
*BIOSECURITY GUIDELINES FOR NIGERIA
POULTRY VALUE CHAIN*

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Acronyms

BYC	Backyard Commercial
DOC	Day-Old Chicks
FMAFS	Federal Ministry of Agriculture and Food Security
HHFR	Household Free Range
LBM	Live Bird Market
KAP	Knowledge Attitude and Practices
NAFDAC	National Agency for Food and Drug Administration and Control
NAICP	National Avian Influenza Control Programme
NIAS	Nigerian Institute of Animal Science
PPE	Personal Protective Equipment
SON	Standard Organization of Nigeria
TDS	Total dissolved Solids
VCN	Veterinary Council of Nigeria

Glossary

Contamination –The process of making a material infected or unclean for its intended purpose by the addition or attachment of undesirable foreign substances.

Deterioration – Is the process of making or growing worse the state of a thing.

Dressed poultry – Refers to poultry that have been processed and prepared, i.e., plucked, gutted, and cleaned, for consumption.

Input suppliers – Those in the business of providing quality and reliable inputs across the poultry value chain.

Isolation –Keeping sick animals separate from healthy ones.

Local chickens – indigenous chickens raised at village/rural areas, usually under free-range, extensive production system as against the exotic/commercial and intensively raised birds.

Poultry value chain – different levels of activities involving poultry and poultry products along the production line to the end user, including production, processing, and marketing
Sanitation – regular cleaning and disinfection of cages, equipment, vehicles, slaughter and processing areas, selling stalls, and maintaining employee hygiene.

Total dissolved solids – total amount of solids dissolved in water.

Traffic control – controlling the movement of people, animals, equipment, and vehicles into and out of, and within the poultry farm and live bird market area.

Visitor – Anyone who is not a farm staff is called a visitor.

1.0 BACKGROUND

1.1 Biosecurity

Biosecurity is the prevention of disease-causing agents entering (bio-exclusion) or leaving (bio-containment) any place where they can pose a risk to farm animals, other animals, humans, or the safety and quality of a food product (UK Department of Agriculture, Environment and Rural Affairs).

In the World Organization for Animal Health (WOAH, 2018) Terrestrial Animal Health Code, biosecurity is defined as ‘a set of management and physical measures designed to reduce the risk of introduction, establishment and spread of animal diseases, infections or infestations to, from and within an animal population’. In simpler terms, biosecurity is preventive disease management (American Veterinary Medical Association).

In a poultry farm, biosecurity and farm management help in decreasing the chances of contracting infectious diseases. The first step to disease prevention is protection from exposure to disease-causing agents. Strictly following the biosecurity guidelines highlighted in this document will assist in decreasing the chances of disease occurrence. From these guidelines, farms are expected to develop their biosecurity plans.

Poultry diseases are controlled by biosecurity, veterinary health care, complete vaccination programs, high-quality feed, appropriate housing, and high standards of farm and bird management.

Disease can occur if a flock is exposed to a disease causing pathogens or if there is a breach in biosecurity. Biosecurity measures must always be practiced. All poultry farm workers should have documented biosecurity training. A biosecurity checklist should be posted or kept at each section of the poultry farm. Biosecurity measures should be audited frequently for compliance.

This guideline provides an overview of the main entities of the commercial poultry production value chain in Nigeria, as well as the biohazards (hazard identification) and their biosecurity solutions (risk management).

The poultry value chain entities are:

- Breeders
 - Local breeding in poultry
 - Industrialized breeding in poultry
- Hatcheries
- Farms
 - Commercial broilers
 - Commercial layers
 - By-products
- Live Bird Markets

- Processing
 - Meat processors
 - Egg processing
 - etc
- Transportation
 - Transporters for day-old chicks
 - Transporters for eggs
 - Transporters for live birds
 - Transporters for droppings
- Input Suppliers
 - Feed millers
 - Manufacturers and sellers of drugs, vaccines and biologics
 - Manufacturers and sellers of poultry equipment

1.2 Justification

Disease prevention is always better and cheaper than treatment. Healthy poultry are more productive and likely to resist infections by pathogens. Healthy poultry and by products will guarantee human health.

1.3 Goal

The goal of this guideline is to ensure that the health and welfare of poultry along the value chain are guaranteed through appropriate biosecurity practices.

1.4 Scope

The guideline identified potential risk factors at critical control points along the entire poultry value chain in Nigeria and provided the appropriate actions and measures to mitigate them.

1.5 Legislative and Regulatory framework guiding the Poultry Value Chain

The Nigeria Animal Disease Control (Amendment) Act 2022 and the Nigerian Institute of Animal Science (Amendment) Act 2015 provide the legislative and regulatory framework that establishes biosecurity measures in the poultry value chain. Such guidelines are expected to improve the efficiency of production, stimulate growth in the industry, protect the health and welfare of birds, and ensure poultry feed safety, food security and food safety. The regulatory bodies within the legislative and regulatory framework are the Veterinary Council of Nigeria (VCN), Nigerian Institute of Animal Science (NIAS), National Agency for Food and Drug Administration and Control (NAFDAC), Standard

Organization of Nigeria (SON) and the Federal Ministry of Agriculture and Food Security (FMAFS), that is also the policy maker.

1.6 Poultry Population and Characteristics in Nigeria

The poultry population in Nigeria has been estimated to be about 135 to 150 million: 103 million chickens (69%), 15 million pigeons (15%), 12 million ducks (12%), 5 million guinea fowl (5%), and 0.2 million turkeys (0.2%). About 69% of the total poultry in Nigeria are indigenous breeds with 78% of them being local chickens (RIM, 1993). In 2006, the poultry population was estimated at 140 million with 25% coming from the large-scale commercial sector, 15% from semi-commercial (Backyard Commercial - BYC) sector and 60% from the backyard (Household Free Range - HHFR) sector (MK&I Steadman 2008; Muhammed 2009).

Local chickens are found in all states of Nigeria, although about 85% of them are reared in northern Nigeria (RIM, 1993). About 83% of commercial birds are produced in southern Nigeria, while 86% of indigenous poultry are produced in villages in northern Nigeria. Almost every rural household (80-90%) keeps chickens (Adene, 1990). Guinea fowls are found mostly in the drier geographical regions of Nigeria, while ducks and geese flourish in villages near lakes and rivers.

Local chickens are kept under small-scale production systems and reared extensively. This type of management system is found mostly in the developing countries of Africa and Asia. The chickens are owned by the household and left to scavenge for food and are poorly managed.

