POULTRY FARMING: A VERITABLE TOOL FOR EMPLOYMENT GENERATION AND POVERTY ALLEVIATION

By

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The Vice-Chancellor,
Deputy Vice-Chancellor,
Principal Officers of the University,
Deans, Directors and Heads of Departments,
My Lords Spiritual and Temporal,
Fellow Academic and Professional Colleagues,
Special Guests,
Gentlemen of the Print and Electronic Media,
Distinguished Ladies and Gentlemen,
Great UNAABITES.

First and foremost I wish to start this lecture by thanking the Almighty God, the KING of kings, and the LORD of lords for making this day a reality. I give all the glory to God that my department and all members of my college nominated me to be the Inaugural Lecturer for today. I deeply appreciate the honor because it's an opportunity for me to share my experience of eighteen years in the academics with my colleagues and the public.

1.0 INTRODUCTION

It is a great privilege for me to present this day, Wednesday 3rd October 2007, the 22nd Inaugural Lecture of the University of Agriculture, Abeokuta (UNAAB).Today's lecture is a coincidence because I assumed duty in the University also on 3rd October 1989. This is the 6th Inaugural Lecture from the College of Animal Science and Livestock Production (COLANIM), the 2nd from the Department of Animal Production and Health, the 1st to be presented in UNAAB by a foundation member of COLANIM, the 1st in the subject area of Monogastric Animal Production and the 1st to be presided over by the current Vice-Chancellor, Prof. O.O. Balogun.

The title of my lecture as advertised is **POULTRY FARMING: A VERITABLE TOOL FOR EMPLOYMENT GENERATION AND POVERTY ALLEVIATION.** The choice of this title was informed from a letter received from the Central Bank of Nigeria, dated 19th November 2003, requesting me to write an article for publication in Bullion Magazine, a quarterly publication of the Central Bank of Nigeria on "**Employment Creation/Opportunities in the Agro-allied sub-sector: The case of Poultry farming."** In that paper, I identified the operations and profitability of poultry business. It is noteworthy that some members of the public who read the publication by then embarked on small-scale poultry farming. By the year 2004, a total of 1,308 poultry farmers benefited from 35,035 Agricultural loans valued at N2.1 billion for poultry farming. Up till today, most of the poultry farmers are still very much in the business as employers of labor rather than job seekers. Mr. Vice Chancellor sir, distinguished ladies and gentlemen, today's lecture will therefore highlight the uniqueness of poultry farming in the livestock industry and at the same time identify employment opportunities in poultry production.

However, at a point I was tempted to change the title of the lecture because of the report of first outbreak of Avian Flu in Nigeria on 8th February 2006. But I later realized that the history of Avian Flu was gradually becoming a thing of the past, just like the previous outbreaks of Rinderpest in cattle and African swine fever in pigs. Hence, I decided to consign the events of Avian Flu to the footnote of history in order to move the poultry industry forward. Interestingly, many stakeholders in the poultry industry that were rendered jobless due to the outbreak of Avian Flu are gradually going back into the business. From the look of things the wound has been healed even though a stronger government intervention, like in other countries could have helped. Besides, Nigeria is aided in the battle against Avian Flu by a $50 million World Bank Credit facility for Influenza control programme. Recently, scientists discovered anti-bodies for the treatment of bird flu in humans.

As at the time of writing this paper, many commercial hatcheries visited were operating at full capacity. Many fast-food establishments that were earlier deserted are now

witnessing high patronage with their usual common menu items. In fact, the National Planning Commission remarked very recently that 'economy had recorded impressive performance. But ironically, many Nigerians (both young and old) are still not gainfully employed. This is a dangerous trend that must be given special attention because of the negative consequences usually associated with unemployment in any society**.**

Mr. Vice Chancellor sir, unemployment problem exists in both the rural and urban areas of Nigeria as a result of imbalance in labour supply, rapid population growth rate and faulty educational system among others (Abiola, 2003). In 2005, a coalition of Civil Society Groups called **Network of NGOs on Population and Reproductive Health (NINPREH)** raised alarm over imminent danger of over population in Nigeria. The groups observed that increase in poverty and unemployment rates were consequences of increasing population. They therefore suggested the need to reduce fertility rate of 5.7% in 2005 to 2% by embracing child spacing, use of family planning methods and discouraging early marriages as a way of improving the quality of life of Nigerians.

