ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

INDIGENOUS CHICKEN REARING SYSTEMS AND THEIR INFLUENCE ON HOUSEHOLD INCOME AMONG SMALL-SCALE FARMERS IN MAU-NAROK DIVISION OF NJORO DISTRICT, NAKURU COUNTY, KENYA

[1]Kyule N. Miriam, [2] Mwangi J. Gowland , [3]Nkurumwa O. Agnes

1. Njoro Girls' High School P.O. Box 52, Njoro
2. Department of Agricultural. Education and Extension
3.Nkurumwa O. Agnes Education and Extension

Manuscript Info

Manuscript History:

Received: 23 March 2014
Final Accepted: 23 April 2014
Published Online: May 2014

Key words:
Commercial rearing, Household Income, Indigenous Chicken, Kenya, Small-scale Farmers.

.***Corresponding Author***

Kyule N. Miriam

Abstract

Poultry production in Kenya is an important source of livelihood for small-scale farmers who produce 80% of the national poultry production; indigenous chicken (IC) rearing remains attractive to poor households because they have a number of advantages compared to other livestock species. Although majority of small-scale farmers rear indigenous chicken, it has been reported that few engage in it as a commercial enterprise for household income. The reasons for low commercialization despite IC's high demand in the market are not well documented. The purpose of this study was therefore, to examine the type of IC rearing systems used and their influence on income obtained from among small-scale farmers. A cross-sectional survey research design was used. The target population consisted of small-scale farmers who reared IC in Mau-Narok Division of Nakuru County. A sample size of 120 respondents was randomly selected from a sampling frame of 10,479 households. Data were collected using a semi-structured questionnaire. Descriptive and inferential statistics were used in data analysis and all tests were computed at α=0.05. Study findings indicated that the type of chicken rearing system used did not significantly influence the household income generated from the enterprise. This could be explained partly by the fact that, IC rearing farmers under intensive system were rearing few birds which translated to low returns to economies of scale. This study recommends that extension service providers should educate small-scale farmers rearing IC on the importance of using appropriate rearing system and increasing the number of IC kept in order to reap maximum commercial benefits from IC rearing.

Introduction

Chicken are the most abundant and widely kept livestock species in the world (Moreki, Dikeme & Poroga, 2010). Indigenous chicken (Gallus domesticus) are widely distributed in rural and peri-urban areas where they play an important role in income generation and food production (Moreki *et al*., 2010; Thornton, Kruska, Henniger, Kristjanson, Atieno, Odero & Ndegwa, 2012). Globally, indigenous chicken (IC) produce 30% of all the white meat consumed (FAO, 2012). In Africa, over 70% of the total chicken population is made up of IC (FAO, 2011). Poultry production in Kenya is an important livelihood activity particularly among small-scale farmers who produce 80% of the national poultry production (Ministry of Livestock and Fisheries Development, 2011). Poultry sub-sector creates employment and promotes overall economic development. Additionally, IC have culturally been used in conventional medicine and for various cultural rites. Compared to other livestock species, poultry, specifically

chicken have the advantages of having quick returns to investment and relatively simple management practices with numerous market outlets for their products. Ndirangu, Birol, Roy & Yakhshilikov (2009), indicated that poultry contributed to farmers' income, wealth and insurance against shocks. A study by Kingori, Wachira and Tuitoek (2010), further indicated that IC rearing was highly associated with women and the youth since it was viewed as a venture for the poor.

Indigenous chickens are have advantages in that they are hardy, adapt well to the rural environments, survive on low inputs and adapt to fluctuations in available feed resources (Kingori *et al*., 2010). Thus, about 90% of the small-scale farmers in Kenya rear IC (Akondo, 2012; Kingori *et al*., 2010). Although IC rearing remains attractive to poor households, most small-scale farmers rear IC as a subsistence enterprise. Available information from the District Agricultural Office Njoro District showed that, very few or none ventured into commercial rearing of IC (District Agricultural Office, 2011). In addition, the rapidly growing competitive uses of agricultural crop products especially maize were increasing the demand for livestock products (Agriculture and Rural Development [ARD], 2012).

A study by the UN (2011), indicated that between 1999 and 2009, Kenya's population increased by 35% to 38.6 million. This rate of growth not only increased demand on land productivity but also exposed the shortcomings of the tradition of land subdivision for inheritance. The study further showed that the average size of about four million small farms have been reduced to less than one acre. Thus, increased landlessness occasioned by the high population growth makes IC rearing an investment of choice due to its low spatial requirements. However, IC rearing has been influenced by several factors, which include; the rearing system used, level of technical knowledge, poor management and poor marketing strategies. Others include; shortage of feeds, improper housing, disease outbreak, parasite menace, predation, lack of technical assistance from extension staff and use poor IC breeds (Kingori *et al*., 2010; Moreki, 2010; Ndathi, Muthiani, Kirwa, Kibet & Cheruiyot, 2012).

In Njoro District, most IC are kept by farmers in the rural settings (District Agricultural Office Njoro, 2011). As one approaches peri-urban set up, farmers tend to venture more into exotic chicken rearing than IC. This has been associated with better adoption levels and the quick returns associated with exotic chicken breeds. However, high costs of poultry feeds and other inputs seem to have driven most exotic chicken farmers out of the sub-sector. This has led to a steady decline in the number of exotic birds with broilers totaling 2,448, layers 5,738 while IC population was 142,721 as at 31st December 2011 (District Agricultural Office Njoro, 2011).

Rearing of IC appears to be the best alternative for most farmers since their feed demands and general cost of production is low (Kingori *et al.*, 2010). Data from Mau-Narok Division indicated that, majority of IC farmers have not given commercial IC rearing the attention it deserves as an important source of household income (Divisional Agricultural Office Report, 2011). Commercial rearing of IC among Mau-Narok small-scale farmers' would boost household income and food security thus contributing to the attainment of Millennium Development Goal (MDG) One (Ministry of Planning and National Development, 2007). The poverty index of Mau-Narok, which stands at 43% would also decline (District Development Office [DDO], 2011).

Globally, IC rearing accounts for 30% of all white meat consumed. In Sub-Sahara Africa, IC are produced by small-scale farmers. In Kenya, 55% and 47% of meat and eggs respectively come from IC (Kingori *et al*., 2010) whose rearing can be a reliable, affordable and easier to manage source of household income. Rearing of IC has many advantages, which include high, currently unmet market demand for IC meat and eggs (ARD, 2012; WSPA, 2012). This is due to the desirable characteristics of IC, which include leanness, good flavour, presumed organic product and changing feeding habits. Supply deficit for IC products worsens during the festive seasons like Easter and Christmas holidays. Though over 90% of small-scale farmers engage in IC rearing, very few of them consider it a commercial enterprise. This is evident in Mau-Narok Division. The reasons why most small-scale farmers' commercial rearing of IC is low despite their high demand in the market are not well documented. This makes it harder for policy makers and other stakeholders to make important decisions on how to improve IC production. This study sought to provide information on the type of commercial IC rearing system that the small-scale farmers in Mau-Narok Division use and their influence on the income generated from the enterprise.