2.0 THE POULTRY VALUE CHAIN

2.1 Breeders

A. Local breeding

2.1.1 *Overview: Local breeding*

Local poultry breeding in Nigeria is usually practiced by small-holder farmers, and this is usually done in their backyards. The local birds are kept as free-range/roaming birds, and they reproduce on their own with little attention. One example of local breeding is seen in the use of the Niger breed of guinea fowls to upgrade the Nigerian breeds of guinea fowls. Another example of local breeding is the crossing of the American Brama and Cochin breeds of chicken with local Nigerian chicken to improve the performance of the local birds.

2.1.2 *Hazard Identification: Local breeding*

In local breeding, the free range production system is practiced predominantly. The birds eat and drink water from unidentified source. In addition, the birds of different ages from different households are mixed freely from different species, which means there is no specific flock health control. Also, the farmers and household members are at risk of infection if there are birds carrying any latent infection picked up as they roam the environment and via contact with wild birds or their feces.

2.1.3 *Risk Management: Local breeding*

To avoid biosecurity hazards, the following precautions should be observed:

- Local breeder farmers should provide clean sources of water and feed to the birds, to avoid risk of contamination and infection.
- Water and feed troughs should be provided should be provided cleaned and changed regularly.
- Avoid mixing birds of different species
- Minimizing contact with wild birds
- .
- Proper culling of sick and disposal of dead birds and are to be practiced.
- Avoid the sale and consumption of sick birds.
- Adequate levels of personal and environmental hygiene should be practiced. This may include:
 - Proper hand washing with soap and running water after touching/handling birds and after disposing of any waste.
 - Regularly sweeping the compound to remove droppings, including sprinkling some water on dusty grounds to reduce raising of dust while sweeping.

- Wearing some protective clothing while cleaning, e.g. wearing a face mask or handkerchief to prevent inhaling dust.
- Practice community approach to disease prevention

B. Advanced/industrialized breeding in poultry

2.1.4 Overview: Advanced/industrialized breeding

In Nigeria, advanced breeding in poultry occurs in commercial poultry farms under the intensive system. There are two types of breeder farms, namely:

- **Grandparent breeder farms:** This unit is responsible for producing parent hatching eggs, and is further divided into two sections:
 - a. Male farm: to produce the hatching eggs for producing male line.
 - b. Female farm, to produce the hatching eggs for producing female line.
- **Parent breeder farms:** This unit is responsible for the production of good quality hatching eggs for hatcheries, which produce commercial day-old chicks (DOCs).

These two sectors are at the highest level in the poultry industry, as they are operated in specialized companies mostly in closed houses to control the internal environment, including temperature and humidity, ventilation, and to reduce the risk of exposure to contamination and diseases. The farms are not raised in open houses because it is difficult to control the environmental elements and apply standards of biosecurity control. The farms are automated to distribute feed, control the environment, and collect eggs from the nests.

2.1.5 Hazard Identification: Advanced/industrialized breeding

These are the points where contamination and transmission of diseases to breeder farms and to humans can occur in advanced poultry breeding settings:

- **Quality of chicks:** Chicks with underlying diseases may transmit infection to other healthy chicks, leading to poor productivity of the flock and mortalities.
- **Farm staff:** Farm workers entering breeding sites may inadvertently introduce diseases from outside, if the workers are sick or when they breach biosecurity protocols.
- **Feed quality:** Poor feed quality can affect flock health through nutrient deficiency, making the birds susceptible to infections. Unsafe feed may also carry harmful pathogens, such as bacteria and mycotoxins producing fungi which can be transferred to the birds.
- **Disease control:** Non-implementation of disease control protocols such as vaccination programs may increase the risk of massive infection and spread of

diseases, within the farm and to other farms. Some zoonotic diseases like avian influenza may also be transmitted to breeder staff.

- **Environment:** If not controlled and monitored, the temperature, humidity, and quality of air may facilitate exposure to pathogens, and thus affect flock health and productivity.
- **Transportation:** Disease pathogens can be easily transferred via transportation from outside the farm into the breeder farm and may be spread to other farm houses.
- **Water:** Water is required for drinking, for regulating temperature and humidity. If the water is contaminated or contains high total dissolved solids (TDS), this will negatively affect flock health and productivity.
- **Vermin (wild birds, rodents etc):** Wild birds and rodents may carry and spread disease in the breeder farms. These vermins usually migrate from one place to another, potentially spreading diseases to other locations.
- **Waste disposal:** If not properly disposed, waste materials like dead birds, droppings, litter, feathers, used vaccine vials, and other fomites can cause diseases and transfer them from place to place, affecting both the health of the flock and humans.
- **Visitors:** Visitors who are not properly screened and disinfected can transfer diseases into farms and from within farms to other farms.

2.1.6 Risk Management: Advanced/Commercial breeding

These are biosecurity precautions to cover these hazard points in section 2.1.2:

Chick quality

- Obtain quality chicks from trusted sources and request the health certificate for chicks.
- safely dispose unhealthy chicks.
- Weigh chicks continually to know the chick's uniformity and trace the sources of disparity
- check cloacal temperature.
- Send samples from chicks to the laboratory for analysis to ensure they are disease free.

Farm staff

- Farm staff must shower in the central cleaning station before entering the farm site. All personal clothing must be removed and replaced with clean work uniforms.
- Farm staff must also shower before entering any specific farms.
- Do not allow movement or transfer of designated farm staff to another farm within the farm site, or to other farms, outside the farm site without strict compliance with strict biosecurity measures

- Dip feet in the footbath filled with disinfectant before entering the farm and when leaving the farm.
- Use disposable face masks and hair covers before entering the farm.
- Shower when exiting the farm.
- All dirty uniforms must be cleaned in the farm laundry room. No uniform must be taken outside the farm site or transferred to other sites.
- Take hand swabs every month and stool samples from farm staff every 6 months to check for infection.
- Medical checks should be conducted every 6 months.

Feed quality

- Select reputable sources of feed if the farm does not have a feed mill.
- Clean and disinfect feed silos before the start of a cycle and before receiving the feed.
- Take samples from the silos and send to the laboratory for testing to ensure that there is no contamination or presence of pathogens.
- When receiving the feed, take samples from each batch and send to the laboratory to check the quality of the feed/contamination.
- Cleaning and disinfecting the feed truck before entering the farm and when it exits the farm.

Disease control

- Use a vaccination program that is approved from the veterinary authorities.
- Collect monthly clinical and environmental samples and send to the laboratory to follow up the flock health situation.
- Take samples from the mortalities and send to the laboratory to identify potential infections.
- Follow biosecurity rules.
- Institute proper and effective insect and rodent control programs
- Report incidences of disease outbreak
-

Environment

- Clean and disinfect all farm equipment after every use.
- Clean and disinfect all cooling pads and heating units

- Take temperature and humidity readings every 3 hours and follow the breeder supplier recommendations.
- Check the concentration of dust, ammonia, and oxygen and follow the breeder supplier recommendations.
- Change the litter of the farm after every cycle of production.

