THE CONCEPT OF VALUE CHAINS IN AGRICULTURE, CLIMATE ACTION AND ENVIRONMENTAL RESOURCES

GLOBAL ISSUES & LOCAL PERSPECTIVES

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Preface

This book adopts an exegetical approach as well as a pedagogic model, making it attractive agriculture and environmental economics teachers, professional practitioners and scholars. It is eschews pedantry and lays bars the issues in such clarity that conduces to learning. The book elaborates on contemporaneous ***The Concept of Value Chains in Agriculture, Climate Action and Environmental Resources*** issues of global significance and at the same time, is mindful of local or national perspectives making it appealing both to international and national interests. The book explores the ways in which climate change, food security, national security and environmental resources issues are and should be presented to increase the public's stock of knowledge, increase awareness about burning issues and empower the scholars and public to engage in the participatory dialogue climate change, food security, national security and environmental resources necessary in policy making process that will stimulate increase in food production and environmental sustainability.

The Concept of Value Chains in Agriculture, Climate Action and Environmental Resources: Global issues and Local Perspectives is organized in three parts. Part One deals with The Concept of Value Chains in Agriculture, Part Two is concerned with The Concept of Climate Actions and Part Three deals with the Concept of Value Chains and Environmental Resources.

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Chapter Four

Potentials of Local /Scavenging Chicken for Sustainable Protein Production and Poverty Alleviation

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Introduction

The Poultry industry in Nigeria has been dominated by imported (exotic) strains of birds (Urgesa and Urgesa, 2023; Akinwumi *et al* 1979 In: Duru, 1987) whose better performance traits has resulted in the neglect of their indigenous counterparts with low biological productivity (egg and meat). Thus the need to raise the contribution of these indigenous species to meet national animal protein supply has become imperative particularly due to lack of sufficient foreign exchange for continuous importation of parent and grandparent stocks (Gadzama, 2024; Duru, 1987).

Chickens (*Gallus gallus or Gallus domesticus*), which are also known as rural, indigenous, scavenging, traditional or family chickens (Jacob, 2010), are the world's major source of eggs and meat which support food industries in almost all the countries of the world. FAO 1981 and 1982 indicated that there are as much as 6.5 billion chickens worldwide with an equivalent of 1.4 birds per individual on earth (Mace and Knight, 2022; NRC, 1991).

These birds have an unprecedented acceptance level globally in comparison to other domesticated animals. Chickens are probably the most nutritionally valued livestock species among the world's poor population. In Nigeria and Mauritius over 70 percent of the rural households own chickens which are reared extensively (the birds are scavengers). In countries like Thailand, where commercial poultry production is greatly developed, 80-90 percent of the rural households still keep chickens in their backyards. A similar situation exists in other developing countries of the world where the chickens exist as vital parts of human existence. Indigenous / local breeds of chickens represent a production system with remarkable qualities and prospects with due consideration to the fact that: (i) they do not compete with man for food (ii) they provide a critical nutritional resource as one of the most efficient producers of animal protein (meat and egg) at least cost; (iii) they serve as a source of insurance against shocks as a result of crop failure during the farming season and also in instances of sickness of the rearers; (iv) they serve as a source of petty cash

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Local chicken farming in Nigeria is experiencing a significant growth because an increasing number of people are drifting away from the consumption of exotic breeds of chicken and red meat due to their health implications and worries (Hartcher and Lum, 2020; Abdulhamid,*et al* 2018).

The pre-dominance of local / scavenging chicken in Nigeria's poultry industry shows that they deserve urgent attention to improve their production potentials through improved technologies and intervention practices towards increasing food security and meeting the protein requirements of the rural populace in villages of third world countries, Nigeria inclusive and also in order to reduce unemployment and poverty in these regions (Bedada, Bogale, Derese and Dabi, 2024). Development of the poultry family is regarded as an alternative means of alleviating poverty and ensuring food security for socio-economically disadvantaged rural households (Urgesa and Urgesa, 2023; Tomar, Akarca, Istek and Ataseven, 2021; Brankaert, (1999) and Gue'ye, (2000). This chapter therefore explores the potentials of indigenous local chickens as a means of attaining sustainable protein production (towards alleviating protein deficiency), economic empowerment /self-reliance and job creation among the resource poor Nigerians.

