Journal of Agriculture and Rural Development in the Tropics and Subtropics
Vol. 114 No. 1 (2013) 51–58

urn:nbn:de:hebis:34-2013030542607 ISSN: 1612-9830 – journal online: www.jarts.info

Management practices and challenges in smallholder indigenous chicken production in Western Kenya

Ochieng Justus [a,*], George Owuor [b], Bockline Omedo Bebe [c]

[a] *Department of Development Economics, Migration and Agricultural Policy (DEMAP) and International Center for Development and Decent Work (ICDD) of University of Kassel, Germany*

[b] *Department of Agricultural Economics and Business Management, Egerton University, Kenya*

[c] *Livestock Production Systems Group, Department of Animal Sciences, Egerton University, Kenya*

Abstract

The potential benefit of indigenous chicken (*Gallus domesticus*) production is still under-exploited in Kenya despite the efforts by different stakeholders to mainstream this production system as a pathway to rural development. The production system is often characterized by low input-low output productivity and low commercialization of the enterprise. This study which dwells on the current management practices and challenges faced by smallholder indigenous chicken farmers was conducted to gain insights into the underlying causes of production constraints. In Western Kenya women (76 %) dominate the indigenous chicken production system. The flock composition consists mainly of chicks, hens and pullets (80 %) which reflects their retention for production purposes. Less than half of the farmers access institutional support services such as extension, training, credit and veterinary services. In addition, indigenous chicken is largely reared in a low input-low output free-range system with only few farmers (24.2 %) adopting management interventions as disseminated by extension service. To improve production and attain increased productivity, policy should focus on repackaging extension messages that considers farmers economic situations and strengthens collective action initiatives. Accessing joint input purchase and collective marketing of chicken products may further assist the farmers to increase profit margins.

Keywords: constraints, indigenous chicken, management interventions, production

1 Introduction

Intensification of agricultural production and diversification into relatively more profitable and competitive livestock enterprises is one of the options to increase food production and reduce rural poverty. The poultry sub-sector in Kenya contributes about 55 % to the livestock sector and 30 % of the agricultural gross domestic product (GDP), or 7.8 % of the total national GDP (GoK, 2007). Therefore, it is an important component of rural household livelihoods as a source of food, income, nutrition, insurance against emergencies and has the potential to reduce poverty.

The increasing demand for animal food products and the trends in consumption and production strongly suggest that much of the demand for meat can be met through increased poultry production (Delgado *et al.*, 2001). The poultry of importance in Kenya is the indigenous chicken (*Gallus domesticus*), which accounts for over 80 % of the total national poultry population, and between 40 % and 60 % of the domestic marketed poultry eggs and meat (Upton, 2000). However, smallholder farmers who keep indigenous chicken face the

* Corresponding author
Email: Ochieng.Justus1@gmail.com
Ochieng Justus, Department of Development Economics, Migration and Agricultural Policy, University of Kassel, Steinstr. 19, D-37213 Witzenhausen, Germany

challenges of improving productivity of their flock in terms of quantity of food (meat) and incomes generated from their sales.

The challenges are particularly great in Western Kenya where indigenous chicken production is characterized by low levels of inputs and outputs (Okitoi *et al.*, 2007), with low productivity levels, which limits their potential for commercialization. The potential of indigenous chickens in this region is not fully exploited when compared to the hybrid industrial chicken despite the growing preference for their meat and eggs. They are familiar with the consumers due to their tasty, safety and nutritious qualities and increasing shift towards traditionally produced animal products (Upton, 2000) hence the associated premium prices compared to the industrial hybrid chicken.

Furthermore, the indigenous chicken are better adapted to production circumstances of scavenging systems characterized by continuous exposure to disease incidence, inadequate quantity and quality feeding, poor housing and health care (Guèye, 1998). To achieve increased productivity, extension service has continuously disseminated management interventions to smallholders for mitigating these challenges. However, majority of smallholder farmers with smaller flock size hardly realizes improved productivity, which could be explained by the manner in which they selectively adopt or refuse to adopt disseminated management interventions package, production practices and challenges. The disseminated management interventions package to improve productivity of indigenous chicken includes housing, feed supplementation, vaccination, brooding, and chick rearing system (Njue *et al.*, 2006). This study was carried out to document management practices and challenges of smallholder indigenous chicken farming in Western Kenya.