RESEARCH FOCUS

There are different rearing systems that small-scale farmers can adopt when rearing IC. These rearing systems are classified according to production objectives either commercial or subsistence, based on management practices

carried out and levels of inputs and outputs (Magothe, Okeno, Kahi and Muhuyi, 2012). Additionally the choice of a particular system is influenced by land availability. In line with production objectives, small-scale farmers rear IC for consumption only, consumption and cultural uses, consumption and income generation or income generation only. The different rearing systems that IC farmers can adopt include:

The extensive system involves the rearing of IC under free range. It is the simplest and cheapest method of rearing chicken (Kenya Institute of Education (KIE), 2011). The free range system is a low input low output system where supplementary feeds and veterinary services are not provided (Ndathi *et al*., 2012; Sebushahu, 2011; Thornton *et al*., 2012). Although this production system is preferred due to its low-input requirements, it has been found to expose IC to harsh conditions such as poor nutrition, uncontrolled breeding, predators, disease and parasite challenges (Okeno, Kahi & Peter, 2011). A study done by Duc & Long (2012), in Vietnam established that farmers who practiced extensive rearing systems paid little attention to their chicken and their production yield was low. Kingori *et al.* (2010), in their study showed that farmers had little knowledge on rearing IC and relied on experiences transferred from generation to generation. Chicken were mostly left to scavenge for feeds during the day and confined in shelters at night (Kingori *et al*., 2010). Occasionally, the bird feeding is supplemented and drinking water is irregularly provided in tins or broken clay pot pieces (Fisseha, Azage & Tadelle, 2011; Gueye, 2010). This system is common in areas with low population density where small flocks of less than 30 adult birds per household are kept with minimal care (Magothe *et al*., 2012).

In the semi-intensive system, birds are left to scavenge during the day around the homestead or in fenced runs (Magothe *et al*., 2012). Additionally, IC are provided with some form of housing ranging from simple shelters to proper chicken houses and the numbers kept range between five to fifty. Duc and Long (2012), found that farmers who engaged in semi-intensive system invested in better housing, breeds and better feed for their chickens. Additionally 80 percent of households that used semi-intensive system had participated in training courses on feeding, rearing, management, breeding and veterinary services. The system is more efficient than the extensive system.

The intensive rearing system is characterized by high investment, good management and high returns (Duc & Long 2012). Birds are totally confined in shelters or runs with flocks ranging between five and 500 adult birds which are provided with commercial or home-made feed rations and health care (Magothe *et al*., 2012). It constitutes less than 30% of the total poultry population in Africa and aims at reducing labour and housing costs per hen (Kitalyi, 2012). Deep litter and slatted floors are the common housing systems used (Magothe *et al*., 2012). Green vegetables were also provided to the confined birds. This system is associated with provision of high level veterinary care and chick mortality is low (FAO, 2012; KIE, 2011). Intensive and semi-intensive systems have been found to have a higher carrying capacity compared to extensive system and the birds reach maturity earlier (Okeno, *et al*., 2011). However, there is inadequate documentation on the influence of the rearing system used by small-scale farmers in commercial rearing of IC on the household income from their IC enterprises.

METHODOLOGY

A cross-sectional survey research design was used. Two locations of Mau-Narok Division in Nakuru County were purposively selected for the study. A total of 10,479 households were targeted of whom a sample of 120 respondents was obtained using a coefficient of variation method by Nassiuma, (2000). Simple random sampling was used to draw the required respondents according to the proportionate households in each location. One hundred households were sampled from Mau-Narok representing 83.3% compared to 20 households representing 16.7% from Sururu because Mau-Narok's households were proportionately higher than those of Sururu.

Both qualitative and quantitative data were collected using semi-structured questionnaires. These were then analyzed accordingly using SPSS. Simple descriptive statistics mainly; means, frequencies, percentages, standard deviations and bar charts were used to analyze quantitative data. The influence of the rearing system used on IC rearing management practices on household income from the enterprise was determined. The inferential statistic used to test this hypothesis was Analysis of Variance (ANOVA).

RESULTS AND DISCUSSIONS

General Characteristics of the Respondents

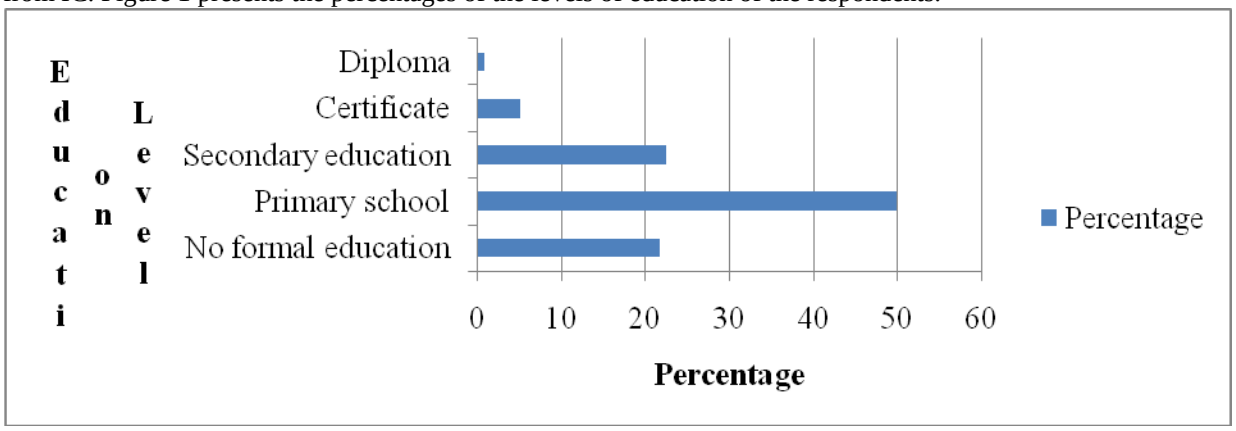
Characteristics that were investigated included: gender, farm size, age, education level and IC rearing systems.

