunity in the new AEC market by selecting products that are unique, and enhancing the strength of such products in order to compete there. Moreover, the MOF is assigned the role of strengthening food security in the ASEAN region by the State Enterprise Policy Office of Ministry of Finance (State Enterprise Policy Office, 2012). Meanwhile, one of important aspects in the free trades and investments among ASEAN countries is the strengthening of food security (Department of Trade Negotiations, 2011). Furthermore, the Ministry of Agriculture and Cooperatives (MOAC) has laid down preparations for the AEC in terms of promoting agricultural products such as organic and value-added products (MOAC, 2012).

With regard to the promotion and strengthening food security in agricultural products, all sectors in Thailand agreed that their work have to emphasize integrated and sustainable development in order to obtain sustainable food production, quality food and providing effective marketing. Furthermore, many sectors in Thailand want to preserve the rice trader leader status in the AEC. In addition, they have emphasized the role of developing native rice varieties to create a selling point and preserving native rice in local areas.

Therefore, the development of native rice varieties was given a high priority to support rice business in Thailand. Moreover, the unique characteristics of native rice can compete for high quality or top grade market (AEC Knowledge Center, 2012). For this reason, the MOF focused on native rice varieties in order to conform to these policies and mission. This study tries to explore the unique agricultural product especially native rice for the MOF in order to make a difference in the AEC market, and tries to find the marketing channel of this product to prepare for the new AEC market.

Marketing organization for farmers (MOF)

The MOF is a state enterprise that was originally established in 1974 by the MOAC. The MOF has many department and provincial branches (Figure 1). The main objectives of MOF are 1) to encourage the farmers to practice effective agricultural marketing, 2) to provide and distribute agricultural inputs with quality and fair price according to the requirement of farmers, and 3) to serve the farmers and farmers' groups in the distribution, marketing and storage of agricultural products. Moreover, it manages the fresh food market which ranks No. 4 in the world due to the quality of agricultural products and warehouses (CNN Travel, 2012). It also provides the venue for developing a comprehensive agricultural market to add value to agricultural products and responding

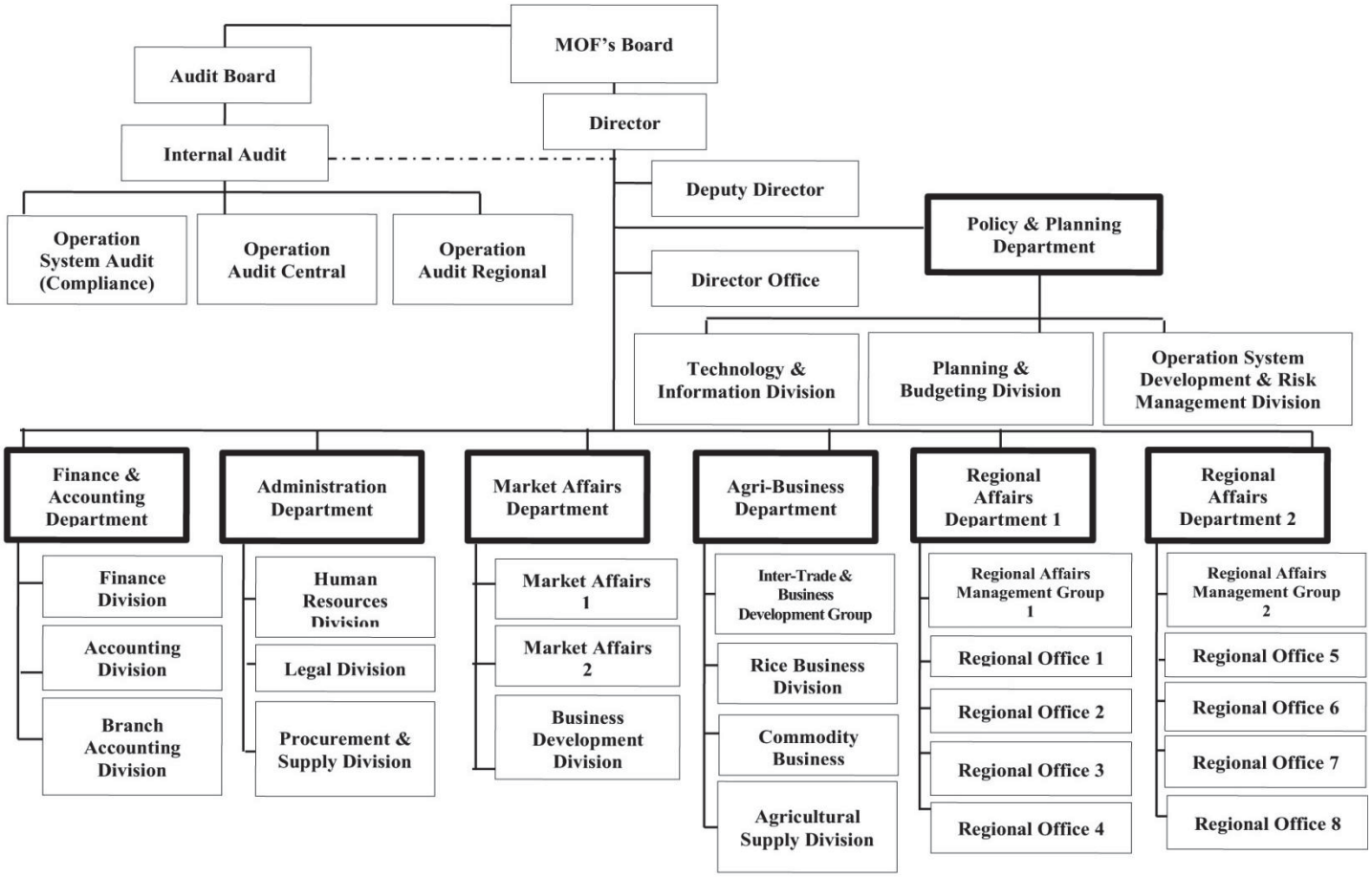

Figure 1. Organization structure of the MOF.

to the lifestyle of modern society. Furthermore, the MOF also plays an important role in implementing various government policies, for example, Rice-Pledging project and preparation for the AEC (MOF, 2012). At present, the MOF has a pilot project to export glass bottle baby corn in vinegar and sweet corn in brine. These products have received attention from foreign countries such as Germany, Russia and Lebanon. With regard to the selection of export companies, the MOF selects by considering the export experience, high quality products that meet the export standard and reliability of the company. Therefore, it can be expected that the MOF can extend market channels for farmers in the future (MOF, 2013).

Uniqueness and differentiation of product

In recent years, the economy, technology and society of Thailand have changed. The important priority of organizations has been to manage or change by adopting the suitable strategy in order to respond to changing circumstances immediately. Creating unique products is very important for their business. Therefore, it is absolutely imperative that organizations need to create product to make a difference and that can compete with others in the market (TCDC, 2014). One of the competitive aspects is the quality of product that consists of performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality (Garvin, 1998). High quality products will increase market share that will lead to increasing profits in the company. Moreover, Porter (1998) said that business companies can create an advantage over competitors by making a different and unique product. Furthermore, the buyers look for a different product in the market and are willing to pay a premium price for such product. In addition, small companies can achieve in the niche market better than the larger companies.

Competitiveness of products in the market

In a volatile competition era, many successful companies have used a variety of strategies and do not focus only one aspect. They may begin by using an advantageous

strategy for competition such as the customer market advantage, product and service advantage, business system/value chain advantage, system assets/resources advantages, partner advantage, and scale and scope advantage. Moreover, the company must be operated using the competitive advantage strategy continuously to succeed ahead of other companies. In addition, the company can gain competitive advantage if they can create products for which consumers are willing to pay a higher price (Shah et al., 2003). Meanwhile, other competitors are unable to duplicate or imitate their products (Barney, 1991; Olson et al., 2000; Hitt et al., 2013). However, companies have to evaluate their goals and marketing channel of products for the company, consumer, and for determining the consumer and competitor assessment in the market.

Marketing channel of products

The marketing channel or channel of distribution or place is a component of the marketing mix in addition to the product, price and promotion. The marketing manager should determine the strategy of the marketing mix efficiently in order to meet the needs of targeted customers. At present, the distribution channels use two forms consisting of direct sales or direct marketing, and sales through intermediaries (Figure 2). These forms differ as follows: the direct sales to consumers or decentralized channel will gain profit more than the other method. However, producers should select the direct market channel that matches with their strengths and production experience. While the producers will gain higher sales volumes through intermediaries or centralized channel, however, they depend on the network of intermediaries (FAO, 2003; Bruch et al., 2010; Madugu et al., 2011). Therefore, the marketing channel is a necessary activity that transfers the ownership of products, and moving such products from the point of production to the point of consumption.

MATERIALS AND METHODS

Chiang Rai Province in the northern region was selected as the study area (Figure 3) because it is close to common borders of three countries namely Thailand, Laos and Myanmar, a place popularly known as the Golden Triangle. Moreover, it is considered to evolve into an AEC trading and distribution center of products in the future. In the year 2013, the border trade of Chiang Rai Province with neighboring countries namely southern China, Myanmar and Laos increased 6.7% in terms of values. As these close areas are located far from their capitals, so they need to buy products from Thailand which offers a variety of commodities (Office of Commercial Affairs Chiangrai, 2014). The important agricultural product of Chiang Rai Province is rice with some native rice varieties preserved in the Chiang Rai Rice Research Center (CRI). Consequently, native rice was chosen as a beginning point for the MOF's business in order to prepare into the new AEC market. In this study, the authors utilized the data that were derived from documents, as well as focus group and in-depth interviews conducted twice during field surveys aimed at concerned target groups in Chiang Rai Province.

The first of field surveys was to explore the native rice and marketing channel of agricultural products in the area. The interviewees included a professional agricultural extensionist of the Chiang Rai Agriculture Office, a deputy secretary-general of trade at Chiang Rai Chamber of Commerce, a community development specialist of Chiang Rai Community Development Office, three staffs of the MOF, two managing directors of private companies, and two owners of import-export companies. The second of field surveys was to study Kiaw Ngu glutinous rice (GS.No.8974) that was developed from experiments of the CRI, and explore the possibility of marketing channel of this rice in the domestic and AEC markets. The interviewees included two professional agricultural research officers of the CRI, two professional agricultural extensionists of the Agricultural Extension Department, a provincial cooperative officer and a cooperative technical officer of the Chiang Rai Cooperative Office, three owners of rice mill, and three farmers.

The authors selected respondents based on the purposive sampling method. The respondents were interviewed in-depth by the research team at each office and village education center. The in-depth interview forms were used to collect the information on the data of the unique agricultural product for the MOF regarding the criteria for product selection, and the uniqueness and competitiveness of product, as well as the marketing channel of such product to prepare into the new AEC and domestic markets. The data were arranged and described by statistical tools, and were analyzed by using qualitative analysis.

RESULTS AND DISCUSSION

Criteria for product selection

In the first of field surveys in Chiang Rai Province, the MOF had many agricultural products for entry into the new AEC market namely native rice, garlic, tea, coffee and dehydrated vegetables. However, the MOF emphasized native rice in the province. The authors and respondents set up the criteria for product selection of the MOF (Figure 4), which had five aspects as follows: the first is the MOF select native species as a product to preserve and to show the identity of the province. The second is the product should be unique which it can create a selling point. The third is the product needs to have safe and quality features that contribute to the strengthening of food security in the ASEAN region according to the aims and objectives of the ASEAN Integrated Food Security (Department of Trade Negotiations, 2011). The fourth is the product can be sold in the quality market at a high price such as the MOF's market or top grade market. Lee et al. (2003) explained the new product as one that has quality and is unique more than the products of competitors, and meet to need of consumers. The company can set a premium price for the product. Finally, product needs to create trade opportunity into ASEAN member countries. Minoiu (2003) mentioned that the selection of agricultural products should focus on food security, high production potential,

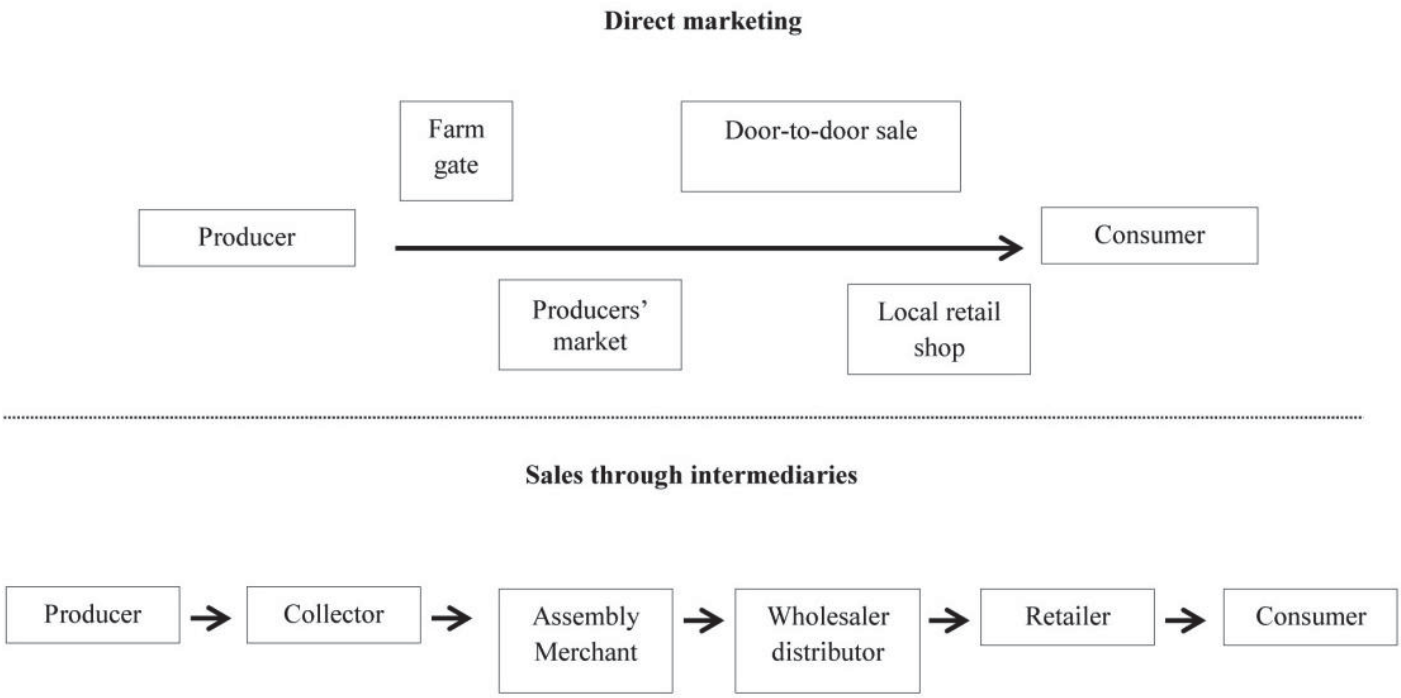

Figure 2. Direct marketing and sales through intermediaries.
Source: FAO (2003).