2 Materials and methods

2.1 Study area

The study was conducted in the Rongo and Homabay Districts in Western Kenya (Fig. 1) where an average of 54 % of households lives below poverty line (GoK, 2005).

The study areas were chosen because households predominantly keep indigenous chicken for food and income and management interventions had been disseminated by extension services in order to enhance productivity levels as a process towards greater commercialization.

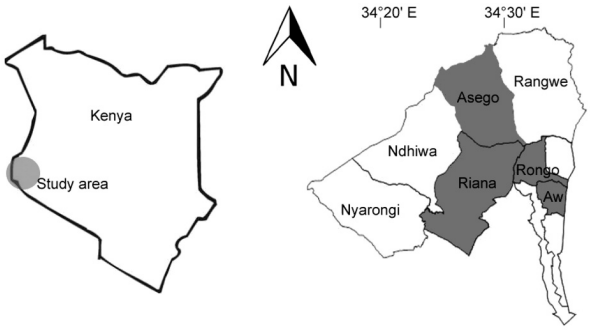

Fig. 1: *Map of Kenya and the study area of Rongo and Homabay District*

2.2 Sampling design and techniques

Multistage stratified sampling technique was used in this study. In the first stage, purposive sampling was used to select two divisions out of the six in Homabay district and two divisions out of three in Rongo district based on population of chicken and availability of market for chicken products. Awendo and Riana divisions were selected representing low indigenous chicken population density and low markets while the Rongo and Asego represented high indigenous chicken population density and high markets access. Second stage involved simple random sampling from the list of farmers provided by Kenya Poultry Farmers Association (KEPOFA) and Poultry Farmers Associations in the two districts. In each division, 30 farmers were obtained randomly giving a total of 120 respondents from all the four divisions in the study area.

2.3 Data Collection and Analysis

Structured interviews and focus group discussions were held during farm households visits to collect primary data. The farm household data of interest included household composition, chicken production practices, labour composition, farmer socio-economic characteristics, chicken management interventions, access to extension services, credit, other sources of household income. Descriptive statistics were used to evaluate collected data on the production practices and challenges in indigenous chicken production system. Data were analysed using Statistical Package for Social Scientists (SPSS).

3 Results

3.1 Demography and Institutional Support among indigenous chicken farmers

The farmers socio-economic characteristics considered in the analysis comprised gender, age, education, average flock size and household size. Institutional support characteristics are access to extension and credit services, training and group membership (Table 1).

Table 1: *Demographic and institutional support characteristics of smallholder farmers in Western Kenya.*

Variables	*Rongo (n=60)*	*Homabay (n=60)*	*Overall (n=120)*
Gender:			
Female (%)	65	86.7	75.8
Male (%)	35	13.3	24.2
Average age (Years)	42.6	42.76	42.7
Education (Years)			
Never went to school	3.3	5	4.2
1–8 years	35	83.3	59.2
9–12 years	28.3	11.7	20
13≥years	33.4	0.0	16.6
Average years of schooling (yrs)	10.6	7.18	8.9
Average household size (n)	6.7	6.6	6.7
Distance to the market (km)	2.6	5.98	4.3
Access to extension (%)	43.3	40	42.5
Extension service source			
NGO (%)	13.3	11.7	13.3
Government (%)	30.3	28.3	29.2
Access to veterinary services (%)	38.2	30	34.2
Access to credit (%)	40.7	55	47.5
Source of credit:			
Formal (%)	26.1	0	10.5
Semi formal (%)	8.7	2.9	5.3
Informal (%)	65.2	97.1	84.2
Access to training (%)	48.3	51.7	50
Group membership (%)	63.3	88.3	75.8
Access to market information (%)	65	50	60

Of the sampled farmers keeping indigenous chicken, women were the majority (76 %) with men representing only 24 %. There were few farmers (4.2 %) with no formal education while over half (59.2 %) had attained basic primary education level in Kenya. The average household size was generally high (seven persons) which is slightly higher than the national average of five persons (GoK, 2005). The farmer's age ranged between 21 to 80 years but the majority of the farmers were 43 years old while fewer young people engaged in indigenous chicken production activities. Distance to the market was on average 4 km away reflecting good access to markets for these farmers. However, farmers in Homabay had to walk longer distances (mean 5.98 km) to the market compared to those in Rongo district (mean 2.63 km) to access markets for chicken products and inputs. In the study area, the most threatening diseases to indigenous chicken production include New Castle Disease (NCD), Coccidiosis and Fowl typhoid.