Appearance and Size

Local chickens range in colour from white to various shades of brown to black. They vary in size thus there are small breeds like the bantanns which weigh less than 1kg; the giant breeds weigh up to 5kg or even more and the scavenger chickens weigh up to 1kg.

Distribution

The chickens are well known (ubiquitous) and present in large number globally.

Habitat and Environment

Local chickens descended from tropical species and are well adapted to a variety of environmental conditions ranging from hot environments to cold environments and high altitudes. Chickens remain on the premises to which they are originally introduced provided they have acclimatized and thus they hardly go feral.

Biology

Feeding

Scavenging chickens are omnivorous livestock which live on seeds, insects, leaves, worms, green grass and kitchen scraps. In most Nigerian rural villages as well as urban settlements chickens are given leftover food, maize bran, kitchen scraps and they also scavenge around for insects and worms. If the birds are provided with evening meal of kitchen scraps, they develop the habit of going home to roost at night. Diets of chicks of scavenging local chickens are usually deficient in energy. Mineral supplementation in the form of cereals or energy-rich-by-products can greatly improve egg and meat production efficiency. However, adult chickens should not be overfed

because they stop scavenging and remain within the rearer's premises without actually producing more eggs and meat. A chicken consumes about 2-3 times as much water as the feed it consumes. Therefore, when water supply is limited, feed intake drops in the birds with a consequent declination in productivity. Therefore, birds should be provided with clean water at all times (Gadzama, 2024; Abera, 2022).

Breeding

Scavenger birds produce little amount of eggs /year while commercial birds produce up to 280 eggs/year. This low productivity in the scavenging chicken is attributed to the minimal investment in the birds. Usually, farmyard chicken (hens) lay about one dozen eggs within 10 days laying phase, these hatches at about 3 (three) weeks of age into young chicks. The incubation period of chickens is 21 days.The hen moves around with the young chicks for about 6 (six) weeks or more after which it begins to lay eggs again. In local chickens egg production depends on day length, with the highest production rate established at 12 hours of daylight.

Normally, hens start egg production at 5 months of age or earlier, however in scavengers it is delayed and thus they begin to lay at about 6 months of age. The average weight of eggs is approximately 55g in commercial layers and approximately 40g for scavenger chickens. Hatching success (hatchability) from breeder flocks of commercial breeds usually exceed 90%. Industrial broilers are marketed at between 6-8 weeks of age in comparison to local chickens whose weight may not be appreciable at that same age (Alene, Mersha, and Woldegiorgis, 2023).

For farmyard flocks a ratio of 1 male to 10-15 females is adequate. Hens are noted for laying eggs without the roosters although for production of fertile eggs roosters must be provided. Removal of chicks stimulates hen to lay more eggs, thus implying that more chicks are hatched and that the chicks need to be fed and cared for until they grow old enough to fend for themselves.

Selection of Foundation Stock

The choice of chicken for utilization as foundation stock by the rearer depends critically on the following factors:

i. The conformation
ii. Body size
iii. The correct colour of the variety
iv. Absence of defects and diseases.

Selection of a good layer hen

The indicators of good layer hen are indicated as follows:

Character	Hen in Production (Good Layer)	Hen Out of Production (Poor Layer)
Comb	Red, large and waxy	Small, grey and scaly
Wattles and ear lobes	Large and soft	small, coarse and dry
Pelvic bones	Pliable and wide apart	Hard and narrow
Cloaca	Large, oblong and wet	Small round and dry

Source: NAERLS (2000)

A hen in production (a good layer) undergoes a considerable development in the ovary, which is reflected in the increased size of the comb and wattles. A poor layer usually appears smaller in comparison to when she is in production. When the body capacity of the scavenging chicken is small and the space between the pelvic bones is narrow, the hen is identified as a poor layer. Invariably, the development and expansion of these parts are tremendously important for good egg laying. Other attributes of a good layer include:

i. Vigorous head
ii. Alertness and healthy eyes
iii. Strong curved beak
iv. Broad and flat back

