FARMERS' PREFERENCES FOR TROPICALLY ADAPTED IMPROVED CHICKEN BREEDS IN SELECTED AGRO-ECOLOGICAL ZONES IN TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

Chickens contribute significantly to the socio-economic development and nutritional requirements of people in Tanzania. The overall objective of this study was to investigate smallholder farmers (SHFs) preference for the tropically adapted improved chicken breeds distributed by African Chicken Genetic Gain (ACGG) project in selected Agro-Ecological Zones (AEZs) in Tanzania. This study was carried out in twelve villages which were implementing ACGG project in both Mwanza and Mbeya regions. The multi-stage random sampling was employed from AEZs level to a village level in which respondents were systematically selected from chick distribution list. The data were collected using questionnaires in which 132 SHFs were interviewed. The results show that, majority of SHFs preferred improved chicken breeds due to fast growth, disease resistance, good body shape, escape from predators, good meat taste, good egg taste and higher egg production just to mention a few. The Logistic Regression (LR) results showed that, SHFs in Mwanza region had greater improved chicken preference compared to those in Mbeya region. The profitability results show that, with the average flock size of about nine mature chickens, SHF can generate TZS 13 685 per improved chickens and TZS 6 427 per local chicken in the study areas. It is concluded that, majority of SHFs preferred improved chicken breeds which have high potential for income generation compared to local ones. It is recommended that, an economically sustainable distribution program of improved chicks to rural societies of Tanzania should be encouraged and supported.

DECLARATION

I, Godwin Wolfgang, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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However, I am entirely responsible for any shortcomings in this study.

DEDICATION

My work is dedicated to the Almighty God (*Yahweh*), under whose protection I did my studies safely and successfully; to my favorite wife Jescar R. Mgaya and my beloved children Restidia, Goodluck, Godbless and Glory who light the torch of my academic career. Finally, the work is dedicated to Mrs. Enesa R. Mlay and her family for their physical, spiritual and moral support. May God bless them abundantly!

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LIST OF ABBREVIATIONS AND ACRONYMS

ACGG	African Chicken Genetic Gain
AEZs	Agro Ecological Zones
AGM	Average Gross Margin
AIDS	Acquired Immunity Deficiency Syndrome
ASDP	Agricultural Sector Development Program
AVC	Average Variable Costs
BA	Black Australorp
BB	Bovan Brown
DAICO	District Agricultural, Irrigation and Cooperative Officer
DV	Dependent Variable
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GM	Gross Margin
GMA	Gross Margin Analysis
HIV	Human Immunodeficiency Virus
IB	Isa Brown
IC	Improved Chicken
IK	Improve Kuroiler
ILRI	Internation Livestock Research Institute
IS	Improved Sasso
IV	Independent Variable
LC	Local Chicken
LM	Logistic Model
LPM	Linear Probability Model
LRM	Logistic Regression Model
MLE	Maximum Likelihoods Estimation
NBS	National Bureau of Statistics
NCD	New Castle Diseases
OLS	Ordinary Least Squares
OR	Odds Ratio
PK	Potchefstroom Koekoek
RUT	Random Utility Theory
SDG	Sustainable Development Goals
SHFs	Smallholder Farmers
SPSS	Statistical Package for Social Science
SUA	Sokoine University of Agriculture
TLMP	Tanzania Livestock Management Plan
TPBA	Tanzania Poultry Breeders Association
TVC	Total Variable Cost
URT	United Republic of Tanzania
USA	United States of America

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Chickens are the most popular poultry worldwide irrespective of culture and region. In 2017, the world chicken population was about 22.9 billion whereby China, Indonesia and United States of America (USA) were claimed to have the highest chicken populations (FAOSTAT, 2018). Chickens are used to produce both meat and eggs. Chicken meat is a good source of protein, improving farm family nutrition and contributing to the overall health of family members while eggs provide a constant source of nutritious food throughout the year. These are special benefits to special groups of young children, pregnant women, elderly and sick ones (Queenan *et al.*, 2016).

In Africa, almost every village household keeps at least a few chickens. In 2017, the African chicken populations were 1.9 billion whereby Morocco, South Africa and Egypt had highest chicken populations (FAOSTAT, 2018). It is estimated that local chicken (LC) breeds make up more than 80% of the total chicken population in the African continent (Mamo *et al.*, 2013). In addition, most African rural households use chickens as a source of high quality animal protein, emergency cash income, woman empowerment and food security (Padhi, 2016; Habte *et al*., 2017; Kamau *et al.*, 2018).

In Tanzania, about 86% of livestock-keepers own chickens (Da Silva *et al*., 2017). The chickens' population in the country was estimated to be 72 million, of which 40 million were local chicken and the remaining 32 million were exotic chicken, which included 24 million broilers and 8 million layers (Ringo and Mwenda, 2018). About 96% of local chickens were in Tanzania Mainland and only 4% in Zanzibar. Tabora, Shinyanga and Singida regions are claimed to have the highest number chickens which cumulatively accounted for 19% (URT, 2017). However, local chickens are associated with low

productivity due to their small body size reaching an adult weight of 1.5 to 1.9kg at an age of 24 weeks or more (Komwihangilo, 2015). A local hen produces less than 60 eggs a year in three to four clutches and wastes a lot of time brooding chicks (*ibid*).

There have been previous efforts to address productivity constraints to LC production in African countries. However, these efforts have had little success due to, among others, lack of a holistic approach in solving the constraints and dissemination of inappropriate technologies given the production circumstances (Magothe *et al.*, 2012). For example, exotic chicken (EC) breeds are often not suited to local conditions and demand high investments in feeds, veterinary support and energy, while local breeds were overlooked (Dessie, 2015). Thus, investing in these EC breeds is usually associated with high costs of production to smallholder farmers (SHFs). In cognizance of this, in November 2014, the International Livestock Research Institute (ILRI) and partners initiated new collaborative research project called African Chicken Genetic Gain (ACGG) project to provide better chickens to African farmers (*ibid*). This collaborative project distributed to SHFs high-producing but agro-ecologically appropriate improved chicken (IC) breeds suiting to local environment.

The introduced breeds which are Kuroiler and Sasso, produce both meat and eggs (i.e. dual purpose) with high level of productivity which is attributed by their genetic potential (Kamau *et al.*, 2018). These breeds are characterized by relatively high productivity due to their fast growth, high level of egg production and large body weight at maturity (URT, 2017). Under local scavenging environment, these IC breeds may gain weight and attain up to 3Kg at 43 weeks (Sharma *et al.*, 2015). This implies that, the introduced chicken could be practically anticipated to contribute positively to improved productivity of SHFs under local Tanzanian environment. This is consistent with government's strategy

stipulated in Tanzanian Livestock Master Plan (TLMP) of 2017 (URT, 2017) of selecting tropically adaptable semi-scavenging dual-purpose chicken breeds and which are suitable breeds for crossbreeding, and introducing them into the family chicken production systems. The implication hereafter is that, the introduced IC breeds have long term benefits to support poverty reduction, productivity growth, increased household animal protein intake, and the empowerment of women farmers in rural communities of Tanzania.

Therefore, ACGG project introduced IC breeds from India and France to demonstrate high-production potential under low-input systems to Tanzania SHFs. This study therefore intended to investigate chicken breed preferences such as eggs and meat productivity, carcass and meat quality, overall tropical adaptability under low-input production systems in Tanzania.

1.2 Problem Statement and Justification

Generally, LC breeds are dominant in terms of livestock ownership (URT, 2017) and have high potential to improve food security and household income of disadvantaged groups such as women and children (Dessie, 2015; Roy, 2017). Therefore, LC production is central in nearly all poor rural smallholder households. In Tanzania, majority of chicken breeds are low yielding, both in terms of egg and meat production (*ibid*). In average, a scavenging LC hen is estimated to produce an average of 40 to 60 eggs annually in three to four clutches while wasting a lot of time brooding chicks (Komwihangilo, 2015). The productivity of these LC scavenging hens is also low due to a long reproductive cycle caused by the natural traits of incubation and brooding (Habte *et al.*, 2017).

Therefore, following low productivity challenge, some research scholars such as Nigussie *et al.* (2015) and Padhi, (2016) argued that chicken genetic improvements are needed to

improve their genetics potential in order to meet the existing and future demand of chicken and their products. Moreover, the improvement should take into account the "traditional taste values" and their effect on market demand which in turn influence consumers' preferences for chicken (Sonaiya and Swan, 2004). However, the low productivity of LC may be attributed to the low production traits, management standards and to the pressure of infectious disease such as New Castle Diseases (NCD) and predation limiting production and utilisation of chicken products (Habte *et al*., 2017; Wong *et al*., 2017).

Hence, as an intervention to improve chicken genetics and delivery of adapted chickens to support poverty reduction, productivity growth, increased household animal protein intake, and the empowerment of women farmers in rural communities is required. Thus, the African Chicken Genetic Gain (ACGG) project as one of the interventions, disseminated to some smallholder farmers out of which 80 percent are women in five AEZs in Tanzania, the dual purpose improved Kuroiler (IK) and Sasso (IS) chicks in order to improve chicken productivity.