Reacting to the results of 2006 National census that gave the figure of approximately 150 million as the population of Nigeria (3.2 annual growth rate), the Federal government also called on Nigerians to embrace a tradition of smaller households in order to address the economic challenges presented by the country's rising population. Government observed that high population rates were synonymous with poverty and therefore discouraged early child marriage. Growth without a corresponding increase in employment is part of the lingering challenges and concerns facing the country at the moment. The unemployment of labour in a 'land surplus' economy is an indication of inefficiency in resource-use, loss in GNP and can bring about socio-political unrest (Miller, 1979). Unemployment is a social evil that must be kept at an 'acceptable' level because it brings about loss of dignity, human suffering, poverty, family disintegration etc.

Frictional, cyclical, seasonal and structural unemployment exist in Nigeria with attendant negative consequences. Frictional unemployment is the continuous flow of individuals

from job to job and in and out of employment in search of better jobs (e.g. from poultry farming to pig farming, pig farming to feed-milling, feed-milling to fish farming and probably from fish farming to politics). An attempt to eliminate frictional unemployment would probably reduce the rate of growth of our economy. However it can be reduced by getting better information about alternative sources of jobs as will be highlighted in this lecture. Cyclical unemployment on the other hand is associated with changes in business conditions, primarily recessions and depressions, while seasonal unemployment comes and goes with seasons of the year in which the demand for particular jobs rises and falls. Structural unemployment however is the one resulting from the increased use of labour-saving machines.

A major problem presently threatening the future social stability of this country and many other countries is the unemployment of youths **(Table 1)**. This is a time bomb with potential explosive consequences and it is on a short fuse. Fortunately government is taking step in the right direction with the proposed scheme of vocational training. I take the stand that all sectors of the economy should adopt a more positive attitude to this problem in order to upgrade the market value of our tertiary educational products.

Table 1: Number of unemployed registered with employment and exchange offices in Nigeria

Category	2004	2005
Lower Grade	311,119 (77.32 %)	295,236 (92.91 %)
Professional & Executive Cadre	91,236(22.68 %)	22,533 (7.09 %)
TOTAL	402,382	317,769

Source: CBN (2005).

Poultry is a paradigm for upgrading the status of youth and especially as an agro-based industry. The need to create employment particularly in the livestock sub-sector necessitated the setting up of the National Directorate of Employment (NDE) poultry-farming scheme. Poultry production is a socio-economic activity that could lead to

improved income and quality of life and it has a high rating because the net return on investment is relatively higher than that of other animal species. Its contributory role to national economy cannot be over-emphasized.

Mr. Vice-Chancellor sir, in this lecture, I will enlighten my audience on employment opportunities in poultry farming. This will provide opportunity for any one **'who wants to be a millionaire'** in poultry business. In addition, I will present my modest contributions to the advancement of the poultry industry in Nigeria. This lecture will therefore be presented under the following headings:

- The birds of the world
- Poultry as a business concern
- My modest contributions to poultry production
- Limitations of poultry production
- Conclusion and recommendations
- Tributes and acknowledgement

2. 0 THE BIRDS OF THE WORLD

The **BirdLife International** which is a unique and global conservation organization working to protect the world's birds and their habitats is represented in more than 100 countries. The organization demonstrates the value of birds and how, through the links between birds, habitats and people, birds can make a difference to the quality of life on earth. According to HBW (2004), BirdLife International identified about 10,200 living bird species in the world, making them the most diverse class of terrestrial vertebrates. However, more than 1,200 species are currently threatened with global extinction. Habitat change and destruction have been considered as the most important threats to biodiversity loss in general and birds in particular (Schei, 2004). BirdLife International promotes bird watching and wildlife tourism because tourism is one of the fastest growing industries in the world. This represents part of the economic importance of birds, which has led to the creation of local jobs and improvements to local economies.

In ornithology, bird 'songs' are regarded as certain vocal sounds that are melodious to the human ear. Males rather than female birds emit most songs. The songs of different species of birds vary and are more or less characteristic of the species. *Zebra Finches*, the most popular species used in bird song research, develop a version of a familiar adult's song after 20 days from hatch. Musicologists believe that bird song has a large influence on the development of music while many composers have used bird song as a compositional springboard. American Jazz musician, Eric Dolphy, often listened to birds while practicing flute. The English singer, Kate Bush, incorporated bird sound effects into much of the music on her 2005 album, Aerial. In the *psychedelic* era of the 1960's and 1970's, many rock bands included bird sound effects in their recordings. Many CDs containing the songs and voices of systematically arranged bird species of Africa and other countries have been produced. It can be concluded therefore that songs of different species of birds stimulated my interest in church music.