Gender of Respondents

More than half of the respondents interviewed (55%) were female compared to 45% male. This implies that most of the farm activities dealing with IC rearing were handled by women and agrees with the findings of Kingori *et al*. (2010). In their study, Kingori *et al*. (2010) found that IC rearing is highly associated with women and the youth as it was viewed as a venture for the poor. In addition, although women are more active in most of the farm activities like IC rearing, they have limited access to productive resources. According to USAID (2011), if women had the same access to productive resources as men, they could increase yields on their farms by 20–30%. This increase could raise total agricultural output in developing countries by 2.5–4% and reduce the number of hungry people in the world by 12–17%, up to 150 million people. Additionally, a study done in Nigeria established that women produced between 60 to 80% of the food in that country (Meludu, Ifie, Akinbile and Adekoya, 2009). They were also responsible for managing household resources and were major pillars for achieving sustainable household food security. Given access to the productive resources, the female respondents in Mau Division could expand their IC rearing enterprises.

Level of Education of the Respondents

Half of the respondents (50%) reported that they had attained primary education while only 22.5% had secondary education. A lesser proportion of 5.8% had attained post secondary school level education while 21.7% had no formal education. Majority of the respondents had attended primary school contradicting the findings of Oyugi (2012), which established high illiteracy level of 77% among rural farmers. Respondents with secondary school level education and above were 28.3%. With high education level, farmers' intellectual capacity is expected to be high. This should enhance application of proper IC rearing practices hence improving the household income derived from IC. Figure 1 presents the percentages of the levels of education of the respondents.

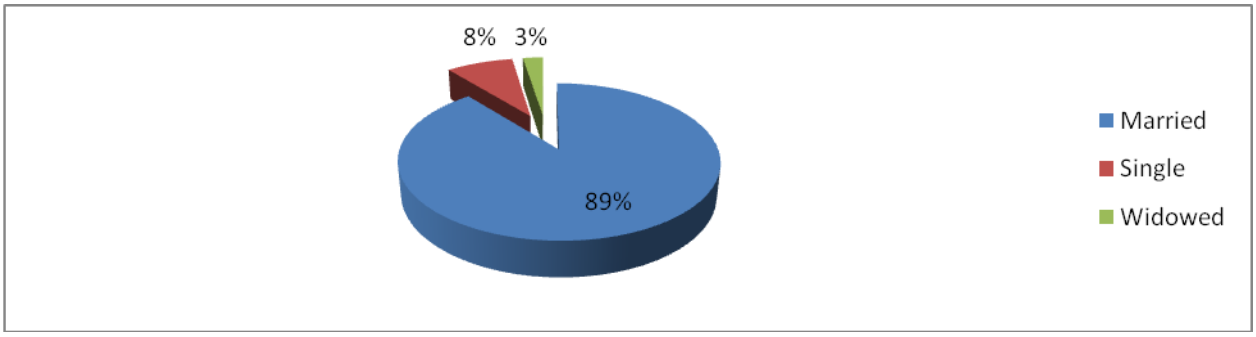


Source: Survey data, Mau-Narok Division, 2012

Figure 1. Distribution of respondents by education level

Marital Status of the Respondents

A large proportion (89.2%) of the respondents reported that they were married, 8.3% were single and only 2.5% were windowed as shown in Figure 2. According to FAO (2011), among the married households, women have limited control over decision making on agricultural resource allocation. Thus majority of the married women in the study area had little contribution in decision making on IC rearing resource allocation.



Source: Survey data, Mau-Narok Division, 2012

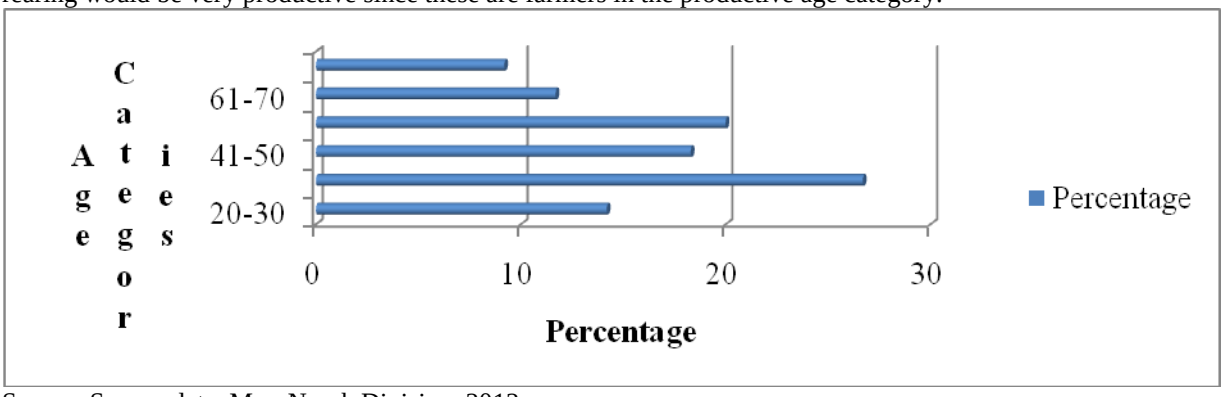
Figure 2. Distribution of respondents by marital status

Farm size of the Respondents

Most of the respondents (82.5%) had less than one hectare of land which agrees with the study done by UN, (2011), indicating that most small-scale farmers owned less than one hectare of land. Only 17.5% had more than one hectare of land. Among the 82.5% with less than one hectare of land, 9.2% did not own any land. These are farmers who were displaced from their farms during the 2007/2008 post election skirmishes that rocked the country. Being unable to buy alternative pieces of land they resulted to renting farms elsewhere or working as casual labourers in other farms and living in rented houses in the shopping centres where, by using simple structures they are able to rear IC. The mean farm size was 0.7 hectares. Mau-Narok being a horticultural hub, the small pieces of land are fully utilised for horticultural activities with little or no room left for IC rearing. This has negative implications on IC rearing as a commercial enterprise for household income as well since most agricultural enterprises often give attention to farm size. A study done by Muiti (2008) found a positive correlation between farm size and production level.

Age of the Respondents

The ages of the respondents were as shown in Figure 3. The respondents' age ranged between 21 years and 87 years with a mean age of 47 and a standard deviation of 15.3. The mean age of 47 years may imply that commercial IC rearing would be very productive since these are farmers in the productive age category.