In most extensive production systems, chicken production receive limited institutional support services such as extension services, credit, veterinary services, training and marketing of the products. Less than half of the farmers indicated having access to extension (42.5 %) and veterinary services (34.2 %) during survey period. Compared to those in Homabay, farmers in Rongo had better access to both extension (43.3 % vs 40 %) and veterinary services (38.3 % vs 30 %) indicating a regional imbalance in receiving extension and veterinary services. The importance of indigenous chicken production to rural households can be increased through proper and timely access to veterinary and extension services.

Accessibility to credit, training and market information facilitates adoption of management interventions in rural areas in Kenya. In the study area, credit was predominantly sourced through informal sources (84.2 %) than formal sources of credit (10.5 %) (Table 1). Informal credit was mainly obtained from groups, neighbours and friends. Semi-informal sources that consist of Micro Financial Institutions (MFI) (5.3 %) were less familiar with the farmers. The received credit comes with a challenge of fungibility as larger part of credit can be directed to meet other needs of the household. Moreover, 75.8 % of the farmers were members of various Self Help Groups (SHGs) with 63.3 % coming from Rongo and 88.3 % from Homabay district.

3.2 Flock structure and dynamics

The chicks, hens and pullets (80 %) dominated the flock structure and were mainly retained for production purposes (Table 2). On average households kept 23 chickens, two times higher than the reported average in Western Kenya (Njue *et al.*, 2006). Comparatively, flock size was higher in Rongo (26.3) than in Homabay (19.2). Farmers reported losing a large proportion of their flock to New castle disease (NCD), which is prevalent in the scavenging systems of Western Kenya. The few cocks (5.29 %) were mainly disposed through sales or home consumption. Farmers selectively leave one cock at a time for breeding purposes. The result also indicates that the number of chicks (45.31 %) and hens (18.29 %) were high in Homabay district.

Table 2: *Indigenous chicken flock structure (%) in Western Kenya.*

Indigenous chicken classes (n)	*Rongo (n=60)*	*Homabay (n=60)*	*Overall (n=120)*
Chicks	30.2	45.31	33.7
Pullets	29.4	16.23	25.10
Hens	17.82	18.29	21.27
Cockerels	16.97	14.23	14.60
Cocks	5.62	5.92	5.29
Flock size	26.30	19.78	23

Table 3: *Production system and flock dynamics (%) of indigenous chicken in Western Kenya.*

Variables	*Rongo*	*Homabay*	*Overall*
Production system:			
Free-range	71.7	86.7	80.0
Semi Free –range	28.3	13.3	20.0
Source of brooders:			
Buy	5.4	5.0	5.2
Local materials	94.6	95.0	94.8
Purpose of keeping IC*:			
Commercial	83.3	95.0	89.2
Subsistence	98.3	98.3	98.3
Celebrations/parties	8.3	15.0	11.7
Emergencies/funerals	11.7	25.0	18.3
Church contribution/tithe	11.7	11.7	11.7
Acquisition of initial breeding stock*:			
Direct purchase	80.0	68.3	74.0
Loan	28.3	33.3	31.0
Gifts	28.3	55.0	42.0
Inheritance	1.7	3.3	3.0
Reasons for slaughter of chicken*:			
Food for visitor	90.0	83.3	86.7
Reasonable ratio of cocks and hen	13.3	25.0	19.2
Prevent cock fighting	21.7	31.7	26.7
Hen does not lay eggs	73.3	31.7	52.5
Injury	30.0	13.3	21.7
Sample size (n)	60	60	120

* Multiple Responses

Many smallholder farmers acquired their breeding flock through direct purchase (74 %) with own capital or loan (31 %) which was relatively high compared to traditional acquisition of flock through gifts (42 %) and inheritance (3 %) (Table 3). Acquisitions of flock through loan involve mutual agreement to share chicken among two or more households. The flock mainly increased through random breeding and hatching of own chicks without buying of chicks, pullets and cockerels from hatchery or any market or indigenous chicken company in Kenya.