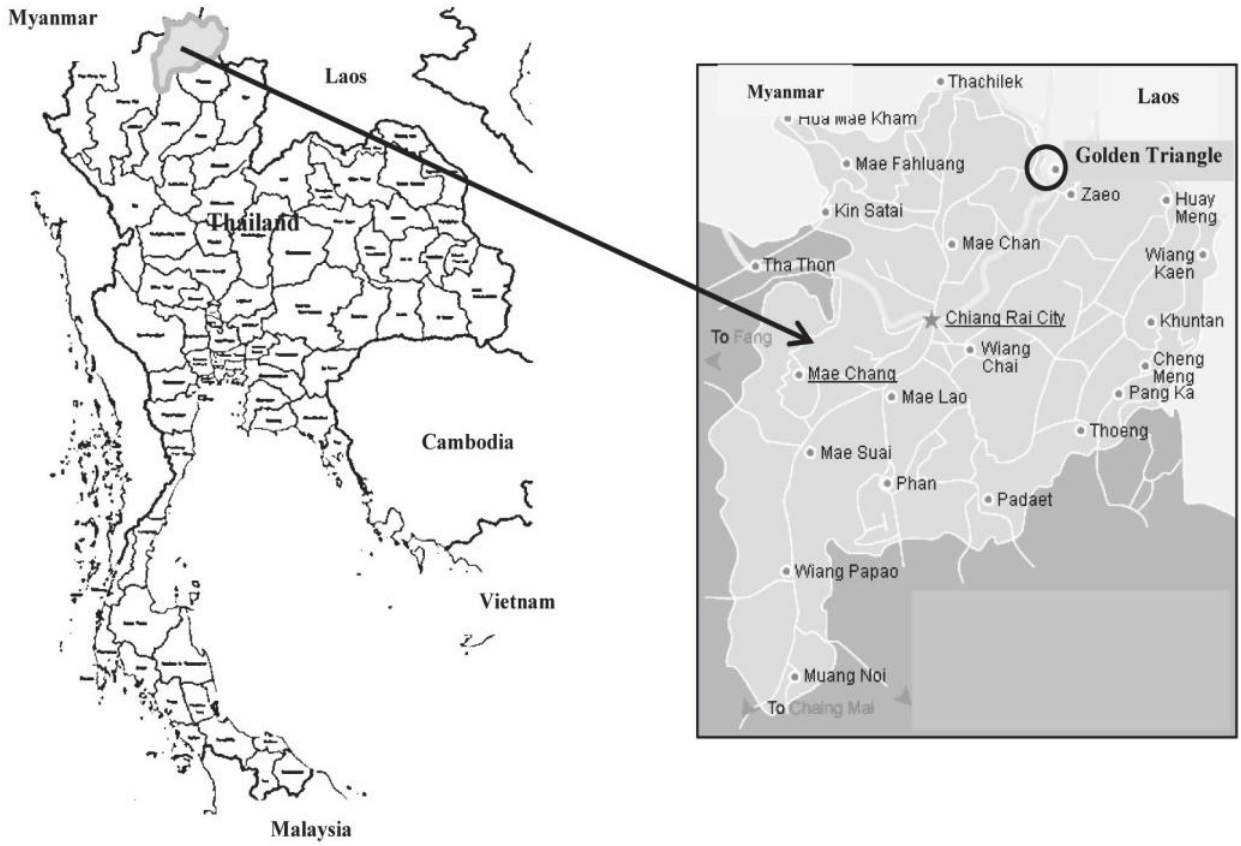

Figure 3. Map of Chiang Rai Province, Thailand.
Source: Google Map (15th September, 2014).

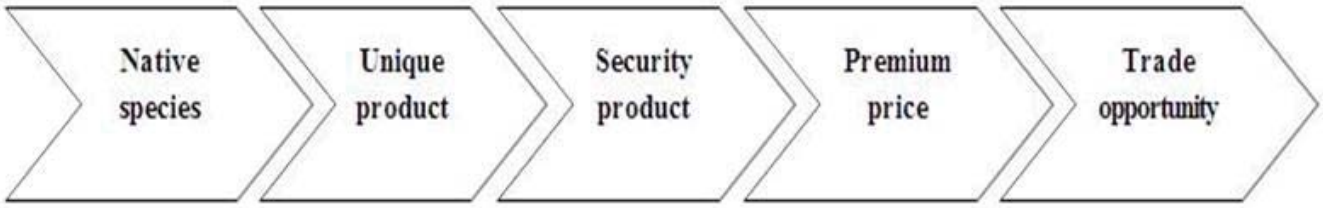

Figure 4. The keywords of criteria for product selection of the MOF.

and it can increase opportunity of trade toward the regional and global markets.

Therefore, Kiaw Ngu glutinous rice was selected as an agricultural product of MOF because it is native rice species in Chiang Rai Province. The experiment of the CRI using this native rice for about 6 years led to the birth of GS.No.8974 variety which is the best and most appropriate for cultivation in the climate and soil characteristics of northern Thailand especially Mae Chan district, Chiang Rai Province. The reason of this experiment was to conserve it in northern Thailand and increase alternative crop for farmers. However, this native rice is gradually disappearing from the local farms because farmers in this area cultivated other high-yielding glutinous rice such as Niaw-San-Pah-Tawng and RD6.

In addition, Kiaw Ngu glutinous rice has been sold in domestic market but it is not the native rice variety in Chiang Rai province. It is a modified rice that rice mills produced by using modified other glutinous rice as Kiaw Ngu glutinous rice by increasing the times of whitening and polishing which resulted in a grain shape like Kiaw Ngu native variety. Moreover, a dessert in the market has been made from modified rice with coconut cream. Therefore, native variety should be conserved and promoted for cultivation in Chiang Rai province, so that its uniqueness can be a selling point. In addition, it can be a safe product due to absence of chemicals, and can create value and sell at high price in the niche market.

Uniqueness and competitiveness of Kiaw Ngu glutinous rice (GS.No.8974)

The second of field surveys focused on the data of Kiaw Ngu native variety (GS.No.8974). The CRI found that distinct features and quality of this rice differ from other glutinous rice as follows: 1) its grain is small and slender like a canine tooth of snake, 2) its skin when cooked is white, sticky, shiny, soft and fragrant, 3) it is suitable for organic farming because it does not respond to chemical fertilizer and it also resists plant diseases and insects, 4) it has high protein, total dietary fiber and antioxidants in vitamin E form, and 5) it can be local-specific variety which can apply the Geographical Indications (GI).

In addition, the CRI evaluated the dessert satisfaction of farmers and rice traders. The results found that they are satisfied with GS.No.8974 more than any other varieties in terms of taste, skin characteristics and fragrant. However, it had the weak point namely low-yield in which GS.No.8974 and RD6 had yield of approximately 469 and 649 kg./rai, respectively, and production cost approximated 5,148 and 5,683 THB/rai, respectively (1 rai = 0.16 ha). The expected price of GS.No.8974 paddy was 18-20 THB/kg., which should be similar to high quality rice. In domestic markets modified Kiaw Ngu was sold approximately 35-36 THB/kg. (Department of Internal Trade of Thailand, 2014). This price can imply that the MOF can set the price of Kiaw Ngu native rice (GS.No.8974) at approximately 38 THB/kg., which is more than modified rice. Therefore, Kiaw Ngu native rice is an alternative crop for farmers who need to increase income for their households. According to Anim (2010), higher income from contract products may not only raise the standard of living of contract farmers, but may also create double effects for employment, infrastructure and economic growth in the region. Moreover, consumers emphasize on their health more and more. Therefore, this rice is also a suitable alternative rice for consumers.

With the unique specifications of Kiaw Ngu native rice, the MOF can use this rice to compete in domestic market especially niche market before it will expand to a new AEC market. The MOF will act as commercial leader of Kiaw Ngu native rice which it should produce under the brand name of the MOF. It is a state enterprise/ organization well known for selling high-quality products, offering reliability to customers and partners. The brand name is effective on buyers' perceptions in terms of quality, value and willingness to buy product (Dodds et al., 1991). Moreover, a good brand name has reflected on the performance, social image, value, trustworthiness and identification, which consumers are willing to pay a higher price for it (Kotler et al., 2002; Aaker, 2004).

Thus, the competitiveness of GS.No.8974 in the future market has six aspects. The first is the unique characteristic of this rice that differs from other glutinous rice. Second, it has reliability under the brand name of the MOF. Third, this rice can be cultivated only in Chiang Rai province, and can offer an opportunity to export to the ASEAN member countries. Fourth, the consumers emphasize on the organic products more and more, which this rice dose not respond to chemical fertilizer and it also resist to plant disease and insect. The fifth, this

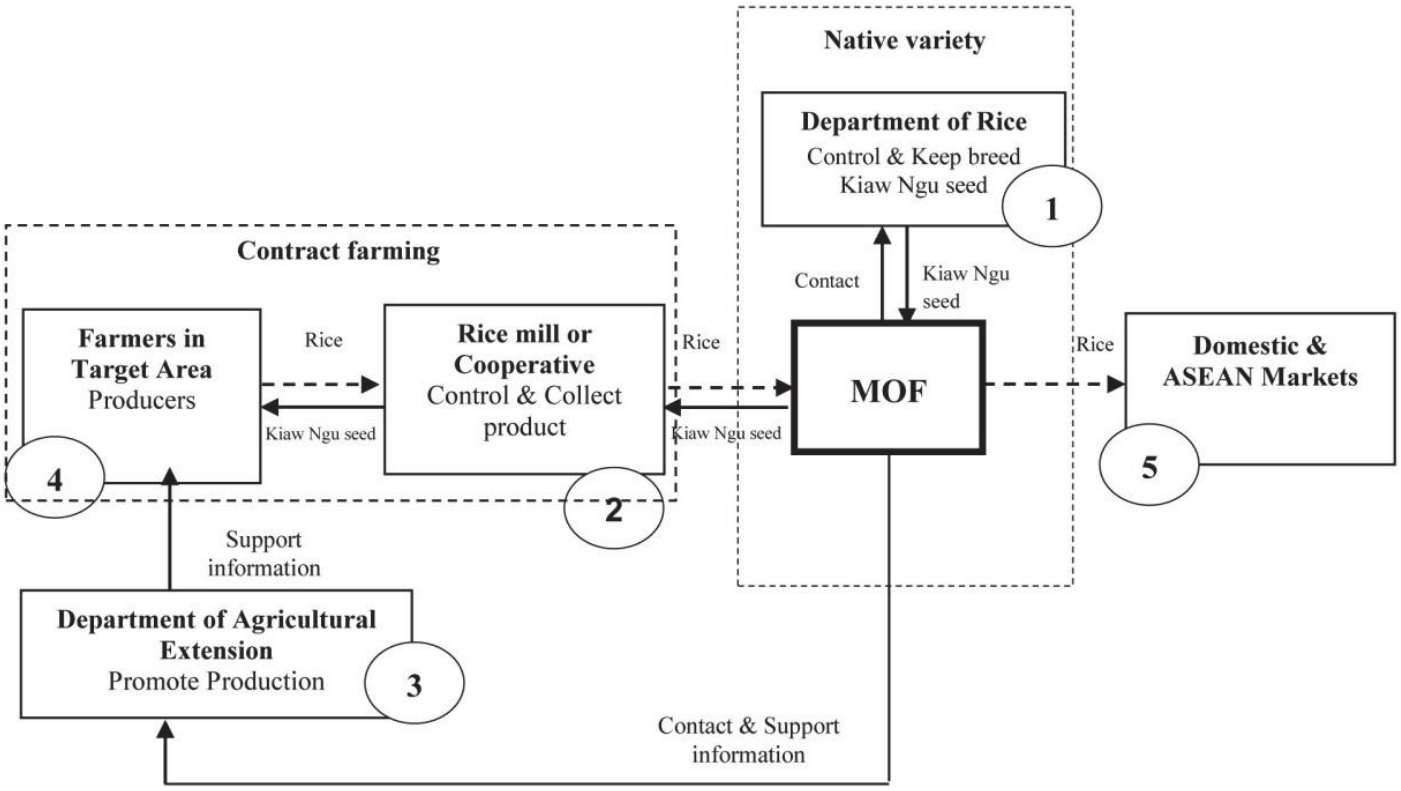

Figure 5. Structure of integrated production and marketing of Kiaw Ngu native rice variety (GS.No.8974).

rice can be sold in the quality market or niche market at a high price especially the dessert market, in which sticky rice with coconut cream is well-known among foreigners. Finally, this rice can grow in target area through integrated production, with its quality and quantity meeting the need of consumers.

Marketing channel of Kiaw Ngu glutinous rice (GS.No.8974)

One of the MOAC's policies involved the increase of the quality of agricultural products for preparing into the new AEC market. Therefore, the marketing channel of Kiaw Ngu native variety (GS.No.8974) should include the contract farming system (CF) because integrated production and marketing may contribute to achieve high efficiency which can control the quality of products from production to marketing parts. Moreover, contract farmers have the certainty of market, price and income. In addition, buyers got quality products on time and meet the requirement of buyers. However, the contract farming of many products has many problems such as contract farmers selling their products to outsiders and the buyers cannot collect products from farmers at the required number. In addition, contract farming involved with a written agreement between company and farmers, but is seldom legally enforceable in practice (FAO, 2012; Glakuy, 2012; Kaur, 2014). Furthermore, Sriboonchitta et al. (2005) and Ruammek (2014) found similar problems of the contract farming namely growers lacked allegiance to the company, the companies delayed payment to contract farmers, and unpredictable weather that may affect the products. Even if the CF has many advantages and disadvantages as above, the MOF should learn these aspects more and more to be more responsive to this project.

Moreover, the MOF should include the CF in Kiaw Ngu glutinous rice (GS.No.8974) production because farmers in Chiang Rai Province have experienced CF system with many companies and many crops such as Japanese rice, bush beans, and soybeans. Therefore, the MOF can use this opportunity to expand the market or to promote this rice among local farmers. However, the MOF should set up collaboration with other organizations (Figure 5) in order to succeed in this production. Shah et al. (2003) described the two factors that are the most important for the company's successful business namely quality of product and relationship with their networks. Thus, the collaboration with other organizations within MOF should be first of all organizations would be the Department of Rice regarding seed production of this rice. The second organization is rice mill or cooperative regarding rice collection from contract farmers in the target area. The

third organization is the Department of Agricultural Extension regarding promoting knowledge of production. The fourth is the contract farmers who participate in cultivating this rice which the MOF should support to rice mill or cooperative to make a contract with them. The MOF will not contract directly with farmers due to potential intervention in the management process in the CF system. Moreover, farmers trust the cooperative or someone in the area who has a close relationship with farmers. However, the MOF has to sign a contract with all organizations. Finally, the MOF will distribute products to customers both in the ASEAN and domestic markets directly such as convenient stores, restaurants and Thai dessert shops.