Source: Survey data, Mau-Narok Division, 2012

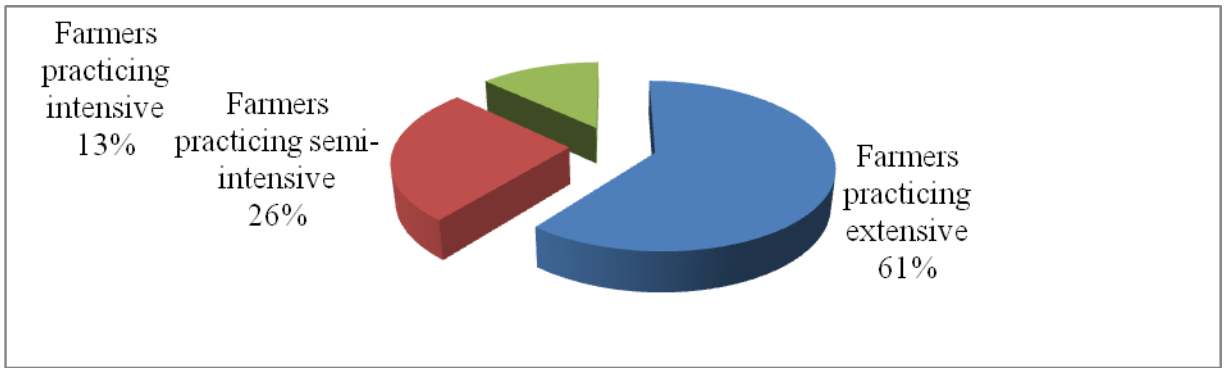
Figure 3. Age of the respondents in years

Young farmers below thirty years of age were very few, a situation that could be attributed to rural urban migration of the youth in search of white-collar jobs. However, 40.9% of the farmers were tending towards old age. According to Kingori *et al.* (2010), old farmers had little knowledge on IC rearing and relied on experiences transferred from generation to generation. This was an indication that most of respondents could be using traditional knowledge in

commercial IC rearing. This traditional knowledge is however crucial and needs to be accumulated and passed on to the younger farmers.

Types of Rearing Systems used by the Respondents

The study findings on the type of rearing systems used indicated that of all the respondents, a majority (61.7%) used extensive system with the mean number of birds kept being 16, 26.7% used semi-intensive and mean number of birds kept were 21, while 13.3% used intensive with a mean number of birds kept as 18.



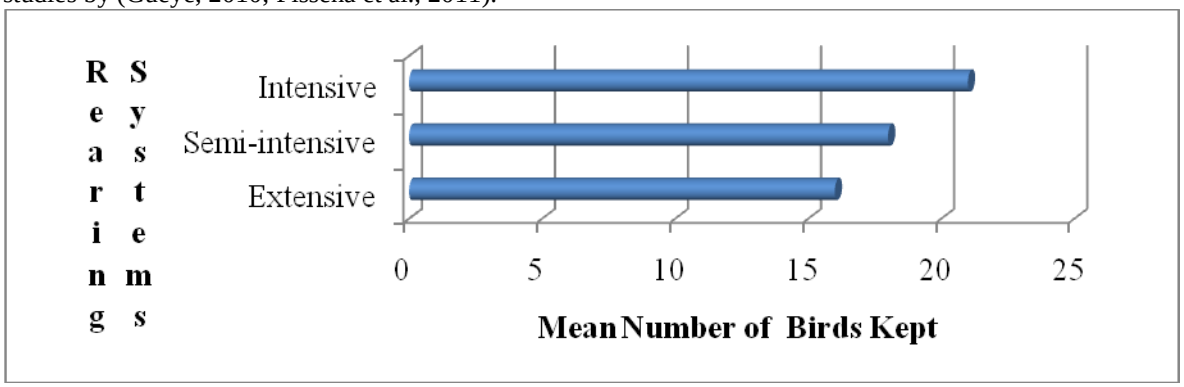
Source: Survey data, Mau-Narok Division, 2012

Figure 4: Indigenous chicken rearing systems used by the respondents

These results concur with Gueye, (2010) and Kingori *et al* (2010) findings that most IC are produced under extensive (free range) rearing system.

Characteristics of the Rearing Systems used by the Respondents

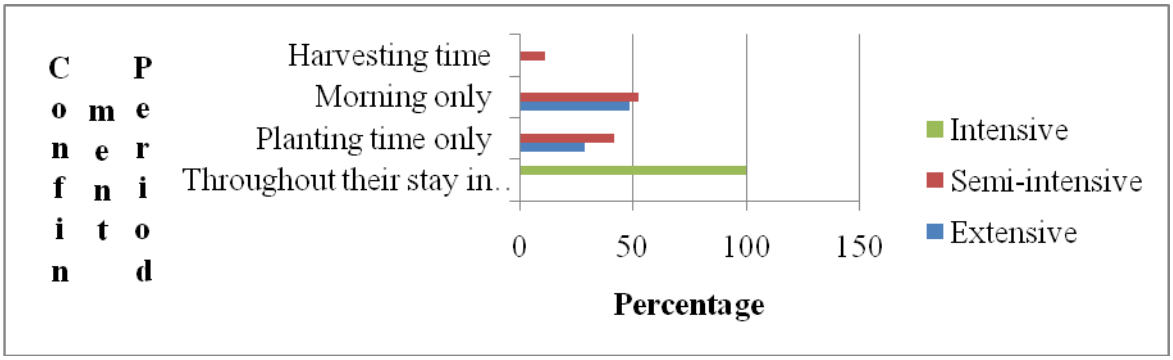
Each of the IC rearing systems was characterized by unique features as presented in Tables 1and 2 as well as figures 5, 6, 7, 8, 9, 10 and 11. Under the extensive system IC farmers were found to allow their birds to scavenge for feeds during the day and confined in shelters at night. This concurs with findings from earlier studies done by Kingori *et al.* (2010). Water was provided to the birds in tins and improvised car tyres, which agrees with the findings of the studies by (Gueye, 2010; Fisseha et al., 2011).



Source: Survey data, Mau-Narok Division, 2012

Figure 5. Mean number of birds kept under each rearing system

The average number of birds kept across the three systems was within the range of the findings of studies done by Aila, *et al.* (2012) and Duc & Long (2012). Keeping few birds as is the case in each of the systems would increase the cost of production per each unit of output hence reducing the profit earned (BayÓn, *et al*., 2012; Sahoo & Tone, 2012).



Source: Survey data, Mau-Narok Division, 2012
Figure 6. Period of birds' confinement in each IC rearing system

Respondents were also found to confine their birds at different times. Confinement of birds was least under extensive rearing system with only 28.9% confining their birds at planting time, 48.5% in the morning and none during crop harvesting. Under the semi-intensive rearing system, none of the respondents confined their birds within their compounds throughout their stay in the farm. Very few respondents (11.3%) confined their birds during harvesting, 41.9% confined during planting time while 52.7% confined during morning only. This agrees with findings of past studies that farmers using semi-intensive system confine their birds at sometime of the day then release them to roam in the fields. Under the intensive system, respondents totally confined their birds in shelters. However, contrary to previous studies (Duc & Long, 2012: Magothe *et al*., 2012), none of these farmers had a deep litter or slated floor houses.