Moreover, the goal of ACGG project is to increase the access of SHFs to high-producing but agro-ecologically appropriate chickens by test improved breeds of chickens from India and Africa to demonstrate their high-production potential under low-input systems (Dessie, 2015). According to Abadi (2017), women are taking the vital role in managing and producing of rural poultry. Hence, the institutional support should target them before any other group.

However, from the evidence portrayed in some literature that improved chicken breeds are highly-producing ones, still there is inadequate empirical evidence on their preferences by

SHFs in Tanzania. Therefore, this study intended to fill this gap by analysing the SHFs chicken traits preference, socio-economic factors influencing their preferences and the profitability of introduced chicken breed kept by SHFs. The findings from this study will contribute to the body of knowledge and understanding on preferential traits, socio-economic factors influencing preference and the profitability of introduced chicken breeds to SHFs in the country vis-à-vis local ones. The results will be also be useful to key stakeholders involved in strategies and policy making at both local and national levels which supports the development of chicken subsector in Tanzania.

1.3 Objectives of the Study

1.3.1 Overall objective

The overall objective of this study was to investigate smallholder farmers' preference for the improved chicken breeds distributed by ACGG project in different Agro-Ecological Zones (AEZ) in Tanzania.

1.3.2 Specific Objectives

The study was guided by the following specific objectives:

i. To compare smallholder farmers' preferences for the improved breeds against local chicken in both Mwanza and Mbeya regions;
ii. To identify the factors determining smallholder farmers' preferences for the improved chicken breeds in the study areas; and
iii. To analyse the profitability of improved chicken breeds against local breeds in the study areas.

1.4 Research Hypotheses

In relation to specific objectives, the null hypotheses are stated as:

i. There is no significant difference in SHFs preference between improved and local chicken.
ii. Socio-economic factors have no significant influence to SHFs preference for improved chicken breeds in the study areas and;

iii. There is no significant difference in gross margins between improved and local chicken in the study areas.

1.5 Significance of the Study

This study provides information on smallholder farmers' preferences traits for the tropically adapted improved chickens, profitability and socio-economic factors influencing their preferences. The findings of this study will be useful to chicken producers, the ACGG project and to other stakeholders who are involved in developing policies and formulating strategies related to poultry subsector at both local and national levels. Specifically, this study will help the aforesaid stakeholders in proposing possible interventions in production and marketing of improved chicken. This will fasten the growth of improved chicken breeds subsector in the country, and thus contributing to poverty reduction and sustainability of the projects is attained. Furthermore, the study is expected to transform livestock towards higher productivity, commercialization level and SHFs income for improved livelihood, food and nutrition security and contribution to the gross domestic product (GDP), thus contributing to achieving of Agricultural Sector Development Program (ASDP II) and Sustainable Development Goals (SDG) at large.

1.6 Organization of the Dissertation

This study is organized into five chapters. Chapter one presents the introduction which include background information, problem statement, study objectives and research hypotheses. Chapter two presents the review of the relevant literature and the thoeries guiding the study while the third chapter is rooted to a detailed description of the study area and the methodology employed. The fourth chapter presents results and discussion of the findings while the fifth chapter presents summary, conclusions and recommendations that are drawn from the findings of this study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of Terms and Concepts

2.1.1 The concept of preference

Preference assumes different meanings, including that of comparative evaluation, prioritization or favouring, and choice ranking (Hansson and Grüne -Yanoff, 2018). According to Levin and Milgrom (2004), rational choice theory starts with the idea that individuals have preferences and choose basing to those. Preferences are also influenced by availability and accessibility of the information sources (Msoffe and Ngulube, 2017). That is, consumer always makes choice, and select most preferred bundle that is available. For example, given two bundles X and Y, bundle X is revealed preferred to Y if X is actually selected when Y was also available to the consumer (Cowell, 2004).

2.1.2 The gross margin concept

The gross margin (GM) for a farm enterprise is one measure of profitability that is a useful tool for cash flow planning and determining the relative profitability of farm enterprises. Generally, GM of a farm enterprise is obtained by farm output less the Variable Costs (VC) attributed to it. That is, when constructing GM, fixed costs (FC) or overhead costs are ignored, as it is considered that they will be incurred regardless of the level of the enterprise undertaken. For the non-forage based livestock like chicken enterprise, its VC includes the cost of acquiring concentrated feed, veterinary drugs, minerals and labour costs (Wooodend, 2010).

Profitability is measured using earnings before interest, taxes, and amortization, net farm income, operating profit margin ratio, rate of return on farm assets, and rate of return on farm equity (Langemeier, 2016). The GM for a farm enterprise is one of the tools that are

used to measure profitability of farm enterprises. The calculation of GM can be the starting point for construction of cash flow budgets and assessment of the whole farm profitability. However, when comparing GM of different farm enterprises one should only compare figures from farm enterprises with similar characteristics and production systems as farms are likely to have different overhead costs (Firth, 2002).

2.1.3 Agro-Ecological Zones of Tanzania

Agro-ecological zones (AEZs) are geographical areas exhibiting similar climatic conditions that determine their ability to support rain fed agriculture (Kate, 2009). AEZs in Tanzania range from higher rainfall areas on the coast and highlands in the North, far West, South and Southwest, to arid and semi-arid areas in the interior of the country (URT, 2014). On the other hand AEZs are also defined as land resource mapping unit, defined in terms of climate, landform and soils, and/or land cover, and having a specific range of potentials and constraints for land use **(**FAO, 1996).

2.1.4 Chicken production systems in Tanzania

It is estimated that 86% of livestock-keeping households in Tanzania own chickens (Da Silva *et al*., 2017). There are three major chicken production systems; traditional/indigenous, improved family chicken and commercial specialised chicken systems (*ibid*).

The traditional/indigenous family subsystem is an extensive scavenging dual-purpose system, with levels of low egg (50 eggs/ year) and meat (1.5 kg for mature chicken) production (*ibid*). Identifiable common ecotypes of LC found in Tanzania are Mbego Kuza, Njachama, Sasamala, Nambuta, Ntewa, Kapera, Bukini, Kisunzu (Komwihangilo, 2015; FAO, 2019). Other ecotypes which are less common and less distributed in the

country include: Mbeya, Morogoro-medium, Ching'wekwe, Kouchi, and Singamagazi (*ibid*).

The improved family chicken subsystem is a semi-intensive, semi-scavenging with about 150-240 eggs per year and attain up 2.5 kg live weight at maturity (Ringo and Mwenda, 2018; FAO, 2019). At present, two dual-purpose IC (Sasso and Kuroiler) have been introduced in Tanzania with purpose of providing a better alternative to SHF keeping LC commercially. The programs such as Tanzania Social Action Fund (TASAF), Agriculture Sector Development Program (ASDP) and District Agriculture Development Plans (DADPs), are encouraging cross breeding as a way to improve quality of LC breeds in Tanzania (*ibd*).

The commercial specialized chicken system is an intensive layers and broilers system with high productivity (2 kg live weight at maturity and 270 eggs/year) and therefore (high input – high output) system based on use of hybrid birds from international breeding companies and using professional housing, feeding and veterinary control systems and high attention to bio-security (Ringo and Mwenda, 2018; Da Silva *et al*., 2017). Some breeds like Black Australorp, Bovan Brown, Rhode Island Red, Light Sussex, and Plymouth Rock are commonly available in Tanzania, especially with local hatcheries and therefore are no longer imported (*ibid*).

2.2 Theoretical Framework

This study is based on Random Utility theory. The rationale behind this is, the bundle of goods contains attributes that give rise to farmers' utility and a bundle that yields maximum utility or satisfaction to the consumer is the most preferred.

Random Utility Theory (RUT) is based on the hypothesis that every individual is a rational decision-maker, maximizing utility relative to his or her choices (Ennio, 2009). RUT assumes that, an individual choose the most preferred bundle that yields the highest utility and that utility an individual attain, exists in the mind of the consumer, and cannot be directly observed (Navrud, 2007; Diaz *at al.*, 2014). Farmers as consumers prefer the goods through which their utility is maximized with respect to the production or consumption attributes (Laroche *et al*., 2008). In this case, it is chicken strains to keep. According to Lancaster (1966) goods possess attributes, and these attributes are the ones that give rise to consumers' utility.

Utility is a function of a vector of the attributes (and potentially socio-economic characteristics of respondents) and some unexplained component or random residual term (Diaz *et al*., 2014). Unordered choice models can be motivated by a random utility (RU) model (Green, 2012). For the i^{th} consumer faced with *j* choices, the utility of choice *j* is given as:

$$U_{ij} = Z_{ij} + \varepsilon_{ij} \quad \text{..... (1)}$$

Where U_{ij} is an individual utility for alternative i, Z_{ij} is observable part of the utility that consumer has for alternative i and ε_{ij} is a random deviate which contains all the unobserved determinants of the utility. If the consumer makes choice *j* in particular, then we assume that U_{ij} is the maximum among the *J* utilities. Hence, the model is driven by the probability that choice *j* is made, which is:

$$Prob(U_{ij} > U_{ik})\ \forall_{k \neq j} \quad \text{.....(2)}$$

In the light of this, the study presumes that smallholder farmers (SHFs) aim to become more productive through chicken farming in order to maximize their utilities. Therefore, SHFs prefer chicken breeds that are more productive in given agro-ecological zone.

