Advanced Research Journal of Plant and Animal Sciences
Abbreviated Key Title: Advan. R. J. Pll. Ani Sci.
ISSN: 2360-7947 (Print) & Open Access
v12: (12): Pp.: 40-48, 2024

Volume-12 | Issue-12| December, 2024|
Full length Research Paper

Sustainability of Poultry Production: Socio-Economic Role and Alternative as Climate Change Resilience of Livestock Production in Ethiopia

[1]Seyoum Bekele Alemu, [2]Meseret Girma Abebe

[1&2]School of Animal and Range Sciences, College of Agriculture and Environmental Sciences, Haramaya University; Dire Dawa, Ethiopia;
Correspondence: meseretgirma4@gmail.com, P.O. Box 138, Dire Dawa, Ethiopia
Corresponding author: Seyoum B.A **Accepted:** 12/12/.2024 | **Published:** 17/12/2024

Abstract: The poultry enterprise sector in Ethiopia is crucial for the sustainability and development of the national economy. With rapid urbanization and a large population, family-based poultry production is becoming an urgent business issue for government organizations, NGOs, and private investors. Poultry products are processed into various food items, providing nutrition, food security, and export opportunities. However, the industry faces challenges such as limited inputs supply, lack of high-quality equipment, and ineffective utilization of local feed resources. Ethiopian poultry breeding programs should prioritize defining production environments and identifying farmers' preferences and production objectives to enhance productivity and conserve local chicken gene pools.

Keywords: Climate-change, Family-based, Resilience, Socio-Economic values

1. INTRODUCTION

The poultry enterprise sector is an important segment of the livestock industry that plays a crucial role in the sustainability and development of the national economy, starting with individual households across the country (Abera, 2022). This sector consists of different production levels and classes, including breeding, hatcheries, broilers and layers farms, and feed processing factorThe rapid urbanization and large population of Ethiopia present numerous alternative business opportunities for millions of youth and rural households, making the development of small-scale poultry production a pressing business concern for all government organizations, NGOs, and private investors. ors. The fast and Fast and easily ready-made food processing chains are expanding, while international brand names and global franchises are increasingly entering Ethiopian food processing markets such as hotels, restaurants, and cafes. Additionally, poultry products are increasingly being processed into vaFurthermore, poultry serves not only as a commercial commodity but also as a symbol of nutrition, promoting food security and generating opportunities for product export ties.

However, nowadays, the poultry production industry is faced with different challenges for its effective development, starting with limitations in input supply and processing and a lack of high-quality poultry production equipment, machinery, and feed ingredients (Ibsa et al., 2019). Furthermore, the feed processing value chain is limited, and the use of locally available poultry feed resources is not being effectively utilized. The other factor stemmed from producers' and consumers' poor understanding of the role of small-scale poultry production in society. This was caused by a lack of day-old chicks (DOCs) and parent stock, poor breed improvement practices leading to inconsistency, and the non-profitability of both the quantity and quality of the poultry products. Therefore, this review article aimed to assess and provide an insightful summary of poultry farming as an alternative climate change resilience strategy, considering the perspectives of farmers, consumers, and stakeholders.

2. Socio-Economic Roles of Family-based Poultry Production

The sustainability and socio-economic value of family-based poultry production can be explained by multiple roles. Egg consumption followed by egg and chick sale was the main purpose of keeping indigenous chickens in Ethiopia (Getachew et al., 2022). The objective of indigenous chicken production was to improve nutrition status and generate income sources for households since they could be reared in situations with limited feed and housing resources (Alem and Teweldemedhn, 2016). In many cases, eggs and poultry are the only and most common items women commercialise in the market. Specifically in the rural areas of Ethiopia, poultry provide women with immediate income to cover household expenses (e.g., food items) by themselves instead of expecting men to provide. Rural women raise poultry for income generation in order to purchase basic commodities such as salt, cooking oil, sugar, and others (Steve and Amdework, 2021).

2.1 Importance of family based Poultry Production

Farmers may engage on family-based poultry production for egg production to hatch and replace the flock with new chicks, and egg sale as alternative source of income and job opportunities and for home consumption and cultural/religious ceremonies (meat/egg) (Boere *et al.,*2018). Types and purpose of family-based poultry production has been summarized in Table 1.