Birds are among the most extensively studied of all animal groups. Hundreds of academic journals and thousands of scientists are devoted to bird research. Some of the birds of Africa include ostriches, pigeons, woodpeckers, sparrows, etc.

2.1 DOMESTICATED BIRDS

The domesticated birds of importance in the tropics include domestic fowls, the common duck, Muscovy ducks, goose, turkey, peafowl, Japanese quail, guinea fowl, pigeons and the ostrich. Domestic fowls are by far the most important in the tropics and they probably originated from four wild species namely: *Gallus gallus, G.varius, G. sonnerati and G. lafayetti.* Some authorities consider that *G. gallus* is the only ancestor of the domestic fowl while others believe that all the four wild species contributed genes to the domestic fowl. The center of domestication is unknown. However, in view of the very wide distribution of the wild species, it is possible that there were several centers of domestication. In terms of distribution, there are more domestic fowls in the non-tropical than in the tropical regions of the world, with more that one-third of all domestic fowls

found in Asia. Although most of the domesticated birds have many things in common, some of them possess unique features.

Ostrich (*Struthio camelus*) is a flightless bird, native to Africa. Its family name is *Struthionidae* while the genus is *Struthio*. Domestication and farming of ostriches commenced in the 1860s in South Africa to meet a demand for their feathers as fashion items. This market collapsed at the onset of World War I, but the ostrich industry revived when new markets in leather, meat and feathers were developed after World War II. Since the mid 1980s its growth worldwide has been spectacular. Ostrich is the only largest living bird, with the slowest respiration rate, but it also has the largest eye among all contemporary terrestrial vertebrates. It has a long neck and legs and the ability to run at speed of about 65km/h. It is the best post-gastric fibre fermenter among birds, having a greatly elongated colorectum which comprises 60-70% of its total intestine length (compared with about 5% in the emu and domestic fowl), and its passage for digesta (40-50h) is more like that of a ruminant than that of other birds (emu 5-6h, domestic fowl 3-5h). It has a specialized cloaca which allows it to expel faeces and fluid urine separately. Ostrich meat tastes similar to lean beef and is low in fat and cholesterol, as well as high in calcium, protein and iron. Egg mass is 1-2kg and this poses problems for artificial incubation. The life span of an ostrich can extend from 30 to 70 years, with 50 being typical. The main problem areas in ostrich production are concerned with reproduction and early rearing.

The domesticated turkey is a poultry bird raised for food and descends from the wild turkey, *Meleagris gallopavo*. Male turkeys strut and demonstrate, usually in groups, to attract hens. The hen in turn makes a call that attracts the males. Hens continue to lay fertile eggs for 3-4 weeks from just one mating. Some commercial turkey hens occasionally produce young from in-fertile eggs in a process called parthenogenesis. The average life span for a turkey is 10 years.

Geese have been domesticated for centuries and they belong to the family *Anatidae*. They usually mate for life, though a small number will ‘divorce’ and re-mate. They are grazers

and are therefore efficient controllers of weeds in cultivated crops such as coffee, cocoa, bananas and pineapple. Geese may live for 20 years or longer. Duck is the common name for a number of species in the *Anatidae* family of birds. Some species, mainly those breeding in the temperate and arctic Northern Hemisphere are migratory, but others particularly in the tropics are not. Guinea fowls have long history of domestication and belong to the family *Numididae*. They have featherless heads and are monogamous, mating for life.

Pigeons belong to the family *Columbidae*. The life span is any where from 3-5 years in the wild to 15 years in captivity. Both parents usually incubate eggs laid by female for about 18 days. Young pigeon meat is often sold under the name *squab.* Trained domestic pigeons are able to return to the home left if released at a location that they have never visited before and that may be up to 1000 kilometers away. They have made contributions of considerable importance to humanity especially in terms of war by making them messengers. Homing pigeons in particular were used to carry messages before the advent of modern instant communications methods. White doves, usually meaning domesticated Rock pigeons, are a traditional Christian and Jewish symbol of love and peace. According to the biblical story, Noah released a dove after the flood in order to find land; it came back carrying an olive branch to symbolize peace. In Christian iconography, a dove also symbolizes the Holy Spirit, in reference to Matthew 3:16 and Luke 3:22 where the Holy Spirit appeared as a dove at the Baptism of Jesus. A voice came from heaven, which said, **'This is my beloved Son, in whom I'm well pleased.'**