2.3 Review of Empirical Studies

Vast number of studies on chickens has been conducted in different parts of Africa. Among other things, issues studied include production performance, farmers' perception, and weight gains. For example, Getiso *et al.* (2017) assessed the production performance of Sasso and Bovans brown chickens breeds under village production system in three agro-ecologies in Ethiopia. This study revealed that SHFs in most agro-ecologies SHFs preferred Bovans brown breeds due to their better scavenging ability, feed consumption and egg taste. However, the results also indicated that, under farmer management condition, production and productivity of the Sasso chicken breed is better than indigenous chicken. But lower than the Bovans brown breed in terms of egg production and disease resistance.

Again, Getiso *et al.* (2017) assessed management practices and productive performances of Sasso chickens breed under village production system in Southern Nations, Nationalities,and Peoples' Regional State (SNNPR), Ethiopia. This study revealed that, Sasso chickens were better in terms of preference traits of better than local chicken in terms of egg production, age at first egg laying and matured body weight both hen and cock and producing more meat as compared to LC. Despite low production and productivity of local chickens they were preferred by some SHF due to their better disease resistance, good mothering ability and better egg taste.

Furthermore, Abadi (2017) assessed perception of farmers on improved chicken breeds and its management condition in North Western Zone Tigray, Ethiopia. Despite the constraints encountered, SHFs were perceiving that producing IC have the benefits such as higher egg production capacity, fast growing ability of chicken and higher selling price of exotic poultry eggs as compared to the local ones.

However, Sharma *et al.* (2015) compared weight gains between Kuroiler chickens and local chicken raised under scavenging conditions by rural households in Uganda. The findings revealed that, the vast majority of the participating farmers preferred raising Kuroiler Chicken (KC) to Local Chicken (LC) because of better weight gain, texture and taste of meat and larger egg size.

Therefore, the experience obtained from literature review show that some SHFs preferred IC due their large body size, higher egg production capacity, fast growing ability and higher selling price of both chicken and eggs. Some studies indicate that, regardless of low production and productivity, LC were preferred due to better disease resistance, good mothering ability and better egg taste. Thus, numbers of empirical evidences which compare production and productivity of IC with LC still there inadequate information on performance of introduced IC in different AEZs of Tanzania. Then, this study dwells on SHFs preference for introduced IC in selected AEZs of Tanzania.

2.4 Analytical Framework

2.4.1 Regression analysis

There are many types of regression analysis; however, at their core they all examine the influence of one or more independent variables (IV) on a dependent variable (DV). Logistic regression (LR) is used to obtain odds ratio in the presence of more than one explanatory variable. LR works very similar to linear regression, with the exception that

the response variable in LR is binomial or dichotomous (Sperandei, 2013). The main advantage of this method of analysis is to avoid confounding effects by analysing the association of all variables together. This tool is relevant and useful in the determination of socio-economic factors that may influence SHFs preferences for the newly introduced improved chicken breeds.

2.4.2 Gross Margin analysis

A number of studies use both gross margins (GM) and net margins as indicators to estimate farming activities' profitability. Profitability synthetically is defined as the enterprise's capacity to obtain profit. Profitability is considered as a decisive instrument for the market economy mechanism, for shaping production according to consumers' needs (Geamunu, 2011). Therefore, it acquires the status of an essential criterion used for assessing economic efficiency (Cojocaru, 2000). Studies that have used GM analysis in measuring profitability include Ekunwe and Soniregun (2007). For example, Ekunwe and Soniregun (2007) used GM to study profitability of median scale battery cage system of poultry egg production. In that concept, the tool is relevant and useful in the determination of the profitability of introduced improved chicken breeds and local ones.

2.5 The Conceptual Framework

A conceptual framework is defined as a network or a plane of linked concepts (Jabareen, 2009). Mugenda and Mugenda (2003) defined a conceptual framework as a hypothesized model identifying the concepts under the study and their relationships. The study assumes that, physical attributes, production characteristics and consumption behaviour performances may also be influenced by characteristics of environmental factors. Thus, chickens in different agro-ecology are expected to perform differently. Environmental factors contributions to some chicken traits or characteristics which in turn lead to SHFs preferences. On other hand, the model in Figure 1 presents, SHFs preferences is also

influenced by their characteristics such as age, sex, Education level, occupation, Means of communication and number of years of schooling.

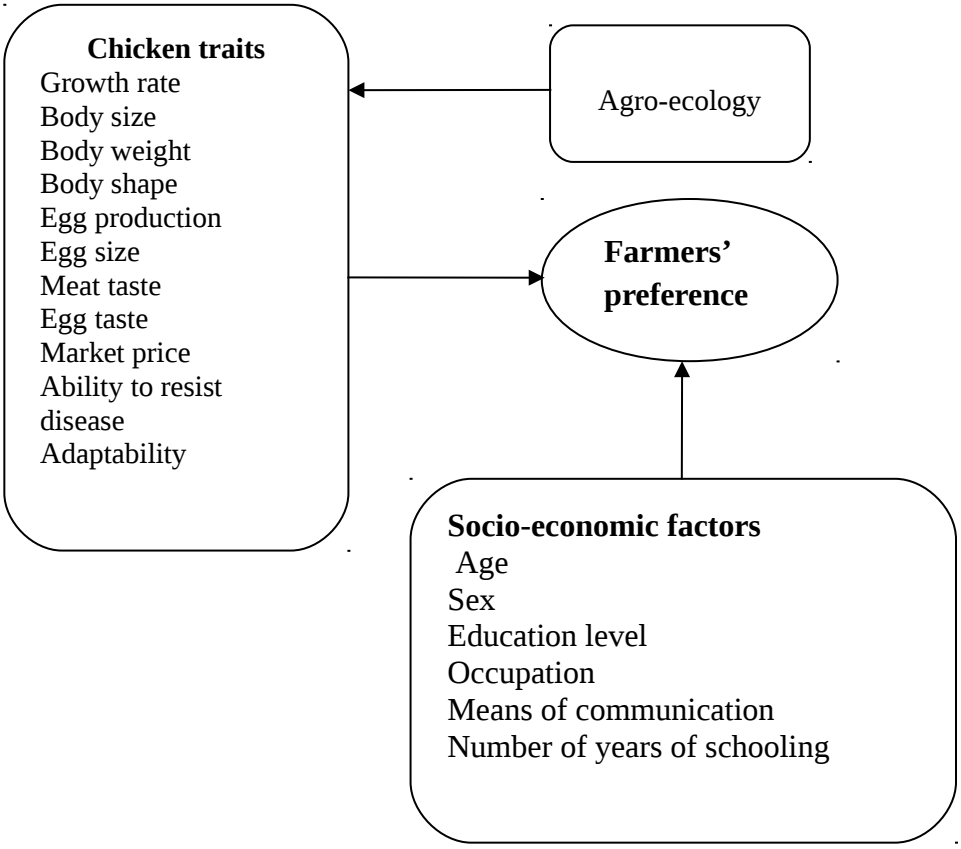

Figure 1: The conceptual framework

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

Tanzania is among of the African countries implemented the ACGG project. Other countries were Nigeria and Ethiopia (Ringo and Mwenda, 2018; Dessie, 2015). The project was implemented in five AEZs namely; Central Zone (CZ), Eastern Zone (EZ), Southern Highlands Zone (SHZ), Lake Zone (LZ), and Southern Zone (SZ) in Tanzania. In the study areas, SHFs received pre-vaccinated, 42 days old chicks of either the two improved breeds namely; Sasso and Kuroiler. The chicks were vaccinated against Mareks and NCD at the hatchery, followed by Infectious Bronchitis (IB) at 0, 7, 10, 16 and 21 days. NDC vaccine was repeated at 10 and 21 days using Lasota vaccine. At 6 weeks, the chicks were again vaccinated for fowl pox before being distributed to farmers.

This study was conducted in six villages of Lake Zone (Mwanza region) and six in the Southern Highlands Zones (Mbeya region) of Tanzania. Mwanza Region lies in the northern part of Tanzania, located between latitude 1^0 30' and 30 south of the Equator. Longitudinally the region is located between 31^0 45' and 34^0 10' east of Greenwich. Averages temperature is about 22.6 °C. The region experiences double or bimodal rains and receives much less rainfall in winter than in summer. Mbeya region on the other hand, is located in the South Western corner of the Southern Highlands of Tanzania. Average temperature ranges from 16 to 25°C. The region enjoys abundant and reliable unimodal rains. Since the regions experience different agro-ecological characteristics, the chicken performance is expected to differ accordingly (Figure 2).