Table.1 Purpose of raising local chicken

Production Types	Priority for	Reasons for the priorities	Ranks
Egg Production	Hatching/mothering ability	Mothering ability to replace the flock easily	1
	Home consumption	Easily and cheaply available protein meat	2
	Sale for income	To cull old and non-productive birds	3
Dual Purpose Production	Replacement(breeding)	To replace the flock easily by natural incubation	1
	Sale for income	To cull old and non-productive birds	3
	Home consumption	Easily and cheaply available protein meat	2
	Cultural/religious ceremonies	Gift and gratitude to strengthen social bond	4
	Create Job opportunity	Only jobless family members participate	5
Meat Production	Home consumption	To cull old and non-productive birds	3
	Sale for income	Sold for their meat markets	1
	Cultural/religious ceremonies	Consumed during cultural, religious and holidays	2

2.2 Management Practices of Family-Based Poultry Production

2.2.1 Feeds and feeding system

Traditional scavenging systems are widely practiced with some sort of supplementary feeding, which accounts for about 96% in most parts of Ethiopia. The major supplementary feed is composed of a mix of various crops produced on farms. These supplementary feeds are more applied during the rainy/wet season (July to September) than the dry season, and this coincides with the shortage of grain and difficulty for scavenging during the rainy season. The amount of additional feed provided depends upon the availability of resources in the house (Dessie et al., 2022).

2.2.2 Water and Watering Frequencies

In family-based poultry farming systems, water is offered to chickens on an ad libitum basis, with varied frequencies in different parts of Ethiopia. Chickens are provided water ad libitum (free access), three times/day, twice/day, and once/day in different parts of Ethiopia (Andualem, 2020). The major sources for household water supply are rivers (30.4%), springs (28.5%), locally constructed underground water (21.4%), and hand-operated pipe water (19.7%). The frequency of cleaning watering troughs varies across different parts of Ethiopia; farmers tend to pay little attention to these troughs, and sometimes they use them without cleaning them for extended periods. Unclean watering troughs are one of the major sources of contamination and infection in village chicken production (Berhanu *et al.,* 2020).

2.2.3 Breeding practices and Housing system

Most farmers construct houses for their chickens using locally available building materials, providing them with separate over. The farmers construct a separate house specifically for their chickens, which they perch inside the main house, on the floor covered by bamboo (known as a kirchat basket), or on the ceiling of the main house, under or beneath locally constructed seating (known as a medeb). However, some farmers keep their chickens at various locations within the main house, sharing them with family members (Adisu, 2013).embers (Adisu, 2013).

2.2.4 Economical Trait Preferences of local chicken

In most parts of Ethiopia framers may prefer different economical important traits along with environmental adaptability of birds (Fekede & Tadesse, 2021). The farmer's preferences and rejection on different ecotypes with reasonable justifications are presented in Table 3.

Table 2: Trait Preferences of Farmers

Colours/plumage	Reason for Preferences	Rejection for preferences
White rose comb	Plumage for cultural ceremony	Easily detected by predators
Black 'Tikur'	For sale and plumage/camouflage from predators	Culturally believed as unlucky and indicate unfortunate phenomena
Red 'key'	Plumage for cultural ceremony	Easily detected by predators
Black grey 'gebsima'	For sale and plumage/resistance from predators	Lack defined colour
White redish"wesera"	Plumage for cultural ceremony	Easily detected by predators
White grey 'gebsima'	Plumage Cultural ceremony	Lack defined colour
Spotted"teterima"	Camouflage from and cultural ceremony for plumage	Lack defined Colour
Rose/double comb(Hen and cock)	Resistant to attack/cannibalism by other birds	-
Single combs (Hen and cock)	Used as ornaments and game birds for their combs	Vulnerable to cannibalism by other birds

Table 3: Household participation on Family-based Poultry Production

Households	Roles	Education level	Shares/owner of the birds	Rank
Women	Mange and decide the purpose of chicken production(for sale, breeding, home consumption) Marketing(sale and buy)	Any level	Family/house queen	2
Men(head of household)	Manage and decide the purpose of chicken production(for sale, breeding, home consumption)	Any level	Family/house head	3
Children (boys and girls)	Manage the birds(provision of feed, watering, guide to shelter at night) Marketing(sale and buy)	Primary- High school	Family/children only	1
Other members	Mange the birds(provision of feed, watering, guide to shelter at night)	Any level	Family/children only	4

There are different types of interventions to improve chicken breeds and genetics for enhancing existing chicken productivity. Including the introduction of exotic breeds and crossbreeding and selection of indigenous. Lack of addressing productive and adaptable chicken breeds still remains one of the most critical challenges to increasing the economic contribution of the sector (FAO, 2019). These traits are mainly due to cultural importance; the explanation may be the fact that farmers in the area use poultry for ceremonial purposes during various festive periods where plumage colour plays an important role. Chickens with white plumage colour are preferred during most holidays (for example, for New Year), and chickens with predominantly black plumage colour are generally believed to cause misfortune as an expression of magic phenomena (Faustino *et al.,* 2010).