During the confinement period, respondents were found to supplement the feeding of the birds using different types of feed supplements. Under extensive rearing system, 66.7% used kitchen waste, 72.2% used grains while less than half (40.7%) used commercial feeds. All respondents in this system fed their birds on green vegetation which could be attributed to the fact that birds are allowed to roam in the compound all day.

Table 1: **Feed Supplementation across the IC Rearing Systems**

Feed Supplementation	**Percentage**			
	All Systems	**Extensive**	**Semi-intensive**	**Intensive**
Kitchen waste	77.5	66.7	74.2	91.7
Grains	83.3	72.2	81.7	93.5
Commercial feeds	57.5	40.7	54.8	75.6
Green vegetation	85.7	100	88.4	68.9
Carrots	20.4	11.3	9.7	40.3
Boiled mashed potatoes	7.9	1.4	6.8	11.7

Source: Survey data, Mau-Narok Division, 2012

Small proportions of 11.3% and 1.4% used carrots and boiled mashed potatoes respectively as supplements. Farmers broadcasted the supplements on the ground which contradicts Sebushahu, (2011) findings but agrees with Kingori *et al.* (2010) findings. Provision of supplements in this system is relatively high which could be attributed to the fact that small-scale farmers in the study area have small pieces of land that were fully occupied with horticultural crops all year round. This is backed by the fact that 74.2% of the respondents admitted that IC were pests in their farms.

Of the 31 farmers, 96.8% supplemented their IC feeding, with 74.2% using chicken waste, 81.7% using grains, 54.8% using commercial supplements, 9.7% using carrots while 6.8% using boiled mashed potatoes. In this system as well, all birds were able to access green vegetation every time they were allowed to roam in the fields. Supplementation was highest under intensive rearing system with 91.7% using kitchen waste, 93.5% using grains 75.6% used commercial supplement and 68.9% provided green vegetation to the birds. Very few of the respondents in this system used carrots and boiled mashed potatoes as a supplement standing at 11.3% and 11.7% respectively. Though these birds are totally confined provision of commercial feeds that would promote faster growth was demanding among the respondents, a situation they associated to the high cost of commercial poultry feeds.

Respondents were also asked to indicate the source of their breeding cocks. The findings were as represented in Figure 7.

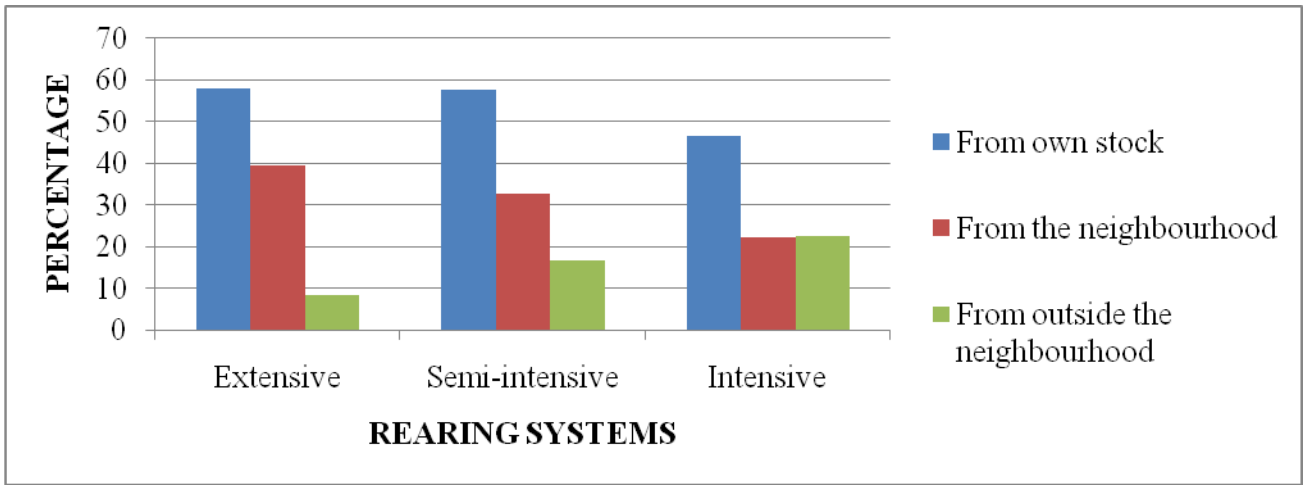


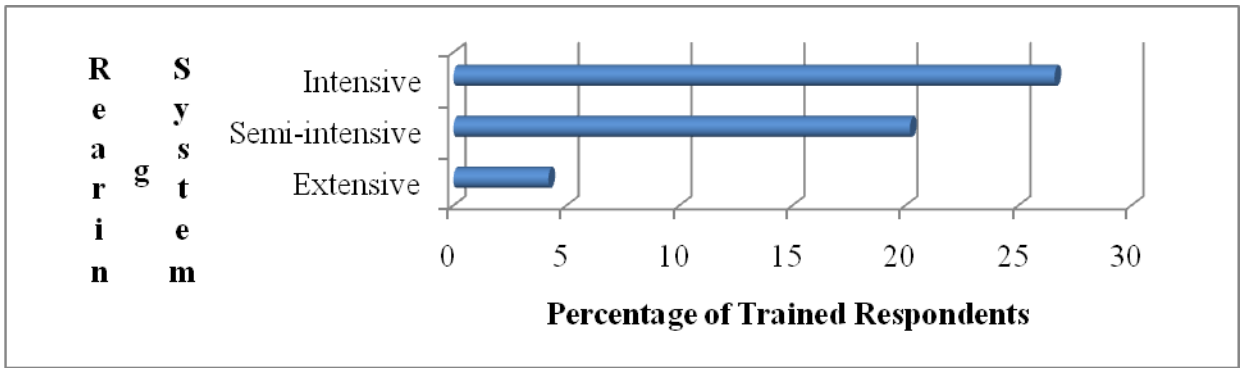
Figure 7. Sources of breeding stock across the IC rearing systems

Under extensive rearing system, 58.1% obtained breeding cocks from their own stock, 39.4% sought from the neighbourhood and only 8.5% sought cocks outside the neighbourhood. This indicates that the level of inbreeding is very high among the flocks reared extensively since hens and cocks spend most of the time together. As birds roam freely cocks from the neighbourhood can mate hens from other farms hence of the three systems, the proportion of farmers sourcing breeding cocks is highest in the extensive system. In semi-intensive system, respondents who sourced breeding cocks from their own stock were 57.7%, 32.6% from their neighbourhood and 16.7% from outside the neighbourhood. In the intensive rearing system close to half (46.7%) of the respondents using sourced their breeding cocks from their own stock which is attributed to confining hens and cocks together encouraging in breeding. Few (22.2%) and (22.6%) sourced breeding cocks from the neighbourhood and outside the neighbourhood respectively.