Figure 2: A map of ACGG Project zones in Tanzania

3.2 Research Design

This study adopted a cross-sectional design. The design was adopted because; the study is observational or descriptive in nature which allows comparing many different variables at the same time. Meaning that, the study measures simultaneously the exposure and outcome in a given population and in a given geographical area at a certain time (Hemed, 2015).

3.3 Sample and Sample Size

The sample was obtained using Krejcie and Morgan, (1970) formula,

$$n = \frac{X^2 NP(1-P)}{d^2(N-1)+X^2P(1-P)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where X^2 is the tabulated value of Chi-square for one degree of freedom at the desired confidence level (i.e. 1.96 for 95% confidence level); N is the population size; *P* is the population proportion (assumed to be 0.50 which provide the maximum sample size) and *d* is the degree of accuracy expressed as a proportion (0.05). The study involved twelve

intervened villages with total of 264 households benefited from ACGG project (i.e. 22 households per village x 3 villages per district x 4 districts = 264 households). Based on the formula in equation 3, the actual sample size (n) was:

$$\frac{1.96*264*0.5*(1-0.5)}{0.05^2*(264-1)+1.96*0.5*(1-0.5)} \approx 113$$

The sampling interval was obtained by formula, K^{th} = N/n which is 264/113 = 2.34. Therefore, at a village level, respondents were systematically selected from Chick Distribution List (CDL) established by ACGG project enumerators where the 2^{nd} individual was selected for interview.

3.4 Sampling Procedure

The multi-stage random sampling procedure was employed from Agro-Ecological Zone (AEZ) to village level. In the first stag[illegible] Lake Zone (LZ) and Southern Highlands Zone (SHZ) were randomly selected out of five zones to get targeted sample size of 113. In the second stage, total of two regions (i.e. one region from each [illegible]ly Mwanza a[illegible]re randomly selected ou[illegible]s in each zone. In the third stage, total of four districts (i.e. two districts from each region) were [illegible]elected and se[illegible]cts were Misungwi and [illegible]f Mwanza region and Mbeya DC and Ileje of Mbeya region. Finally, a total of twelve villages (i.e three villages from each district) were also randomly selected. The selected villages were [illegible]aya[illegible] Mbeya[illegible]gole, M[illegible]dola in [illegible]; Mwambola, Nyamasale and Nyansenga of Sengerema district; Chamabanda, Mabuki and Nguge in Misu[illegible]

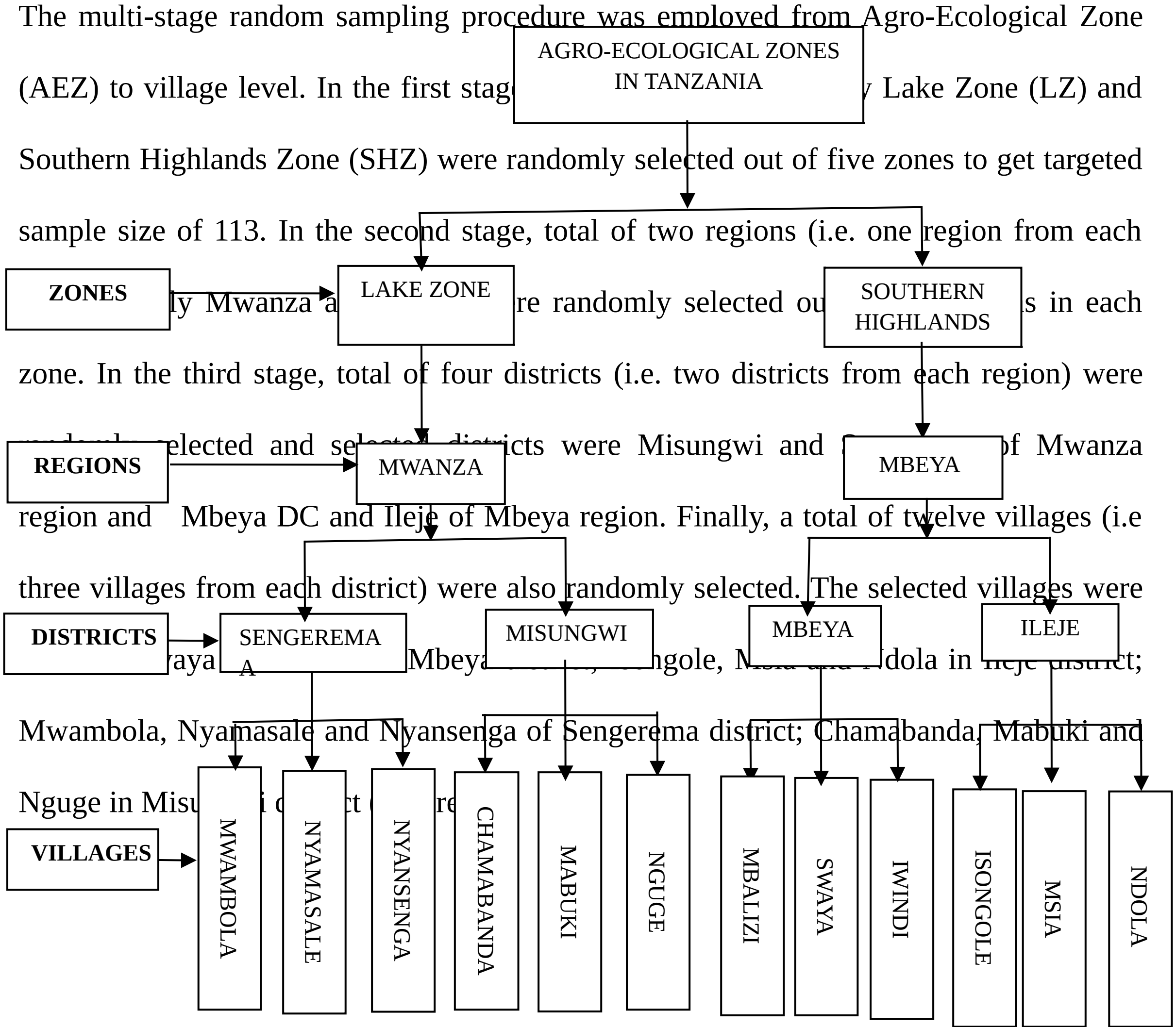

Figure 3: Multistage random sampling

3.5 Data Collection

The primary data were collected using structured questionnaires from smallholder farmers participated in the implementation of ACGG project (Appendix 1). A normal discussion with stakeholders specifically District Agriculture, Irrigation and Cooperative Officers (DAICOs), ACGG project enumerators was also conducted to ensure sufficient data is generated for meaningful analysis and evidence based recommendations.

3.6 Data Analysis

The data obtained were coded and recorded into the spreadsheets for statistical analysis. The data were analyzed using Statistical Package for Social Sciences version 16.0 (SPSS 16.0) and means, frequencies, and percentages and test statistic were generated.

3.6.1 Compare smallholder farmers preference

Descriptive statistics was used to analyse the first objective. The cross tabulation was used to obtain results on frequencies and corresponding percentages.

3.6.2 Logistic Regression (LR) analysis

The logistic regression model (LRM) was used to analyze the second objective. The LRM is also called Logit model (LM). The model is a non-linear specification that ensures predicted probability is [0, 1] for all independent values (IV). The cumulative distribution function of the logistic regression model is given in equation 4.

$$E(Y) = P = \frac{exp(X_i\beta)}{1+exp(X_i\ \beta)} \quad \text{..... (4)}$$

Whereby dependent variable Y= {1=if a farmer preferred improved chicken, 0=otherwise}.

However, the model cannot be estimated with ordinary least square (OLS), instead maximum likelihoods estimation (MLE) was used. The model in equation (2) can further be expressed as:

$$\frac{P}{1-P} = \exp\ (\boldsymbol{X\beta}) \quad \text{..... (5)}$$

$$\ln\ (\frac{P}{1-P}) = \boldsymbol{X\beta} \quad \text{.....(6)}$$

Whereby P is the probability for a farmer to prefer improved breeds, $1-P$ if a farmer does not prefer the breeds and $\boldsymbol{X}$ is the vector of independent variables (IV). Assuming

$y* = \ln\ (\frac{P}{1-P})$ therefore,

$y* = X\beta$ ..... (7)

Where X is the matrix of independent variables (IV) and β is the matrix of parameters

Table 1: Definitions of independent variables used in logistic regression model

Variable	Variable definition	Variable type	Measurement
Location	Location of respondent	Categorical	1=If respondent reside in Mwanza, 0=Otherwise
Age	Age of respondent	Categorical	1=35years, 0=Otherwise
Sex	Sex of respondent	Categorical	1=Male, 0=Otherwise
Education level	Education of respondent	Categorical	1=Went to formal school,0=Otherwise
Occupation	Occupation of respondent	Categorical	1=Farming, 0=Otherwise
Phone	Respondents owns phone for communication	Categorical	1=If farmers own a phone, 0=Otherwise
Years of schooling	Number of years of schooling	Categorical	1=Below 12 years, 0=Otherwise

3.6.3 Profitability analysis

The gross margin (GM) was used to analyze the third objective. Gross Margin Analysis (GMA) is preferred method because it allows for easy enterprise selection, establishment of net farm income and is useful in subsistence enterprises with small fixed income.