Semi-subsistent farming systems, where chickens are kept for multiple purposes under low/no input, adaptive traits are of considerable importance to farmers. Disease resistance attracted the highest preference, which implies the economic importance of the adaptive traits of chickens. In Ethiopia, there exists a diverse indigenous chicken gene pool, and genetic improvement for enhanced antibody response, resistance to parasitism, and productivity within and across chicken ecotypes is achievable (Psifidi *et al.,* 2016).

Farmers develop diverse alternative ways to improve village poultry productivity, targeting locally adaptable genetic resources given the most value. This approach could potentially provide improved chickens that are readily acceptable by farmers and facilitate the conservation of locally adaptable chicken genetic resources. The trait of mothering ability, which required high production performance measured by the ability to hatch an optimum proportion of incubated eggs and looking after chicks, is ranked above the traits of egg production performance and body size of chickens (Yadeta *et al.,* 2019).

This is likely because poultry keeping in rural Ethiopia is semi-subsistence-orientated; farmers have limited access to markets and hence place less value on egg production. However, the farmers preference for traits contradicts the Ethiopian government's ongoing efforts to enhance the productivity of village poultry by introducing commercial and specialised egg layer-improved chickens (Berhanu *et al.,* 2020).

Traditional economic analysis prioritizes egg and meat production, often overlooking the adaptive significance of chickens. This suggests the need to revisit the national strategy to enhance village poultry productivity and rural livelihood. It is important to understand farmers' preferences and production objectives in the prevailing production system in order to achieve increased productivity in village poultry. Good mothering ability, a preferred trait of chickens by farmers, is characteristic of indigenous chickens in rural Ethiopia (Zelalem, 2015).

Productivity and wider adoption of new breed technologies should target indigenous chicken genetic resources. Noticeably, meat and egg taste, a typical attribute of indigenous chicken, was also among the highly preferred and valued traits of chicken. This is an incentive for farmers to keep indigenous chicken and an opportunity to preserve the local genetic pool at the farm level (Shishay *et al.,* 2016).

The prevailing production system, future breeding programs need to consider indigenous genetic resources, targeting the preferred and most valued traits of chickens, to enhance village poultry productivity (Aditya *et al.,* 2013). The chickens kept by smallholder farmers are unimproved indigenous flocks, well-adapted to the local environments but having slow growth rates and minimal egg productivity (Tadelle et al., 2001; Addis and Aschalew, 2014).

In Ethiopia, the improvement of the productivity of indigenous chicken ecotypes is mainly focused on the introduction of high-yielding exotic chickens to replace indigenous stocks, but it is still limited due to the failure of imported exotic breeds due to less adaptation to local environmental conditions, poor management, lack of input and output markets, and shortage of quality feeds, vaccines, and veterinary inputs. The imported exotic chicken for genetic improvement schemes has failed (Teklewold, 2006; Fulas et al., 2018; FAO, 2019; and Nigussie, 2011).

The Ethiopian poultry breeding programs require and give priority to defining production environments and identifying the breeding practices, production objectives, and trait choices of village farmers as inputs for developing appropriate breeding strategies. Ethiopian poultry breeding programs should use the approach considering the preference and production objectives of farmers to achieve the twin goals of enhanced productivity and conservation of the adaptable local chicken gene pool. An alternative to local genetic resources is the introduction of chicken strains that are adaptable to the tropics and resemble the local chicken traits that are preferred and highly valued by farmers (Fikadu, 2021).

Farmers' religious backgrounds, ages, and education levels were found to be a source of preference heterogeneity. Chickens with predominantly white plumage colour were not preferred by followers of Ethiopian Orthodox Christianity, reflecting the sociocultural significance of chickens with predominantly red plumage colour. Disease-resistant chickens were preferred by older respondents, and this could be because older farmers have more risk-aversive behaviour and a lack of access to animal health services. Similarly, farmers with higher education levels preferred chicken profiles with good meat and egg taste (Dana *et al.,* 2010).

Farmers preferred chickens with larger body sizes compared with smaller ones. The trait "eggs per clutch" displayed a positive mean parameter, indicating farmers' preference for hens that lay a larger number of eggs per clutch. The farmers prefer chickens with good disease resistance; mothering ability, meat, and egg taste are the typical attributes of Ethiopia's indigenous breeds of poultry. To enhance productivity of the village poultry sector through the distribution of exotic chickens that were characterised by poor mothering ability, they were not preferred (Nigusie, 2021).

Ethiopian farmers select hens and cocks for breeding purposes and retain hens in the flock mainly because of high egg production, followed by body size/weight, brooding ability, and the growth rate in other ways. Body size/weight was ranked first, followed by egg productivity, brooding ability, and growth rate for selection of traits for egg and meat production (the majority of farmers selected breeding hens based on egg production, brooding ability, large body size, plumage colour, and comb type; Haile Michael *et al., 2015*).