Transport

- All trucks must be cleaned and disinfected in the washing station before entering the farm site.
- Disinfect the truck again before entering the specified farm.
- Do not allow trucks to move between the farms. Trucks must be cleaned and disinfected each time before use.
- Use specified service trucks for each farm.

Water

- Take and analyze water sample from the water source before starting the cycle.
- Take monthly water sample and send to the laboratory to check for the water quality – both chemical and biological.

Vermin (wild birds and rodents)

- Remove all trees or grass around and inside the farm site.
- Use appropriate pest control procedures.
- Fence the farm site to avoid cats, dogs or any animals entering.
- Review pest control procedures monthly.

Waste disposal

- Collect daily the farm mortality.
- Dispose mortalities and other waste using a waste incinerator or sanitary landfill.
- Do not allow transfer of the dead birds from one site to another site to avoid disease spread.
- Each farm must have its own waste incinerator.
- All used vaccine vials must be collected and put in a separate bucket with disinfectant before disposal
- Collect the staff housing formite and send to the incinerator within the farm premises but outside the critical zones

Visitors

- Do not allow visitors to the farm site without strict compliance with the biosecurity measures
- Essential visitors must be under quarantine procedures for a period of not less than 72 hours before entering to the farm site.
- Record all details of visitors in the visitor's log file and the reason for the visit.
- Visitors must see the new flock first, then progress to the old flock.

2.2 Hatcheries

2.2.1 Overview: Hatchery process

The hatchery is the unit responsible for producing chicks for the poultry farm. It is a critical control point in the poultry industry because the poultry production cycle starts from the hatchery. There are two types of hatcheries:

- Grandparents' hatchery, that is responsible for producing the parent stock chicks, and
- Broiler and layer hatcheries, that is responsible for producing the commercial broiler and layer day-old chicks (DOCs).

A hatchery has many units, such as egg, incubation, hatcher, chick room, maintenance, dispatch, and transport units. These units are operated with modern automated machines and many equipment which work with modern technology. This requires high performance knowledge and skills from the hatchery team.

Put in bullet form

The hatchery process involves series of steps which starts with:

- Receiving the eggs from the breeder farms,
- sorting, disinfecting,
- storing in egg store rooms,
- setting the eggs into the incubators for 18 days,
- transferring the eggs from the incubators to hatcher machines on day 18,
- setting the eggs into hatcher machines for 3 days until day 21,
- sorting the chicks,
- vaccinating the chicks, and
- finally transferring the chicks to commercial farms.

Note that the vaccination room is used for the preparation of vaccines and storage of the equipment used for the chicks' vaccination process, including the injection machine, needles, spray machine, etc. Also, disposal of hatchery waste is automated in the hatchery and is centrally collected in a rubbish tank. A waste truck then comes to collect the rubbish tank which is lifted and taken to the sanitary waste disposal site, where the waste is offloaded.

2.2.2 Hazard Identification: Hatchery process

The critical points in the hatchery process that are susceptible to biosecurity hazards are:

- **Quality of eggs:** If the eggs are dirty (contaminated), they can transfer pathogens to the hatchery and subsequently to the chicks.
- **Hatchery staff:** Hatchery staff can transfer the contamination from outside into the hatchery, or from one hatchery section to another section if they do not adhere to biosecurity rules.
- **Hatchery sections:** If any hatchery section is not cleaned and disinfected, it can contaminate and transfer infection to other sections.
- **Equipment:** Unsanitary equipment, such as egg lifter, weight scales, jack pilot/forklift, rectal thermometers, egg trays, hatcher trays, trolleys, chick boxes, incubators, egg transfer machines, hatcher machines, can also contaminate and transfer infection to eggs, chick embryos, or chicks.
- **Employee uniforms:** Unclean uniforms can transfer contamination to all hatchery sections.
- **Chick sorting area and sorting team:** Chicks with defects or infections may be allowed to pass through to farms and spread infection. Sorting teams who do not wear appropriate PPE, such as masks, hair covers and gloves, may transfer infection to chicks and vice versa.
- **Vaccination equipment and vaccination team:** The vaccination equipment and team can be a source of contamination to chicks if biosecurity rules are not followed.
- **Ventilation system:** This can be a source of contamination if not cleaned and disinfected regularly.
- **Input materials to hatchery:** Input materials, such as egg paper trays, vaccine needles, vaccines, medicines, disinfectant products, PPEs, hatchery spare parts, etc., can be a source of contamination if not cleaned or sterilized.
- **Transport trucks:** Transport trucks for eggs and chicks can be a source of contamination to eggs or chicks, either from farms to hatcheries and vice versa, if not cleaned or sterilized.
- **Hatchery waste:** The waste materials are a source of contamination if not properly disposed off. In addition, the waste disposal tank and truck may be a source of contamination if not cleaned and disinfected properly.

2.2.3 Risk Management: Hatchery process

These are the biosecurity precautions to cover these hazard points:

- **Quality of eggs:** The egg room team should monitor the eggs received from the parent farms daily and remove any dirty, cracked or misshapen eggs, which may carry defects/infectious agents. The eggs should be properly disinfected with safe

disinfectants. Swab samples should be collected by the quality control team regularly and sent to the laboratory to check the bacteria load.