This project is meant to prepare for the new AEC market. The MOF has plans that will expand the market for Kiaw Ngu native rice variety (GS.No.8974) in the neighboring countries such as Laos and Myanmar. However, the MOF has to succeed in the production of this rice and dominate the domestic market just like before.

Conclusion

Thailand has the potential in rice production for consumption in domestic markets and exporting to other countries. However, neighboring countries namely Laos, Vietnam, Myanmar, Indonesia, Malaysia and Cambodia have become rice competitors and partners of Thailand. Therefore, the MOF that is a state enterprise should select agricultural products for the niche market (top grade market) for competition and leadership in the market. The MOF selected Kiaw Ngu native rice (GS. No. 8974) as a potential product that can make a difference in the AEC market. Furthermore, in the current domestic market only modified rice is found. Therefore, it is a good chance for the MOF to create a new market for this unique rice. However, the MOF will start production of this rice for distributing to the domestic market before-hand. The initial stage of production may be difficult because local farmers have not yet seen the benefits of this rice production. However, they may participate in cultivating this rice by considering income and potential of the market in the future. In the first year of the project, the MOF should set up collaboration with other organizations. The second year, the MOF should demonstrate and propagate this unique species of rice. After that, the MOF should support rice mills or cooperatives to make contracts with local farmers. Moreover, the MOF should provide the extension officers to advise and make follow-up visits after recommendation of the new crop to farmers. The MOF can take advantage from marketing channel of this rice through the contract farming model to promote this native rice in its supply chain. It is possible to propose methods to develop its integrated trade. However, the MOF will succeed in this project when it conducts this project continuously, which it can well coordinate with other agencies.

Conflict of interest

The authors have not declared any conflict of interest.

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Influence of demographic characteristics on adoption of improved potato varieties by smallholder farmers in Mumberes Division, Baringo County, Kenya

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Potato (*Solanum tuberosum* L.) is widely consumed as a staple world over with direct consumption by humans as food being 31.3 kg per capita. Ministry of Agriculture through collaborative efforts with other stakeholders has developed improved potato varieties and released them for farmers to plant in Kenya. The main aim of this study was to investigate the influence of selected factors on adoption of improved potato varieties in Mumberes division, Baringo country. The study used a cross sectional survey research design where 128 household heads were sampled and interviewed. Statistical Package for Social Sciences (SPSS) version 17.5 aided data analysis. Descriptive statistics were used to summarize key observations in the study. Ordinal Logit regression was used to test the study hypothesis. It was revealed that perception, access to extension services, family size and access to credit were the key factors influencing adoption of improved potato varieties. The study recommended that there is need to increase access to extension services in the study area. Credit service providers should intensify their provision of these services. The research institutions should endeavor to look for varieties more resistant to blights so as to promote further adoption.

Key words: Adoption, Baringo County, demographic characteristics, improved potato varieties, perception, smallholder farmers.

INTRODUCTION

Irish potato (*Solanum tuberlosum,* L.) is a crop of major economic significance worldwide. Potatoes play a major role in food security due its usefulness as both a cash crop and a food crop. With increasing cereal prices, potatoes have the potential of relieving pressure from the poorest of the poor and promote food security (Hoffler and Ochieng, 2009). Potatoes are ranked fourth after wheat, rice and maize in cultivation on a global scale. Among the tuber crops, potato is the most important and ranks first. It has an estimated annual output of 300 million tonnes cultivated on about 19 million hectares globally (FAO, 2008). Further, FAO asserts that the average production globally is about 17 t/ha whereby the direct consumption by humans as food is 31.3 kg per capita. The importance of potatoes as food in developing countries is because they are grown and eaten locally with

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little significance in the international market.

In Kenya, potato ranks second after maize in order of importance for utilization purposes (Muthoni and Nyamongo, 2009). About 500, 000 farmers grow this crop on about 120, 000 ha per season where the annual production is about 1 million tons in two growing seasons (MoA, 2008). The average annual production of potato is reported to be 1 million tones and per hectare yield of 7.3 mt/ha (Obare et al., 2010). However, 14.5-20 mt/ha at farm level and 25-35mt/ha under research conditions are attainable.

Food security in Kenya is a measure of available maize in the country. Nonetheless, maize productivity has steadily declined over the years, which has promoted low food security in the country. In addition, the prices of cereals such as maize and rice have been on an upward trend thus increasing the burden on the poorest of the poor (Hoffler and Ochieng, 2009). However, potato may act as a way out of this situation. This is so because potatoes produce more calories compared to cereals and are easy to cook and process. These aspects combined with a short maturity period of about three months imply that potato production is able to address the twin problem of food security and low household incomes that faces smallholder farmers in developing countries (Mpogole et al., 2012).

In the recent years, there has been a steady decline in the output and productivity per unit area of the potato varieties being grown by farmers. This has prompted research institution and organizations to look for newer varieties which are higher in productivity and less resistant to blights and other potato diseases. Improved potato varieties promise increased savings since they are bred with superior characteristics such as pest resistance and high yields (Abong et al., 2009). Through collaborative efforts between Kenya Agricultural Research Institute (KARI), the International Potato Centre (CIP) and the Regional Network for Improvement of Potato and Sweet Potato (PRAPACE), significant developments of several high yielding varieties of potato have been made in Kenya (Kaguongo et al., 2008). The MoA (2007) also indicated that efforts have been focused on development and dissemination of high yielding varieties.

Research on adoption has pointed to factors such as demographic characteristics of famers; for example, level of education, gender, age and experience of the farmers, farmers perception about the technology, family size, technological factors such as complexity, the location of adopter institutions, access to extension services and access to production resources as some of the factors that may influence adoption of agricultural technologies (Ani and Ifah, 2004; Delgado and Johnson, 2005; Idrisa et al., 2010; Mwabu et al., 2006; Namwat et al., 2010; Obare et al., 2010). Given the role that improved potato varieties can play in averting food insecurity, the adoption rate of improved potato varieties is expected to be high for potato farmers world over. To the contrary, this was not the case in the study area. Thus, this study was designed to investigate the influence of demographic factors namely access to extension, access to credit, age, level of education, family size, gender and perception on adoption of improved potato varieties in Mumberes division, Baringo County, Kenya.

Significance of potato sector in food security

Potato (*S. tuberlosum* L.) is a crop of major economic significance worldwide. This crop provides a reliable source of income, employment and food for many populations in the developing countries (FAO, 2008). Globally, potato provides employment and food security to an estimated 800 million people (Hoffler and Ochieng, 2009). As the prices of major staples including wheat, rice and maize continue to rise, millions of people in the developing countries including Kenya are facing food crises. However, the prices of potato have remained relatively stable and thus can be targeted in improving food security in the developing countries (Muthoni and Nyamongo, 2009).

Potatoes have less significance in international trade compared to cereals and therefore they can form a significant source of food in developing countries. Maganga (2012) has pointed out that the potato sector can help improve the incomes of smallholder farmers and subsequently curb food insecurity together with poverty. This is partly because potatoes are grown and consumed locally, mature within a short period (3 to 4 months) and have high yields (about 40 tons/ha). Additionally, potato can be grown in areas with limited land and abundance of labour (FAO, 2008).

According to FAO (2008), Kenya's annual potato output is about 790, 000 tons. Thus, Kenya ranks 8th in Africa and 5th in sub Saharan Africa in potato production. The crop follows maize in order of importance as a staple and plays a vital role in food and nutritional security of the country. Additionally, in high altitudes, it is a major cash crop for smallholder famers and is grown by about 500, 000 farmers on 120, 000 ha. The farmers produce about 1 million tons in two growing seasons (MoA, 2008).

Potato has a superior comparative advantage to major cereals in the high altitude areas. While farmers complete only one planting season for maize, three cropping season are possible with potato in these areas (Muthoni and Nyamongo, 2009). This way, it acts as a more reliable source of income for farmers. In addition, in the high altitude areas, the average revenue for potato is more than twice that of maize (Obare et al., 2010). Thus, in such areas, potato becomes a more realistic venture which should be promoted not only for food security but also to ensure increased revenues for farmers. With the increasing population and low output from agricultural land, use of improved potato varieties may be one way out of the looming food security situation world over.

Adoption of technologies: Significance of demographic factors

For a farmer to decide whether or not to adopt an innovation, there are other aspects and characteristics that come into play. They include farmers' specific demographic characteristics such as age of the household head, education level, family size, marital status and gender of the household head, access to credit services as well as access to extension services. All these factors have been shown to be significant in determining farmer's decision to adopt a technology.

Perceptions act as a filter through which new technologies are taken in and interpreted. Through perception, farmers are able to transform the information they receive into psychological awareness and later make decision of whether or not the information can be utilized. The way a farmer perceives a technology may influence adoption. The technology-specific attributes have been shown in the past to significantly determine farmers' decision to adopt a technology (Idrisa et al., 2010).

Kafle and Shah (2012) noted that farmer's perception on an innovation largely depends on their knowledge and the information they have about the technology. Thus, by evaluating their yield for a short period, farmers are able to prefer a said technology compared to another. More so, base on their perceptions, farmers are able to assess the expected outcomes of any innovation. The actions taken by the farmer many times depend on their evaluation of the outcomes depending on his/her personal perspectives. Since the role of any technological improvement in agriculture is to improve production, adoption of improved potato varieties may be influenced largely by the perceptions that the farmers have (Idrisa et al., 2010). Perception was treated as either positive or negative as this is a subjective aspect emanating from an individual.

Access to extension is a function of whether or not one is visited by extension service providers and the number of times such a farmer is visited. Influence of this factor to adoption is widely acknowledged by various authors (Okoedo-Okojie and Onemolease, 2009; Odoemenem and Obinne, 2010; Namwata et al., 2010). Using knowledge obtained from extension agents, farmers are expected to increase the outputs of their farm enterprises. Extension agents fragment manage the complex agronomic aspects of an agricultural technology by simplifying it for the farmers. This may facilitate adoption of agricultural technologies. Namwata et al. (2010) indicated that access to extension services is a significant factor that influences adoption of improved potato varieties.

Accessing credit helps farmers to invest in buying of raw materials. Therefore, if farmers can access credit within the household, their chances of adopting a said improved crop variety will increase. However in Kenya, there are gender based differences in accessing credit (Mikalista, 2010). Olwade et al. (2010), noted that among the strongest determinants of fertilizer use intensity in Kenya were gender and access to credit. Research has shown that if farmers cannot purchase farm inputs, they are less likely to intensify their adoption of improved agricultural technologies.

Potato production is a relatively labor intensive venture since it increases labor demand during planting, weeding and harvesting (Muthoni and Namgongo, 2009). Thus, it provides employment for family members during peak seasons. Improved potato varieties promise to reduce labor since they are developed with resistance to chemical damage thus facilitating chemical weeding. Subsequently, both families with larger family sizes and those with smaller family sizes would adopt.

Thus adoption may not necessarily be influenced by family size. Gender of the household head is an indicator of marital status. The influence of gender on adoption of agricultural technologies is widely acknowledged. Gender influences division of labor, the type of agricultural commodity to be planted (Nkamleu and Manyong, 2005) and access to extension services (Feder and Umali, 2002; Mikalista, 2010; Namwata et al., 2010; Ofuoko et al., 2009). Delgado and Johnson (2005) reported that gender of the household head would influence the enterprise the family would be involved in. Thus, gender may influence adoption of the improved potato varieties in the study area.

Summary

The past studies reviewed have shown that the said factors are significant in influencing adoption of various agricultural technologies world over. However, specific technologies may vary in their adoption depending on subjective treatment of the technology by the farmers. More so, there are temporal and spatial variations in the adoption patterns of various technologies. In this study, the aim was to investigate if the factors that were believed to influence adoption of other technologies in other parts of the world could have influenced adoption of improved potato varieties in Mumberes division, Baringo County.

Theoretical framework

This study was guided by both the general systems theory as developed by von Bertalanffy (1968) and the diffusion of innovation theory as developed by Rogers (1995). According to the systems theory, components of a system interact with one another to form one whole. The theory's stronghold is its use of the feedback loops to restore equilibrium. The proponents of the theory argue that incase one component of the system changes, the systems equilibrium is compromised and has to be restored using these loops. This is by looking at the two-

way flow of technology and information between farmers and the public organizations, through extension, and nature of families and their characteristics that constitute the system. The interdependence of these sub systems within the larger system made it more suitable for a study such as this one.

According to the diffusion of innovation theory, a technology has four main elements that may influence its adoption. They are the innovation itself, the communication channels, time and the social context within which the adopter institutions are located (Rogers, 1995). Viewed from a multidisciplinary perspective, adoption is a multi-dimensional process dependent on many of factors such as perceived profitability, costs of establishment, compatibility with value systems and the ability to com-municate new knowledge and information between developers and among adopters or potential adopters.

Definition of variables

Adoption of an innovation can be viewed from two diverse points. One, it can be viewed as merely the utilization of the technology or innovation which creates a dichotomous dependent variable. Alternatively, it can be viewed as the extent to which the technology is being used or utilized and this creates a continuous dependent variable. This study used dichotomous dependent variable approach where adoption was measured by whether or not famers were growing the improved potato varieties. Lack of adoption was defined by failure to grow the improved potato varieties in the past four years preceding the study.

MATERIALS AND METHODS

Study area

The study was conducted in Mumberes division which is located in Baringo County at an altitude of about 2400 m above sea level. The division has a cool climate with an average annual rainfall of approximately 1425 mm per year and a mean temperature of about 18°C. Night temperatures range between 14 and 18°C. The average slope of the land ranges between 14 and 22% (MoA, 2010). Soils are mainly clay loams with an average pH of between 5.0 and 6.5. These features make this division a high potential area characterized by its ability to promote crop growth. The main agricultural activities in this area are crop and animal agriculture. Various crops are grown which include potatoes, maize, vegetables such as cabbages and kales, and fruits such as plums and pears. However, potato farming is the main agricultural activity for farmers and forms the backbone of agricultural sector in this area. The area has a total population of 21, 891 of which 11,009 are males and 10,882 are females. Also, there are 2660 farming households in Mumberes division (Kenya National Bureau of Statistics, 2010). The division has four locations namely; Mumberes, Chemoswon, Timboroa and Seguton. Their populations are 1253, 482, 581 and 344 households, respectively (KNBS, 2010). All these locations were included in this study.