Selection of a good Cock

After choosing the best local hen, it is essential to complement the choice with a good cock of high reproductive performance. With due consideration to the fact that the mating ratio of the cock to the hen is 1:15; a cock's prolific capability is thus of immense importance in the improvement of the next generation. The choice of a good cock should be based on the following qualities:

i. Good conformation
ii. Good body size
iii. Absence of disease and defects
iv. Good health and vigor
v. The combs/wattles must be bright/red and soft
vi. Strong legs
vii. Sharp and attractive eyes
viii. High sex drive

All these qualities are of great importance in order to ensure the emergence of best offsprings.

Health

According to Tafida et al (2014) diseases account for 43.8% annual deaths of domestic chickens in Nigeria. During the first 8 weeks of age, 40-60% of young chickens die as a result of disease and predator attacks (Alebachew, Ejigu, Adnie and Gebeyehu, 2022; Ajuyah, 2013). It is well established that scavenging local chickens are better adapted to local conditions and are not easily

disposable to local disease conditions in comparison to the exotic breeds, which are fragile. However, the incidence of diseases outbreak in local free range chicken flocks can have devastating consequences (Tafida, 2014). Local chickens are infested by diseases such as newcastle disease, fowl pox, coccidiosis and fowl cholera. The birds may also be exposed to internal and external parasitic infections. Newcastle disease has been documented as the most prominent disease ravaging rural communities. Adoption of preventive measures through simple management practices can set the chickens free from parasitic infections and diseases.

Uses

They are multipurpose animals and they are useful for:

- Cock fighting
- Religious rituals
- Eggs and meat production
- Feather
- Cash

Chicken meat Production

The local / domestic chicken is mainly kept for its meat, which is tasty and highly nutritious. It has high acceptance and preference; most people prefer it to the exotic breed because of its taste and texture. Olumu (1983) reported that with a protein component of 19.20%, local chicken meat compares favourably well with beef (18.20%), turkey (22.20%), rabbit (21.00%), lamb (17.80%) and pork (15.10%). Local chicken meat also has low fat content (6.10%) in comparison to beef (19.00%), turkey (9.30%), pork (31%), rabbit (6.5%) and lamb (36.60%). A broody hen that produces 60 eggs and two slaughter birds / year can provide 4kg meat per caput, which is significantly higher than the annual protein consumption in rural areas (Hailemichael and Gebremedhin, 2020; NAERLS, 2000).

Chicken Egg

According to Olumu (1983) the local / domestic chicken eggs have a low cholesterol level (11.5%) as against guinea fowl (9.5%), duck (14.5%), turkey (12.0%) and geese (13.4%). The egg protein content of chicken (12.8%) also compares favourably well with that of guinea fowl (14.3%), duck (13.5%), turkey (13.0%) and geese (14.0%).

Behaviour

Local chickens are gregarious in nature with a pronounced pecking (social) order. They are also passive. When they become acclimatized with their environment they remain in the vicinity and

are most unlikely to go feral. They develop homing instincts particularly when given a little evening meal daily. As such they go back home at night to roost.

Husbandry

Scavenging / local chickens are reared using different methods in various regions of the world. They are usually reared by women and children and occasionally men who spend greater part of their time at home feeding the birds and chasing away predators. There are various indigenous local practices in relation to chicken production in rural villages:

i. Some villagers abandon the birds to scavenge around the villages without any care or attention (for shelter, food and disease control).
ii. Others provide houses for them at night
iii. Some chicken rearers lead the birds to the fields where they scavenge around and find extra food.

In Ghana farmers culture termites for chickens by placing moist piece of cow dung over termite nests. The termites which burrow into the dung are fed to chickens on a daily basis. In other regions of the world like Nigeria some farmers culture earthworms and maggots for use as chicken feed. The scavenger chicken flocks usually comprises of 5-20 birds/household (family). Generally, the mortality rate in this production system is very high due to constraints like predators, pilferers, parasites and diseases especially Newcastle. The labour input is quite minimal. Laying hens build their own nests for egg production, thereafter they incubate, hatch and brood (Tolasa, 2021).