- **Hatchery staff:** Staff must shower with antiseptic soap in the hatchery shower area before entering the hatchery. Note that there are two shower areas in the hatchery: one shower area that serves the clean area egg room, the setter room, and offices; and another shower area that serves the dirty area chick room. This ensures movement into the hatchery in one direction and does not allow employees working in the clean area to go into the dirty area and vice versa, to avoid transfer of contamination. The quality team should routinely collect hand swabs and stool samples from the employees and send to the laboratory.
- **Hatchery sections cleaning and disinfection:** All hatchery units must be cleaned and disinfected regularly, and every end of the process by cleaning the walls and floors, doors, tables and drain lines using approved detergents and disinfectants. The quality team should routine collect swabs from surfaces and air samples and send to the laboratory to check the microbial loads.
- **Equipment:** All units have equipment and must not be transferred from one section to another, e.g., egg trays and trolleys, chick boxes, incubator machines, egg transfer machines, hatcher machines, etc. There are different cleaning procedures for various hatchery equipment, and they are done at different locations. All equipment at every section must be cleaned and disinfected separately, daily and at the end of every process, using approved detergents and disinfectants with hot water between 40-60°C. The quality team should collect swab samples from these equipment and send to the laboratory to check the quality of the cleaning and disinfection process routinely.
- **Employees uniforms:** All hatchery units have separate uniforms and with specific uniform colors for each section to identify the employee. All uniforms used by employees must be cleaned and disinfected in the hatchery laundry after the end of duty. Staff are not allowed to use any personal clothing inside the hatchery and not allowed to take out the work uniforms out of the hatchery.
- **Chick sorting area and sorting team:** All fecal material must be removed and the chick sorting area cleaned and disinfected, including the chick sorting tables and chicks transfer belts, using approved detergents and disinfectants, after every hatch. The quality team collects swab samples routinely and send to the laboratory to check the quality of the cleaning and disinfecting process. The sorting team must use PPE such as face masks, hair covers and hand gloves, before starting the sorting process and change them after the end of each flock batch. Quality team should collect fluff samples from chicks from each flock and send them to the laboratory to check any disease or contamination.
- **Vaccination room, equipment and vaccination team:** The vaccination room must be cleaned and disinfected after each process to get good vaccine results. Swabs from the room and air samples must be collected by the quality team and sent to the laboratory to check the quality of the cleaning and disinfecting process. The vaccine equipment must be cleaned and sterilized at the end of every

vaccination process for each flock and needles should be changed after every 1500 chicks vaccinated. The spray vaccine machine should be cleaned and sterilized at the end of each operation. The quality team should collect routine swab samples from the spray machine and send to the laboratory to check the quality of the cleaning and disinfecting process. Used vaccine vials must be safely disposed by collecting in a trash bag with appropriate disinfectant poured into the bag to kill any live viruses/organisms.

- **Ventilation system:** The ventilation system that includes air intake and air filter must be changed and cleaned following the recommendations from the manufacturers. This is done by the hatchery maintenance team. The quality team routinely collect swabs and air samples and sends to the laboratory to check the air quality.
- **Input materials to hatchery:** Any material entering the hatchery must be disinfected by fumigation or disinfection spray or ultraviolet device, depending on the type of the material entering the hatchery.
- **Transport trucks (egg, chicks):** The egg truck must be cleaned and disinfected before collecting the eggs from the farm and vice versa. It must be washed at its designated washing station. The chick truck must be cleaned and disinfected before use, before transferring the chicks to the farm and vice versa. It must be washed at its own designated washing station. The quality team should collect swab samples from the trucks routinely and send to the laboratory to check the quality of the cleaning and disinfecting process.
- **Hatchery waste:** The waste disposal tank and truck must be periodically washed and disinfected at its designated washing station. The quality team collects swab samples from the trucks routinely and sends them to the laboratory to check the quality of cleaning and disinfecting process, and microbial load.

2.3 Farms

2.3.1 *Overview: Poultry farm production*

The Food and Agriculture Organization (FAO) categorized the poultry production system into four sectors based on biosecurity standards.

- Sector 1 is made up of industrial and integrated poultry producers who practice "high" biosecurity,
- Sector 2 is made up of commercial poultry producers who practice "moderate to high" biosecurity (no contact with other birds),
- Sector 3 is made up of commercial poultry producers who practice "low" biosecurity (contact with other birds and closed/open sheds), and
- Sector 4 is made up of village or backyard poultry producers who practice "low" biosecurity (FAO. 2019).

The management practices of Sector 2 and 3 and part of Sector 1 are the same and hence the biosecurity guidelines are also the same. This report therefore describes the commercial sector which is part of Sector 1 and all farms in Sector 2 and 3. However, sector 4 (free range and backyard poultry) which practice limited biosecurity measures has different biosecurity guideline

Layers are meant to produce eggs, with production of eggs starting from 18 weeks of age on average, and this can last for one and half years. Broilers are raised for meat, and when properly fed, can reach market size at six weeks of age. Local poultry are scattered all over the country and are principally produced in the backyard farms.

a) Rearing techniques

Layers and broilers are usually brought to the farm as day-old chicks by the farmers. Before chicks are brought to the farm, the brooder houses are prepared to minimize bacterial load with the use of detergents to wash and clean the houses thoroughly, and then disinfect them. Houses should be left fallow for at least one week before the arrival of the day-old chicks after disinfection. Litter in the form of sawdust or wood shavings is then introduced in the brooder house. While the chicks are in the brooder house, the minimum temperature should be about 34°C for at least four days and this is achieved through the use of safe heat sources). Temperatures are adjusted downwards after every three days depending on the season the brooding is taking place. The minimum period of stay in the brooder house could be four weeks also depending on the season of brooding, whether it is rainy season or dry season. Air flow in the brooder house could be adjusted by intermittent opening of the windows.

b) Brooder house

The capacity of a brooder house should be determined by the farmer before it is built. The main entrance to the house should have a footbath. The walls should not have sharp edges and the floor should be made of concrete. Windows should be covered with expanded wire gauze and ventilation should not be impeded in any way. Good biosecurity on the farm cannot be practiced when the housing is not well constructed.

c) Poultry farm by-products

Poultry by-products include droppings, feathers and eggshells. The droppings are usually sold as manure to farmers or could be used for biogas production. Feathers are crushed and used as raw materials for poultry feeds. Eggshells can be fed to other farm animals like pigs.

2.3.2 *Hazard Identification: Poultry farm production*

- Due to non-compliance with biosecurity measures which include improper cleaning and disinfection Microbial invasion of the brooder house and possibly the chicks in the brooder, Due to non-compliance with biosecurity measures which include improper cleaning and disinfection excessive dampness or coldness of the house, can result in respiratory pathogens affecting the birds and causing respiratory disease.
- Inappropriate cleaning and disinfection of chick feeders and drinkers.
- Feeding of contaminated feeds and water.
- Absence of footbath for disinfection.
- Not dipping feet in the footbath before entering the poultry house.
- Not applying disinfectant in the footbath.
- Birds having contact with contaminated water, feed and raw materials used in producing the feeds.
- Failure to identify and/or remove dead birds from the brooder house.
- Introduction of new birds into the already existing flock on the farm.
- People, vehicles, wild birds, rodents, insects, pests, etc., getting in contact with commercial birds.
- Poor ventilation in the poultry house.
- Negligence towards vaccination of birds, especially from the hatchery.
- Stress as a result of poor handling or restraint of birds during vaccination or use of wrong equipment.
- Circumstantial starvation can also introduce stress in the poultry house.
- Improper disposal of poultry droppings or inability to remove the droppings when due.
- Contamination of poultry by-products with microbes could lead to the spread of disease-causing agents in the environment.
- Failure to isolate sick birds for evaluation.
- Misuse of antimicrobials.