The genetic diversity in terms of both productive and adaptive traits is yet to be unravelled. The availability of village chicken resources forms the basis for transforming the subsistence mode of production to a more economically productive base. Given that the potentials, major constraints, and possible solutions for improved production have been identified, it is imperative to conclude that a holistic, interdisciplinary approach to rural poultry production, including institutional and organisational capacity, is important to tackle the major constraints and to bring the anticipated improvements.

In view of the experiences from past poultry improvement programs, which have centered on introducing commercial exotic stocks, a new approach aiming to increase flock productivity instead of individual animal productivity using locally available resources is suggested (Fisseha, 2010).

3. Egg Production Performance of Local (Indigenous) Chickens

Egg quality characteristics from local (indigenous) chickens were assessed based on external and internal quality attributes. External egg quality includes egg shape and texture, egg color, egg shape index, egg shell, and whole egg and shell weight (Fisseha, 2010). The average weight of eggs from local hens is 43 gm (with a range of 34–60 gm), while the average weight of eggs from Ethiopian local breed chickens is 47 gm.

The average dry shell weight of eggs from local hens in different parts of Ethiopia is 4.5 g. Eggs with higher shape index percentages are more circular in shape than those of eggs with lower shape index percentages. The 'normal' chicken eggs are supposed to be elliptical (oval) in shape, and eggs that are unusual in shape, such as long/narrow, round, and flat-sided, would not be placed in grades AA or A in the developed world (Fisseha, 2010).

3.1 Feed intake

Farmers offered feeds for their chickens from local poultry feeds such as sorghum, maize, wheat, barley grain, and grain by-products and human food left with or with no processing and addition of any supplementation twice at (8:00 AM and 5:00 PM) hours a day, and refusals were collected the next morning. Elwardany et al. (1998) determined the difference between the feed offered and the refusal for each individual farmer, taking into account the feed consumed and feed intake, and then divided this difference by the total number of chickens owned by each farmer.

3.2 Feed conversion ratio (FCR)

The feed conversion ratio was determined by calculating the weight of feed consumed and egg mass (Zhenhua*,* 2018).

$$\text{Feed Intake(gram/day} = \frac{(\text{Feed offered(gram)} - \text{Feed refused(gram)})}{\text{No of layers in replication}}$$

$$\text{FCR} = \frac{\text{Feed consumed (gram / hen / day)}}{\text{Egg mass (gram / hen / day)}}$$

3.3 Egg production Performances and egg mass

Egg production Performances of local chickens will be assessed by collections of eggs per day along with the number of birds alive and recorded as daily egg production. All eggs were weighed immediately after collection for each day. The rate of lay for each day was expressed as the average percentage of hen-day egg production (HDEP %) and computed taking the average values from each day following the method of Hunton (1995). Then egg mass was calculated on a daily basis by multiplying average egg weight with (HDEP %) (Taju *et al.,* 2015).

$$\text{Hen-day egg production \%} = \frac{\text{No of eggs collected per day}}{\text{No of the hens present that day}} x100$$

M = P * W

W =M/P

Where M=average egg mass/hen/day

P=number of egg production/hen

W= average egg weight (g)

3.4 Assessment of Internal Quality of Table Egg collected form market

3.4.1 Eggshell weight and strength

Representative egg samples were randomly collected from farmers, and each sample weighed. We then broke the egg thoroughly and separated it from the shell membrane. The eggshell weight was measured by an electronic sensitive balance, and shell thickness was measured with a screw gauge micrometre having a sensitivity of 0.001 mm at three positions of the egg, which were taken from the air cell (broad end), equator, and sharp endpoints. The average of the three measurements was taken as the thickness of each eggshell. The eggshell was air-dried for about 24 hours and weighed by a sensitive balance (Hunt *et al.,* 1977).

3.4.2 Albumen quality

Albumen quality was determined by albumen height, albumen ratio, and Haugh unit. Representative samples of eggs were randomly taken and carefully broken and spread on a flat tray, and then the standing-up ability (viscosity) of the albumen was measured by using a tripod micrometer. The albumen ratio was calculated based on the sample egg weight and albumen weight using the formula suggested by Pradeepta (2015). Haugh unit (HU) score was calculated from the albumen height and egg weight using the following formula (Haugh, 1937).

$$\text{Albumen ratio}(\%) = \frac{\text{Albumen weight}}{\text{Egg weight}} X100$$

$$HU = 100\log(H - 1.7W^{0.37} + 7.6)$$

Where: HU= Haugh Unit, H= albumen height (mm), W= egg weight (g).