The GM is analysed as presented in the equation 8.

$GM = TR - TVC$ ..... (8)

$TR = P_i * Y$ ..... (9)

Whereby TR is the total revenue or total sales which is basically obtained by Price (P_i) multiplying by the amount of chicken sold (Y) while TVC is the total variable costs which includes the feeds costs, transportation cost and treatments or medication costs.

3.7 Limitation of the Study

During the study some limitations were encountered. The project aimed at keeping improved chicken breed at local environment where record keeping remains to be a challenge which may have an effect on statistics used in this study. One of the analyses carried out in this study was the profitability analysis using GM which requires proper record keeping on the sales and purchase. To overcome this limitation, GM was computed for all costs that were paid in cash rather than in kind. At village level, in some cases, it was difficult to locate some of the SHFs as respondents specifically due to a number of reasons including migration whereby some project beneficiaries, moved out of their homes for different farming activities such weeding, bird scaring and harvesting and other economic activities that require them to stay away from their families. In overcoming these limitations, the research team spent some addition time looking for respondents in the selected villages and those who completely missed were replaced by next smallholder farmer in the chick distribution list established by project enumerators.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Overview

The main objective of this study was to investigate smallholder farmers' preference for the tropically adapted improved chicken breeds distributed by ACGG project in selected AEZs in Tanzania. The specific objectives were to identify smallholder farmers' preference traits of chicken breeds; to determine the socio-economic factors influencing smallholder farmers' preference for improved chicken breeds; and to analyse the profitability of tropically adapted improved chicken breeds. The results of the study are organized as follows: section 4.2 highlights the socioeconomic characteristics of the respondents, 4.3 presents the data on farmers' preference; 4.4 dwells on the factors influencing SHFs preferences and 4.5 presents profitability analysis of both IC and LC.

4.2 Socio-economic Characteristics of the Respondents

This sub-section presents socio-economic characteristics of the respondents in the study areas. The information includes age, sex, education and occupation of SHFs as presented in Table 2.

Table 2: Socio-economic characteristics of the respondents

Variables	Variable description	Mwanza region (n=66)	Mbeya region (n=66)	Overall (n=132)
Age	Less than 36 years old	30(22.7%)	18(13.6%)	48(36.4%)
	Above 35 years old	36(27.3%)	48(36.4%)	84(63.6%)
Sex	Male	11(8.3%)	12(9.1%)	23(17.4%)
	Female	55(41.7%)	54(40.9%)	109(82.6%)
Education	Non-formal	7(5.3%)	9(6.8%)	16(12.1%)
	Primary education	56(42.4%)	54(40.9%)	110(83.3%)
	Secondary education	3(2.3%)	3(2.3%)	6(4.5%)
Occupation	Off farming activity	1(0.8%)	0(0%)	1(0.8%)
	Farming activity	65(49.2%)	66(50%)	131(99.2%)

4.2.1 Age of the respondents

The age of the respondents ranged from 21 to 80 years meaning that both younger and older SHFs were involved in ACGG project implementation. The results as presented in Table 2 shows that 84 (63.6%) were above 35 years old and the rest 48 (36.4%) were below 36 years old. But the overall mean age was 43.2 years indicating that most SHFs involved were of medium age and the active working group. This is the age group with enough time and energy to perform various income generating activities including chicken production to supplement their main household incomes (URT, 2013). Similar findings were reported by Oluwafemi (2015) that majority of respondents involved in chicken production are young people.

4.2.2 Sex of the respondents

The results as presented in Table 2 show that, most of the respondents in both regions were female 109 (82.6%) and only few respondents were male 23 (17.4%). The higher proportion of female respondents may be explained by the fact that female were purposeful targeted by the ACGG project for poverty alleviation through high producing chicken breeds as a pathway to women empowerment (Goromela *et al*., 2018). The results obtained by this study are similar to those reported by Mamo (2013), Dessie *et al.* (2013), Moreda *et al.* (2013), Oluwafemi (2015) and Pius and Mbaga (2018) that females constituted majority (about 80%) of the African smallholder farmers whereby chicken keeping is the business of females.

4.2.3 Education of the respondents

Most of the SHFs interviewed had formal education at the level of primary school 110 (83.3%) and very few had secondary school education 6 (4.5%) and the rest non-formal education 16(12.1%) (Table 2). Generally, the literacy level in the study areas was relatively high as the majority of the farmers had the minimum education level that

enables him/her to read and write. The higher proportional in literacy level found by this study represent a prospect for further intellectual growth and contribution to socio-cultural development of society (URT, 2017). The findings of this study is similar to those reported by Pius and Mbaga (2018) and Getu and Birham (2014).

4.2.4 Occupation of the respondents

Large proportion of SHFs i.e. 131 (99.2%) of the smallholder farmers were engaged in farming as their main occupation while, fewer i.e. 1(0.8%) respondents were engaged in off-farming activities (Table 2). The results were expected since the majority of individuals in rural Africa are essentially smallholder farmers and the results concur with those of Bukwelles (2015).

4.3 The Smallholder Farmers' Preference for Chicken Kept

This sub-section presents SHFs preferences for chicken breeds kept in the study areas. The following are the sections under this subsection.

4.3.1 Smallholder farmers' preference in relation to their socio-economic characteristics

The data on age variable showed that, older SHFs preferred IC compared to younger ones. That is, 63 (47.7%) of older SHFs preferred IC while 21 (15.9%) preferred LC while 41(31.1%) of the younger SHFs preferred IC breeds and the rest 7(5.3%) preferred LC ones (Table 3). On the sex variable, large proportion of female SHFs preferred IC compared to male SHFs. That is, 87 (65.9%) of the female SHFs preferred IC and the rest 22 (16.7%) preferred LC while 17 (12.9%) of male SHFs preferred IC and the rest 6 (4.5%) preferred LC.

On the education variable, SHFs who went to formal school had greater preference for IC compared to those who did not. That is, 93 (70.4%) of educated SHFs preferred IC and

remaining 23 (17.4%) preferred LC. Finally, farming SHFs greatly preferred IC i.e. 103 (78.0%) while 28 (21.2%) preferred LC ones.

Table 3: Smallholder farmers' preference in relation to their socio-economic characteristics

Variables		Breed preference		
		Improved chicken	Local chicken	Overall (N=132)
Age group	Below 36	41(31.1%)	7(5.3%)	48(36.4%)
	Above 35	63(47.7%)	21(15.9%)	84(63.6%)
Sex	Male	17(12.9%)	6(4.5%)	23(17.4%)
	Female	87(65.9%)	22(16.7%)	109(82.6%)
Education level	Non-formal	11(8.3%)	5(3.8%)	16(12.1%)
	Primary	93(70.4%)	23(17.4%)	116(87.8%)
Occupation	Off farming	1(0.8%)	0(0.0%)	1(0.8%)
	Farming	103(78.0%)	28(21.2%)	131(99.2%)

4.3.2 Smallholder farmers' preference in relation to their location

Majority SHFs i.e. 104 (78.8%) preferred IC while fewer 28 (21.2%) of them were still preferred the LC breeds (Table 4). The percentage of SHFs preference shows significant proportion difference ($p<0.10$) in the study regions. The findings of this study are not similar with those obtained by Roy (2017) that consumers had more trust in the way local breeds that were raised due taste, and were willing to pay more for the local chickens and eggs. It assumed that behavioural change was archived after awareness creation by ACGG project and practical experience in IC production.

Table 4: Smallholder farmers' preference in relation to their location

Breeds of preference	Mwanza region (n=66)	Mbeya region (n=66)	Total (N=132)	x^2 Value
Improved chicken	56(42.4%)	48(36.4%)	104(78.8%)	0.089*
Local chicken	10(7.6%)	18(13.6%)	28(21.2%)	

* Significant at 10%

4.3.3 Smallholder farmers adopted IC compared to those remained with LC only

During the study, it was found that majority SHFs i.e. 96 (72.7%) adopted IC while fewer of them i.e. 36 (27.3%) remained with LC (Table 5). The adoption percentage showed significant different ($p<0.05$) of SHFs adopted IC and those remained with LC in the study areas.