2.3.3 *Risk Management: Poultry farm production*

- Thorough cleaning and disinfection of the brooder house with detergents and disinfectants.
- Provision of warmth in the brooder house by adequate lighting and heating.
- Chicken feeders and drinkers should be cleaned and disinfected at least three times in one week.
- Water to be given to chicks should be tested for coliforms before giving to the birds. Use water-purifying agents at the recommended dose to purify the drinking water for the birds.
- Batches of feed for chicks should be checked to make sure feeds do not expire before they are given to the birds.

- People entering the brooder house should all have their boots or feet dipped inside the footbaths before entering the house.
- Dead birds should be quickly removed from live birds to avoid cannibalism and transfer of infections.
- Windows of brooder house should be covered with wires mesh.
- There should be restriction of movement in the poultry house.
- Practice the “**all-in, all-out**” system of production.
- Vaccination of chicks should be done by trained professionals.
- Birds should be fed as at when due.
- Poultry droppings should be disposed of appropriately.
- Poultry by-products should be collected and stored safely to prevent contamination.
- Samples should be collected from dead birds for laboratory analysis.

2.4 Live Bird Markets

2.4.1 *Overview: Live bird markets*

The following are the main characteristics of live bird markets (LBMs) in Nigeria. Birds of different ages, breeds and species are transported for long distances from farms with different levels of biosecurity to LBMs. Some birds are slaughtered in the LBMs or bought live and taken to homes for slaughter, processing and cooking. Birds being sold are provided with little food and kept congested irrespective of age, breed, type and species in the same cages that are dirty and made of local materials and difficult to clean and disinfect or decontaminate. The water supply is grossly inadequate and sometimes not potable. The structures and infrastructures in the LBMs are inadequate and inappropriate. The LBMs are usually located within the main markets where food and other items or goods are sold. Traffic control is minimal and difficult to enforce. An appreciable number of the LBMs operate daily throughout the year. Local Government staff in charge of the LBMs concentrate more on collection of revenue than on disease control. The level of knowledge, attitude and practices (KAP) of most local government staff, fowl sellers and processors on biosecurity is very low. The level of sanitation in LBMs is low, including poor drainage and pile up of organic materials. Eggs of different types and species of birds, chicks, rabbits, guinea pigs, tortoises, wild birds are also sold; even cats, dogs and free-flying wild birds have access to LBMs. There is little or no control of insects and rodents in the LBMs. There are no clearly delineated areas for loading and off-loading, selling and processing of birds.

Previous Government Interventions in Live Bird Markets

Prior to the advent of outbreaks of Highly Pathogenic Avian Influenza in Nigeria in 2006, LBMs have received little attention by governments at all levels. The World Bank-assisted Avian Influenza Control Project (AICP) had as one of its strategies, the establishment, development and upgrading of selected model Live Bird Markets (LBM) across the

Country, As at the time the project ended in 2012, a total of about fifteen (15) biosecured LBMs had been constructed and put into use by various Fowl Sellers Associations (FSA) in ten (10) States.

Following the end of the World Bank-funded AICP, and in recognition of the positive effects of these model LBMs in the control, prevention and management of poultry diseases in the Country, the Federal Government under the Veterinary & Pest Control Services Department of FMAFS, has continued to intervene in the building and establishment of additional LBMs.

2.4.2 Hazard Identification: Live bird markets

- Poor design of infrastructures in LBMs make the facilities difficult to decontaminate and thus prone to microbial contamination.
- Susceptibility of birds to pathogens is influenced by *age, type, and species* of birds. An example is infectious bursal disease to which layers are more susceptible than broilers; and generally young birds are more susceptible to pathogens than adult birds because their immune system is still developing. Mixing birds of different ages, breed and species (inadequate isolation) could lead to ease of transmission of pathogens and the death of susceptible ones.
- After recovery from a disease condition, birds could remain inapparent carriers of pathogens. The excretions and secretions from such live birds that are not properly removed by good sanitation could contain viable pathogens that may spread to susceptible birds in the LBMs. The slaughtering and processing of live birds at home could expose the consumers to zoonotic pathogens.
- Poor husbandry practices such as poor feeding can lower the immunity of birds and makes them susceptible to infections. Birds kept under congested conditions could fight or cannibalize each other and become stressed, which lowers immunity.
- Cages and other equipment constructed with local materials such as bamboo cannot be adequately decontaminated, thus will maintain pathogens for long periods which later become available to infect new birds brought for sale.
- Lack of potable water can constitute a biosecurity hazard, because water is needed for washing and cleaning of buildings, equipment, vehicles and hands. Without proper cleaning, organic materials cannot be removed, and proper disinfection will not be achieved. Water is also needed for drinking by birds and humans and removal of solid waste in LBMs.
- Food and goods sold in the main markets (*poor isolation*) could be contaminated by zoonotic pathogens from infected live birds. It will be very difficult to stop the activities of the main market to decontaminate an infected LBM, situated right inside a main market.

- Transportation (poor welfare) is stressful and can lower immunity and enhance susceptibility of the birds to disease.
- Traffic control is minimal and difficult to enforce, which enables mechanical spread of pathogens into and out of a LBM, via unchecked movement of contaminated humans, animals, wild birds, equipment, and vehicles.
- The almost uninterrupted operation of LBMs daily throughout the year makes it impossible to decontaminate the area, leading to buildup of pathogens.
- There are no dedicated surveillance activities in most LBMs for disease control, to detect, prevent and respond to potential outbreaks of infectious and zoonotic diseases.
- Most local government staff, fowl sellers and processors have low knowledge, attitude, and practices (KAP) on biosecurity e.g. sanitation exercises, leading to likelihood of the introduction, maintenance and spread of pathogens in LBMs.
- The aggregation of diverse and unrelated species, breeds and types of animals and animal products in LBMs creates a hotbed of potential pathogens with massive biosecurity implications.
- With little to no control of insects and rodents in the LBMs, this aids the mechanical and biological transmission of pathogens to birds and humans.
- Lack of separate areas for loading, selling and processing could increase the possibility of cross contamination and spread of avian pathogens in LBMs.

2.4.3 *Risk Management: Live bird markets*

- Build proper and adequate infrastructures and use appropriate equipment that can easily be decontaminated.
- LBMs should be limited to birds of the same type and species. Construct separate markets for the sales of eggs, micro-livestock and wild birds.
- Food and goods should not be sold in LBMs and existing LBMs should be relocated and stand alone.
- Ensure high standards of sanitation during slaughter and processing of live birds in the LBMs and discourage home slaughter.
- Provide adequate floor space, water and feed and place live birds in metal or plastic cages that can easily be decontaminated.