Housing:

Many local chicken rearers in Nigeria are known to provide some form of shelter for their birds at night to reduce chick mortality, loss to predators, loss due to accidents and harsh climatic conditions. Shelters provided for the birds include spare rooms e.g. kitchen, stores, wire cages, or small mud structures of about one (1) metre high that are usually attached to the rearers main building and the structure may have some form of light (bush lanterns) mainly to scare off pilferers and predators. Other forms of housing include hand woven basket cages (like round bottomed cone) made with palm fronts, it is used as a night shelter, as a brooder or hatching cage as well as for transporting chicks to the market for sale. Peasant chicken keepers usually adopt the semi intensive system of production whereby they provide shelter/houses with nests and cages, the chickens are confined within an area of land (garden or yard). The chickens are allowed to roam freely outside the houses, which are usually opened in the morning (6:00-6:30am) and closed in the evenning (5:30-6:30pm) when the chickens go back to roost for the night (Ayalew, Chanie, Fentahun, Yinnesu, Dagnew and Moges, 2023).

Materials for Construction of Chicken House

- Local chicken houses can be built from locally available and cheap materials e.g. mud, bamboo, raffia sticks/wood thatch etc.
- The houses should always have an opening in front to serve as entrance for the birds and rearers
- The floor should be covered with litter to absorb moisture from the chickens' faeces/droppings. The litter must always remain dry to prevent accumulation of ammonia, which encourages the predisposal of the birds to diseases and parasitic infections. Moisture absorbent litter materials such as wood shavings, chopped straw are recommended for use
- The house should be well ventilated at all times and the windows should be reinforced with wire mesh
- It should be easy to clean and disinfect
- It should be spacious in order to avoid overcrowding.
- Drinking troughs should be provided and birds should be supplied with cool, clean fresh water at all times.
- Feeders that will not allow adult chicken to step in and scatter feed is advisable.

Advantages Scavenging Chickens over other Birds

- There are no social, cultural or religious taboos against local chicken meat and egg consumption unlike other sources of animal protein like pork and beef.
- They are easy to manage
- They provide high quality animal protein in the form of meat and eggs for poor households thereby enhancing animal protein food security and improvement of the nutritional status of rural households.
- The meat has low cholesterol level.
- Many people in the cities show preference for local/village/scavenger chicken meat in comparison to the exotic chicken (commercial broilers) due to its texture and stronger flavor and the fact that they are free ranging chickens that feed on natural components (leaves, worms, insects etc)
- They are more suited to urban farming in comparison to most livestock types and as they can be raised in many urban settings
- They are easy to manage (small sized, easy to transport alive)
- They do not transmit diseases to man.
- Produces good returns with little investment (source of petty cash)
- They develop homing instincts particularly when given a little evenning meal daily as such they go back home at night to roost.
- They are hardy (they are adapted to harsh local climates and ecological conditions)

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- They provide resource poor population with source of additional income and promotes self sufficiency thereby alleviating rural poverty.
- They are less susceptible to local poultry disease than the more fragile hybrid (exotic breeds)
- They make better uses of garbage (as free range birds under extensive system of management) compared to exotic breeds that require imported / locally formulated feed and other inputs like antibiotics, vitamin and mineral premix.

Marketing Prospects

The potentials for local chicken products (meat and eggs) marketing is high in Nigeria. Local chicken are sold in many markets as live chickens and roasted chickens in many cities and peri-urban settlements particularly in Northern Nigeria. The sale of local chickens in Nigeria is not well organized, the farmers are at the mercy of retailers who buy the products at farm gate price and resell to retailers who hawk the birds on the streets of major cities and sell to consumers. The price of a live chicken is usually determined by the plumage, colour, size, age, sex, market location and health status of the birds (Kejela, Kejela, Banerjee Sandip Banerjee and Taye, 2019; Dunya *et al*, 2015).