Population and sample

The study involved a cross sectional survey of all the four locations in Mumberes division. The study was carried out between March and May 2013. A sample size of 128 households was used which was determined using the formula suggested by Gatotoh et al. (2011).

The formula is stated as:

$$n = NC^2/C^2 + (N-1)e^2 .$$

Where n is the sample size, *N* is the population size, *C* is the coefficient of variation, while *e* is the standard error.

Nassiuma (2000) asserts that the coefficient of variation should be less than 30% while the standard error should lie between 2 and 5%. In this study, C was set at 23% while the standard error was set at 2%. Thus,

$N = 2660(0.23^2)/0.23^2 + (2660-1)0.02^2 = 128$

The locations were equally represented in the study as the 128 household heads were selected proportionately from all the locations as shown in Table 1.

Data collection

Primary data for this study was collected using pre-tested structured interview guides. The interview guides were preferred because the population is comprised of illiterate and semi literate persons who cannot complete questionnaires (Ministry of Planning and National Development, 2005). Household heads that were purposively selected from the households were interviewed. Heads of households are at the core of decision making in many households of African communities (Idrisa et al., 2010). The instrument contained both close-ended and open-ended questions. Close ended questions provided a basis for quantifying the data obtained while the open ended ones provided useful information that was used in explaining observations in the study.

The instrument had three sections. Section I contained information on demographic characteristics of the farmers, including age, gender, education level, experience and family size. Section II contained information on social aspects of the farmer, including awareness and perceptions about improved potato varieties, and access to extension services. The third section collected data on farmers' economic factors namely access to credit services, other sources of income, land owned and actual land committed to potato production.

Statistical analysis

Descriptive statistics were used to summarize the main findings of the study. Ordinal logit regression model was used to test the study hypothesis. The logistic models have been widely used in adoption studies due to their slightly flatter tails compared to the probit models. The data was analyzed with the aid of SPSS version 17.5. The logit regression equation was stated as follows:

$$Adoption\ (Yi) = \beta_0 + \beta_1 AGEHH + \beta_2 EDUCLEV + \beta_3 PERCEPT + \beta_4 FAMSIZE + \beta_5 EXTENS + \beta_6 CREDIT + \beta_7 GENDER + \varepsilon$$

Table 1. Summary table for proportionate sampling.

Location	Population (households) (n)	Proportion (p) (n/N)	Number to be sampled (n/N)x 128
Mumberes	1253	0.471	60
Chemoswon	482	0.181	23
Timboroa	581	0.218	28
Seguton	344	0.130	17
Totals (N)	2660	1	128

Adopted from Kenya National Bureau of Statistics (2009).

Table 2. Definition of variables as used in the model.

Variable	Type	Measurement
Dependent variable		
Y_i	Dummy	1 = Adopted; 0 otherwise
Explanatory variables		
Gender (GENDER)	Dummy	1 = Male; 0 otherwise
Age of the household head (AGEHH)	Continuous	Age in years
Education of the household head (EDUCLEV)	Continuous	Total number of years in school
Family size (FAMSIZE)	Continuous	Total number of persons in the household
Access to credit (CREDIT)	Dummy	1 = Household head receives credit; 0 otherwise
Amount of credit received (AMOUCRED)	Continuous	The total amount of credit received for farming per year
Access to extension services (EXTENS)	Dummy	1 = Household head receives extension services; 0 otherwise
Perception (PERCEPT)	Dummy	1 = Farmer perceives that improved potato varieties are tastier, cook faster, increase family incomes, can improve food security, mature faster, have a ready market; 0 otherwise

Measurement of dependent and explanatory variables

Adoption (the dependent variable) was dichotomized such that a value of 1 was for an adopter farmer while 0 was given or a non adopter. The explanatory variables namely age of the household head, education level, family size, access to credit services, access to extension services and marital status and perceptions were defined as shown in Table 2.

RESULTS AND DISCUSSION

The demographic characteristics of the respondents that were studied in this study are gender of the household head, age of the farmer, level of education of the farmer, household size and marital status of the respondents.

Most of the respondents (68%) were males indicating that many of the households in the division are male-headed. Majority of the respondents (more than 70%), were aged between 20 and 40 years with average age being 34.22 years. Additionally, results showed that most of the respondents (about 70%) had at least primary level education with the average years in school being 1.59. Many households (about 58%) had family sizes of between 5 and 9 members with average family size of 4.59 members. The study further showed that only 17% of the respondents were able to access extension services while the rest did not. Furthermore, about 78% of the respondents were able to access credit services while the rest did not. The study also showed that only 26.8% of the farmers had adopted improved potato varieties and were growing them on their farms. Farmers in the study had land sizes ranging between 0.25 and 5 ha allocated to potato production. The average land size allocated for potato production was 1.25 ha.

This study was designed with a key objective of identifying the factors that may be influencing adoption of improved potato varieties in Mumberes division Baringo country. To achieve this, we performed a regression analysis and the results of which are indicated in Table 3. The pseudo R^2 value obtained was 0.645. This indicates that the explanatory variables can accurately predict the dependent variable and thus be able to explain farmer's adoption of improved potato varieties. The overall model thus is significant at 95% confidence interval.

From the results, it can be shown that family size was a significant factor influencing adoption of improved potato varieties. Large families provide readily available and

Table 3. Logit analysis for the adoption of improved potato varieties.

Parameter	B	Std. Error	Z	Significance
(Constant)	.081	.223	.364	.717
Gender of the respondent	-.704	.095	-7.437	.000
Age of the farmer	-.006	.004	-1.379	.171
Family size	.009	.011	.828	.409
Education level	-.074	.064	-1.160	.248
Extension services	.644	.139	4.647	.000
Access to credit	.595	.133	4.461	.000
Farmer perception $R^2 = 0.645$	.276	.095	2.891	.005

cheap labor which is important in adoption decision. Improved potato farming is labor intensive especially during peak seasons, that is, planting, weeding and harvesting. Availability of cheap labor thus will enhance adoption (Muthoni and Namgongo, 2009).

Access to extension services was also another factor that had significant influence on adoption. Although, only 17% of the farmers received extension services, this factor is significant. Low access to extension services has been noted to be a limiting factor to increasing agricultural productivity in Sub-Saharan Africa and in many developing countries (Kabungo, 2008; Okoedo-Okojie and Onemolease, 2009). Access to extension influences farmers' profitability as farmers become equipped with information by the extension agents (Okwoche et al., 2012). This may influence their adoption of agricultural technologies as they know which agricultural investments are more profitable to them. Extension services also provide farmers with the required agronomic knowledge which allows farmers to accept or reject technologies (Namwata et al., 2010). The information required by potato farmers includes availability of seeds, agronomic practices such as fertilizer application and spacing as well as available of markets. The results from this study supported Barungi et al. (2013) who acknowledged that although access to extension services was among the important factors that influenced adoption of agricultural technologies, the level of access to extension is important in the adoption process.

Access to credit services was another significant factor that influenced adoption of improved potato varieties by the farmers. Access to credit was measured by whether or not the farmers were receiving any financial support for their agricultural production. Access to credit allows farmers to purchase farm inputs which are major constraint in agricultural production especially in Sub Saharan Africa (Okwoche et al., 2012). Smallholder farmers face the challenge of lack of collaterals to secure credits thus leading to low access to credit (World Bank, 2008). However, this may lead to a vicious cycle of poverty as the poor are trapped in a cycle of income inequality as they try to repay the credit with other sources of income on the farm or off the farm. Simtowe and Zeller (2006) argued that access to credit allows farmers to adopt even risky technologies since their household's-risk bearing ability is boosted while at the same time relaxing their liquidity constraint. The findings supported Barungi et al. (2013), Namwata et al. (2010) and Simtowe and Zeller (2007) who reviewed various factors that affect adoption in Uganda, Tanzania and Malawi, respectively. The authors independently highlighted credit access as an important factor in adoption of improved agricultural technologies. The authors reported that actual access to credit had a significant influence on adoption in their study areas.

Farmer perception was another key significant factor in influencing adoption in the study area. Farmers had strong positive perceptions about high yields, short time to maturity, good taste, market availability and increased incomes from the improved potato varieties may have influenced the adoption of improved potato varieties in Mumberes division. Farmers agreed that improved potato varieties were tastier, matured early, increased household incomes and yields more compared to the old varieties they had been growing. The attribute of early maturity is especially important in food security as well as helping families to meet their economic obligations such as paying schools fees and loans. Thus, this may have been a key motivating factor to adopting the improved potato varieties. Additionally, it allows farmers to have many cropping seasons in a year thus reducing pressure on land especially where land pressure is dominant.

As noted by Idrisa et al. (2010), early maturity allows a farm produce to be harvested early thus avoiding droughts or heavy rains. The results from this study are in line with Kaguongo et al. (2008), Idrisa et al. (2010) and Chi (2008) who found out that a farmer's perception about a technology actually influences their adoption of such a technology. Attributes related to a technology largely influences how a farmer will perceive its importance. This in turn will influence their decision of whether or not to adopt (Idrisa et al., 2010).

The perception by farmers that improved potato varieties were not resistant to blight may lead to low adoption among the study population. This may be because blights require a lot of capital investment in controlling

controlling since only chemical control is possible. In addition, losses as a result of blights in African countries go as high as 75% on varieties that are susceptible. Kaguongo et al. (2008) attributes this to the high number of times farmers in the tropics have to apply fungicides in order to control late blights. The authors note that farmers can spray up to ten times with an average of 5 sprays per growing season in Kenya.

CONCLUSION AND RECOMMENDATION

The decision of a farmer to adopt a technology or not is influenced by many factors. These factors are either farmer related (farm and nonfarm) or they may be technology related. Technology related factors are mainly judged by famers through their perception. Farmer characteristics including age, gender of the household head, family size, access to extension services and access to credit services are also key factors in influencing adoption. In this study, the key factors that were significant in influencing adoption were perception, family size, access to extension services and access to credit services. Farmer perception was also key in influencing adoption. Short time to maturity, good taste, increased incomes and market availability were the main aspects that motivated farmers to adopt improved potato varieties.

However, susceptibility to blights was also a key issue that farmers felt needs to be addressed in light of the improved potato varieties. The study recommends that there is need to increase farmers' access to extension by increasing the number of extension agents in the study area. Financial institutions also need to increase their presence in the study area and educate farmers on the need to have increased access to credit services. To ensure that there is increased adoption and for it to be main-tained, there is need for research institutions to keep researching on improving the resistance to blight as this may deter further adoption due to the susceptibility of the current grown varieties.

Conflict of Interest

The authors have not declared any conflict of interest.

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Agricultural extension reforms and development in Uganda

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This study was done with the objective of contributing to the policy debate on the changing landscape of agricultural rural services in Uganda. The study examines the perception of Agricultural Extension providers on the new changes in provision of agricultural extension services. Data was collected from twenty two key informants. Result show that political interference is negatively affecting the image of the National Agricultural Advisory Services (NAADS) and undoing some of its achievements. This suggests the need to re-evaluate the current political support given to agriculture to ensure that it builds on past achievement of NAADS and addresses its weaknesses.

Key words: National agricultural advisory services, agricultural extension, political interference, Uganda.

INTRODUCTION

A number of countries have taken bold steps to modernize agriculture through enhancing agricultural extension, a sector that is key to increasing the farmer knowledge to new agricultural technologies. Uganda is one of the SSA countries that invested significantly in improving provision of agricultural extension and other agricultural development programs. Uganda has recently initiated three major rural development programs, which build on the progress of past efforts. The Prosperity for All (PFA) was Uganda ruling party's election manifesto in 2006, which implemented programs comparable to the Plan for Modernization of Agriculture (Joughin and Kjær, 2010). PFA set a goal of enabling households to earn an annual income of UGX 20 million (approximately US$10,000 per year).

The second major agricultural program is the Africa-wide Comprehensive Africa Agriculture Development Program (CAADP), which Uganda has committed to implement and has prepared its investment strategy. The major goal of the country level CAADP investment strategy is to enhance agricultural-led economic growth and to achieve the millennium development goals (MAAIF, 2010). The CAADP has set a goal of achieving a 6% agricultural annual growth and allocation of at least 10% of government budget to the agricultural sector. In 2007/08, Uganda's agricultural growth was only 2.6% (Ibid), underscoring the weak growth of the sector. The investment strategy, which Uganda has prepared, will be implemented through its Development Strategy Investment Plan (DSIP).

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The third strategy is the medium term development framework – the National Development Plan (NDP) – was initiated in 2008 following the expiration of the Poverty Eradication Action Plan (PEAP), which was implemented from 1997 to 2008. Evaluation of the PEAP found that one of its major weaknesses was the low agricultural productivity due to low investment in the sector, which employs 73% of the population and contributes 20% of the GDP (UBOS 2010). To address this shortcoming, the NDP gives more emphasis on the agricultural sector. To implement this focus, the Agricultural Sector Development Strategy Investment Plan (DSIP) was formulated to serve as the broader framework of the agricultural sector investment and development strategies. DSIP, which is a medium term plan running from 2010/11 to 2014/15 is designed to harmonize and consolidate all past agricultural development strategies, namely, the Plan for Modernization of Agriculture (PMA) and the Prosperity for All (PFA) (MAAIF, 2010).

It is important to reflect on the past agricultural development strategies in order to learn from their strengths and weaknesses. Of particular importance for this study are the agricultural extension services, which have seen dramatic changes under the PEAP and the new development strategies. The Government of Uganda initiated agricultural extension reforms that included the demand-driven National Agricultural Advisory Services (NAADS) program. The main objective of the reforms is to enhance agricultural technology advisory services. This had the key strategy to implement the PMA strategy, which was Uganda's overarching poverty reduction strategy with an objective of transforming agriculture from subsistence to commercial farming. The NAADS program, whose implementation started in 2001, was PMA's main pillar, which attracted significant investment by the government and donors. NAADS targets the development and use of farmer groups, and in the process empowers them to procure advisory services, manage linkage with marketing partners. The NAADS program has been one of case studies of decentralization of agricultural services that uses the new demand-driven advisory services approach, in which private-sector agricultural extension providers are given a key role in providing agricultural advisory services in sub-Saharan Africa (SSA).

This study was done with an objective of contributing to the policy debate on the changing landscape of agricultural rural services in Uganda. The study focuses on the agricultural extension services, which is the major rural services under the PMA, PFA and other government programs. The present study examines the perception of Agricultural Extension (AEA) providers on the new changes in provision of agricultural extension services.