Table 5: Smallholder farmers adopted improved compared to those remained with local chicken only

Variable	Mwanza region (n=66)	Mbeya region (n=66)	Overall (N=132)	x^2 Value
SHFs remained with local chicken	11(8.3%)	25(18.9%)	36(27.3%)	0.06*
SHFs adopted improved chicken	55(41.7%)	41(31.1%)	96(72.7%)	

*Significant at 10%

4.3.4 Types of improved chicken breeds reared

In the study areas, both older and younger SHFs were equally producing Kuroiler chicken (KC) i.e. 24 (18.2%) while majority i.e. 60 (45.5%) older and 24 (18.2%) younger were keeping Sasso chicken (SC) i.e. 24 (18.20%) (Table 6). On the sex variable, majority of SHFs i.e. 67 (50.8%) females and 17 (12.9%) males kept SC while others 42 (31.8%) females and 6 (4.5%) males were keeping KC. On the education variable, majority of SHFs i.e. 67 (50.8%) educated and non- educated ones i.e. 17 (12.9%) were keeping SC while other educated SHFs i.e. 42 (31.8%) and non-educated i.e. 6 (4.5%) kept KC. Lastly, on occupation variable majority of faming SHFs 84 (63.6%) kept SC while others farming SHFs i.e. 47 (35.6%) and Off farming SHF i.e. 1 (0.8%) were keeping KC. Only age variable shows significant proportion difference ($p<0.05$) of IC reared by SHFs in the study areas.

Table 6: Types of improved chicken breeds reared during the study

Variable description	Improved chicken breeds reared			x^2 Value
	Kuroiler	Sasso	Total	
	Respondents age			
Below 36	24(18.2%)	24(18.2%)	48(36.4%)	0.014*
Above 35	24(18.2%)	60(45.5%)	84(63.6%)	
	Respondents sex			
Male	6(4.5%)	17(12.9%)	23(17.4%)	0.26
Female	42(31.8%)	67(50.8%)	109(82.6%)	
	Respondents education			
Non- formal	6(4.5%)	10(7.6%)	16(12.1%)	0.984
Formal education	42(31.8%)	74(56.0%)	116(87.8%)	
	Respondents occupation			
Off farming	1(0.8%)	0(0.0%)	1(0.8%)	0.186
Farming	47(35.6%)	84(63.6%)	131(99.2%)	

*Significant at 5%

4.3.5 Sources of improved chicken breeds reared

Majority of SHFs i.e. 53.8% obtained the improved stock from the ACGG project, 26.5% were obtained from others sources such as internal breeding which some IC managed to hatch their chicks and some were crossed with local chickens while 19.7% purchased from different sources including Silverlands Company. Sources of current stock for the IC breeds showed significant proportion difference ($p<0.05$) in the study areas. Meaning that, there were significant variations in percentages of IC breed sources in Mbeya and Mwanza regions. About 100% of the respondents bought the idea to raise the IC from the ACGG project.

Table 7: Sources of improved chicken breeds reared

Variables	Mwanza region (n=66)	Mbeya region (n=66)	Total (N=132)	x^2 Value
Sources of obtaining IC breeds				
ACGG	44(33.3%)	27(20.5%)	71(53.8%)	
Purchase	16(12.1%)	10(7.6%)	26(19.7%)	0.000*
Others	6(4.5%)	29(22.0%)	35(26.5%)	
Source of the idea for IC rearing				
ACGG project	66(50%)	66(50%)	132(100%)	-

*significant at 1%

4.3.6 Disease management

In total 130 (98.5%) of SHFs were using vaccines to control NCD, 117 (88.6%) were using veterinary medicines for de-worming, 111 (84.1%) were using veterinary medicines for coccidiosis treatments and 74 (56.1%) were using veterinary medicines for the pest control (Table 8). The high rate of major diseases treatment such as NCD, worms, coccidiosis, and delousing was expected due to project interventions, where medications and vaccines were initially provided and beneficiaries were taught on the important diagnosis and promptness in seeking advice for disease control. That is why other research scholars such as Sambo *et al.* (2014) argued that most poultry farmers tend to use herbal products to control a wide range of diseases for their flocks regardless of the appropriate doses. The management percentages of coccidiosis, delousing, *gumboro* and others (fowl pox and coryza) diseases show significant proportion difference ($p<0.05$) in areas of study. That is, despite similar interventions diseases management level of farmers in the study areas were different depending on the type of disease and level of awareness created.

Table 8: Disease management

Diseases/Vaccination	Mwanza region (n=66)	Mbeya region (n=66)	Overall (N=132)	x^2 value
Vaccination	64(48.5%)	66(50.0%)	130(98.5%)	0.154
De-worming	55(41.7%)	62(47.0%)	117(88.6%)	0.055
Coccidiosis	60(45.5%)	51(38.6%)	111(84.1%)	0.032**
Pest control	27(20.5%)	47(35.6%)	74(56.1%)	0.000*
Pox and Coryza	22(16.7%)	7(5.3%)	29(22.0%)	0.002*
Gumboro Disease	17(12.9%)	2(1.5%)	19(14.4%)	0.000*

*, and ** are significant at 1%, and 5% respectively.

4.4 Socio-economic Factors Determining Smallholder Farmers' Preference

This sub-section presents SHFs determining SHFs preferences for chicken breeds in the study areas. The factors include both socio-economic characteristics and preference traits of chicken.

4.4.1 Socio-economic factors influencing farmers' chicken preferences

The study assumed that, SHFs preferences are determined by location (agro-ecology), respondents' age, sex, education level, occupation, communications network (phone) and number of years of study at schools. For example, older SHFs preference is likely to stick to LC compared to IC. However, only the data on location variable conform to this assumption. In Table 9, SHFs in Mwanza region (Lake Zone) seemed to have greater preference to IC than SHFs in Mbeya region (Southern highlands) ($p<0.10$). This is because weather in Lake Zone supported IC performance compared to Southern Highlands.

Table 9: Socio-economic factors determining smallholder farmers' preference

Factors	B	S.E.	Wald	df	Sig.	Exp(β)
Location	-0.757	0.46	2.714	1	0.099*	0.469
Age	-0.451	0.507	0.793	1	0.373	0.637
Sex	-0.339	0.584	0.337	1	0.562	0.713
Education	0.242	0.639	0.144	1	0.704	1.274
Occupation	1.68	4.4E+04	0	1	1	5.364
Own cellular phone	0.728	0.467	2.432	1	0.119	2.071
Years of schooling	20.488	1.7E+04	0	1	0.999	7.9E+08
Constant	-21.335	1.7E+04	0	1	0.999	0.000

Nagelkerke R^2 (pseudo R^2) is 12.4%, * significant at 10%

4.4.2 Chickens characteristics

The study assumed that, SHFs preferences are also influenced by chicken characteristics such growth rate, body size, body weight, body shape, egg production, egg size, meat taste, egg taste, market price, ability to resist disease and adaptability. The results as presented in Table 10 show that SHFs preferred IC breeds due to their fast growth rate, large body weight, large egg production, ability to adapt, bigger egg size and sold easily at good prices. These findings are similar with those of Getiso (2017) who claimed that improved chicken breeds (Sasso) were selected for having large body size and producing high amount of meat. However, the percentage of high egg production, highly adaptive and easiness to sell at good prices for IC show significant different ($p<0.05$) in the two regions. However, despite the fact that, IC breeds have significantly superior performance compared to LC but specifically their performances differ across AEZs.

On the other hand, SHFs preferred LC due to ability to survive, ability to scavenge, brooding and hatching ability. The percentage of ability to survive show for LC showed significant proportion difference ($p<0.05$) in the two regions. This is due to fact that chicken breeds may differ in performance across AEZs. The results is in the line with those of Mulugeta *et al.* (2019) that the chicken breeds were well adapted in highland and midland agro-ecology and they were producing better than the ones kept in lowland agro-

ecology. Additionally, during ACGG project implementation egg production per hen per year ranged from 160–171 eggs and 156–168 eggs for Sasso and Kuroiler respectively. The mortality rate for Kuroiler was between 10–25% while Sasso was between 30–60% and more chicken died in the Lake zone followed by the Southern zone, while the lowest mortality was recorded in the central zone (Goromela *et al.*, 2018).

Table 10: Preference traits of chicken breeds

Chicken attributes	Mwanza region (n=66)	Mbeya region (n=66)	Overall (N=132)	x^2 Value
Improved chicken breeds				
Grow fast	40(30%)	36(27%)	76(58%)	0.481
Large body weight	43(33%)	33(25%)	76(58%)	0.078
Egg production	41(31%)	25(19%)	66(50%)	0.005*
Highly adaptive	47(36%)	19(14%)	66(50%)	0.000*
Egg size	34(26%)	23(17%)	57(43%)	0.053
Easily sold at higher price	33(25%)	15(11%)	48 (36%)	0.001*
Local chicken breeds				
Ability to survive	6(5%)	15(11%)	21(16%)	0.032**
Scavenging ability	8(6%)	12(9%)	20(15)	0.332
Good meat taste	6(5%)	13(10%)	19(14)	0.083
Good mothers	8(6%)	6(5%)	14(11)	0.572
Good hatching ability	8(6%)	5(4%)	13(10%)	0.381
Good egg taste	5(4%)	6(5%)	11(8%)	0.753

*, ** are significant at 5%.