3. 0 POULTRY AS A BUSINESS CONCERN

Mr. Vice Chancellor sir, distinguished ladies and gentlemen, this is the aspect of my lecture that will focus attention on commercial poultry production. A prospective commercial poultry farmer should consider the following factors for the establishment of poultry farming:

3.1 Type of operation

There are different branches of the poultry industry that can be considered for a take off. These include broiler production, point of lay production, egg production, hatchery operation, poultry processing and marketing.

BROILER is a North American term used to describe young male or female chickens less than 12 weeks old based on fast growing breeds, reared and sold specifically for poultry meat. For broiler production, the rapidity of turn over is very high and the current projected profit per broiler is ₦300. The costs of day-old chicks, house and equipment are part of the fixed capital in the short run. Although the market prospect may be difficult to predict, the poultry farmer could be assured of ready markets for production. This optimism arises from the ban on the importation of poultry products by the Federal government and the growing fast food businesses in Nigeria requiring massive production of broilers. Costing and pricing of poultry products are vital factors in the poultry industry. Costing is the process of calculating the various costs that arise in running the business while pricing is the process of establishing a selling price after considering the various costs involved to sell a product. The 3 steps involved in the costing and pricing of dressed broilers are presented in **Table 2**.

Table 2: Costing and pricing of dressed broiler

Step	Calculation
1	Dressing % = $\frac{\text{Carcass Weight (kg).} \times 100}{\text{Liveweight (kg)}}$
2	Carcass cost price/kg = $\frac{\text{Liveweight price/kg.} \times 100}{\text{Dressing \%}}$
3	Carcass selling price/kg. = $\frac{\text{Carcass cost price/kg.} \times 100}{\text{100- Gross profit margin reqd.}}$

Point of lay production as a business entails rearing of pullet chicks from 0-18 weeks. Such chicks must be obtained from reputable hatcheries. The products are disposed off and not used in production by the producer. Very few poultry farmers are involved in this type of operation partly because of the problems associated with the brooding of day old chicks and the risk of disappointments by the potential buyers. However, this is a manageable risk by insistence on substantial non-refundable deposits.

The expansion of the business of egg production can partly be attributed to quick turn-over. The current estimated gross or net daily profit from the sale of eggs from 2,000 layers is ₦5 000 depending of course on the use of birds of superior genotype, provision of favorable environment and managerial skill. Moreover, spent fowls which are by-products of the egg industry ensure greater returns to the egg producers at the end of the laying cycle since the cost of production is largely integrated with that of eggs. Egg production business is probably the quickest way of making your millions in poultry farming. In this operation, do not joke with the welfare of the poultry attendants. Carry them along in decision-making.

Chick production business is a specialized branch of the poultry industry that deals with hatchery operations (Oluyemi and Roberts, 1979). This branch serves as the biggest employer of labor in the poultry industry. The hatchery is a manufacturing unit. Its raw products are fertile hatching eggs, its manufacturing process is the incubation of the eggs and its finished products are the day old chicks. Whether or not the hatchery is successful depends largely on the number of eggs that produce saleable stock. In this operation the market is highly competitive. Items on which running costs are expended will include administration, selling and delivery, maintaining the breeders, etc.

The Tropical Agriculturalist (2001) reported that farmers in developing countries have very small farms to cultivate and so the maximum use of limited resources will be of great importance as proper integration of several enterprises can be practiced. Integrated farming (or integrated agriculture) is a system of agricultural techniques developed in France in 1993 by *Forum de I'Agriculture Raisonnee Respecteuse I'Environnement*

(FARRE). It is an attempt to reconcile agricultural methods with the principles of sustainable development by balancing food production, profitability, safety, animal welfare, social responsibility and environmental care. Integrated farming maximizes production through optimum utilization of available resources. Integration of poultry with other enterprises such as fish and crop production will require a compatible arrangement. Examples of compatible enterprises with poultry are:

- Duck – fish farming (e.g. in Malaysia): Raising ducks on the embankment of fishponds fits very well with a poly-culture practice in fish farming, as ducks are highly compatible with cultivated fish. One duck produces about 72kg of droppings in a year. About 25kg of duck manure is required to yield 1kg of fish flesh. Therefore, 500 ducks kept in 1 hectare pond will produce 36 tonnes of manure in a year to yield 1,400kg of fish.
- Swine – chicken, fish farming
- Poultry – fish, rice, other crops.