The changing landscape of provision of agricultural rural services in Uganda

As is the case in other countries, the performance of the publicly provided and funded traditional agricultural extension services in Uganda was poor (MAAIF and MFEPD, 2000). To address this problem, the NAADS program was introduced by the Act of 2001, which gave it a mandate to develop a demand driven, farmer-led agricultural service delivery system targeting the poor subsistence farmers, with emphasis to women, youth and people with disabilities. Its development goal is to enhance rural livelihood by increasing agricultural productivity and profitability in a sustainable manner. NAADS also aims to empower farmers to participate in the decision making process of type of technologies to be promoted by the providers of advisory services in their sub-county. This demand-driven approach differed significantly from the traditional supply-driven. The first phase of NAADS (2001-2009) was introduced in 2001 in six pilot districts. The program was rolled out to 545 sub-counties or 83% of all the sub-counties in 2006/07. NAADS, a twenty five year program in 2011, had now been rolled out to 79 of the 80 districts and to 710 sub-counties in the country. In the State of Nations address on 01 June 2010, the President stated that the program had been rolled out in all 80 districts, 929 sub-counties and 137 urban councils. Hence virtually, NAADS has reached all sub-counties and the biggest challenge is whether it has reached the farmers, in other words, whether it has met its expectations.

NAADS operates through farmer groups at village level. The farmer groups in a given sub-county form the farmer forums. Each farmer group prioritizes three enterprises and the advisory service needs. The priority enterprises and advisory service needs are sent to the farmer forum, which determines three priority enterprises in the sub-county. NAADS supports the selected priority enterprises and the required advisory services needed to address the identified constraints and advisory service needs. Following selection of the three enterprises, NAADS provides technologies for demonstration on a member of a farmer group's (or host farmers) field-technology development site (TDS). The host farmer is chosen by fellow members of the group, and private service providers are contracted to carry out the demonstrations and advise farmers at these TDSs.

Until early 2008, advisory services were provided by private providers, who included non-governmental organizations (NGOs), private extension agents with no affiliation to NGOs. In the sub-counties where NAADS was not operating, the public extension agents continued to provide agricultural extension services. In the sub-counties where NAADS was operating, the public extension agents regulated and facilitated private extension service providers. NAADS changes in 2008 reinstated the public extension service provision. The government directed the districts to stop contracting private extension workers. This change meant that the public extension workers now provide most of the advisory services with the private extension workers

contracted to provide only specialized services. A circular from the Ministry of public services dated 14th January 2010 directed that all agricultural extension staff at the sub-county level be converted to NAADS. The conversion exercise was to cover all extension staff based at the sub-county level on permanent and pensionable terms. The public extension workers contracted under NAADS were to be well enumerated and facilitated under the NAADS program. This directive set a goal of achieving the conversion by April 2010. However, this directive was not fully implemented.

Like NAADS phase I, NAADS phase II (under DSIP) provides advisory services in conjunction with the specialized export crop authorities (coffee, cotton, and tea), dairy development authority, and the genetic information resource center and data bank. Additionally, cooperatives and NGO will continue to provide advisory services under the supervision of public extension services.

Under NAADS phase II, four major areas show the similarities and differences with the first phase. NAADS phase II plans to provide advisory services by:

1. Empowering farmers to make and implement decisions on farm management and livelihoods. This component is meant to consolidate the achievement under NAADS phase I, under which a large number of farmer groups were formed. One of the strategies for enhancing farmers' capacity to make and implement decisions is formation of the high level farmer organizations, which will help farmers groups to enhance their capacity to make and implement decisions and to have vertical and horizontal linkage along the value chain. This will also help farmers to have greater voice in marketing and bargaining power.
2. Improving access to new agricultural technologies and information: Unlike the major thrust of NAADS phase I, this component will form a stronger research-extension linkage through formation of adaptive research support teams (DARST) in each district, under which the linkage of extension service providers and farmer groups with the zonal agricultural research and development institutions will be strengthened. Under DARST, participation of extension and farmer groups in decision making of type of research at zonal research and development institutions will increase. The DARST will also organize technology demonstration in villages in order to enhance farmer access to new technologies. Enhancing access to new technologies and information will also involve linking farmers to credit institutions for farmers willing to take up credit.
3. Delivering appropriate advisory services and information. This component aims to strengthen the farmer groups formed under NAADS phase I and to form new ones. Like NAADS phase I, this program will be implemented using the public-private partnership of providing advisory services. However, the public extension service providers will take a greater role. Unlike NAADS phase I however, delivery of advisory services will use a variety of methods including Farmer Field Schools (FFS). Different advisory services will also be used including extension services through mobile phones, films and radio programs. Instead of using the farmer groups, the TDS will be located at farms of model farmers.
4. A component which shows a significant departure from NAADS phase I is the agribusiness development and value addition. This component is a significant departure from the NAADS phase one, which largely focused on agricultural production. Under this component, NAADS will enhance provision of marketing services and value addition. DSIP states that the private sector will play a leading role in implementing agribusiness and value addition. Secondly, NAADS phase II has a particular emphasis on advisory services of sustainable land management (SLM) technologies. Benin et al. (2010) and Nkonya (2008) identified weak advisory services on SLM as one of NAADS weaknesses. This appears to be a step towards addressing this weakness.

METHODOLOGICAL APPROACH

Qualitative approach is used to achieve the objective of examining the perception of Agricultural Extension (AEA) providers on the new changes in provision of agricultural extension services. Respondents were selected from five districts, namely Kabale, Ntungamo, Nakasongola, Sironko and Lira. The districts selected were based on the period of implementation of the NAADS program in the districts. The respondents included District Agricultural Officers, farmer associations, NGO agricultural extension workers, NAADS coordinators and rural service providers who were knowledgeable on the changes in the agricultural extension reforms in Uganda. A total of 22 key informants were interviewed. The farmer associations accounted for 27% of interviewees while the NAADS coordinators and districts agricultural officers each contributed 18% of the participants. The results presented in this paper represent the interpretation of the personal opinions of the respondents. This is noted as a weakness which limits the generalization of the results.

RESULTS AND DISCUSSION

Strengths of the current agricultural extension system

The current agricultural advisory services are mainly provided by public extension services and by NGOs and private providers. The NGO and private providers provide specialized advisory services while the public AEAs provide the traditional advisory services. The key informants who participated in this study identified six strengths of the current system and we discuss them below.

Wider coverage was the most frequently cited strength of the current agricultural extension system (Table 1). Public AEAs are more available where they are recruited in the sub-counties and in terms of coverage they are

Table 1. Strengths and weaknesses of the current agricultural extension system.

Variable	Public AEA	Private AEA	Total
Strengths			
Wider coverage by public AEA	5	2	7
Well trained & Higher qualification of public AEA	5		5
Private AEA capacity to offer specialized services	2	3	5
Timely provision of extension services and better payments by private AEA	2	3	5
Better monitoring and supervision by public AEA	2	2	4
Trainings	1		1
Weaknesses			
Low salary and poor facilitation of public AEAs	5	1	6
Poor monitoring and supervision	3	3	6
Private AEAs profit oriented	3	2	5
Inadequate staffing	4	1	5
Lack of skills on modern farming methods	2	1	3
Inefficiency in recruitment and procurement process	1	1	2
Costly provision of extension services	2		2
Political interference	1		1
Misappropriation of funds	1		1
Weak linkage between MAAIF and district as result of decentralization	1		1
Limited sanctions	1		1
Few enterprise selection	1		1
Model farmer approach limiting wider impact	1		1
Non cooperation from farmers	1		1

more able to cover wider operational areas even though they may not be as efficient as the NGOs and private extension providers. The public extension workers are based in the sub-counties and are more in touch with the farmers, and the farmers can approach them at any time when their services are needed. Distribution of AEA and accessibility however differs. Access to agricultural extension services across districts shows that the central region has the highest density of AEAs per 100,000 rural households. A hundred thousand rural people in the central region are served by 15 AEAs while the corresponding number for the northern region is only 8, which is 86% smaller than the case in the central region[1].

Other strengths of the agriculture extension system reported by the key respondents was that, the public AEAs are available to do follow up after trainings or provision of services if they are well facilitated. They are salaried workers who are stationed in the districts and sub-counties and available for monitoring projects. Unlike the contracted NGO/private extension workers who do not continue with follow ups when their contracts end. On-the-job trainings of public AEA was also reported as one of the strengths of the agriculture extension system.

Figure 1 also shows a similar trend - with districts closer to Kampala having fewer rural people served by one AEA. Kalangala in the central region reported the highest density of AEAs (58 AEAs per 100,000 rural people) while Kaabong - a new district in the northern region – reported the lowest density (1.8 AEAs per 100,000 rural people). This demonstrates the poor agricultural extension services in the remote areas. This is consistent with findings of Jagger and Pender (2006), who observed that access to programs and organizations is concentrated in areas with high market access.

Well trained and higher qualification of public AEAs, private AEAs capacity to offer specialized services, and timely provision of extension services by private AEAs was each reported five times by the key informants (Table 1). The Public AEAs are well trained from recognized institutions at University or Diploma level. They are skilled experienced professionals who know their duties well and follow their professional ethics.

This is consistent with Nkonya et al. (2012) and Swanson (2008) who find share of government affiliated AEA with degree or post-graduate education highest compared to other private or NGO AEAs, reflecting positive results of governments investment in government AEA when it was the major service provider of agricultural extension.

The key informants observed that using NGO/private service providers for specialized activities is better since they possess specialized skill which the government

[1] Equivalent density for east and western regions is 10 and 8.4 respectively.

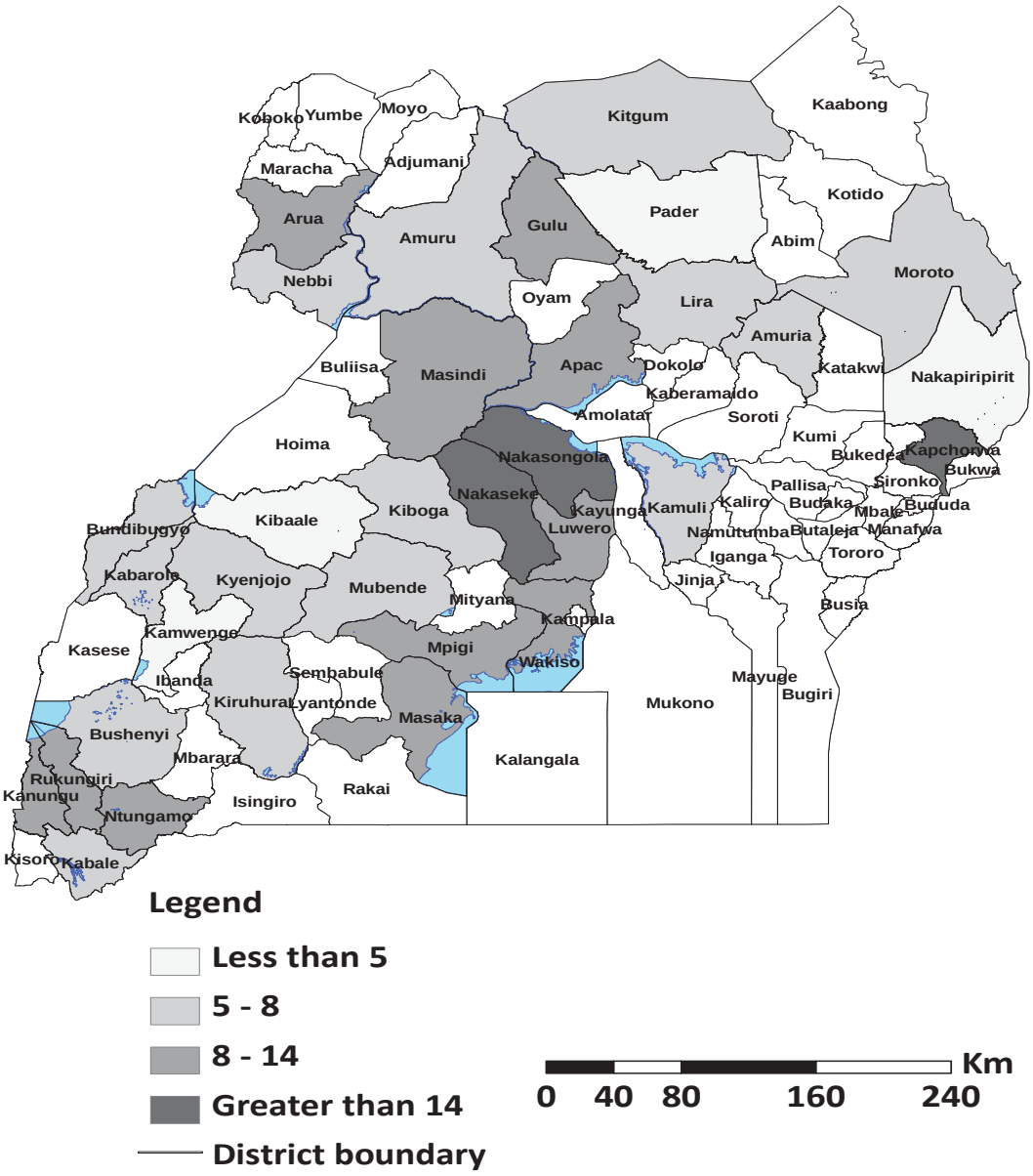

Figure 1. Number of agricultural extension agents per 100,000 rural people.

extension worker may not have. Farmers demand specialized services which can better be provided by the NGO/private extension providers and monitoring can be done effectively by the farmers themselves. The key informants also reported that the NGO/private extension providers are able to complete their work on time according to their terms of contract. If NGO/private AEAs are contracted through NAADS, there are very specific outputs required which makes them more able to provide expected deliverables according to their terms of reference.NGO/private Service providers provide better services since they receive good payments which are higher than that of the public extension workers.

The key informants also observed that private extension workers are easier to use in mobilizing farmers. Additionally, key informants observed that AEA affiliated with NGOs work more closely with farmers in their area of jurisdiction than is the case with the public AEAs. However, their coverage is always limited with budget. For example, Rutatora and Mattee (2001) observed that NGOs have become a major provider of agricultural extension services in Tanzania but their coverage is limited and always closer to urban areas. Jagger and Pender (2006) also observed lower concentration of NGOs in remote areas in Uganda. The NGO affiliated AEAs have done well in improving the fruit and vegetable sector, capacity building, building farmer groups and forming higher level organization.

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Weaknesses of the current agricultural extension system

One of the most frequently cited weaknesses by both the public and private AEAs were low salary payments and poor facilitation of public AEAs (Table 1). The key informants reported that the contracted private extension workers earn more money than the public extension workers. This creates a disincentive to the public AEAs who in some cases have to supervise the private NGO/AEAs who earn more than they do. The public AEAs also have poorer working facilities than NGO/private AEAs.