- Ensure adequate potable water supply and improve/upgrade the level of sanitation in LBMs.
- There should be well-defined entry and exit manned gates to LBMs, and the flow of live birds, humans, vehicles and equipment should be in a one-way direction.
- There is a need to introduce rest days for all LBMs for the purpose of decontamination within the year. At such times, no activity in the LBM is allowed.
- Government officials, fowl sellers and processors in charge of LBMs should be regularly trained on biosecurity, and regular awareness campaigns should be conducted on the need for biosecurity in LBMs.
- Introduce regular insect and rodent control programs in LBMs.
- Provide separate areas for loading, selling and processing in LBMs.
- Regular surveillance should be conducted in LBMs

2.5 Processors

Overview of poultry meat processing

There are various levels of poultry processing operations. These range from low level manual processing units seen in local markets to intermediate levels and advanced levels, depending on the extent of automation of the operations, i.e., semi-automated or fully automated operations seen in industrial settings. While the local market process is usually located right next to open live bird markets, other higher levels of processing outfits are usually located within a farm operation or in more exclusive settings.

A. Low-level manual poultry processing

2.5.1 Overview: Low-level manual poultry processing

There are some peculiarities with the processing points located within the open live bird markets. Live bird markets usually have more than one type/species of bird. It accommodates broilers, spent layers, ducks, guinea fowls, pigeons, etc., and very often, other species of non-avian animals are accommodated. These birds are sourced from different farms, from various locations and they are of different ages. Stocks are replenished as at when needed without regard to biosecurity.

In addition, the volume of buyers of processed poultry and poultry products varies depending on the day of the week and the season of the year. Usually, the volume of buyers is higher during the weekends than on weekdays. Traffic of poultry buyers is highest during festive seasons.

It is important to note that the processing of poultry at live bird markets is fundamentally the same across the country. Characteristically, the following are used for the dressing of the poultry:

- i. One source of fire to boil water.
- ii. The same water may be used to dress many birds by different people.
- iii. A knife and table are commonly seen for use by all.
- iv. Processing is done in the open.

2.5.2 Hazard Identification: Low-level manual poultry processing

Hazards from open live bird market processing can result from the birds, equipment, water, fire injuries, and from market workers/processors. The mixing of different birds and animals in LBMs from different sources also increases the risk of introducing diseases, which may be zoonotic. Birds not fasted when brought in and slaughtered have high chances of ruptured intestines, resulting in contamination of the meat and also serve as a source of infection to processors. Use of unsanitary equipment can contaminate processed birds. Water used may be sourced anywhere and may not be safe. Open LBM processors/workers do not adhere to any specific rules to ensure their personal safety, nor the wholesomeness of the dressed poultry. The processors are generally exposed to high risk of infections and injuries, such as when igniting fires and from careless handling while processing. This can make them potential sources of disease transmission to their customers because of poor handling of the dressed birds.

2.5.3 Risk Management: Low-level manual poultry processing

To reduce biosecurity hazards at open LBMs, the following must be done:

Birds

- Open live bird market operators should limit their stock to only one type of poultry or one type of poultry product to reduce cross infections.
- Birds should be introduced through an “all-in, all-out” basis.
- Birds intended for processing should be separated and fasted from feed for 4-8 hours, with unrestricted provision of potable water.
- Records should be kept on the sources of the birds for the purpose of contact tracing.
- Sick birds must not be processed or sold. Sick birds must be culled and safely disposed by incineration.
- Incinerators should be constructed within 100 meters of the open LBMs.

Processors/workers

- They must be trained in proper handling and processing of birds.
- The processors/workers must be in good health before processing. The processors/workers should undergo medical checks twice a year.
- Sick or injured processors must never process birds.
- They must wear appropriate personal protective equipment (PPE), i.e., gloves, masks, aprons, head covers, when processing, and maintain personal and environmental hygiene, such as washing hands with soap and water after handling birds.

Water

- Use potable water that is safe for drinking.
- The water for processing birds should be changed as frequently as possible.
- Used water and other effluents must be disposed of safely.

Equipment

- Equipment should be non-porous for ease of washing and disinfection
- Knives, tables, dressing vats, etc., must be washed, cleaned and disinfected adequately before and after use.
- Equipment when not in use should be kept secured in designated places.

B. Organized poultry meat processing

2.5.4 Overview: Organized poultry meat processing

In Nigeria, the organized poultry meat processing houses are an extended part of an existing farm. They are established to complement the operations of the poultry farm to ensure availability of poultry products regardless of the season of the year. Organized poultry processing can be semi-automated to fully automated.

In semi-automated, it is a combination of manual operations and the use of some machines. In fully automated, every aspect of the processing line is mechanized, with minimal human involvement. The level of automation is usually determined by the scale of production/processing. Thus, the higher the scale of production, the higher the level of automation needed. In general, organized poultry processors have an improved work environment, enclosed with different levels of equipment and automation.

Organized poultry processing has different sections. These include:

- **Changing room:** This is where workers enter to wear their work clothes and other PPE, before entering the processing chambers.
- **Rest point:** This is the receiving area for birds to be processed. Birds are held for not less than 30 minutes before they are slaughtered.

- **Slaughter point:** In fully automated processing, the birds are hung upside down on a chain line and stunned, before slaughter. In semi-automated where stunning is not available, the birds are placed in stationery cones for manual slaughter. (Stunning aids in easier bleeding of the birds).
- **Scalding:** This is the use of hot water to loosen the feathers to make plucking easier.
- **De-feathering (plucking):** This is the removal of the feathers, which may be manually done or by a machine.
- **Washing:** This is the washing of the carcasses to remove any debris on the body of the birds. This is the first stage of washing. Note: In fully automated settings, the washing is happening simultaneously across the different sections.
- **Evisceration:** This is the opening of the carcasses and the removal of the visceral.
- **Washing:** This is the second stage of washing to ensure there is no trace of blood on the carcasses.
- **Straining:** This is the point where the birds are kept to drain the water from them.
- **Weighing and Packaging:** This is where the carcasses are weighed and packaged with appropriate information, including NAFDAC certification number, date of production, and expiry date.
- **Freezing:** The carcasses are first blast-frozen and maintained in temperatures not less than -18°C.

2.5.5 *Hazard Identification: Organized poultry meat processing*

Biosecurity hazards can occur at any point within the organized poultry processing spectrum.