Study findings showed that, inbreeding of the flock was highest among the birds reared under extensive system and least among birds reared under intensive system. These results concur to the findings of Duc and Long (2012) that farmers rearing IC under intensive system carry out standard practices among them proper breeding. Across the three systems a large proportion of the respondents sought their breeding cocks from the existing flock. These findings concur with the findings from a study by Okeno, *et al.* (2011) which established that a large proportion (84.5%) of small-scale farmers obtained their breeding stock from existing stock in their farms.

Training of Respondents on IC Rearing across the Rearing Systems

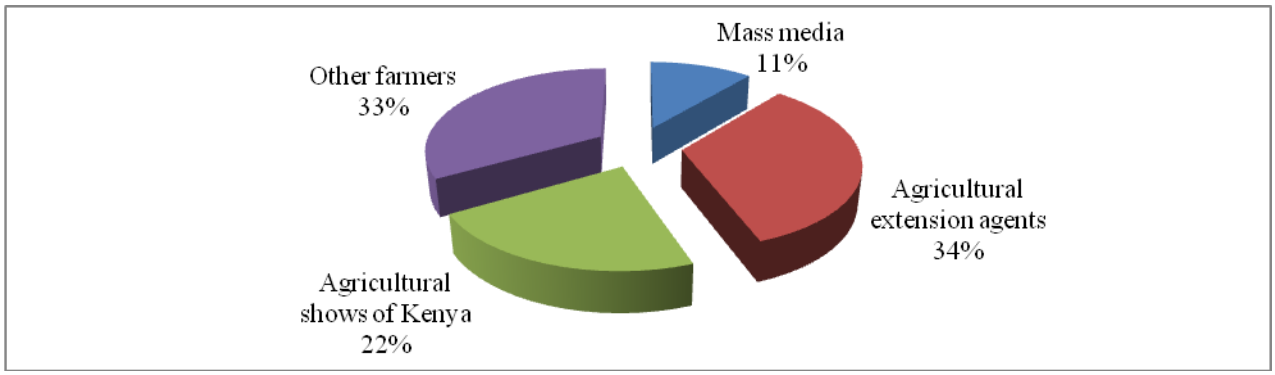
The respondents practising extensive rearing system had the least respondents' training on IC rearing among the three systems. However, training level across all the systems was below average and this would negatively affect IC commercialisation since most respondents would not embrace modern IC rearing management techniques



Source: Survey data, Mau-Narok Division, 2012

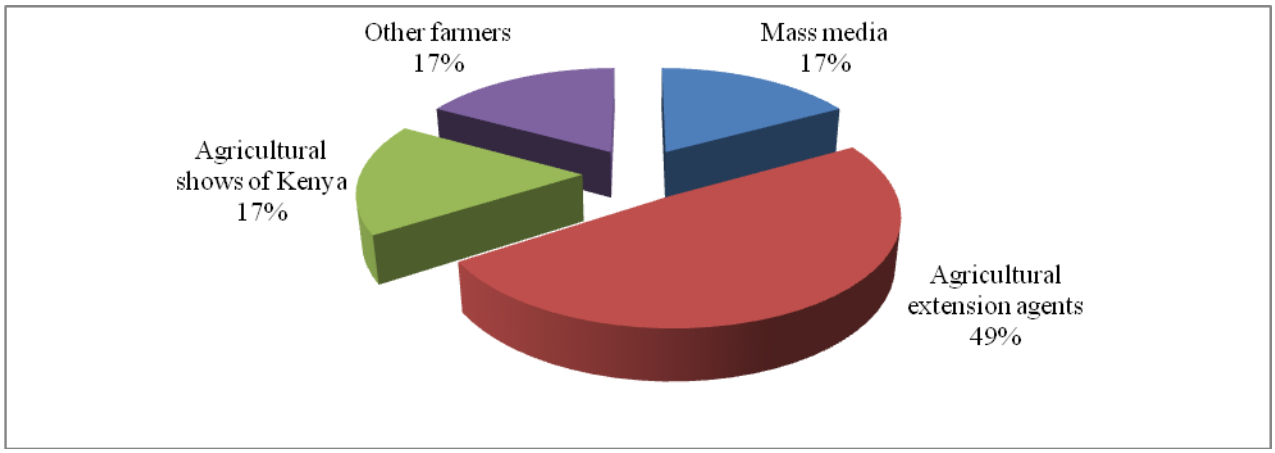
Figure 8: Training on IC rearing in the last five years in each of the rearing systems

Among the 4.2% trained respondents practising extensive rearing system, agricultural extension agents were their main information sources.



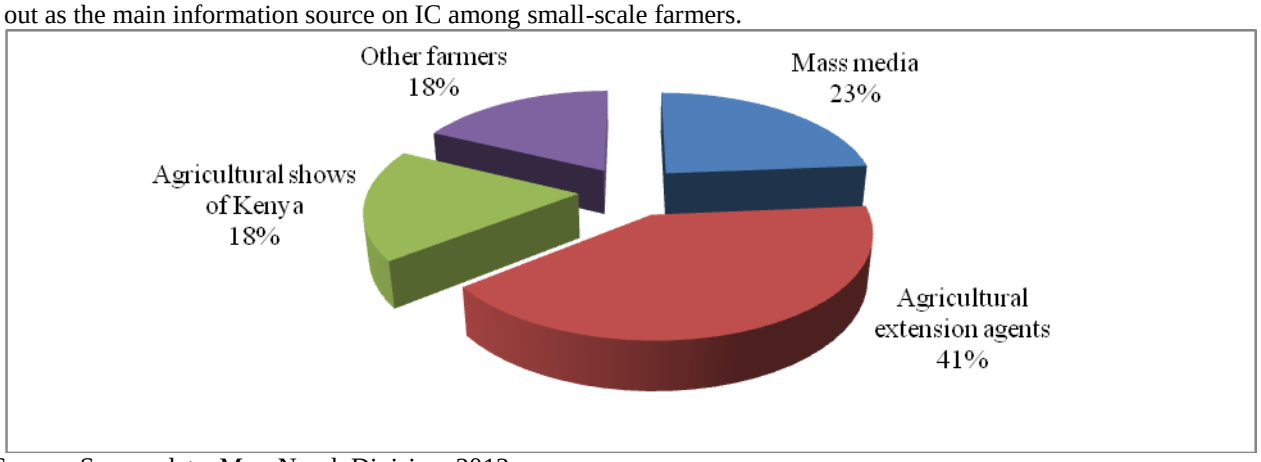
Source: Survey data, Mau-Narok Division, 2012
Figure 9: Percentages of information sources among trained respondents practising extensive rearing system

Those in semi-intensive rearing system 20.2% of them had received training in the last five years where agricultural extension agents were the main information source while all the other sources had an equal contribution of 17 % each.