Poor monitoring and supervision was also frequently cited by key informants as a major weakness (Table 1). Monitoring of the activities of the private extension workers is poorly done and this leads to poor advisory services from private providers who may not be committed to providing quality advisory services. The problem is compounded by corruption, which the key informants observed to be common due to the competitive nature of awarding contracts. The key informants also observed that there are no consistent follow ups after the contracts of the NGO/private extension workers are signed. This has been due to the limited capacity of the districts production department and the NAADS secretariat.

The private AEAs contracted are profit oriented and are not concerned much about the successful impact of the services they provide (Table 1). The key informants observed that, unlike the public AEAs who are committed to their work, the private AEAs look out for their personally monetary benefits. Inadequate staffing at the districts and sub-counties was also reported by the key informants. This had resulted in a few AEAs serving a large number of farmers. The key informants noted that with limited staff poorly facilitated only a few farmers were reached.

The implementation of the NAADS approach of contracting NGO and private extension workers to provide specialized services has been faced with a number of challenges. The selection process of the NGOs and private AEA for provision of specialized services starts with, identification of the specialized services needed in the selected enterprises. This is done at the NAADS sub-county farmer forum. The district then places an advertisement, which states the kind of advisory services required and the professional qualification of the providers. Interested applicants pick up application forms and apply for the position to the sub-county. The sub-county farmer's forums are involved in the selection process. They are supported by a technical team composing of the staff from the production department, financing department, audit department, NAADS coordinator and sub-county chief. A suitable qualified applicant is selected and awarded the contract. Payments are made in phases with an initial payment to begin the work and other payments upon provision of reports and after approval of the Subject Matter Specialist (SMS) that the assigned task was well performed. The farmers' forum has members with low level of education, limited capacity to evaluate and select the advisory service applicants properly. Selection therefore is sometimes biased and may not necessarily be based on merit. Once the farmer's forum rejects an individual, the technical advisors cannot guarantee the selection of suitable candidate even if that applicant is highly qualified. Corruption is also a major problem in the selection process. As it will be seen in the discussion below, there is also lot of political interference and nepotism in the selection process. Aside the biases in the selection process, the selection process takes a long period of time. The selection committee after selecting the preferred candidate, sends the information to district NAADS coordinator and then to the NAADS secretariat for approval. The process takes a period of time before the extension worker is contracted. In some sub-counties that are very remote, NAADS had failed to recruit staff as there were few applicants out of whom there were no qualified applicants or in some cases, no applicant submitted application. This is consistent with Jagger and Pender (2006) and Rutatora and Mattee (2001). NAADS may not have full knowledge of the background of the NGO/private extension agents bidding for service provision. Applicants sometimes falsify documents submitted and the NAADS selection committee may not be able to verify the documents. This may result in awarding contracts to non-qualified persons. The corruption problem in NAADS recruitment process has been widely cited as a major problem (Parkinson, 2008; Feder et al., 2010).

The key informants also mentioned that it was costly for the government to pay both the private and public extension workers. However, this weakness is contrary to the strength discussed above that pluralistic extension services creates potential for providing specialized advisory services. The Private AEAs also provide advisory services on technologies and/or services prescribed in the terms of reference. So if farmers ask for other advisory services on technologies or services, the private provide would always decline providing them even if they are able to do so. This suggests a considerably large number of private providers to give specialized services.

Other weakness of the current extension system (Table 1) each mentioned included the political interference which will be discussed below, misappropriation of funds, weak linkage between the Ministry of Agriculture (MAAIF) and districts since decentralization of powers. Supervision of the district staff by the central government has been weakened since the district officials are answerable to the district and not the ministry. Also included in the weakness is the limited sanction for public AEA. One key informant observed that public extension workers are permanent and pensionable and even in case of mismanagement it takes a long time for a public extension officer to be disciplined and even during investigations he/she still may receive salary.

In addition, it was noted the NAADS program (phase 1) looked at only a few selected enterprises leaving out other important services. Advisory services on other enterprises which farmers are engaged in but not selected under the NAADS program are not given. This approach has however been revised under NAADS phase II - as discussed earlier – through prioritization by Village Farmer Forum (VFF) increasing the number of selected enterprises per sub-county.

NAADS approach of using selected host farmers (or model farmers) and technology development sites to carry out demonstrations and advisory services were noted by one key informant to have the weakness of not reaching out to a large number of farmers. Another key informant also cited non-cooperation from farmers. Overall, the key informants showed key strengths and weaknesses of the new extension services.

Enhancing advantages and address disadvantages of the current extension approach

In addressing the issue on what needs to be done to enhance the advantages of the current extension approach and who should be responsible for each of the action, the following suggestions were made (Table 2):

There is the need to build the skills of the new public AEAs to provide services on agro-business enterprise and other specialized skills which farmers may need. This was the most frequently cited measure by the key informants. Training of AEAs could be done by providing refresher courses and trainings for the extension workers to update their knowledge on modern farming methods. The key informants also suggested that the salary payments of public AEAs be increased to motivate them in providing quality services. The public AEAs should be well facilitated and should have access to transport facilities. Also, key informants noted that, monitoring and supervision of the activities of the AEAs should be properly monitored.

Currently, there are farmers in NAADS sub-county communities who do not participate in NAADS since they do not belong to farmer groups. To address this shortcoming, key informants suggested more vigorous sensitization of farmers to join farmers - an aspect, which is consistent with the RDS policy. The sensitization should also promote PMA's prime objective of commercializing agriculture such that the farmers manage their farms as business rather than simple way of life.

Key informants also suggested that the recruitment process of NGO/private AEAs should be strengthened to address the corruption and low capacity of farmer forum to vet the applicants. NAADS should also re-examine the hiring process to ensure a competitive recruitment process in order to appoint competent service providers. Members selected to sit on the farmer's forum should have a certain minimum level of education. They should be able to understand the qualification of the applicant and use the right criteria in selecting the most qualified applicant.

Additionally, key informants suggested the need to increase the agricultural extension budget as the government implements the DSIP plan, which aims to achieve the Maputo Declaration of allocating at least 10% of government budget to agriculture. With an increase in budget, the number of staff could be increased to serve more farmers.

The current political interference and the rapidly changing agricultural policy landscape have created confusion on the NAADS approach. Hence there is need for clarifying the NAADS approach. Farmers should be well informed on the NAADS program, its objectives and implementation strategies and how the farmers can benefit from the program. Extension workers together with other stakeholders like politicians and religious leaders should all be involved in educating farmers on the NAADS program. There is also the need to increase the Technology Development Sites and consequently model farmers in order to increase access to new technologies.

Other suggestion to enhance the agriculture extension program and address its problems included the need to give NGO/private extension workers long term contracts and to better coordinate and supervise their work. Current short-term contracts compromise the propensity of NGO/private AEAs to invest in improving their advisory services. There is also the need to increase the enterprises selected per subcounty and increase the number of farmers benefiting per subcounty. The Ministry of Agriculture (MAAIF) should restructure programs to ensure that enterprises not covered under NAADS program are either integrated or create a separate program to support those enterprises. Also suggested was the need to increase the number of beneficiaries from the program and encourage farmers co-funding.

Successes and failures of NAADS program in selected districts

Successes of NAADS in selected districts

The most frequently cited success of NAADS was

Table 2. Measures to enhance advantages and address disadvantage of the current agricultural extension system.

Parameter	Public AEA	Private AEA	Total
Capacity building	7	4	11
Increase salary and facilitation of public AEAs	7	1	8
Improve monitoring and supervision	3	3	6
Sensitization of farmers	4	2	6
Selection of competent private AEAs	1	4	5
Increase funding	4		4
Increase staffing	3		3
Limit political interference	1		1
Increase TDS		1	1
Long term contracts for Private AEAs		1	1
Increase enterprise selection	1		1
Farmer to co-fund	1		1
Increase number of beneficiaries	1		1
Improve quality of services	1		1

Table 3. Successes of NAADS programs in selected districts.

Successes of NAADS	Kabale	Lira	Nakasongola	Ntungamo	Sironko	Total
Group formation	x		x	x	x	4
Higher adoption rates of technologies	x	x		x		3
More commercialized	x				x	2
New enterprises	x		x			2
Empowered to demand advisory services	x					1
Linked to SACCOS			x			1
Better food security			x			1

formation of farmer groups. Four of the give districts reported that NAADS enhanced farmer group formation (Table 3). For example, in Nakasongola three farmer cooperatives for milk and poultry were established and are operating successfully. This is consistent with the design of NAADS, which provides advisory service through farmer groups. Provision of rural services through community groups is increasingly becoming popular in community-driven development (CDD) and other participatory development programs (Mansuri and Rao, 2004). Working in groups has helped farmers to exchange information and pool production and marketing resources.

The second most cited NAADS success was higher adoption of agricultural technologies – a success that was reported by three of the five districts visited for the study (Table 3). This is consistent with Benin et al. (2010) who observed higher adoption rates of NAADS beneficiaries. In Kabale for example, key informants reported that a lot of farmers were now using improved seeds and breeds.

Introduction of new enterprises were reported in two districts. In Nakasongola, key informants reported that the introduction of improved dairy breeds has recorded much success. Dairy which was the sixth priority enterprise of farmers in Nakasongola but now it is the second priority enterprise after cassava. Other priority crops in the districts are poultry, mangoes and oranges.

Consistent with the PMA objective, two districts also reported commercialization as a success story of NAADS. Introduction of new enterprises was also reported as a NAADS success in two districts. Benin et al. (2010) also found a significant increase in new enterprises for farmers in NAADS sub-counties (Figure 2).

Other success stories of NAADS – each reported by only one district – include: improved food security, farmer empowerment, and linking farmers to microfinance (SACCOS) institutions. The qualitative results show that the successes perceived by key informants were consistent with NAADS structure of providing advisory services through groups, advising farmers on new technologies, introducing new technologies and commercialization of agriculture. The small number of farmers reporting empowerment is a problem which raises concern about how NAADS achieved its prime

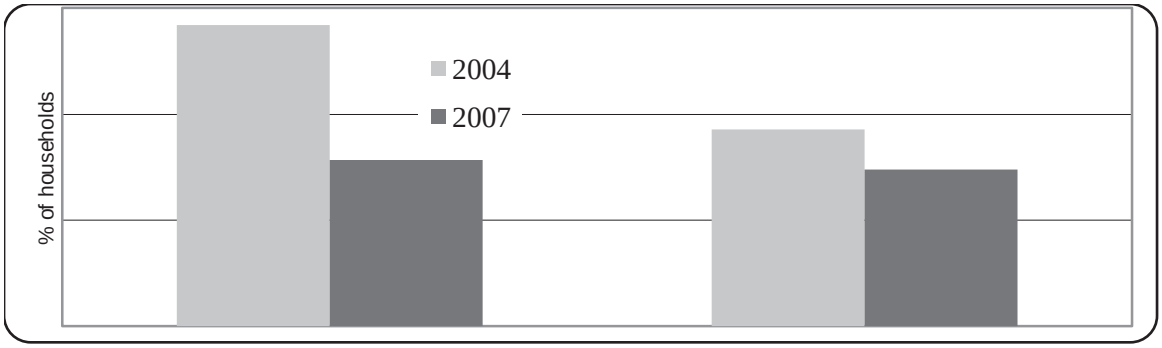

Figure 2. New enterprises adopted by NAADS and non-NAADS farmers in 2004 and 2007.
Source: Benin et al. (2010).

objective of empowering farmers. As it will be seen below, some of the factors which led to limited empowerment include corruption, political interference and procurement loopholes, all of which are likely to dampen empowerment efforts.

Failures of NAADS in selected districts

Political interference was the most cited failure of the NAADS program. All of the five districts mentioned political interference as NAADS weaknesses (Table 4). This is consistent with the Joughin and Kjær (2010), who observed an increased political interference which increased after the introduction of the PFA program. Given that the PFA was contained in an election manifesto, it took a political tone and approach. NAADS was meant to be an implementing instrument of PFA. Consequently, it attracted significant political attention from the president. The PFA was initiated with an objective of working within the existing government programs - especially PMA and NAADS, which serve the major sector. Technically, it was supposed to harmonize the rural development programs but it took a different approach. Unlike PMA which gave the private sector a leading role in its implementation, the PFA approach gave the government a leading role in provision of extension services, credit provision and agricultural input distribution.

As seen in Table 5, the frequency of President Yoweri Museveni's speeches criticizing NAADS after formation of PFA (2007 - 2011) was quite high. On average, the president mentioned NAADS in public speeches reported in the *New Vision* newspaper once in every two months. This is quite a high frequency for one agricultural program to attract such high profile attention. Worse still, most of the president's comments were negative. The tone of the president's speeches seem to ignore NAADS achievements discussed above and cited by other studies (Benin et al., 2010; Scanagri, 2005; OPM, 2005; Benin et al., 2007). Such political interference has tarnished NAADS' image among farmers. Given that NAADS is still charged with implementation of NAADS phase II under DSIP, there is need for restoring NAADS' image by addressing its past weaknesses discussed earlier. This requires an unbiased political attention which builds on NAADS strengths and addressing its weaknesses. There is also need on NAADS part to clarify its approach in order to clarify the changes precipitated by the rapidly changing agricultural policy landscape.

Corruption was reported by two of the five districts. This is consistent with other studies which have reported corruption in contracting service providers (Parkinson, 2008; Feder et al., 2010). Corruption was also one of the reasons of reinstating the old public extension services. Other weaknesses reported by at least two districts include low capacity of farmer forum to recruit competent service providers, weak or lack of advisory services on marketing and inadequate inputs.

CONCLUSIONS AND POLICY IMPLICATION

This study was done with the objective of contributing to the policy debate on the changing landscape of agricultural rural services in Uganda. The study examines the perception of Agricultural Extension (AEA) providers on the new changes in provision of agricultural extension services. Most studies focus on the perspectives of the beneficiaries, that is, farmers and not the service providers, that is, AEA who are the implementers and administrators of the program. Our findings provided timely in-depth information on the AEAs perspectives of the programme and how to improve on the program and achieve better results. Evidence show that the NAADS program has wider coverage even though distribution of agricultural extension agents differs across regions with the central region having the highest density of agricultural extension agents per 100,000 rural households. NAADS has enhanced the formation of farmer groups. This is consistent with the design of NAADS, which provides advisory service through farmer

Table 4. Failures of NAADS programs in selected districts.