3.4.3. Egg yolk quality

The egg yolk quality was determined by measuring yolk weight, yolk height, yolk diameter, yolk ratio, yolk index, and yolk color. Yolk weight was measured by a digital sensitive balance. The yolk height and the diameter were measured using a tripod micrometre and ruler, respectively. Yolk color was measured by removing the yolk membrane, mixing the yolk thoroughly, and taking droplets on pieces of white paper and comparing them with Roche Fan measurement strips on a scale ranging from 1 to 15. Yolk ratio and yolk index were also computed using the following formula (Eke *et al.,* 2013):

$$\text{Yolk ratio}(\%) = \frac{\text{Yolk weight}}{\text{Egg weight}} x100$$

$$\text{Yolk index}(\%) = \frac{\text{Yolk height}}{\text{Yolk diameter}} x100$$

4. Climate Change Resilience: Future Alternative Opportunities of Poultry Production

Climate change is defined as deviations in climate patterns over a long period of time (Ngaira, 2007). Global climate change is primarily caused by GHG emissions that result in warming the atmosphere (IPCC, 2013). The livestock sector contributes 14.5 percent of global GHG emissions (Gerber *et al.,* 2013) and, therefore, plays a significant role in increasing land degradation, air and water pollution, and decreased biodiversity (Bellarby *et al.,* 2013; Reynolds *et al.,* 2010; Steinfeld *et al.,* 2006; Thornton and Gerber, 2010). It is vital that we find ways to reduce waste and GHG emissions while accommodating future growth in livestock production (Gerber *et al.,* 2013). Climate change poses a threat to agricultural and socioeconomic development (Niang *et al.,* 2014). It affects livestock production through competition for natural resources (particularly water), quantity and quality of feeds and forage, heat stress, livestock diseases and pests, and biodiversity loss at a time when demand for livestock products is expected to increase by 100 percent by the mid-21st century (Garnett, 2009). The challenge is maintaining a balance between productivity, food security, and environmental preservation (Habtamu, 2021).

Ethiopia is one of the most vulnerable countries to climate variability and climate change due to its high dependence on rainfed agriculture and natural resources and its relatively low adaptive capacity to deal with these expected changes. Challenges include the underdevelopment of water resources, low health service coverage, a high population growth rate, low economic development, inadequate road infrastructure in drought-prone areas, weak institutional structures, and a lack of awareness. Ethiopia has frequently experienced extreme events, like droughts and floods, in addition to rainfall variability and increasing temperatures, which contribute to adverse impacts on livelihoods. Primary environmental problems are soil erosion, deforestation, recurrent droughts, desertification, land degradation, and loss of biodiversity and wildlife. Given the nation's vulnerability to climate change impacts, there is a pressing need for adaptation across all sectors.

Poultry production in Ethiopia has the potential to make a considerable contribution to national and household economies. Village poultry play a crucial role in rural communities by providing valuable protein for smallholder farming families. This is particularly true in Ethiopia, where there are few and inflated other alternative animal protein sources available to the population and no cultural or religious taboos relating to the consumption of eggs and poultry meat (Tadelle *et al.,* 2000). Poultry in Ethiopia are not only a source of high-quality protein for the family but also provide a small cash income and play an important part in the religious and cultural life of the society (Aklilu *et al.,* 2007; Dessie and Ogle, 2001). Moreover, rearing poultry in Ethiopia is one of the most appropriate activities for rural women and for landless and marginalised farmers, for whom it provides an important source of income. It also generates employment opportunities for the poor and at the same time increases the overall supply of high-quality animal protein to the community (Zelalem, 2015).

Continuing urbanisation in developing countries, along with population growth and rising incomes, is fuelling a global demand for livestock products that will significantly increase in the coming decades (Delgado *et al.,* 1999). The demand for agricultural products will increase by about 70 percent as the global standard of living increases during this period. To feed the projected global population, we will have to produce more food on the land we currently have (FAO, 2009).
However, intensive farming practices can damage land and ecosystems. The trend of consuming more animal products negatively impacts ecosystems and water sources, particularly in developing countries. Water pollution can result from antibiotic use, animal excreta, fertilisers and pesticides used in forage production, and runoff from pastures (Steinfeld *et al.,* 2006).