- Unclean processing clothes and PPE may contaminate processed birds and may also pose a health risk to the workers.
- The presence of unhealthy birds at the rest point may set off a widespread infection along the processing line down to packaging and to the end consumer.

2.5.6 *Risk Management: Organized poultry meat processing*

To reduce biosecurity hazards in organized poultry processing settings, the following must be done:

- Workers should be trained on standards required for processing operations.
- Workers should ensure strict adherence to the instructions associated with every stage of the processing line.
- Workers should be in good health before entering processing units. Medical checks should be performed at least twice a year.
- All processing clothes and PPE should be washed, cleaned and disinfected before use, and after use.
- The birds pass ante mortem inspections by a licensed veterinarian.
- Unhealthy birds should be culled and safely disposed of by incineration.

2.6 Transportation

2.6.1 *Overview: Transportation in the poultry value chain*

Transportation means the moving of people, goods or items from one location to another either by road, rail, air and water. Transportation in poultry involves moving birds, equipment, products and by-products between locations.

In Nigeria, bulk of transportation of poultry, poultry products and by-products are mainly by road, although occasionally, day old chicks and hatchable eggs are air freighted over long distances. Usually some big hatcheries transport day-old chicks in appropriately designed vans., other types of vehicles such as cars, buses, trucks, motorcycles etc are used.

Live Birds

Live table birds are put in plastic and cane basket cages and then transported in all types of vehicles. Live birds from the rural areas are sold on village market days, which often attract buyers from other villages and urban market agents. Some of these agents assemble large numbers of poultry, including other species of birds bought from a number of markets and convey them in large baskets in trucks or placed on vehicle roof-top to cities and towns for sale. In some cases, this large cane basket containing multiple species of live birds are transported in the midst of the human population. Live birds from farms are often packed into modified buses, arranged on cane bedding materials and transported over long distances. Most of these vehicles are not specifically designed for this purpose.

Table Egg

Table eggs are packed in either plastic or paper crates. These crates are stocked in cartons and then transported in all types of vehicles. Throughout the transportation process, quality control measures are not being implemented to monitor the temperature, handling, and condition of the eggs.

Frozen Poultry

Frozen poultry are usually transported by processors to their sales outlets, supermarkets and major customers in cold vans and refrigerated trucks. Retailers use all types of vehicles including motorcycles in transporting frozen poultry.

Dressed Poultry

Dressed poultry are usually packed in empty feed bags or polypropylene bags and transported using all types of vehicles including motorcycles.

Poultry droppings/litter

Poultry droppings or litter are commonly transported for various purposes, including organic fertilizer production, soil amendment and biogas production. In Nigeria, poultry

droppings are packed into empty feed sacks and transported in all types of vehicles, including motorcycles and animal carts.

2.6.2 *Hazard Identification: Transportation in the poultry value chain*

While transporting poultry, poultry products and by-products, there are some points along the value chain associated with the introduction of biosecurity hazards.

This can occur when the vehicles for transport are dirty and not properly cleaned, after each cycle of farm or facility visit. These could serve as a potential source of contamination and transmission of infection to other farms and facilities.

In the case of frozen chickens, deviations from the desired temperature in the process of transporting will expose them to unfavorable temperatures leading to spoilage or microbial growth, which will affect product quality and safety. Also, bagging of poultry by-products, such as droppings, in damaged bags during transportation will lead to contamination of the vehicles, and may also lead to environmental contamination due to the associated spillage.

2.6.3 *Risk Management: Transportation in the poultry value chain*

To reduce biosecurity hazards during the transportation of poultry, poultry products and by-products, the following should be done:

- There should be periodic training of farm workers and transportation personnel on proper biosecurity protocols to minimize the risk of disease transmission.
- Use specialized vehicles for transport of poultry, poultry products and by-products.
- Ensure vehicle maintenance and roadworthiness to avoid breakdowns and prolonged transport times, which may affect optimal temperatures for the transport of poultry, etc.
- Clean and disinfect every vehicle used to convey poultry, poultry products or by-products before the next trip or use.
- Maintain accurate records of transportation activities for contact tracing and disease management.
- clean and disinfect Plastic crates before reuse.
- Paper crates should be disposed or destroyed after each usage.
- Encourage the use of plastic crates for proper cleaning and disinfection
- Proper temperature control, particularly for chilled or frozen products, during transportation is vital to prevent spoilage and bacterial growth and maintain the quality and safety of poultry products.
- Proper bagging of poultry by-products during transportation to avoid spillage.

2.7 Input Suppliers

Input suppliers are those in the business of providing quality and reliable inputs across the poultry value chain. They are classed into three major groups:

- Feed millers
- Manufacturers and sellers of drugs, vaccines and biologics

- Manufacturers and sellers of poultry equipment

A. Feed millers

2.7.1 Overview: Feed millers

The Nigerian feed mill industry addresses the nutrient needs of poultry feed, which constitutes over 70% of the total input cost. These are standard practices that are usually carried out in a feed mill. The feed mill is enclosed with a perimeter fencing to avoid entrance of pathogens from uncontrolled movement into the premises. At the entrance of the building, a gate is fixed and there is a footbath where disinfectant is applied daily to prevent disease pathogens from entering through the visitors and vehicles that enter the premises. Quality raw materials are sourced from reputable input suppliers. Nutrient value of the raw materials (grains) are determined to ensure that the feed meets the nutrient requirement of the birds. Raw materials are stacked on hard wood or metal pallets to avoid spoilage. During storage, raw materials are separated from the finished feed to avoid contamination. The crushed feed is packed in new bags to avoid contamination. Bagged crushed feed are stacked on hard wood or metal pallets and stored in a clean and well-ventilated room to ensure feed safety. The stored finished feed is safely moved to the farm, either manually or via clean vehicles to prevent contamination or deterioration. Finished feed are not sold after more than three (3) months of storage to avoid rancidity and infestation of microorganisms in the feed.

The three sub-sectors identified in the Nigerian feed milling industry are:

- Industrial Feed Millers
- On-Farm Feed Millers, and
- Commercial Toll-Feed Millers

The following criteria are used:

- **Industrial Feed Millers:** These are feed millers who manufacture feed strictly on a commercial basis. Industrial feed millers usually have their own registered brands and in-house quality assurance laboratories. The design and layout of feed mills should permit good hygiene practices, including protection against cross contamination. Industrial feed mills have the capacity of producing 2,000 tonnes and above daily.
- **On-Farm Feed Mills:** These feed mills are located on livestock farms and are meant to produce feed for the farm stock. An On-farm feed mill must be located at the entrance end of the farm and should be at least 200 meters away from the poultry production area(s) of the farm. The feed production level should meet the requirements of the farm. There can be a breach of biosecurity at On-farm feed mills if they adopt indiscriminate milling for other farmers.