In the integration of poultry with fish farming, the poultry manure is used directly to feed the fish. The waste is thereby converted into a useful commodity. Combining a fish culture system with other livestock components is a way of reducing the increasing cost of fish production and minimizing the cost of feeding. Onuoha and Onyebinama (2001) compared the costs and returns for integrated and non-integrated polyculture and poultry. They concluded that integrated polyculture and poultry made positive contributions to the profit of the farm. Integrated farming augments production of animal protein, improves economy and generates employment particularly in rural areas.

3.2 Location of the poultry farm

Legal clearance must be obtained from appropriate authority before establishing poultry enterprise to prevent the demolition of structures, culminating in the termination of the enterprise. The enterprise must not be a source of nuisance in the nature of foul odor and noise to neighbors. Ensure access to water, electricity and proper drainage.

3.3 Capital outlay

This will depend on the size and type of operation and the management system. For the take off, personal savings up to N250, 000 can be utilized particularly for small-scale broiler production. Alternatively agricultural bank loans on liberal terms may be considered. Agricultural Credit Guarantee Scheme Fund (ACGSF) and the National Directorate of Employment (NDE) Poultry Farming Scheme can provide loans to prospective poultry farmer. Decree 20 of 1977 established the ACGSF to induce Deposit Money Banks to lend to agriculture. The lending limit to individual is ₦20 000 without tangible security or ₦1 million with tangible security, to Co-operative societies and Limited liability companies is ₦10 million with collateral. Analysis of loans guaranteed for livestock by ACGSF in 2004 and 2005 showed that poultry sector dominated, accounting for 89.44 and 88.09% of total loans guaranteed respectively **(Table 3)**.

3.4 Manpower required

For a small-scale operation, one poultry attendant should be able to manage a minimum of 2000 birds either on the deep litter or in cages. Occasional operations such as manual removal and vaccination require additional labor which could be provided by members of the family.

3.5 Feed supply

In Nigeria, feed cost accounts for about 70% of the cost of poultry production. This is due to the high cost of some critical feed ingredients (e.g. maize and soybean) which are needed in poultry ration. The need for well-balanced poultry diets and the competition with the human needs particularly for maize and soybean are some of the constraints against poultry production. The entry of unemployed young graduates into the feed milling business has increased the number of feed mills in Nigeria in recent times. This trend has impacted favorably on the feed supply situation in the country especially in terms of feed quality. However, a small-scale poultry farmer with 1,000 birds should be

able to acquire a sizeable feed mill for the production of cheaper and good quality poultry diets. But this is applicable where the facilities can source other users to avoid underutilization.

3.6 Poultry products and by-products

The main poultry products are eggs and poultry meat. Eggs from the farm should be collected regularly and stored under low temperature. The period of egg storage should be as short as the exigencies of marketing permit. However, the egg producer must realize the fact that age, health of birds, nutrition and environmental temperature are some of the factors that can affect egg qualities and hence their marketability. Egg products can be used to enrich some fast food products, exploiting their properties of binding, emulsifying, foaming, thickening and leavening.

The embargo on the importation of poultry products in 2002 by the Federal Government is to protect the infant domestic industry with emphasis on small-scale commercial poultry producers in Nigeria. However, this expectation is yet to be realized since the output of poultry products (e.g. poultry meat) lags behind other livestock products whereas poultry farmers collected over 80% of loans guaranteed for livestock over the years **(Table 4)**. It is time that Nigerian poultry farmers rise to the challenge of filling the gap created by this ban of importation so as to discourage black marketing.

Poultry by-products such as poultry droppings, poultry offal and hatchery wastes can be processed to provide additional source of income to the poultry farmer. Physical, chemical or biological treatment will destroy pathogens, recover nutrient content and improve acceptability, palatability and storage quality. Modern broiler and layer farm production has resulted in the production and accumulation of enormous amounts of poultry manure. Disposal of this manure is of significant environmental concern. However, urban agriculture as a means of solving urban poverty has encouraged the use of poultry droppings as manure for vegetable gardening and feed ingredient in fish farming. This approach is facilitating waste management. The concentrations of nitrogen,

calcium and phosphorus in poultry wastes are higher than in the wastes of other species while nutrient content of broiler litter is higher than that of caged layer **(Table 5)**.