Beef is the primary meat consumed in Ethiopia, and the demand for beef is a major driver of the size of the cattle population, which results in high GHG emissions. Chicken meat has much lower emission intensity than beef and other large ruminants. However, compared to the total meat consumption, chicken consumption is currently low compared with other countries. In this scenario, reducing cattle beef consumption to 30% by 2030 and increasing meat consumption for small ruminants to 40% and poultry meat to 30% was evaluated. For this, the reduction potential of reducing the beef and dairy cattle by 10% and 5%, respectively, and increasing small ruminants' by 20% and poultry by 50% annually is among the Ethiopian government's plans (Bateki and Wilkes, 2031). Replacing less productive cattle with better breeds and reducing the total number of cattle. If low-productivity animals are replaced with more productive animals and farmers reduce the total number of animals on the farm so that each animal is better fed and managed, total GHG emissions will reduce. Increase poultry numbers and productivity

Increasing animal productivity can be a very effective strategy for reducing GHG emissions per unit of livestock product. Improving the genetic potential of animals through planned cross-breeding or selection within breeds and achieving this genetic potential through proper nutrition and improvements in reproductive efficiency, animal health, and reproductive lifespan are effective and recommended approaches for improving animal productivity and reducing GHG emission intensity. Residual feed intake may be an appealing tool for screening animals that are low CH_4 emitters, but currently there is insufficient evidence that low residual feed intake animals have a lower CH_4 yield per unit of feed intake or animal product (Bateki, 2021).

Selection for feed efficiency will yield animals with lower GHG emission intensity. Breed differences in feed efficiency should also be considered as a mitigation option, although insufficient data are currently available on this subject. Reducing the age at slaughter of finished cattle and the number of days that animals are on feed in the feedlot by improving nutrition and genetics can also have a significant impact on GHG emissions in beef and other meat animal production systems.

Improved animal health and reduced mortality and morbidity are expected to increase herd productivity and reduce GHG emission intensity in all livestock production systems. Pursuing a suite of intensive and extensive reproductive management technologies provides a significant opportunity to reduce GHG emissions. Recommended approaches will differ by region and species but will target increasing conception rates in dairy, beef, and buffalo; increasing fecundity in swine and small ruminants; and reducing embryo wastage in all species. The result will be fewer replacement animals, fewer males required where artificial insemination is adopted, longer productive life, and greater productivity per breeding animal (Pierre, 2013).

5. CONCLUSION

From the assessment of the review, it is possible to conclude that the indigenous chickens provide high-quality protein to family nutrition and generate income for smallholder households even though their production and reproduction performances were low. The majority of the farmers practiced selection of hens and cocks for breeding purposes based on productivity traits of the chickens, which showed egg and meat production was the major aim of the farmer to raise chickens in Ethiopia. Identification and understanding of farmers breeding objectives and farmers' traits of chickens might be used in future research directions and the intervention to increase the genetic potential of local chickens through the selection and crossbreeding with tropically adapted exotic breeds, which give more production in semi-scratching chicken production systems to satisfy the need of the community focusing on improvement of those traits.

Ethical Statement

The study was conducted on the topic entitled "Sustainability **of Poultry Production: Socio-Economic Roles and Alternatives as Climate Change Resilience of Livestock Production in Ethiopia** and followed the international guiding principle for biomedical research involving animals listed under article 2012 of the International Council for Laboratory Animal Science (ICLAS). Therefore, the School of Animal and Range Sciences Animal Ethics Committee and Committee for Control and Supervision of Experiments on Animals in Ethiopia approved the experimental procedure dated 5 May 2021.

Acknowledgement

The authors thank all of the local farmers and egg marketing retailers of Awaday, Haramaya, Babile, and Adele woredas for primary data on family-based poultry production.

Availability of data and materials

Brief quotations from this review article are not allowable without special permission, provided that accurate acknowledgement of the source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by permission, but permission must be obtained from the author and correspondences.

Author’s contribution

Seyoum Bekele, the first author, generated the primary data, manipulated it, organised it, analysed it with SPSS, and interpreted it. Meseret Girma (PhD, Associate Professor, Instructor in Animal Nutrition), the corresponding author, designed the manuscript for publication format, translated, and corrected the English language grammar.

Competing Interest: The authors argued and declared that there were no competing interests on sources of data and the farmers interests.

Funding source: The authors declared that Haramaya University, Awaday, Adele, and Babile woredas farmers and egg marketing retailers are the source of funds for

data collection, experimental samples of eggs, and all material required for data collection.

References

Abera Geleta Sime.2022.Review on poultry production, processing, and Utilization in Ethiopia. *International journal of agricultural sciences and food technology. 8(2):147-152.DOI:10.17352/2455-815X.000156*

Abdo Mohamed Samson Haile Mariam, Gebremedhin G and Kefyalew Gebeyew.2016. Challenges and Opportunities of Small Scale Poultry Production System in Jigjiga Zone, Somali Regional State, Ethiopia. *Journal of Poultry, Fisheries & Wildlife Sciences*. DOI:10.4172/2375-446X.1000144.