4.5 Chicken Keeping Profitability Analysis

4.5.1 Chicken prices at farm gate (TZS)

During the study, it was observed that majority SHFs sold their chickens at farm gate prices. Generally, the IC breeds were sold at superior prices over the local ones but the prices of IC in Mwanza region (Lake Zone) differed with that of Mbeya region (Southern Highlands). The IC breeds in Mwanza region were sold relatively at high price of TZS 21 818 per chicken compared to the price of TZS 20 053 per chicken in Mbeya region (Figure 4). The results of the study is in line with results of Abadi (2017) who argued that most respondents mentioned that improved poultry breeds are superior over the local one

in the attributes of chicken fast growth, market price and egg production capacity. The percentage increase in price of IC as compared to that of LC is given by:-

$$\% \text{ increase in price} = \frac{\text{IC price} - \text{LC price}}{\text{LC price}} x100\% \quad \text{.....(10)}$$

From equation 10, in Mwanza region the percentage increase in price = $\frac{21\,818 - 13\,811}{13\,811} x100\% = 57.8\%.$ Likewise from equation 10, in Mbeya region the percentage increase in price = $\frac{20\,053 - 13\,545}{13\,545} x100\% = 48.0\%$.

Therefore, SHFs in Mwanza region reared IC as compared to LC and were likely get an increase in price of 57.8% while those in Mbeya region were likely to get an increase of 48.0%. The difference in percentage increase in price in two regions was influenced by perception of IC breeds as purely exotic breeds (broilers) by some customers. During the interview some SHFs in Mbeya region claimed that majority customers perceived IC as purely exotic chicken breeds.

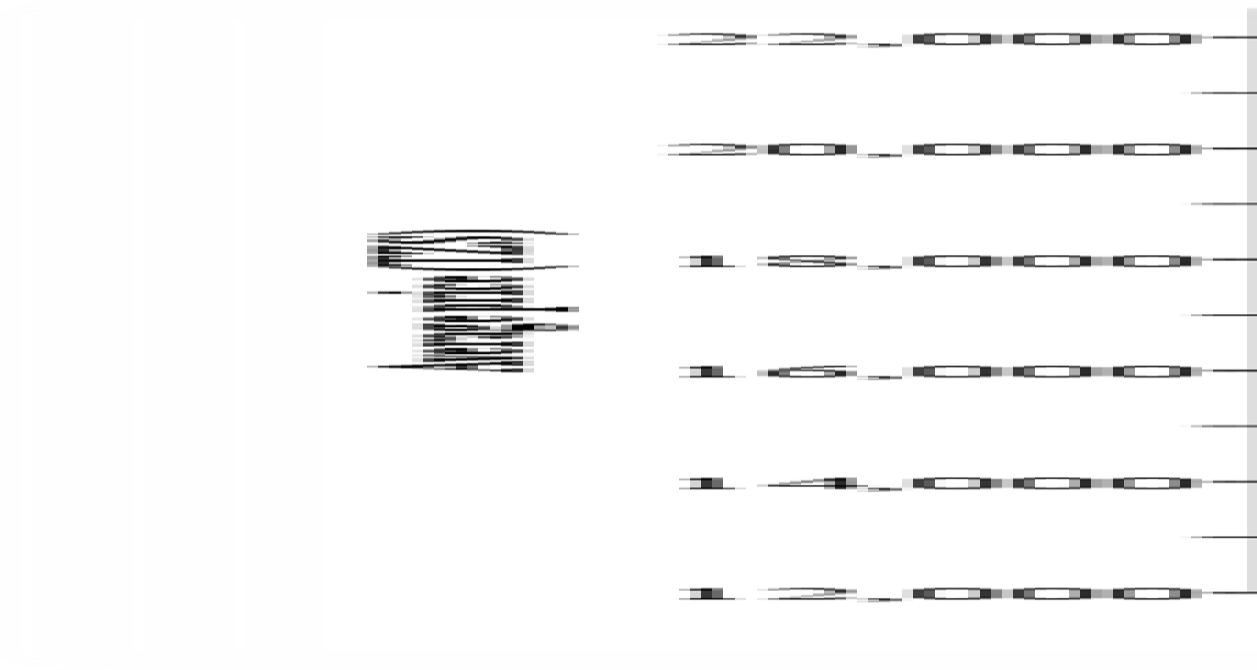

Figure 4: Average chicken selling prices (TZS) at farm gate

4.5.2 The Gross Margin Analysis (GMA)

The GMA approach was used to analyse profitability of chicken breeds. Generally, the average GM of an adult IC was TZS 13 685 while that of LC was TZS 6 427. The average GM of IC showed no significant difference (P<0.05) in both regions but the average GM of IC is twice the average GM of LC (Table11).

The percentage increase in Average Gross Margin (AGM) of IC as compared to that of LC is given by:-

$$\% \text{ increase in GM} = \frac{\text{IC average GM} - \text{LC average GM}}{\text{LC average GM}} \text{x} 100\% \quad \text{..... (11)}$$

From equation, in Mwanza region the percentage increase in average GM = $\frac{13\ 464 - 5\ 456}{5\ 456} x100\% = 146.8\%$ Likewise, from equation, in Mbeya region the percentage increase in average GM = $\frac{13\ 906 - 7\ 398}{7\ 398} x100\% = 87.9\%.$

Therefore, SHFs in Mwanza region reared IC compared to LC ones were likely get an increase in average GM of 146.8% while those in Mbeya region were likely to get 87.9%. The findings of this study is in line with Ahuja *et al.* (2008) that IC bring in much more market orientation and contribute significantly more to cash flows at the household level. The difference in percentage increase in average GM in two regions was influenced by the differences in market prices offered by customers. During the interview some SHFs particularly in Mbeya region reported that, some customers failed to differentiate IC from exotic breeds (broilers), thus offered lower prices.

Table 11: Smallholder farmers' profitability analysis

Variables	Mwanza region (n=66)	Mbeya region (n=66)	Overall (N=132)	Mwanza region (n=66)	Mbeya region (n=66)	Overall (N=132)
	Improved chicken			Local chicken		
Average chicken sold (Y)/SHF.	7	10	9	7	10	9
Average chicken market price (P)	21 818	20 053	20 936	13 811	13 545	13 678
Total revenue (TR)=P*Y	152 727	200 530	176 629	96 677	135 455	116 064
Supplementation cost	43 000	43500	43250	43 000	43 500	43 250
Transport cost	1 982	2 667	2 325	1 982	2 667	2 325
Medication cost	13 500	15 300	14 400	13 500	15 300	14 400
Total Variable Cost (TVC)	58 482	61 467	59 975	58 482	61 467	59 975
Gross margin (GM)	94 245	139 063	116 654	38 192	73 983	56 090
Average GM=GM/Y	13 464	13 906	13 685	5 456	7 398	6 427

4.6 Hypotheses Testing

The following hypotheses were tested during the analysis;

4.6.1 Hypothesis testing on SHFs preferences for the improved and local chicken

Test of hypothesis to compare SHFs preferences for the improved chicken against local ones was carried out. The essence of testing this hypothesis is to confirm if preference for improved chicken is significantly different from that of local ones. The null hypothesis states that, there is no significant difference in SHFs preference between improved and local chickens. The independent sample t-test indicates a significance value of 0.089 which is less than 0.10 meaning that there is significant difference in SHFs preference between improved and local chicken in the study areas.

4.6.2 Hypothesis testing on socio-economic factors determining SHFs preference

Test of hypothesis to identify the socio-economic factors determining SHFs preference for improved chicken was carried out. The null hypothesis states that, socio-economic factors have no significant influence to SHFs preferences for improved chicken in the study areas. The LR analysis results show that, location (region) variable significantly influenced ($p<0.10$) the SHFs preferences for the improved chicken breeds in the study areas. That is SHFs in Mwanza region seemed to have greater preference to IC than those

in Mbeya region. The Nagelkerke's R^2 suggests that the model explains 12.4% of the variation in the outcome.

4.6.3 Hypothesis testing on gross margin

The null hypothesis states that, there is no significant difference in gross margin between improved and local chicken. The independent sample t-test shows significant mean different ($p<0.05$) in gross margin between improved and local chicken. In the other hand the test shows significant difference in gross margin of improved chicken between Mwanza and Mbeya regions.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENTATIONS

5.1 Summary

The overall objective of this study was to investigate smallholder farmers' preference for the tropically adapted improved chicken breeds distributed by ACGG project in selected AEZs in Tanzania. The specific objectives were to compare smallholder farmers' preferences for the improved chicken breeds against local chicken in both Mwanza and Mbeya; to determine the factors influencing smallholder farmers' preference for the improved chicken breeds in the study areas; and to analyse the profitability of improved chicken breeds against local breeds in the study areas.

The results on preferences showed that majority SHFs i.e. 104 (78.8%) preferred IC while fewer 28 (21.2%) of SHFs were still preferred the LC breeds. However, older SHFs (i.e. above 35 years old) greatly preferred IC compared younger (below 36 years old). More female SHFs preferred IC compared to male SHFs and educated SHFs had greater preference for IC compared to those who did not go to school. Finally, SHFs participating in farming SHFs greatly preferred IC.