Source: Survey data, Mau-Narok Division, 2012
Figure 10: Percentages of information sources among trained respondents practising semi-intensive rearing system

As well, of the 26.6% trained respondents under intensive rearing system close to half obtained IC rearing information from agricultural extension agents. Across the three systems agricultural extension agents have come out as the main information source on IC among small-scale farmers.



Source: Survey data, Mau-Narok Division, 2012

Figure 11: Percentages of information sources among trained respondents practising intensive rearing system

Generally, the level of training on IC rearing across the three systems was low with extensive system having the lowest (4.2%), semi-intensive had 20.2% while the intensive system had the highest (26.6%). The low level of training of farmers would affect the extent to which farmers carry out IC rearing management practices.

Table 2: **Gender of Respondents by IC Rearing Systems**

Rearing System	**Gender**	
	Male Percentage	**Female Percentage**
Extensive	55.6	62.1
Semi-intensive	27.8	24.2
Intensive	16.7	13.6

Source: Survey data, Mau-Narok Division, 2012

A cross tabulation of gender and rearing system indicated that there was a higher percentage of women in extensive rearing system than the men. The proportion of males in intensive rearing system was higher than the females, a situation that could be attributed to women's limited access to resources hence venturing in systems that have low input demand. These findings agree with Kingori *et al.,* 2010, findings that intensive rearing system is input intensive while extensive rearing system requires fewer inputs.

A cross tabulation of age against gender indicated that over half of age groups 20-30, 31-40, 41-50, and 51-60 reared their birds under extensive system. Majority of the productive age groups reared their birds under extensive system, which is a low input-low output system. Age group 61-70 had the highest proportion of respondents rearing birds under extensive system. This could be attributed to their old age, which indicates that they depended on traditional knowledge to rear their birds. However, respondents aged above 70 years had the highest percentage of respondents rearing birds by intensive system.

Table 3: **Age of Respondents in Years by IC Rearing Systems**

Age in Years	**Rearing System in Proportion Percentage**		
	Extensive	**Semi-Intensive**	**Intensive**
20-30	58.8	23.5	17.6
31-40	56.3	34.4	9.4
41-50	59.1	18.2	22.7
51-60	62.5	29.2	8.3
61-70	71.4	21.4	7.1
Above 70	45.5	18.2	36.4

Source: Survey data, Mau-Narok Division, 2012

This contradicts Kingori *et al.,* 2010, findings and could be explained by the fact that these respondents owned the birds but care and management of the birds was done by younger people most likely their children.

Influence of IC Rearing Systems on Household Income

The income from IC was put in categories and compared against each rearing system. The results were as shown in Table 4. It was established that of the 71 farmers using extensive system of IC rearing, over 90% got an income of less than 10,000 Kenya shillings. Thirty one farmers used the semi-intensive system of whom, more than half earned an income of less than Kenya shillings 10,000 and only 22.6% got an income ranging between 10,001- 20,000.

No single farmer in this system got over 20,000 Kenya shillings in this system. Intensive rearing system is the only system that recorded a high percentage of farmers earning the highest income from their enterprises though majority got an income of less than 10,000 Kenya shillings. Generally the income the farmers got from the three systems were not much different.

Table 4: **Categories of Income from each Rearing System**

Rearing System	Income Category	Frequency	Percent
Extensive	Below 10,000	64	90.1
	10,001-20,000	5	7.0
	20,001-30,000	1	1.4
	30,001-40,000	1	1.4
Semi-intensive	Below 10,000	24	77.4
	10,001-20,000	7	22.6
Intensive	Below 10,000	13	72.2
	10,001-20,000	4	22.2
	20,001-30,000	1	5.6

Source: Survey data, Mau-Narok Division, 2012

The study tested the hypothesis "The type of commercial IC rearing system that the small-scale farmers in Mau-Narok Division use has no statistically significant influence on the household income generated from the enterprise". This hypothesis was tested using ANOVA. The total income was calculated based on the total number of birds a farmer had and uniform average selling price was used for each category of birds as follows: cocks = KShs. 500, Hens= KShs 350, chicks=KShs. 100, Growers=KShs 200 while an egg=KShs. 10 (DAO, 2012). The means of the incomes from each rearing system were compared to determine whether the rearing system used had any influence on the household income. The results were as presented in Table 5.

The results of the analysis indicated that the difference in mean incomes of the three rearing systems is statistically insignificant. The study therefore, accepted the null hypothesis that the type of commercial IC rearing system has no statistically significant influence on the household income generated (P-value = 0.516).

Table 5: **ANOVA Results on the Influence of the Rearing System on the Household Income from IC**

	N	Mean	Std. Deviation	Std. Error	Minimum Income	Maximum Income
Extensive	71	5648.45	5267.61	625.15	350.00	34900.00
Semi-intensive	31	6886.45	4266.74	766.33	1200.00	17300.00
Intensive	18	6391.11	5943.28	1400.84	1050.00	22600.00
Total	120	6079.66	5123.76	467.73	350.00	34900.00

P= 0.516 > 0.05, F= 0.665

Source: Survey data, Mau-Narok Division, 2012

Under normal circumstances, the mean for intensive system should have been different from the others, however in Mau-Narok Division; the situation is different with the semi-intensive system having the highest mean of the three systems. This could be explained by the fact that, IC rearing farmers under intensive system were rearing few birds which translated to low returns to economies of scale as indicated by Lindstad, *et al*., (2012). In addition the mean income of semi-intensive system was higher than intensive due to the lower feed cost implication since these birds supplement their feeding through scavenging.

Conclusions and Recommendations

The type of commercial rearing system used by a small-scale farmer in Mau-Narok Division had no influence on the household income generated from the enterprise. Rearing few numbers of birds especially in the intensive and semi-intensive systems increases the cost of production per bird lowering the income obtained. The few number of birds kept across the three IC rearing systems could thus be attributed to the lack of influence of the rearing system used since they made the enterprises economically less viable. Secondly, training of farmers on IC rearing was very dismal which had a negative effect on the household income obtained across the three systems. Majority of the households got incomes below KShs. 10,000. Thirdly, most of the women use the extensive rearing system, which

requires low input but is a low output system; a situation associated to their inability to access and control production resources.