- **Commercial Toll-Feed Mills:** These feed mills necessarily service many livestock farmers. Since this has biosecurity implications, it is therefore important that these feed mills must be located at least two kilometers away from any poultry production activities.

2.7.2 *Hazard Identification: Feed mill*

- Uncontrolled movement into the feed mill premises may introduce disease-causing agents in the premises.
- Use of contaminated raw materials to produce finished feed can lead to unwholesome feed that will consequently infect the birds.
- Use of unhygienic and inappropriate bags for bagging finished feed can contaminate the feed.
- Storage of raw materials and finished feed in the same place can contaminate both items.
- Storage of raw materials and finished feed on the floor will lead to rancidity, thereby leading to growth of harmful microorganisms which can cause infection. This can also attract vermin which may gain entry to the operation area and introduce infection.
- Failure to disinfect the entrance gate via footbath will expose the operation area to contamination.
- Feeds kept in the store for more than 3-4 months will increase the likelihood of microbial contamination.
- On-farm feed mill servicing other farms will expose the owner's farm to higher risk of microbial contamination.
- On-farm feed mill located very close to the poultry operation area increases the chance of microbial contamination.

2.7.3 *Risk Management: Feed millers*

- Raw materials should be checked for contamination before transporting to the feed mill.
- Raw materials should be cleaned and checked for quality e.g. colour, texture, moisture, odour to avoid deterioration.
- Raw materials should be checked for specification for nutrient composition.
- Samples of the finished feed should be sent to the laboratory for analysis.
- Finished feed should not be allowed to remain in the store after 3-4 months.
- Feed mills must use appropriate new bags for all products at all times. Bags should not be recycled.
- Stack bags of raw materials on hard wood to avoid deterioration and rancidity.
- Daily cleaning of the operation area should be observed.
- Workers should change into PPE at the cloak room before entering the operation area.
- Routine cleaning of machines should be observed.

- On-farm feed mill should strictly service its farm only.
- The distance of siting feed mill away from poultry production activity should be observed: at least 200m away from poultry production activity in the case of On-farm feed mill, and 2km away from poultry production activity in the case of Commercial Toll feed mill.

B. Input suppliers for Veterinary drugs, vaccines, biologics and equipment

2.7.4 Overview: Veterinary drugs, vaccines, biologics and equipment suppliers

Veterinary drugs, vaccines and biologics are meant to prevent and treat diseases. The use of these medical applications has immensely supported the poultry business from encountering high mortality, curtail and control disease spread. Poultry operators are protected from being infected with zoonotic diseases. The poultry business is a business of numbers and operators make robust profit because profit is measured by livability. The use of these medical applications for either prevention or treatment is to prevent mortality and ensure that birds are healthy and also to protect the health of the consumer.

The inappropriate and indiscriminate use of these medical applications will result in huge mortality, unwholesome and unsafe poultry products for the consumer. The unguided use of antimicrobials is associated with the menace of antimicrobial resistance. Biosecurity measures should be applied in the handling of vaccines, drugs, and biologics to protect the birds, the consumer and the poultry operator.

Some of the areas that can pose a threat to biosecurity measures includes

- i. The method and means of supply to the poultry farm
- ii. The mode of administration.

In the same manner, equipment used in poultry production are meant to increase output and reduce drudgery. The type of equipment used in the farm depends on the capacity of the farm. A farm with high bird capacity will use more sophisticated equipment while a farm with medium or low bird capacity will use simple equipment.

The areas that can pose biosecurity threat include:

- i. Means and method of transportation of poultry equipment from the point of manufacture or sales to the poultry farm.
- ii. Mode of installation in the poultry house

2.7.5 *Hazard Identification: Veterinary drugs, vaccines, biologics and equipment suppliers*

- Indiscriminate use of drugs, vaccines and biologics leading to microbial resistance .
- In the supply and transportation of vaccines, drugs, biologics and equipment, it is observed that the input suppliers are not conscious of biosecurity measures. They convey these items in dirty truck exposing them to disease causing agents that may come in contact with the birds.
- Administration of vaccines, drugs and biologics by wrong personnel.
- Wrongapplication of vaccines, drugs and biologics, could cause gross mortality as a result of disease outbreaks which may not be reported
- Most agro-dealers transport and sell vaccines to farmers without a cold chain, the vaccines are denatured and lose their potency.
- In the farm unused drugs and biologics are not kept in cool places for future use. rather the attendants expose unused drugs to both rain and sun and will still use them for the birds
- Some farmers administer expired vaccines, drugs and biologics to birds
- It is observed that after vaccination, the vaccine bottles are not properly disposed which result in disease resistance.
- Some operators allow equipment to be installed in the farm when birds are already stocked in the farm which can cause injury to the birds.
- Some operators allow damaged equipment to remain in the farm until it starts causing damage either on the birds or workers before it is removed.
- Most attendants are not kitted with PPE while administering these items.
- Sick attendants or personnel with open wounds are seen to be handling and administering drugs and vaccines to the birds, this can affect the quality of the drugs and vaccines or transmit the disease to the birds.

2.7.6 *Risk Management: Veterinary drugs, vaccines, biologics and equipment suppliers*

- Vaccines, drugs, biologics and equipment should be transported to the poultry farm in a clean vehicle, vaccines in particular should be conveyed in a vehicle that has cold chain facility to maintain its potency
- Vehicles used for the conveyance of these items should be washed and dried before and after use
- To avoid indiscriminate use of veterinary drugs, vaccines and biologics, veterinary personnel and trained animal health workers should prescribe and administer to the birds in accordance with the national treatment guidelines
- Vaccines, drugs, and biologics used in the farm should be stored in a cool, clean and well-ventilated room to maintain its quality.
- Footbaths with disinfectants should be placed at all entrances of the compound to prevent entry of pathogens.
- Expiry dates of vaccine, drug and biologics should be checked before use.

- Attendants having infectious disease or suspected to be affected by an infectious disease or with open wound should not be allowed to administer drugs, vaccines and biologics to birds. It could affect the quality of these products or cause transmission of disease to the birds especially if it is a zoonotic disease.
- Poultry attendants should be kitted with PPE while working in the farm
- After vaccination, the vaccine bottles should be properly disposed off.
- Installation of equipment should be done before stocking.
- Damaged equipment should be removed before it starts affecting the health of the bird.

Equipment and tools must be handled with care. They are not to be thrown around the farm so that it does not injure any worker or bird. References

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