The SHFs preferred IC breeds due to their fast growth rate, large body weight, large egg production, ability to adapt, bigger egg size and sold easily at good prices. On the other hand, SHFs preferred LC due to ability to survive, ability to scavenge, brooding and hatching ability. The LR results showed that SHFs in Mwanza region (Lake Zone) seemed to have greater preference to IC than SHFs in Mbeya region (Southern highlands) ($p<0.10$).

The analysis of average prices showed that SHFs in Mwanza region who reared IC instead compared to LC ones were likely get an increase in price of 57.8% while those in Mbeya region were likely to get 48.0%. Generally, the average GM from selling IC is

TZS 13 685 while that obtained from selling LC is TZS 6 427. That is, average GM obtained per IC sold was twice as much as the average GM obtained from selling LC. The percentage increase in GM in Mwanza region was 146.8% while those in Mbeya region were likely to get 87.9%.

5.2 Conclusion

It is concluded that, majority SHFs preferred improved chicken breeds due to their performances. The improved chicken breeds have high potential in generating more household incomes compared to the local chickens.

5.3 Recommendations

5.3.1 Recommendation to smallholder farmers

Smallholder farmers should join efforts by forming farmers groups or cooperatives. The smallholder farmer groups/associations will help members in the following aspects:-

- Raise the general price level of improved chicken breeds and their products;
- Reduce per-unit costs by purchasing inputs in bulk in order to benefit from economies of size or scale;
- Develop new markets for improved chicken breeds and their products; and
- Access extension services and other services.

5.3.2 Recommendation to the policy markers

Due to the potentiality of IC to individual farmers' income as well as national income, it is recommended that, an economically sustainable distribution program of improved F1 chicks to rural societies of Tanzania should be encouraged and supported.

5.3.3 Area for further research

In regard with the findings emanated from this study, the researcher recommends further studies to focus on comparison of production performances of Kuroiler and Sasso chicken breeds under low input production system in selected agro-ecological zones in Tanzania.

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APPENDICES

Appendix 1: Questionnaire

A	**Enumerator's information**	
A1	Name of enumerator:	
A2	Telephone number:	
B	**General information**	
B1	Region of respondent:	
B2	District of respondent:	
B3	Village of respondent:	
C	**Respondent information**	
C1	Name of respondent:	
C2	Respondent Telephone number:	
C3	Age of respondent:	
C4	Sex of the respondent (1 = Male, 2 = Female)	
C5	Education level of respondent (1 = Non formal, 2 = Primary, 3 = O-level, 4=A-level, 5 = Above a-level)	
C6	Occupation of respondent (1 = Farming, 2 = Off farm, 3 = Salaried and 4=Others (specify…….)	

D: Flock size and chicken traits

D1: How many chickens do you have at present? ….....

Local chickens …….. Improved chickens…….. Crossed chickens ……

D2. What is the source of current stock? …….

D3: Which kind of chicken breeds you prefer most? ..... (1=Local breeds, 2=Improved breeds).

D3.1: If you prefer local chickens, give reason(s) for your preference.

1.....
2.....
3.....
4.....
5.....

D3.2: If you prefer improved chickens, give reason(s) for your preference.

1.....
2.....
3.....
4.....

5.....

D4: What kind of improved chicken you're currently raising? ..... (1=Kuroiler,

2=Sasso,
3= Black Australop (BA), 4= don't know)
D5: Where did you get the idea of raising these improved chickens? .....…..

(1=ACGG project, 2=Imitate from peer farmers, 3= others (specify……

D6: How do you perceive the following attributes in your flock?

Attributes		Local chicken	Improved chicken
1	Growth rate		
2	Adult weight		
3	Body size		
4	Body conformity		
5	Rate of lay		
6	Egg size		
7	Egg colour		
8	Extra feed requirement		
9	Egg number		
10	Survivability		
11	Scavenging ability		
12	Tolerance to disease		
13	Tolerance to feed and water shortage		
14	Escape from predator		
15	Meat taste		
16	Egg taste		
17	Temperament		
18	Plumage colour		
Code:1=Very poor, 2=Poor, 3=Average, 4=Good, 5=Very good, 6=Excellent			

F: Chicken feeding

F1: Do you give supplementary feed to your chickens at any time of the year? ..... (0=No, 1=Yes).

If yes, tick months when supplementary feed most abundant (tick all that apply):											
1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th

F2: If not, tell why? (Enter all that apply) …… (Codes: 1=Lack of awareness about supplementary feed, 2=Unavailable feed, 3=High cost of feed, 4=Time shortage, 5=Lack of money to buy feed, 6=others (specify)……

F3: If yes, fill in the table below on supplementary feeding types and methods for your chickens

What is the feed type you use?	1=Grains, 2=Vegetables, 3=Root crops, 4=Legumes, 5=Oil seeds, 6=Commercial feed (e.g. wheat bran, oilseed by-products, mash), 7=Kitchen waste, 8= Other (specify)
Any processing before feeding?	1=No processing, 2=Chopped, 3=Ground, 4=Other (specify) …….
What method of feeding is used?	1=Put into containers, 2=Thrown on ground for collective feeding, Other (specify)
What marketing channel is used?	1= Fellow farmer / individuals; 2=Traders; 3= Village market; 4=City market; Other (specify, e.g. NGO)
How do you transport the feed?	1= Walking (carrying feed), 2 = owned car/truck/motorcycle, 3 = hired car/truck/motorcycle, 4=seller brings the feed with his/her own transport, Other (specify)
What time do you provide supplementary feed? ……..	1=Morning only, 2=Afternoon only, 3=Evening only, 4=Morning &/or Afternoon, 5=Morning &/or Evening, 6=Afternoon &/or Evening, 7=Morning, Afternoon and/or Evening, 8 = Always available
What is the source of feed?	0=From own farm, 1=Purchased, 2=Both?
Number of months per year purchased	
Average monthly cost during months when purchased (including process)	
Average monthly cost of transport	

F4: If purchase, do you have difficulty with obtaining the feed during anytime of the year?

…… (0=No; 1=Yes; 77=Not applicable)

F5: If purchase feed, do you have issues/challenges with quality of feed you usually purchase..... (0=No; 1=Yes; 77=Not applicable)

G: Chicken marketing

G1: Do you think the following factors influence the chicken selling price? (Put code). Why?

Factors	1=Yes, 0=No	Why?
Age		
Bird sex [Hens, Cocks]		
Body weight		
Health condition		
Period of sale		
Market level		
Others (Specify)		

Factors	1=Yes, 0=No	Why?
……..		

G2: Indicate the chicken sales prices in different market levels as indicated in the table below

Factors	What is the average selling price per chicken? (Tsh).					
	Local chicken			Improved chicken ….....		
Age	Home market	Market nearby	Town market	Home market	Market nearby	Town market
<6 months						
6 to 12 months						
> 12 months						
Bird sex						
Cocks						
Hens						
Body weight						
Big (≥ 3 kg)						
Medium (1-2 kg)						
Small (≤ 1 kg)						
Period of sale						
Non-festive						
Religious Festival						
Traditional festivals						

H: Chicken sickness treatment

H1: Have you ever given you chicken any vaccine or any medication in the past 12 months. (1=Yes, 0=No)

Disease	Vaccination/Routine Medication in the past 12 months? (**0=No; 1=Yes**)	Vaccination/Routine Medication provider (**Code a**)	Total cost of vaccination/routine medication in the last 12 months (**0 = None**)
Newcastle			
Gumboro			
Coccidiosis			
Deworming			
Pest management			
Other (specify……			
a)Vaccination provider	0 = Self, 1=Government extension, 2=Private provider(e.g. para-vet, shop, company), 3=Cooperative or farmer group, 4= Research / training institute, 5 = NGO/Project, 6 = Other farmer / neighbour, 7= Local healer, 8=Certified vet, 9=Other (specify)		

I: Watering and housing services

I1: Is clean water made available to the birds throughout the day? ……

(0 = No, 1 = Yes)

I2: Do you provide your chickens with clean water in a specific container / trough? ……

(0=No; 1=Yes)

Do you provide your chicken with specific housing? ..... (0=No, 1=Yes)				
If specific housing, indicate				
Chicken Breed Type	Housing system (Code b)	Construction cost (Tsh)	When built (year)	Used for other breed/ species (code c)?
Local chicken				
Improved chicken				
Crossed chicken				
b) Housing system	0=Free range (no housing), 1= Chicken house (coop/hut) made from mud/iron sheet/wood/rocks/bricks, 2=Kept in home (e.g. kitchen), 3=Confined in individual cage, 4= Confined in basket (e.g. bamboo), Other (specify)			
c) Used for other breeds	0=no, 1= for all POULTRY species kept by the household, 2= for all breeds of chicken only, 3=with other livestock species			

D5: What are the biggest constraints/challenges you are currently facing in raising improved chicken? [Rank them].

a. High mortality, b. Low productivity, c. High feed demand, d. Shortage of feed, e. Disease, f. Predator, g. Poor market access, h. Low prices, i. Others (specify).....