Failures of NAADS	Kabale	Lira	Nakasongola	Ntungamo	Sironko	Total
Political interference	x	x	x	x	x	5
Corruption	x			x		2
No market advisory services	x			x		2
Low capacity of farmer forums to recruit providers	x		x			2
Inadequate inputs			x		x	2
Covers only priority enterprises				x		1
No benefit to large scale farmers & youth	x					1
Poor enterprise selection		x				1
Inadequate staffing			x			1
Procurement loopholes			x			1
Farmer high expectation					x	1
Low quality inputs					x	1
Late delivery of inputs	x					1
Weak monitoring of advisory service providers			x			1
Paying matching farmers for farmers with no direct benefit is problematic		x				1

Table 5. Frequency of President Yoweri Museveni's speech mentioning NAADS, 2007-2011.

Date	Key message of speech	President's speech mentioning NAADS
14.01.07	Museveni orders NAADS to be investigated following complaints that its impact on modernizing the farming community is not felt.	*"I am going to study, investigate, engage NAADS in a dialogue and come up with a stand on its future activities. I have not been aware about the way they have been implementing their programs. We should find an appropriate policy towards modernizing agriculture since it is the backbone of our economy,"*
05.09.07 10.09.07	Government spends lot of money on NAADS program but has achieved little impact due to misuse of funds by officials. Museveni suspends NAADS funds until cabinet sits and reviews the program aimed at improving service delivery and accountability of donor funds. NAADS officials to be probed	*"We want to have a change so that the money benefits the people instead of being spent on things you do not see"* *"Imagine all that money has been coming to one sub-county. Many officials have been misusing this money, organizing one seminar where one person talks and he gives an accountability of sh2m,"*

Table 5. Contd.

17.09.07	Museveni advises more funds from the NAADS program should be allocated for the purchase of farm inputs	*… the President suggested that the funds be used to buy farm implements. Museveni asked MPs to spearhead the campaign against poverty by actively training the 'wananchi' using NAADS materials and local extension workers*
23.09.07 07.10.07 08.10.07	NAADS program will not be stopped since it is a good program introduced by the NRM government. The program has been halted to undergo a review process of its performance and impact. Legal actions to be taken against officials who mismanaged funds.	*"…since it was the NRM government that introduced the program to help modernize agriculture and enhance production, it could not simply close it".* *"…the Government would audit the utilization of funds…, including taking legal action against those involved in swindling the funds".*
06.04.08 14.08.08 22.08.08	President's poverty tours to promote government's PFA program.	*"The crusade we have now is to change the living situation of our people so that they can use their small pieces of land to earn high incomes,"* *"… poverty was still a problem because "people are sleeping and even NAADS that we sent to wake them up joined them in sleep."* *"I am happy that you have woken up and are engaging in commercial agriculture. I have seen the projects and I have instructed NAADS to construct dams in places where these projects are so that you can do some irrigation during the dry seasons,"*
08.09.08	Museveni tells NAADS to support farmers move from subsistence farming to commercial farming.	*"NAADS should do more work by moving into the villages to help farmers who are currently engaging in subsistence farming...We need to stop producing for home consumption only.* *"I am going to talk to the people managing NAADS to strengthen their monitoring and advisory roles. I will ask them to increase the number of model farmers in the district," he said. "Don't get scared of telling me the truth about the performance of NAADS. We need to find out how they are working so that we advise them to improve,"*
10.02.09	The president warned the agriculture minister, Hillary Onek, against mishandling the implementation of the NAADS program.	*Museveni said he was writing to "clarify one point one more last time." He instructed Onek to stick to the six homesteads per parish, instead of scattering resources to many homesteads. "This is not acceptable to me. NAADS are again bringing confusion with 'demonstration' farmers, 'model' farmers, 'lead' farmers, etc,"... Resources should only be spent on six homesteads…Any NAADS official that fails to implement this or any other provision in the NAADS program will face severe sanctions"*

Table 5. Contd.

14.09.09 01.10.09 04.10.09 23.12.09 17.01.10	Museveni sets up special taskforce to investigate, cause arrest and prosecute people involved in theft and misuse of funds meant for NAADS. This follows accusation by the President of NAADS official misappropriating public funds and inflating agricultural inputs.	*"The special committee attached to the President's office will verify the standards of government projects to ensure they conform to stipulated goals,"* *"NAADS officials approve companies to tender cow dung and grass, just to steal money. What sort of officer can approve this? Is this person fit to be in public service? Why should such a person be on the payroll of the Government?"* *"I am going to send my spies to verify the authenticity of the list (lists of beneficiaries submitted to him during his tours of Prosperity-for-All projects). If the listed beneficiaries are non-existent or the figures attached to the names of farmers don't match, the Police will take the NAADS officials to the university of understanding (Luzira prison)". "If you see Police detectives combing the villages, don't get alarmed. They would be carrying out investigations on my instructions."*
22.12.09 30.12.09	Museveni announced that NAADS program will be reformed in 2010 to benefit more farmers. More farmers were to receive inputs	*"Next financial year we are going to transform NAADS into a poverty alleviation program. We are going to spread wealth so that at least each family gets two or three goats or pigs or sizeable number of poultry … This will cure the envy and arguments that the NAADS program had benefited only the rich farmers and a few people"*
23.06.10 07.07.10 09.08.10	Museveni again stopped the releasing of NAADS funds pending a review of the program.	*"I have been thinking of ways of sending this money to the poor. I will continue withholding sh120b NAADS funds unless I am satisfied that it will now reach the poor,"* *"Those who have not yet got NAADs money should not worry. The program is not ending tomorrow. I will make changes to ensure funds reach as many farmers as possible…I have told them, hold on, don't distribute it. Let me go round the country. When I come back, I will tell you how to use it."*
22.07.10 18.08.10	Museveni decides to stop NAADS tendering system. The award of tenders to supply inputs to farmers under NAADS is was not cost-effective. Funds to be channeled directly to farmer to make their own procurement	*"We started NAADS to make poor Ugandans rich, but they are supplied inputs at high prices which they cannot afford. I am going to stop the system such that farmers can buy inputs for themselves...These farmers only lack the money, but they can buy the farm inputs from their villages,"*
04.10.10 10.12.10 10.01.11	Museveni Lifts Ban on NAADS Money Disbursement for the scheme to facilitate the PFA program. Funds will directly be sent to villages or zones.	*"I have moved across the whole country assessing the implementation of Naadsprogramme and I am closing my tour in Kampala District. I have identified the problems in Naads and together with other stakeholders, we have resolved on how to go about them," he said adding "So now , the funds I had blocked are going to be released but this time round all those implementing the programme must religiously follow the set new guidelines ,"*

Source: The New Vision Online (Archives January 2007 - March 2011).

groups. Provision of rural services through community groups is increasingly becoming popular in community-driven development (CDD) and other participatory development programs (Mansuri and Rao, 2004). Working in groups has helped farmers to exchange information and pool production and marketing resources. The NAADS program has also promoted the adoption of agricultural technologies.

However, political interference is negatively affecting the image of the National Agricultural Advisory Services (NAADS) and undoing some of its achievements. This shows a clear case example of how a well structured agricultural program could fail to achieve the desired results due to politicization of the program. NAADS was used as one of the major implementation strategies of the prosperity for all (PFA), a political manifesto of the ruling party in the 2006 election. After formation of PFA in 2005/06, the frequency of the president speeches on NAADS increased tremendously. Between January 1, 2007 to March 2011, frequency of president's NAADS speeches reported in New Vision was once in every two months. Most of the comments on NAADS were negative. The tone of the president's speeches seem to ignore NAADS achievements discussed above and cited by other studies (Benin et al., 2010; Scanagri, 2005; OPM, 2005; Benin et al., 2007). Such political interference has tarnished NAADS' image among farmers. Funding for NAADS from the government was also suspended several times in an attempt to coarse the program to implement some of the president's agendas. The political nature of the PFA program and its emphasis on the greater role of government involvement in provision of agricultural services and subsidies was contrary to the pluralistic and demand-driven approach under NAADS. There is need of re-evaluating the current political support given to agriculture to ensure that it builds on past achievement of NAADS and addresses its weaknesses. There is also need for clarifying the NAADS approach. The political interference and the rapidly changing agricultural policy landscape have created confusion on the NAADS approach, which in itself was still not well-understood. Farmers should be well informed on the new NAADS implementation strategies and how the farmers can benefit from the program. Particularly, the role of the private sector in provision of advisory services and access to input program all need to be well-articulated to ensure that they do not compromise the potential of private AEAs to offer specialized advisory services required under DSIP and involvement of the private sector in agricultural processing and marketing.

Abbreviations

AEA, Agricultural Extension Provider; **CAADP,** Comprehensive Africa Agriculture Development Program; **CDD,** Community Driven Development; **DSIP,** Development Strategy Investment Plan; **NAADS,** National Agriculture Advisory Program; **NDP,** National Development Plan; **NGO,** Non-Governmental Organization; **PEAP,** Poverty Eradication Action Plan; **PFA,** Prosperity for All; **SACCO,** Savings and Credit Cooperative; **TDS,** Technology Development Site.

Conflict of Interest

The authors have not declared any conflict of interest.

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Assessment of farm families' acceptability of small ruminants' milk for consumption in selected rural communities in Ogun State, Nigeria

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A total of 150 rural families were selected to ascertain acceptability of small ruminants' milk for consumption by rural dwellers in selected rural communities of Ogun State. The result of the study showed that majority of the respondent (38%) consumed milk products such as local cheese commonly referred to as '*wara*', and this was largely consumed either fresh (38%) or fried (32%). Other milk products consumed by the rural farm families include *nono* (5%) and yoghurt (7%). Half (50%) of the farm families take the local milk products as the need may arise and 34% consumed the milk product at least once a month. Most (64%) of the respondents slightly favoured consumption of small ruminants' milk. Stubbornness of goat and stupidity of sheep, small quantity of milk being produced were factors militating against consumption of milk. Age, marital status, family size, level of education and religion and had no relationship with their disposition to sheep and goats' milk consumption in the study area. It was thus recommended that small ruminants' milk should be intensively explored and made available in processed forms for acceptance and consumption by the rural farm families. Also, government should support the consumption and sale of small ruminants' milk so as to alleviate poverty and reduce malnutrition among the rural farm families.

Key words: Sheep and goats' milk, acceptability, consumption, rural farm families, Ogun State.

INTRODUCTION

Livestock management constitutes an essential component of agricultural production, whereby farm animals such as cattle, sheep, goats, pigs and poultry are kept for various reasons. While farm animals such as pigs and poultry are kept for meat and egg production, other farm animals, such as cattle, sheep and goats are kept for milk, meat, wool, hide and skin production. Among these animal products, meat and milk are essential part of mankind's diet, given their proteinous and contributory values to man's physiological growth and healthy living. According to Pollot and Wilson (2009), protein is an essential nutrient for growth, tissue repair and healthy living, and could be sourced from both plants and animals. Animal products provide the best quality of protein in human diet.

Although milk is a naturally occurring and universal food

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for young mammals, it is consumed beyond infancy, especially in humans. Man at different ages still find milk consumption essential especially in the processed form as pasteurised milk (Adewumi et al. 2001; Adewumi, 2007). Milk for processing or pasteurisation, however, comes largely from ruminant farm animals, especially cattle. According to Food and Agriculture Organisation (2001), dairy cattle produce about 84.6% (494, 600 L) of the world's milk as against 2.1% (12,500 L) by goats and 1.3% (7, 800 L) by sheep. This cannot be unconnected with the body size and physiological make up of the dairy cattle in relation to that of sheep and goats, which of course give the former an added advantage of producing higher quantity of milk. Hence, the dairy (milk) industry depends heavily on dairy cattle as the source of raw milk for production of milk and other by- products for man's consumption.

Products made with goat's or sheep's milk have some different and interesting characteristics especially, taste, aroma, appearance and chemical constituents, compared to the counterparts made with cow's milk (Hayaloglu and Karagul-Yuceer, 2011). Dairy sheep and goats though, do not produce as much milk as dairy cattle, their milk is believed to be richer in nutrients and of better quality, and has more beneficial health properties than that of cattle (Cebalbs et al., 2009). It is more nourishing and digestible than that of cattle, and as such is recommended[1] for children's consumption on the ground that its protein nature is similar to that of human's milk (Anisman-Reiner, 2007). Ceballos et al. (2009) further added that goats' milk could help prevent diseases such as anemia and bone demineralization and also help with the digestive and metabolic utilization of minerals such as iron, calcium, phosphorus and magnesium. Elwood et al. (2007) equally indicated that the conjugated linoleic acid (CLA) in small ruminants' milk is cancer-fighting and could improve insulin action and reduce blood glucose levels in humans.

The potential of adequately sourcing the needed proteinous food by the rural households is in their reared livestock, consisting of the micro animals and small ruminants (Koyenikan and Adeyemo, 2002; Okunlola, 2002). While the micro livestock such as chicken and rabbits can provide egg and meat to the households for consumption, the small ruminants have the added advantage of providing milk for the rural households for consumption. Although, the reared small ruminants are dominantly local breeds, the animals have been observed to have the capability of producing as much as 281.98 ml per day following parturition (Bemji et al., 2007; Adewumi and Olorunisomo, 2009), and this can be increased by 48 to 78% on administration of bovine somatotropin (Lactotropin^{MR}) after the peak lactation, which mostly take place at the third week of lactation (James, 2000; 2009). This implies that the rural households in the country have the potential of improving their healthy living, especially that of their infants and young ones, through regular consumption of processed or pasteurised milk from their small ruminants. Ready consumption of the small ruminants' milk will however depend on the rural farm families' reaction or acceptability of sheep and goats' milk for human consumption. In view of this, the study took an empirical look at the rural farm families' reaction to sheep and goats' milk consumption in selected rural communities in Ogun State, Nigeria.

MATERIALS AND METHODS

This study was conducted in selected rural communities in Ogun State. A total of ten rural communities, namely Alabata, Idera-Osiele, Kila, Olugbo, Olokose, Olodo, Igbogila, Isaga-orile, Olorunda and Kofesu were randomly selected across the Egba division of the State. From each of the villages, fifteen farmers were randomly selected to give a total of 150 respondents. Both primary and secondary data were used. The primary data were ob-tained through a well structured and validated interview schedule and direct observation. The secondary data were obtained from journal, literature, mimeograph and relevant materials. Data were subjected to frequency counts and percentages, chi-square test, correlation and regression. A self-developed rating scale based on extensive literature review was designed for measurement of the rural farm families' acceptability of sheep and goats' milk for consumption. The respondents' responses on the 18 questions were rated on 5point rating scale of Strongly Agree = 5, Agree = 4, Disagree = 3, strongly Disagree = 2 and Undecided = 1 for positive statements, and vice-versa for negative statements.[2]

For analyses of responses on each of the acceptability statements, the obtained mean values were rated in the order of 1.0 to 1.99 as 'unfavourable acceptability'; 2.0 to 2.99 'slightly favourable acceptability' and 3.0 and above as' favourable acceptability'. Based on the obtainable minimum of 18 and maximum of 90 scores from the 18 statements, the cumulated scores of the respondents were delineated into four categories on a range score of 18 to 35 as 'unfavourable acceptability'; 36 to 53 as 'slightly unfavourable acceptability'; 54 to 71 as 'slightly favourable acceptability'; 72 to 90 as 'favourable acceptability'. With this categorisation, the levels of acceptability were cross-tabbed with the respondents' socioeconomic characteristics under chi-square analytical tool for the test of hypothesis one.