The study recommends that; extension service providers should educate small-scale farmers rearing IC on the importance of using appropriate system of rearing, increasing number of IC kept in order to reap maximum commercial benefits from IC rearing. Government and non-government development agents should facilitate small-scale IC rearing farmers to shift from subsistence to commercial IC rearing, which will go a long way in alleviating poverty and boosting food security among many households. In addition, agricultural development partners' especially financial institutions and Non- Governmental Organisations should consider offering credit or grants respectively to IC rearing farmers to enable them expand their enterprises. Such finances will help female IC farmers buy the necessary inputs hence promote IC rearing improving the household income obtained from their enterprises. Lastly, the government should enact laws that enhance women's access to production resources since they play a key role as IC producers and contribute to household food security.

REFERENCES

Agriculture and Rural Development (ARD) (2012). Implementing Agriculture for Development – Action Plan 2010 -2012. Retrieved on 28/8/2012 from

Aila, F. O., Oima, D. Ochieng, I. & Odera, O. (2012). Bio-Security Factors Informing Consumer Preferences for Indigenous Chicken. Business and Management Review Vol. 1(12) pp. 60 – 71 February, 2012 ISSN: 2047 - 0398

Akondo, P. (2012). Indigenous chicken farming. Retrieved on 21/04/2012 from

BayÓn, L., Otero, J., Ruiz, M., Suárez, P. & Tasis, C. (2012). The Profit Maximization Problem in Economies of Scale. Journal of Computational and Applied Mathematics, 236: 3065-3072.

DDO, (2011). Njoro District Development Report. Unpublished.

District Agricultural Office Report, (2011). Agribusiness report – January to June 2011, Njoro District. Unpublished.

Divisional Agricultural Office Report, (2012). Agribusiness report – January to June 2012, Mau-Narok Division. Unpublished.

Duc, N. V. & Long, T. (2012). Poultry production systems in Vietnam. Retrieved on 30/6/2012 from http://www.fao.org/docrep/013/al693e/al693e00.pdf

FAO, (2012). Retrieved on 27/4/2012 from FAO, (2011). State of food and agriculture report. Retrieved on 27/4/2012 from

Fisseha, M., Azage, T. & Tadelle, D. (2012). Indigenous Chicken Production and Marketing Systems in Ethiopia: Characteristics and Opportunities for Market-Oriented Development. Working Paper 24. Nairobi, Kenya, ILRI. Retrieved on 5/4/2012 from

Gueye, E. F. (2010). Family poultry. Retrieved on 5/4/2012 from

Kenya Institute of Education, (2011). Secondary Agriculture. Form Four Student's Book. Kenya Literature bureau: Nairobi.

Kingori, A., Wachira, A. & Tuitoek, J. (2010). Indigenous Chicken Production in Kenya. International Journal of Poultry Science 9 (4): 309-316, 2010. Retrieved on 28/08/2011 from Kitalyi, A. J. (2012). Village Chicken Production Systems in Rural Africa: Household Food Security and Gender Issues, Issue 142. Retrieved on 15/7/2012 from http://books.google.co.ke/books/about/Village_Chicken_Production_Systems_in_Ru.html?id=sKUIT7AwFA4C&redir_esc=y

Lindstad, H., AsbjØrnslett. E. & StrØmman, A. (2012). The Importance of Economies of Scale for Reductions in Greenhouse Gas Emissions from Shipping. Energy Policy 46: 386-398

Magothe, T.M., Okeno, T.O., Muhuyi, W.B. & Kahi, A.K. (2012). Indigenous Chicken Production in Kenya: I. Current Status. World's Poultry Science Journal, Vol. 68, March 2012. doi: 10.1017/S0043933912000128

Meludu, N.T., Ifie, P.A., Akinbile, L. A. & Adekoya, E.A. (2009). The role of women in sustainable food security in Nigeria: a case of Udu local government area of Delta State. Journal of Sustainable Agriculture. 2009. 15 (1). 87-93

Ministry of Agriculture (2011): Poverty Reduction Strategy. Retrieved on 12/8/2011 from

Ministry of Livestock and Fisheries Development, (2011). Animal Production Annual Report, Nairobi, Kenya
Ministry of Planning and National Development (2007). Millennium development goals in Kenya. Retrieved on 15/7/2012 from
Moreki, J., Dikeme, C. & Poroga, B. (2010). The Role of Village Poultry in Food Security and HIV/AIDS Mitigation in Chobe District of Botswana. Livestock Resources Rural Development, 22, Article #5. Retrieved on 4/4/2012 from
Muiti, A. M. (2008). The Influence of School Pupils' Knowledge of Agriculture on Environmental Conservation in Akithii Division Nyambene District, Kenya. Egerton University, Unpublished Thesis
Nassiuma, D. K. (2000). Survey Sampling: Theory and Methods. Nairobi: Nairobi University Press, pp. 59-61.
Ndathi, A., Muthiani, E., Kirwa, E., Kibet, P. & Cheruiyot, H. (2012) Constraints and Opportunities in Indigenous Chicken Production and Marketing in Mashuru and Loitoktok Divisions of Kajiado District. Retrieved on 5/4/2012 from
Ndirangu, L., Birol, E., Roy, D. & Yakhshilikov, Y. (2009). The Role of Poultry in Kenyan Livelihoods and the Ex Ante Impact Assessment of HPAI on Livelihood Outcomes. Retrieved on 28/8/2011 from

Okeno, T.O., Kahi, A.K. & Peters, J.K. (2011). Characterization of Indigenous Chicken Production Systems in Kenya: Household Flock Structure, Dynamics and Breeding Practices. Retrieved on 14/7/2012 from
Oyugi, M. A. (2012). Gendered Farmer Involvement in Production of Bambara Groundnut in Butere and Mumias Districts, Kenya. Egerton University, Unpublished Thesis.
Thornton, P., Kruska, R., Henniger, N., Kristjanson, P., Atieno, F., Odero E. & Ndegwa, T. (2002). Mapping Poverty and Livestock in Developing World. ILRI, Nairobi, Kenya, pp: 124
Sebushahu, T. (2011). Country sector poultry review. Retrieved on 3/7/2012 from Sahoo, B. & Tone, K. (2012). Non-parametric measurement of economies of scale and scope in non-competitive environment with price uncertainty. Omega (2012), doi:10.1016/j.omega.2011.11.008 (Article in Press).
UN, (2011). National report on drought risk reduction policies and programmes. Retrieved on 13/8/2012 from
USAID, (2011). Importance of Investing in Women and Agriculture. Retrieved on 20/12/2012 from World Society for the Protection of Animals (WSPA), (2012). Livestock production and climate change. Retrieved on 7/9/2012 from

Acknowledgement

The author is very grateful to Prof. J. G. Mwangi and Dr. A. O. Nkurumwa for their support in refining this work. The National Council of Science, Technology and innovation (NCSTI), provided financial support for this work and their assistance is highly appreciated.