The value of poultry wastes as a source of these nutrients provides more incentive for the utilization of this resource for plants and animals (Fontenot *et al*., 1983).

Table 3: Loans under the Agricultural Credit Guaranteed Scheme Fund (ACGSF) for livestock (N million).

Purpose	2004	2005
Poultry	170,199.0	220,830.5
Cattle	8,770.0	8,502.3
Sheep & Goats	1,950.0	2,100.0
Others	9,385.0	19,245.0
TOTAL	190,304.0	250,677.8

Source: CBN (2004, 2005).

Table 4: Estimated output of livestock products ('000 tonnes)

Item	2001	2002	2003	2004	2005
Poultry meat	81.1	82.3	83.1	91.4	110.9
Goat meat	421.8	442.1	490.6	511.6	524.4
Mutton	400.6	419.9	472.5	486.5	498.1
Beef	177.0	185.6	232.5	239.8	235.1
Pork	53.5	56.1	58.5	62.3	66.5
Milk	1001.5	1049.6	1093.7	1185.9	1245.2
Eggs	466.5	488.9	509.5	525.4	580.0

Source: CBN (2005).

Table 5: Nutrient content of poultry wastes

Nutrient	Broiler Litter	Dehydrated caged layer excreta
Crude Protein (%)	31.3	28.0
Crude fibre (%)	16.8	12.7
Ether extract (%)	3.3	2.0
ME (Kcal/kg)	2181	NA
Minerals (%)		
Calcium	2.4	8.8
Phosphorous	1.8	2.5
Potassium	1.8	2.3
Sodium	0.2	0.9

Source: Sreeniva (2005)

Poultry waste up to 20% in cattle ration and 5% in poultry diet will not affect performance. Khamis *et al*. (1996) indicated that '**broiler litter-green berseem silage'** could successfully constitute approximately a third of the fattening diet of sheep. This practice will result in cost advantages to farmers who integrate poultry with ruminant livestock. Abiola (1999) recommended 10% sun-dried poultry manure as protein supplement in the diets of weaner pigs. Poultry manure is one of the richest sources of nutrients (especially nitrogen) for which fast growing vegetables have an almost insatiable appetite. Extraction of the nutrients in waste poultry manure in a soluble form results in the formation of brown coloured solution called **"chicken manure tea"** which was found to perform at an equivalent level to that of standard chemical fertilizer in the growth and development of tomato (Price and Duddles, 2004). Poultry manure application at the rate of 30 t/ha performed a dual role of improving the performance of Corchorus olitorius (an important vegetable in Nigeria) and served as means of disposal of poultry droppings (Adenawoola *et al*., 2005).

It is therefore not surprising that a wheel- barrow of fresh poultry dropping costs as much as N200 in some parts of Lagos State where it is used primarily for vegetable production.

At this juncture, I'm sure that the audience will be convinced that marketing of poultry waste is perhaps a cheap means of deriving income from poultry business since the only fixed capital investment is the wheel- barrow for the evacuation of poultry wastes. The economic benefits of poultry manure use by integrated poultry-maize farmers in Ekiti and Osun states of Nigeria were evaluated by Bamire and Amujoyegbe (2003) who found that the mean net income earned per annum by poultry manure users was 1.40 times higher than that for non-users. Many experiments have produced overwhelming evidence that organic fertilizer offers affordable and readily available solution to many soil fertility problems.

Turkey droppings have been used to fuel three electric power plants in United Kingdom. So far the plants have been providing 55 megawatts of power using 700,000 tonnes of turkey dung per year. A similar power plant will be installed in Western Minnesota before the end of 2007. Research studies showed that maggots on poultry droppings have high nutritional potentials for poultry diets. The biological value of maggot protein has been found to be close to that of fish meal and superior to that of groundnut cake and soybean meal. About 1-2 tonnes of maggots could be produced in a month in a 20,000 hen- laying house. Such maggots could be dried for sale as stable source of income. Again in some parts of Lagos State, dried maggots are available for sale as feed ingredients for fish. From the foregoing, it is obvious that marketing of dried maggots is another veritable tool for employment generation.