Over 90 % of the farmers prepared brooders from local available materials such as old cartons, old metal, old iron sheets, old cooking pots and plastic basins, timber, banana leaves commonly known in the study area as *thach* filled with ash, soil, sawdust, rugs or grass. In addition, many households slaughtered chicken mainly for food for the visitor (86.7 %), to prevent cock fighting (26.7 %), when a hen does not lay eggs or eat eggs (52.5 %) and to keep a reasonable ratio of cocks and hen (19.2 %).

Moreover, indigenous chicken was kept mainly for subsistence and commercial purposes (over 80 %) besides other uses such as church contribution, celebrations and emergencies like funerals. The common production systems were found to be free range (80 %) and semi intensive system (20 %). Indigenous chicken were predominantly kept in free range or scavenging system because it is cheap, less labour intensive and few management interventions are used. However, some farmers vaccinated and supplied the indigenous chicken with food supplements when they come back from forage at lunch time and in the evening. Battery and deep litter systems were not practiced by farmers in Rongo and Homabay Districts regarding them as too expensive and too labour intensive.

The usage of hired labour increased with intensification of IC production from free range to semi free range (Table 4). The households that used hired labour (27 %), supplemented it with family labour consisting of mainly women and children. In both production systems use of family labour was the most dominant in both regions. In free range and semi-free range systems, more than three quarter of the farm households used only family labour while the remaining a quarter hired labour.

3.3 Adoption of management interventions

Management interventions are technologies used by indigenous chicken farmers to improve the production and profitability of the enterprises. They include poultry disease prevention and control, predator control, suitable feeding and watering systems, improved housing, genetic improvement and chick rearing. Management intervention package disseminated to farmers comprise feed supplementation, vaccination, chick rearing, brooding and housing. Although, farmers had knowledge of the benefits of housing chicken flock, adoption of housing remained very low with majority of them (73 %) having no housing for chicken. They house chicken at night in their living houses or kitchens.

Consequently, indigenous chicken farm households experienced high mortality from diseases (96 %) within the first year of hatching, mainly from NCD. In addition to losses caused by NCD, other losses in rural areas include predators (87 %) such as birds like eagles,

Table 4: *Percentage (%) of farm households using labour by production system in Western Kenya.*

		Family only	*Casual only*	*Permanent only*	*Family & Permanent*	*Family & casual*
Free-range system (%)	Rongo	76.7	2.3	7.0	9.3	4.7
	Homabay	98.1	0.0	0.0	1.9	0.0
Semi-free range (%)	Rongo	58.8	11.8	0.0	29.4	0.0
	Homabay	75.0	25.0	0.0	0.0	0.0
Overall (%)	Free-Range	88.4	1.10	3.3	5.3	2.1
	Semi-Free Range	64.0	16	0.0	20.0	0.0