Slow Growth of the Scavenger Chicken Industry

The factors militating against the growth of the village chicken industry in Africa, Nigeria inclusive, Asia and Latin America include:

i. High Hatching Mortality: Hatching mortality rate of local chicken is usually high (40-60%). A hatch of eight (8) to nine (9) village chicks results in only two (2) or three (3) surviving birds after a few days. The survival rate of chicks at 0-8 weeks is less than 20% (Tirfie, 2021; Kejela, 2020; NAERLS, 2000). In Nigeria, a survey study revealed that (80)% of chickens die before the age of eight weeks and this trend of losses was noted to be similar to what is obtainable in other developing countries of the world. Most of the losses are attributed to hunger and starvation, predators (e.g. cats, hawks, dogs, snakes etc), diseases, parasites, cold, heat and dehydration, accidents, getting lost, pilferers which can all be prevented with ease. High mortality rate have been documented to be highest during the dry season due to dehydration along with other factors.

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ii. Acute Chronic Diseases: Inadequacy or lack of veterinary services in the villages could result in poultry disease becoming epidemic. Third world endemic poultry diseases like Newcastle disease, fowl pox coccidiosis and pollurum could be very devastating wiping out entire chicken populations over wide areas. Parasites like lice are also prevalent.

iii. Low egg production and small egg size: Egg is usually produced in 2-3 clutches/hen/year with about 10eggs/clutch (i.e. a mean clutch size of 8-9eggs and 2.5 clutches/year). Hatchability in local chickens is good (80%) and compares favourably with performance under improved birds. However, egg production in clutches reduces the total number of eggs produced while brooding further decreases the total number of hen-days available for egg production (NAERLS, 2000). In Nigeria a survey revealed that the annual production per hen was merely 20 eggs (Tilahun, Mitiku and Ayalew, 2022; NAERLS, 2000). Such low production, which implies poor returns on investment is a common phenomenon in the third world countries and it is attributed to low genetic potentials, inadequate nutrition and poor management practices (Kebede, Bilal, Lindtjor and Engebretsen, 2023; Abdulhamid *et al*, 2018). Majority of villages do not provide shelter in form of next boxes (laying areas) for their flock, thereby resulting in egg loss due to chickens laying arbitrarily in places where they find shelter for protection of their eggs. However it is pertinent to note that some village chickens have substantial egg laying potential if adequately fed. Some village chickens in China have been reported to have such potentials (Philips In: NRC, 1991). The potentials of the village chicken for egg production under rural conditions is extremely high if the number of clutches raised / hen / annum is increased through research and practical interventions.

iv. Crop Damage: Sometimes they cause extensive damage to crops thus it is often necessary to confine the birds in order to protect young crops and vegetable gardens.

Research Conservation Needs of Local / Scavenging Chickens for Sustainable Production

Areas to be addressed towards achieving optimal local chicken production include:

1. Management: Improved management practices is required foremost at the subsistence or village level of production in order to reduce mortality to a great extent. More attention should be provided to the birds so as to adequately reduce mortality of birds since incubating and brooding hens which spend the night on the ground without any form of housing are extremely vulnerable. Constructing simple inexpensive nest boxes and shelters for them can greatly increase production by ensuring that more chicks survive against predator attack. Provision of good nutrition by giving supplementary feed in the mornings

and evenings of about 55-65g/day/chicken and provision of clean water ad- libitum will go a long way towards promoting growth rate and good health.

2. Disease control: Disease control is an integral aspect which should be put into perspective in order to attain sustainable production of chickens. Village flocks should be monitored by (i) inaugurating fundamental structural surveillance health schemes or regimes to routinely check the prevalent health problems associated with chickens with particular reference to newcastle disease, fowlpox and coccidiosis which constantly wipe out large population of chickens in developing countries. (ii) by initiating improved extension services to assist and educate subsistence farmers on the need to seek professional advice from veterinary officers through the appropriate units within their locality. The use of vaccinations should not be ruled out.
3. The issues of low genetic potentials can be taken care of through selection of good foundation stocks, culling of unproductive birds, upgrade of birds by cross breeding, avoidance of in-breeding. Expected improvement outcomes is usually increased growth rate, high viability and bigger egg size

Strict adherence to improved management practices will surely increase performance of the scavenging birds produced under free range managemet

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