RESULTS AND DISCUSSION

Socioeconomic characteristics of respondents

Table 1 shows the socioeconomic characteristics of the respondents. It revealed that 52% of the respondents were males and 48% females. Most of the respondents (66%) were married and 56% had between 6 and 8

[1]The recommendation is processed or pasteurised goats' milk and not the raw milk. According to Basnet et al. (2010), unmodified goat's milk can cause significant morbidity and even mortality in infants; electrolyte imbalances, metabolic acidosis, folate deficiency, species specific and nonspecific antigenicity and infectious risks.

[2] In both cases of positive and negative statements, the undecided scale remained one, based on the fact that it has no affirmative strength in relation to other four response ratings.

Table 1. Socioeconomic characteristics of respondents (n = 150).

Variable	Frequency	Percentage
Sex		
Male	78	52
Female	72	48
Age		
≤ 30	12	8
31 – 40	30	20
41 – 50	30	20
51 – 60	54	36
≥ 61	24	16
Marital status		
Single	6	4
Married	99	66
Widow	42	28
Divorced	3	2
Family size		
≤ 5	57	38
6 – 8	84	56
9 – 11	9	6
Educational background		
No formal education	6	4
Vocational education	18	12
Primary school education	27	18
Secondary school education	84	56
Tertiary education	15	10
Occupation		
Farming	69	46
Artisan	42	28
Traders	39	26
Religion		
Christianity	75	50
Islam	54	36
Traditional religion	21	14
Number of goats kept		
≤ 5	3	2
6 – 10	108	72
11 – 15	36	24
≥ 16	3	2
Number of sheep kept		
≤ 5	39	26
6 – 10	63	42
11 – 15	6	4
≥ 16	0	0
Farming experience		
≤ 5	6	4
6 – 10	39	26
11 – 15	60	40
≥ 16	45	30

family members. This implies that most of the farm rural families will have more labour to help in milking. Also, 36% of the respondents were within the age range of 51 and 60 years and 56% of them had secondary school education as the highest level of education. This is in agreement with Okunlola (2002) who stated that 56% have certain level of education among rural families. This will enhance rural families' adoption of new innovations. Farming was indicated as the primary occupation by 38% of the farm families and 50% of them practice Christianity as mode of worship. Goats were largely reared by the respondents (72%) while 42% reared between 6 and 10 sheep. The large goat rearing as compared to sheep is in line with Okunlola (2002) and Oyesola (2002). The observed higher proportion of goats to sheep rearing cannot be unconnected with hardiness of goats to withstand harsh environmental condition than sheep and the twin (and sometimes triplets) birth-given quality of the animal, against single parturition quality of sheep (Okeke et al., 2007). Sheep and goat rearing by the rural farm families however suggests that they have the potentials of improving their household nutrition, not only in terms of consumption of the animal's meat but as well milking the animal for consumption (Adewumi et al., 2001). Also, 40% of the farm families had been rearing the small ruminants for upward of 11 to 15 years.

Forms of milk and milk products consumption by the rural farm families and the pattern of consumption

Table 2 shows the milk and milk products consumed by the farm families in the rural communities. Majority of the respondent (38%) consumed milk products such as local cheese commonly referred to as '*wara'* by the Yoruba speaking tribe in Nigeria, and this was largely consumed either fresh (38%) or fried (32%). Other milk products consumed by the rural farm families include *nono* (5%) and yoghurt (7%). Interactive discussion with the respondents however shows that these local milk products – '*wara'* and *'nono'* were made from cow milk and bought for consumption at affordable prices. The marketing price of these milk products was about ₦20.00 (13 cent)[3], thereby making it affordable for most of the respondents for consumption. Yoghurt on the other hand is commercially produced by medium and large scale industries and this could be obtained for consumption at a price range from ₦60.00 (38 cent) to ₦80.00 (51 cents) depending on the volume or litres per package. The market prices of yoghurt, which was considered expensive by the rural farm families, could be responsible for the observed low percentage (14%) of yoghurt consumption among the respondents. Evaporated (8%) and powdered milk (10%), which are mainly produced from imported cow milk were also

[3] The exchange rate was based on ₦158 to one United States of America's dollar, as at September 2012.

Table 2. Forms of milk products consumed by the rural farm families (n = 150).

Variable	Frequency	Percentage	Sources of milk/milk products
Milk products			
Fresh cheese (*wara*)	57	38	Cow
Nono	8	5	Cow
Yoghurt	10	7	Cow
Fried cheese	48	32	Cow
Milk			
Powdered milk	15	10	Cow
Evaporated milk	12	8	Cow

* Multiple responses.

Table 3. Pattern of cow milk and milk products consumption (n = 150).

Pattern of consumption	Milk		Milk products	
	Frequency	Percent	Frequency	Percentage
Daily	0	0	0	0
Weekly	0	0	0	0
Bi-weekly	0	0	24	16
Monthly	18	12	51	34
As the need arises	45	30	75	50

observed to be less consumed by the farm families in the rural communities. This cannot be unconnected with the high market prices of these types of milk which can be gotten at the least price of ₦90.00 (58 cents) for a tin of evaporated milk and ₦550.00 (US$3.47) for a tin of 450 g powdered milk. However, consumption of evaporated (8%) and powdered milk (10%) by the farm families was made possible due to packaging of the milk in small size sachets of ₦10.00 (less than a cent).

Pattern of milk and milk products consumption

Table 3 shows the pattern of milk and milk products consumption. Half (50%) of the farm families take the local milk products as the need may arise and 34% consume the milk product at least once a month. A few of the respondents consumed milk at least once a month (12%) and as the need may rise (30%). This observed irregularity of milk and milk products consumption by majority of the farm families suggests that they hardly afford market prices of processed milk or milk products. This cannot be unconnected with poverty level of the rural families, in which most of them depend on about US$2 a day for meeting their essential needs. In view of this, they hardly spend on milk consumption but on plant-based foods that are less expensive in relation to milk. In essence, milk consumption is rather considered a luxury and as such is largely consumed occasionally or as the need may arise by the respondents.

Rural farm families' acceptability of small ruminants' milk for consumption

Table 4 shows the rural farm families' categorised levels of acceptability of sheep and goats' milk for consumption based on their obtained cumulated ranged scores from the itemised acceptability statements (Table 5). In view of the obtainable minimum and maximum scores of 18 and 90 respectively, most (64%) of the respondents had between 54 and 71 scores, suggesting that acceptability of small ruminants' milk for consumption was slightly favoured by the rural farm families in the study area, while 8% within the range score of 72 and 90 favourably accepted sheep and goat milk for consumption. This observed degree of acceptability of small ruminants' milk by the surveyed rural farm families was believed to have been influenced by their conception of nutritive value of the milk and little or no cultural biases against the milk. The mean score of the respondents on the perceived nutritive value of the small ruminants' milk, which ranged between 2.0 and 2.99 suggests that they considered "*milk from the small ruminants as highly nutritious*" (M = 2.98) and "*consumption of the small ruminants' milk has the potentials to improve one's healthiness*" (M = 2.92). Ceballos et al. (2009) reported that goat milk have unique nutritive properties which distinguishes it from cow

Table 4. Measures of rural farm families' acceptability of sheep and goats' milk for consumption.

Acceptability measures	Mean	Standard deviation
A. Nutritional value		
1) +Sheep and goats' milk are readily consumable and digestible.	2.80	0.89
2) +Milk from the small ruminants are highly nutritious than that of cattle.	2.98	0.52
3) +Consumption of the small ruminants' milk has the potentials to improve one's healthiness.	2.92	0.53
4) +Sheep and goats' milk are cheap sources of animal protein for households.	2.84	0.65
B. Milk/income generation sources		
1) +Sheep and goats are cheap source of milk for household consumption.	2.48	0.84
2) +Appreciable income generation cannot be derived from sheep and goats' milk marketing.	2.98	0.82
3) +The quantity of milk that could be gotten from sheep and goats is too small to be encouraging for regular consumption.	3.90	0.61
C. Technical exploration		
1) +Exploration of sheep and goats' milk for processing and marketing could become a steady source of income generation.	3.12	0.52
2) +Technical training on efficient milking of sheep and goats could stimulate small ruminants' milk production and consumption in the rural communities.	3.88	0.72
3) +If well processed and readily available, I will gladly consume sheep and goats' milk.	3.50	0.07
4) +Sheep and goats' milk could be explored for the purpose of meeting protein requirement of the family.	2.80	0.73
D. Cultural biases		
1) -Consumption of sheep and goats' milk could lead to transmission of animal-induced diseases to man.	3.87	0.70
2) -Consumption of sheep and goats' milk is not forbidden by culture of the land.	3.24	0.92
3) -Perceived body odour of the small ruminants makes the consumption of sheep and goats' milk discouraging.	3.48	0.76
4) -Children might behave as animals on regularly consumption of sheep and goats' milk.	2.48	0.95
E. Small and large ruminants' milk substitution		
1) +Sheep and goats' milk could serve as substitute for cattle's milk.	2.88	0.80
2) +Milk from sheep and goats is as attractive as that of cattle's.	2.82	0.52
3) Cheese from sheep and goats can be substituted for cattle's.	2.88	0.79

Mean score categorisation: 1.0 – 1.99 as unfavourable acceptability, 2.0 – 2.99 as slightly favourable acceptability, and ≥ 3.0 as favourable acceptability for positive statements; and 1.0 – 1.99 as favourable acceptability, 2.0 – 2.99 as slightly favourable acceptability, and ≥ 3.0 as unfavourable acceptability for negative statements.

Table 5. Levels of rural farm families' acceptability of sheep and goats' milk for consumption (n = 150).

Category	Class interval	Frequency	Percentage
Unfavourable	18 – 35	6	4.0
Slightly unfavourable	36 – 53	36	24.0
Slightly favourable	54 – 71	96	64.0
Favourable	72 – 90	12	8.0

Mean score = 54.84, Standard deviation = 2.59.

milk and make it valuable for both health and nutrition. Similarly, milk from the small ruminants was considered as "*cheap sources of animal protein for households*" (M = 2.84) and is believed to be "*readily … digestible"* by the farm families (M = 2.80). This finding suggests that the rural farm families were aware of the nutritive value of milk and as such would want to consume it when available and affordable to them. This position was based on the respondents' indications that "*sheep and goats' milk could serve as substitute for cattle's milk"* (M = 2.88); and that "*cheese from sheep and goats can be substituted for cattle's*" (M = 2.88). They found the small farm animals' "*milk … attractive as that of cow's*" (M = 2.82). This corroborates the findings of Adewumi et al. (2001) who evaluated the sensory and marketability of sheep milk in Akure, Nigeria. The author came to the conclusion that sheep milk compared favourably with liquid and reconstituted powdered milk in the market. The surveyed rural farm families held little or no cultural biases against consumption of the small ruminants' milk.

Table 6. Chi-square result of the tested between the rural farm families' socioeconomic characteristics and their level of acceptability of sheep and goats' milk consumption.

Variable	X	*df*	P_{value}	Decision
Age	5.939	12	0.919	Not significant
Marital status	13.028	6	0.592	Not significant
Family size	7.837	6	0.250	Not significant
Education	2.279	6	0.892	Not significant
Religion	4.627	6	0.592	Not significant
Farming experience	9.654	9	0.379	Not significant

This was based on their stance that "*consumption of sheep and goats' milk is not forbidden by culture of the land*" (M = 3.24); and were against the notion that "*… body odour of the small ruminants makes the consumption of sheep and goats' milk discouraging*" (M = 3.48). However, Apata and Adewumi (2011) pointed out that sheep and goat odour was one of the factors militating against the consumption of sheep and goat milk. Contrary to the possibility of zoonotism, the rural farm families were against the conception that "*consumption of sheep and goats' milk could lead to transmission of animal-induced diseases to man*" (M = 3.87). They were however skeptical about the possibility of that their "*children might behaved as animals on regularly consumption of sheep and goats' milk*" (M = 2.48), as commonly believed in the study area that children placed on milk, from small ruminants, might put up animalistic behavior.

Exploration potential of the small ruminants for milk production may however be undermined by the rural farm families' conception that "*appreciable income generation cannot be derived from sheep and goats' milk marketing*" (M = 2.98); and that "*the quantity of milk that could be gotten from sheep and goats is too small to be encouraging for regular consumption*" (M = 3.90). In addition, they hardly considered "*sheep and goats are cheap source of milk for household consumption*" (M = 2.48). The apparent low quantity of milk production by the small ruminants might have been induced by the poor production quality of the local breeds of sheep and goats reared by the farm families. This is in line with the findings of Adewumi et al. (2001) and Bemji et al. (2006) observation of low quantity of milk production by local breeds of goats reared by the Armenia rural farmers.

Chi-square test of the relationship between the rural farm families' socioeconomic characteristics and their level of acceptability of sheep and goats' milk consumption

Result of the chi-square test of the relationship between the respondent's socio-economic characteristics and their level of acceptability of sheep and goats' milk consumption (Table 6) shows no significant relationship at $P < 0.05$ level. This implies that age, marital status, family size, level of education and religion, and had no relationship with their disposition to sheep and goats' milk consumption in the study area. The observed non-significant relationship between the tested variables might have been informed by the rare cases of the small ruminants' milk production, marketing and consumption in the surveyed rural communities. This is based on fact that cow's milk constitutes the main milk readily available in the Nigerian markets, and even the source of locally produced milk or milk products. In addition, sheep and goats rearing, as observed by Lawal-Adebowale (2012), are hardly raised for milk, but largely for meat consumption and income generation in southwest Nigeria.

CONCLUSION AND RECOMMENDATION

This study thus revealed that small ruminants' milk was never consumed by the rural dwellers in the study area. Farm families favoured small ruminants' milk for consumption and had no cultural biases against the small ruminants' milk. Therefore, the rural farm families need to be provided technical training on efficient milking and processing of the small ruminants' milk for safe consumption.

Conflict of Interest

The authors have not declared any conflict of interests.

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