Abebe Garoma. 2023. Constraint and Opportunity of Village Chicken Production, in Ethiopia. *Austin Journal of Veterinary Science & Animal Husbandry DOI: 10.26420/austinjvetscianimhumab.2023.1112*.

Abune Gudeta.Women Participation in Poultry Production. The Case of Ada'a, Lume and Akaki, East Shewa, Ethiopia .*European Journal of Agriculture and Forestry Research.* 11, (2), 40-46. DOI: https://doi.org/10.37745/ejafr.2013/vol11n24046

Addisu Hailu, Zewdu Wuletaw and Hailu Mazengia.2013. Breeding practice and objective of indigenous chicken in North Wollo, Amhara regional State, Ethiopia. *International Journal of Livestock Production.* https://www.researchgate.net/publication/263390093.

Andualem.2020. Husbandry Practice and Reproductive Performance of Indigenous Chicken Ecotype in Awi Zone, Amhara Regional State, Ethiopia. *International Journal of Applied Agricultural Sciences:* 6(6): 179-184.

Ajayi F.O and Agaviezor B.O. 2016. Fertility and Hatchability Performance of Pure and Crossbred Indigenous Chicken Strains in High Rainforest Zone of Nigeria. *Journal of Livestock Production*, 7(12): 141-144.DOI: 10.5897/IJLP2016.0308

Alem Tadesse and Teweldemedhn G/Tinsae.2016.Economic and Social Values of Family Poultry Production and Its Constraints in Ethiopia. *Elixir International Journal.*

Alemayehu G, Misba A, 2018. Farmers' Breeding Practice & Traits of Economic Importance for Indigenous Chicken in Lume District, Oromia Regional State, Ethiopia. *Global Journal of Science Frontier Research*.

Bateki C, Wilkes A, Wassie SE. 2021. Livestock Greenhouse Gas Emissions in Ethiopia by Region: A Graphic Summary. Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Berhanu Bekele, Aberra Melesse, Sandip Banerjee, Wondmeneh Esatu and Tadelle Dessie.2020. Farmers' Preferences towards Breeding Objective for Indigenous Chickens in Different Agro-Ecologies of Ethiopia. *African Journal of Agricultural Research.* DOI: 10.5897/AJAR2020.14784.

Boere A, Vernooij A, Hilde DH, Mebratu L, Dawit K,2015. Investment opportunities in the Ethiopian Poultry sub-sector. Business Opportunities Report Poultry in the series written for the "Ethiopian Netherlands business event.

Demeke Wondmagegn Getnet Haile .2020.Business Opportunity Report Invest in The Ethiopian Poultry Sector

Dessie Abera,Alemayehu Abebe and Habtamu Alebachew.2022..Assessment of poultry feed and handling mechanisms of poultry production challenges in Benishangul-Gumuz Region, Western Ethiopia. *Journal of Animal Husbandry and Veterinary Science.* DOI: 10.1080/23311932.2024.2313254

Desire Aberaa, Alemayehu Abebeb and Habtamu Alebachew 2024.Assessment of Poultry Feed and Handling Mechanisms of Poultry production Challenges in Benishangul-Gumuz Region, Western Ethiopia. *Journal of Animal Husbandry & Veterinary Science*.DOI: 10.1080/23311932.2024.2313254

Ebsa Yared A, Harpal S, Negia Gebeyehu G, 2019. Challenges and chicken production status of poultry producers in Bishoftu, Ethiopia. Volume 98, Issue 11: 5452-5455 https://doi.org/10.3382/ps/pez343.

Entag.2020. Business Opportunity Report Invest In the Ethiopian Poultry Sector

Feleke Assefa Teka Tadesse Abeba Dancho .2015.Challenges and Opportunities of Village Poultry Production in Arbegona Woreda, Sidama Zone, Southern Ethiopia

Fikadu Wodajo Tirfie.2021.Review on Poultry Production Status and Economic Contribution of the Sector in Ethiopia. *Food Science and Quality Management* DOI: 10.7176/FSQM/109-01

Finance, Newsletter.2021. Ethiopia to Shift from Beef to Chicken Production under Updated Climate Plan.

Fisseha Moges, Azage Tegegne and Tadelle

Dessie.2010.Indigenous chicken production and marketing systems and Characteristics and opportunities for market-oriented development. *ILRI (International Livestock Research Institute).* https://hdl.handle.net/10568/2685.