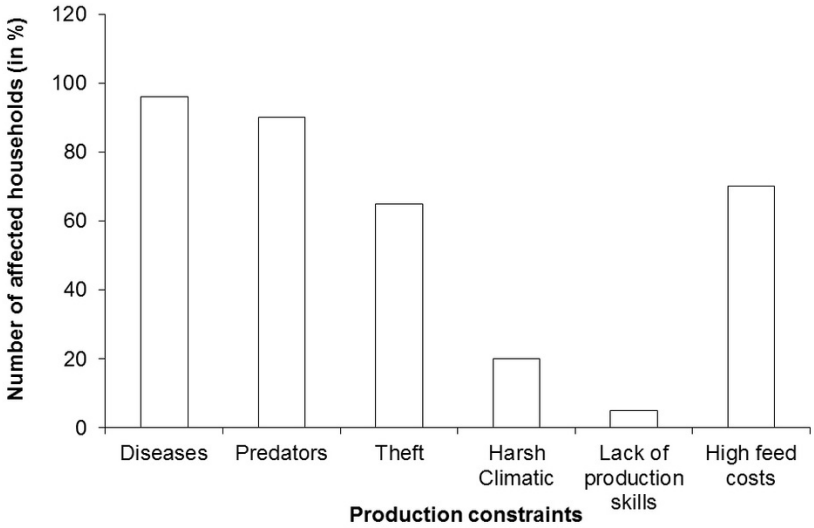

Fig. 2: *Indigenous Chicken Production Constraints in Western Kenya.*

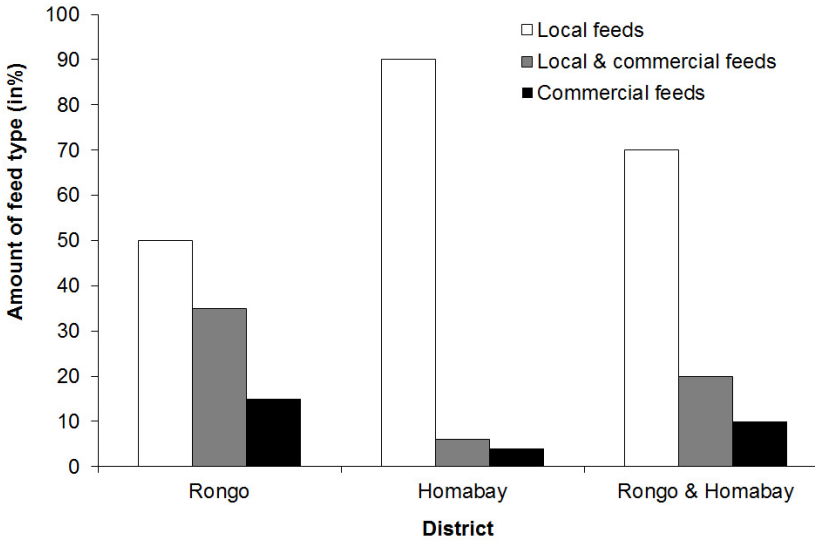

Fig. 3: *Types of Feed Used by Smallholder Farmers.*

hawks, crowns, wildcats and dogs. The other production constraints highlighted by farmers include theft (56 %), high costs of feeds especially commercial feeds (58 %), climatic conditions (14 %) and lack of knowledge in production skills and general management of indigenous chicken enterprises (6 %) (Figure 2).

In contrast to housing, feed supplementation was highly adopted with majority of the farmers using local feeds (74.6 %) and a few using commercial feeds (6.8 %) or both local and commercial feeds (18.6 %) as illustrated in Figure 3. The local feeds were mainly from homemade rations. In terms of feeding of indigenous chicken local feeds was of diverse ingredients including termites, shrimps (*ochonga*) from fresh lake fishing, water, earthworms and fish meal for protein supply. Other protein source included sunflower seed cake, rumen content mixed with blood then cooked. Energy sources were maize, sorghum, millet, poshomill remains, maize flour, kitchen remains and avocado. These were fed with vegetables (kales, cabbage).

The results indicate that only a few farmers (24.2 %) adopted and used the management interventions package as disseminated by the extension service while more than half (75.8 %) selectively adopted components of the management interventions package that suited their socio-economic conditions.

Table 5: *Adoption of management interventions by indigenous chicken farmers in Western Kenya* .

Management interventions (%)	*Rongo (n=60)*	*Homabay (n=60)*	*Overall (n=120)*
Vaccination	96.7	48.3	72.5
Feed Supplementations	60	57	58.3
Housing	43.3	8.3	25.8
Brooding	48.3	85	66.7
Chick rearing	56.7	25	40.8
Package	26.7	3.3	24.2

Management interventions package which consist of feed supplements, housing, vaccination, brooding and chick rearing practices was more adopted in Rongo (26.7 %) than in Homabay district (3.3 %).

4 Discussion

Indigenous chicken production is predominantly under management of women which is similar to results from other African countries (Aklilu, 2007). The credit from SHG was more familiar with farmers because it is readily accessible and plays an important role in increasing agricultural production, farm income, poverty reduction and improvement in household food security (Owuor *et al.*, 2004). Membership to groups help farmers to access group credit, share agricultural labour, joint input purchase, joint vaccination against NCD, extension services, lobby for favourable agricultural policies and promote unity among farmers. Although being a member to group enhanced access to extension; less than half obtained extension services from Non-Governmental Organizations (NGOs) and government. Regular extension visits are necessary to enhance adoption of management interventions because extension services provide information, knowledge and skills that enable farmers to address various production constraints (Ochieng *et al.*, 2011).