Poultry offal meal and hatchery wastes have also been used as dietary protein supplements for poultry and pigs. With the emergence of large- scale poultry farming in Nigeria and the declining availability of protein concentrates, the re-cycling of such wastes would reduce feed cost in poultry business and also provide employment opportunities. The nutritional value of hatchery wastes will be addressed in more details later on.

3.7 Target market

Mr. Vice Chancellor sir, it is important to emphasize that there are few if any social or religious stigmas attached to the use of poultry meat in human diet. Hence the demand is high for live birds from local markets either for home consumption or as gifts at the time of festivities such as Christmas, New Year, Easter, Id El- Fitri, etc. Restaurants, hotels and supermarkets in Nigeria are noted for fast food business that involves the sale of products like chicken burger, egg bonze among others. Besides, fowl meat has good potential export driven nature worldwide while exportation of eggs into some West African countries is a lucrative business. Apart from the use of eggs in human diet, other uses of eggs provide employment opportunities in different industries. Eggs are used in the manufacture of vaccines, emulsion paint, in the leather tanning, production of shampoo for beauty saloons, photo-engraving, production of glue and some pharmaceuticals. Eggs can also be used as leavening agent in baked foods and for the production of egg powder that can later be incorporated into baby foods.

The monumental work of Akinwumi *et al.* (1973) on the population of poultry in Nigeria indicated an egg consumption of less than 50 eggs per caput per annum which was then substantially lower than those of other parts of the world. Since then, consumption of poultry products should have increased in view of the increasing awareness of the nutritional benefits in consequence of greater enlightenment and of probably improved purchasing power. With the current Nigerian population census of approximately 150 million, the conservative estimate of 50 eggs per caput per annum translates to 30 million layers, assuming a laying performance of 70% Hen-housed. For the management of only the layers, the corresponding requirement for labor is 30,000. However, the ancillary labor requirements will considerably increase this estimate. Greater estimates are justified for broiler production especially in the light of the ban on frozen chickens. These estimates of consumption and labor requirement are still potential rather than actualized. The reasons for this undesirable state of affairs are a matter for separate lecture. But suffice to say that given the potential wealth of the nation, a change in values and better management of the nation’s resources, a radical transformation should be expected.

3.8 Record Keeping

At any level of production, either backyard or commercial, efficiency of performance is demanded and to this end, record keeping is an indispensable tool. Any one aspiring to become an entrepreneur in poultry farming must learn how to keep daily, weekly, monthly and yearly records for all classes of poultry. Records provide information that can be used to detect and correct management errors and to prevent the spread of diseases. Flock, egg production and veterinary records are useful for efficient poultry management.

3.9 Profitability of poultry business

Results of several studies in Nigeria have confirmed the profitability of poultry business. The return to management has been found to be higher than the income earned by peers in the civil service job. The following are some of the advantages of poultry farming:

(a). Poultry farming can provide wider employment opportunities than any other livestock business because there are many branches in the poultry industry.

(b). Poultry farming is characterized by quick financial returns on investment as a result of short generation interval.

(c). Spent hens (i.e. culled layers) can provide greater returns to the egg producer.

(d). Poultry is suitable for research in breeding, genetics and nutritional studies

(e). Poultry can re-produce their kinds faster than other livestock.

(f). Poultry keepers particularly at the village level earn more income, spend less on food, have better food security, more assets and a lower school drop-out rate than rural dwellers who do not keep poultry. Women and children are particularly involved in small-scale poultry production for paying school fees from their backyard poultry micro-enterprises.

(g). Poultry farming provides several tonnes of poultry manure for organic farming than manure from other livestock.

(h). Chickens provide vital service in keeping animals such as cattle free of ticks. One chicken can consume 200 ticks in 3 hours.

From the standpoint of a profitable poultry enterprise, the genetic potential of the birds is the beginning of wisdom. The commercial stocks, particularly the domestic fowl, are products of genetic engineering. If the genotype of the bird is deficient, all other efforts including good nutrition and health management will amount to an exercise in futility. From grandparents to commercial stock involves strain development by selection and it also involves complete reciprocal mating to identify strains that have special combining ability. Nigeria is still dependent on other nations in the basic area of quality of birds despite the fact that genetic, economic and nationalistic reasons have been advanced for Nigeria to be a supplier of poultry stock in the tropics. The leadership role of Nigeria as a source of high quality commercial stock in Africa would be of great benefit in job opportunities.