Getachew Worku Alebachew, Alemu Kefale Ejigu,Liuel Yizengaw and Samrawit Gebeyehu.2022.Poultry Production and Marketing Systems in Ethiopia. *Austin Publication group.* https://www.researchgate.net/publication/366918817

Gutu Fekede and Y. Tadesse.2021.Breeding Practices and Preferred Traits of Indigenous Chicken in Western Oromia, Ethiopia Journal of Livestock Science. 12: 85-94.DOI: 10.33259/JLivestSci.2021.85-94.
H.E. Fitsum Assefa, Phd Minister of Planning and Development, Federal Democratic Republic of Ethiopia

Habtamu Taddele Menghistu A, B, C, Amanuel Zenebe Abraha B, D, Gebrehiwot Tadesse Mawchaa, Girma Tesfayc,
Tadesse Teferi Mershaa and Yisehak Tsegaye Redda.2021.Greenhouse Gas Emission and Mitigation Potential from Livestock production in the Dry lands of Northern Ethiopia. https://doi.org/10.1080/17583004.2021.1921620

Hassen Kebede, Dasash Omer Hussen and Achenef Melaku .2012.Study On Status and Constraints of Village Poultry Production In Metema District, North-Western Ethiopia. DOI: 10.5829/idosi.aejsr.2012.7.6.7233.

HAUGH, R.R., 1937: The Haugh unit for measuring egg quality. 43, 572-573.

M. S. Islama, I. A. Begumb, A. K. M. G. Kausarc, M. R. Hossainb and Md. Kamruzzamana.2015. Livelihood Improvement of Small Farmers through Family Poultry in Bangladesh. *Journal of Business, Management and Social Research*.www.journalbinet.com/ijbmsr-journal.html

Mebagebriael Estifanos and Gebrehiwottadesse 2021.Challenges and Opportunities of Backyard Poultry Production in Ezha District, Gurage Zone of Ethiopia. DOI:org/10.4314/mejs.v13i2.7

Minakshi Sharma, Dr. Bhagirath Sing.2022. Poultry Farming Dynamics: A Spatial and Socio-Economic Study. *International Journal for Advanced Research in Sciences and Technology.www.ijerm.org.*

Nuraini A. Napirah H,.,Hafid F., Nasiu R., Libriani Y. and Yaddi, E.2020.Feed consumption, average daily gain and

feed conversion of broiler with different levels of feed. *Journal of tropical animal production and food security.* DOI:*10.1088/1755-1315/465/1/012047*

Pradeepta, K., Rath1, P., Kumar, M., Bandi, K. and Nrusingha Cha.2015.Evaluation of different egg quality traits and interpretation of their mode of inheritance in White Leghorns. *Veterinary World.DOI: 10.14202/vetworld.2015.449-452*

Shishay Markos, Brhanu Belay and Tadelle Dessie.2016.Village chicken breeding practices, objectives and farmers' trait preferences in western zone of Tigray, Northern Ethiopia*. Journal of Agricultural Research and Development Vol. 6(1). pp. 001-011.* . DOI: http://dx.doi.org/10.18685/EJARD(6)1_EJARD-15-015

Steve Hartrich & Amdework Berhanu.2021.Market Systems Analysis of the Poultry Sector in Sidama & Amhara, Ethiopia. *International labour organization.*

Taju Hussein, Mengistu Urge , Getachew Animut and Sisay Fikru.2015.Effect of Replacing Soybean Meal with Processed Kidney Bean Meal on Egg Production and Economics of White Leghorn Layers .*Journal of Poultry, Fisheries and Wildlife Sciences.3(1):2-6. DOI: 10.4172/2375-446X.1000134*

Y.J.Alhassan1, M.S Utono, A.B.Yusuf, A.Umar D. Epenu and A.Ismaila.2021.Economic Analysis of the Characteristics of Extensive System of Poultry Farming in North-western Nigeria. https://www.researchgate.net/publication/350591597

Yadeta N, Jabesa A, Mengistu A, 2019. Village Chicken Production Performances and Producers Trait Preference in Buno Bedele and Ilu Ababor Zone South-Western Ethiopia. British Journal of Poultry Sciences 8 (2):34-43. DOI: 10.5829/idosi.bjps.2019.34.43

Zelalem G. Terfa S. Garikipat Girma T. Kassie Tadelle Dessie R.M. Christley.2019.Understanding Farmers' Preference for Traits of Chickens in Rural Ethiopia. DOI: 10.1111/Agec.12502

Zelalem G. Terfa.2015.People, Poultry and Poverty: Assessing Economic Value of Poultry Health Service and Genetic Resources in Rural Ethiopia

Zhang, Y., Smuts, J.P., Dodbiba, E., Rangarajan, R., Lang, J.C.and Armstrong, D.W. 2012.Degradation study of carnosic acid, carnosol, rosmarinic acid and rosemary extract (*Rosmarinus officinalis L*.).*Journal of Agriculture and Food Chemistry*.60:9305–9314. DOI: 10.1021/jf302179c.