The flock structure reflects dominance of chicks, hens and pullets retained to sustain flock growth. In Western Kenya, 50 % of flock comprises chicks (Kaudia & Kitalyi, 2002) while cocks are fewer because are disposed through sales or home consumption. Comparatively, flock size was higher in Rongo than in Homabay as a result of more losses in chicken flocks from NCD reported in the latter region. Use of local feeds was popular because they are cheap, easily accessible and affordable and are mixed with commercial rations to keep costs low. Water supply was rather irregular for chicks in free range system against the threshold of five chickens per one litre of water every day and even more during hot weather (Ahlers *et al.*, 2009). Mostly they purchased chick mash and grower mash for chicks and growers in order to enhance growth. Though commercial feeds are of high nutritive values, costs are prohibitive and their suitability for indigenous chickens is yet to be resolved (Kingori *et al.*, 2003).

Majority of the farmers highlighted diseases as a major constraint in indigenous chicken production. Consequently, indigenous chicken experienced high mortality from diseases within the first year of hatching. The majority of the farmers highlighted NCD as a major constraint in indigenous chicken production. This disease kills between 50 % to 100 % of susceptible chickens particularly chicks (Ahlers *et al.*, 2009; Sonaiya & Swan, 2004) in Africa and Asia where adoption of chicken housing remains low (Nahamya *et al.*, 2006). The negative impact of diseases and predators can be reduced if the farmers take indigenous chicken production as an economic activity and vaccinate their flock. Vaccination of flocks is effective but most farmers were unable to vaccinate mainly because of lack of information, skills and high cost of vaccines (Njue *et al.*, 2006).

In general, more management interventions were adopted in Rongo than in Homabay because of better off-farm incomes and higher literacy levels which help them to conceptualize technologies better. Adoption of the package is influenced by socio-economic and location characteristics making farmers to adopt technolo-

gies that suit their specific circumstances. Few farmers had separate housing for their chicken with majority sharing their houses with the chicken. This leads to mortality from harsh production environment under which chickens are exposed into in free range system. Past studies indicate that chicken not housed are exposed to rain, cold, predators, theft and pose management difficulties in inspecting for signs of illness or injury and vaccination against diseases (Ahlers *et al.*, 2009). A study by Mekonnen (2007) also shows that predators, diseases and thefts account for 71 %, 28 % and 1 % of the losses in flocks respectively under free range production systems in Ethiopia. Therefore, improved housing for chicken would help to reduce various losses caused by diseases, predators and exposure to rainfall as they forage for feed.

The free range production system was the most practiced by farmers followed by semi-intensive which is consistent with results reported by (Guèye, 1998) for Africa. Free range system is mainly for subsistence but some products (eggs or live chickens) are sold to supplement family income while others are given out as gifts to friends and relatives. The system is very cheap and less labour intensive compared to semi-intensive and intensive systems. However, some studies have indicated that about 95 % of the indigenous chicken is raised under free range system by rural smallholder farmers in Ethiopia (Tadelle *et al.*, 2000). The difference varies from one region to another, where regions characterized by high poverty levels and poor arable soils preferring to keep indigenous chickens as an important asset for their livelihoods.

5 Conclusions

The indigenous chicken production in Western Kenya is largely reared in a low input- low output free-range system followed by semi-intensive system. Only a few smallholder farmers are able to adopt management interventions package yet adoption of full package is often associated with higher productivity. Therefore, policy makers and NGOs should mainly target women through training on the importance and application of management interventions at farmer and extension levels. Adoption of management interventions can be improved in rural areas through increased access to repackaged extension messages that considers farmers economic situation. Technical skills are required specifically in disease control, housing and equipment and collective marketing initiatives. Joint input purchase and collective marketing of chicken products are necessary for achievement of economies of scale and making indigenous chicken production a viable option to rural development in Kenya.

Acknowledgements

This study was financed by African Economic Research Consortium (AERC) through Collaborative Masters in Agriculture and Applied Economics (CMAAE) Program. The institutional support from Egerton University is highly acknowledged.

References

Ahlers, C., Alders, R. G., Bagnol, B., Cambaza, A. B., Harun, M., Mgomezulu, R., Msami, H., Pym, B., Wegener, P., Wethli, E. & Young, M. (2009). Improving village chicken production: A manual for field workers and trainers. ACIAR Monograph No. 139. Australian Centre for International Agricultural Research: Canberra. URL `http://aciar.gov.au/files/node/11129` 194 pp. Last Accessed 17.7.2012.

Aklilu, A. H. (2007). *Village Poultry in Ethiopia. Socio-technical analysis and learning with farmers*. Ph.D. thesis Wageningen University, Wageningen, The Netherlands.

Delgado, C. L., Mark, W. R. & Meyer, S. (2001). Livestock Revolution to 2020: The Revolution Continues. Annual meeting of the International Agricultural Trade Research Cons (ATRC), Auckland, New Zealand January 18th-19th, 2001.

GoK (2005). Geographic Dimensions of Well-Being in Kenya: Who and Where are the Poor? A constituency Level Profile. Government of Kenya (GoK), Ministry of Planning and National Development, Central Bureau of Statistics, Volume II, Nairobi, Kenya.

GoK (2007). Kenya Integrated Household Budget Survey (KIHBS) 2005/06. Volume 1. Basic Report. Government of Kenya (GoK), Nairobi, Kenya.

Guèye, E. F. (1998). Village egg and fowl meat production in Africa. *World's Poultry Science Journal*, 54, 73–86.

Kaudia, T. J. & Kitalyi, A. (2002). The Bangladesh model and other experiences in family poultry development: Commercializing rearing of village chicken in Kenya. INFPDE-Conferences International Network for Family Poultry Development (INFPD). URL `http://www.fao.org/ag/AGAInfo/themes/en/infpd/documents/econf_bang/add_paper12.html` accessed on April 22 , 2011.

Kingori, A. M., Tuitoek, J. K., Muiruri, H. K. & Wachira, A. M. (2003). Protein requirements of growing indigenous chicken during the 14–21 weeks growing period. *South African Journal of Animal Science*, 33 (2), 78–82.

Mekonnen, G. M. (2007). *Characterization of Smallholder Poultry Production and Marketing System of Dale, Wonsho and Loka Abaya Weredas of Southern Ethiopia*. Master's thesis Hawassa University, Awassa, Ethiopia.

Nahamya, F. H., Mukiibi-Muka, G., Nasinyama, G. W. & Kabasa, J. D. (2006). Assessment of the cost effectiveness of vaccinating free range poultry against Newcastle disease in Besedde sub country, Jinja District, Uganda. *Livestock Research for Rural Development*, 18 (11), Article No. 158.

Njue, S. W., Kasiiti, J. L. & Gacheru, S. G. (2006). Assessing the economic impact of commercial poultry feeds supplementation and vaccination against Newcastle disease in local Chicken in Kenya. Proceedings of a final research coordination meeting organized by the Joint FAO/ International Atomic Energy Agency (IAEA) held in Vienna, 24–28 May 2004.

Ochieng, J., Owuor, G. & Bebe, B. O. (2011). *Management Interventions and Indigenous Chicken Productivity: The case of Smallholder Farmers in Western Kenya*. Lap Lambert Academic Publishing, Saarbrücken, Germany.

Okitoi, L. O., Ondway, H. O., Obali, M. P. & Murekefu, F. (2007). Gender issues in poultry production in rural households of Western Kenya. *Livestock Research for Rural Development*, 19 (2), Article No. 17.

Owuor, G., Wangia, S. M., Onyuma, S., Mshenga, P. & Gamba, P. (2004). Self-help groups, a social capital for agricultural productivity. The case of smallholder maize farmers in Ukwala Division, Siaya District, Kenya. *Egerton Journal of Humanities*, 6, 159–176.

Sonaiya, E. B. & Swan, S. E. J. (2004). *Small-scale poultry production: technical guide*. FAO Animal Production and Health Manual 1. FAO of United Nations, Rome Italy.

Tadelle, D., Alemu, Y. & Peters, K. J. (2000). Indigenous chicken in Ethiopia: genetic potential and attempts at improvement. *World's Poultry Science Journal*, 56, 45–54.

Upton, M. (2000). The Livestock Revolution–Implications for Smallholder Agriculture: A Case of milk and Poultry Production in Kenya. Livestock Policy Discussion Paper No. 1. Food and Agriculture Organization (FAO), Rome, Italy.