4.0 MY MODEST CONTRIBUTION TO POULTRY PRODUCTION

Mr. Vice-Chancellor sir, distinguished ladies and gentlemen, I'll now present some of my modest contributions to research activities in poultry production. I have realized over the years that the shortest way to increase animal protein intake, particularly in a developing country like Nigeria is through improved poultry production and efficient animal product processing. Many research studies have confirmed that in underdeveloped countries, consumption of low-quality proteins is greater than in developed countries. My research projects therefore focused attention on hatchery operations, economy of poultry production, poultry meat and egg processing with a view to increasing animal protein intake in Nigeria and providing employment opportunities for the youths.

4. 1 Hatchery Operations

Presently in Nigeria, the costs of day old chicks are very exorbitant due to high cost of production. In addition, poor quality chicks from doubtful sources have ruined many

poultry farmers. The challenge is the drastic transformation of the chick production sector of poultry industry through poultry breeding and hatchery management. The trend towards mammoth walk-in incubators in Nigeria is only part of the answer. The high demand on the few hatcheries hardly leaves any room for poultry species other than the domestic fowl. These are the turkeys, ducks and quails, the production of which can greatly expand and enrich the poultry industry, improve poultry consumption by accommodating a variety of tastes and expand job opportunities. These considerations stimulated my interest in experiments for improved efficiency of small-scale incubators with particular reference to egg turning frequency and egg incubation position. In a preliminary study, Abiola (1999) observed that manual turning of eggs once a day in electric table-top incubator produced hatchability of 75%, minimal egg weight loss while chick weight was influenced by egg weight **(Table 6)**. Previous studies on egg positioning were based on chicks hatched from eggs set small ends up in modern incubators. In a study of egg incubation position in electric table top- incubator, Oyebimpe and Abiola (2003) reported hatchability of 85.8% for eggs in horizontal position and 64.2% for eggs in vertical position **(Table 7)**.

Table 6: Effect of turning frequency of egg in electric incubator on hatchability and mortality

	Frequency of egg turning/day		
Parameters	0	1	2
Initial egg weight (g)	49.82± 0.99	52.16± 0.42	48.81± 0.12
Chick weight (g)	36.62± 0.25	36.70± 0.47	36.68± 0.00
Hatchability (%)	40.00± 0.12	75.00± 0.33[a]	66.77± 0.30[b]
Mortality (%)			
Dead-in-germ	60.00± 0.03	7.00± 0.08	6.33± 0.05
Dead-in-shell	-	18.00± 0.11	27.00± 0.18

a,b,c, Means in the same row with different superscripts are significantly (P<0.05) different.

Table 7: Effect of egg incubation position in electric incubator on hatchability and mortality

Parameter	Incubation Position	
	Horizontal	Vertical
No. of eggs set	24	24
Average initial egg weight (g)	58.9±0.9	58.80±0.1
Average final egg weight (g)	55.1±0.8	55.0±0.1
Average egg weight loss (g)	6.5±0.1	6.4±0.1
Chick egg weight ratio	0.7±0.1	0.7±0.0
Hatchability (%)	85.8±6.2[a]	64.2±6.9[b]
Sex of Chicks		
Male	11	8
Females	8	6
Sex ratio	57.9±4.2	61.5±6.4
Hatching Weight of Chicks (g)		
Male	39.4±4.8	39.1±6.4
Females	35.7± 5.9	36.0±8.9
Mean	37.6±4.2	37.6±4.6
Mortality (%)		
Dead-in-Germ (DIG)	-	-
Dead-in-Shell (DIS)	14.2±5.8[b]	35.9±6.9[a]

a, b, Means followed by different superscripts differed significantly (P<0.05)

Some of the problems militating against the hatchery industry in Nigeria include:

(a) High cost of incubators

(b) Persistent epileptic power supply

(c) High cost of electricity tariff

(d) High cost of generating set

In order to assist the hatchery industry in Nigeria and to respond to the calls for universities in developing countries to focus research agenda to be more relevant to local needs, I designed portable **'Hurricane Lantern Incubators'** in 2004 and 2005 **(Figures 1-4).** The fabricated incubators have the capacity to hatch either very small or big hatchable eggs which are usually difficult to set in the egg setter of modern incubators. They are designed for employment generation in the poultry sector, thus bringing hatchery operations to the doorsteps of poultry farmers in Nigeria.

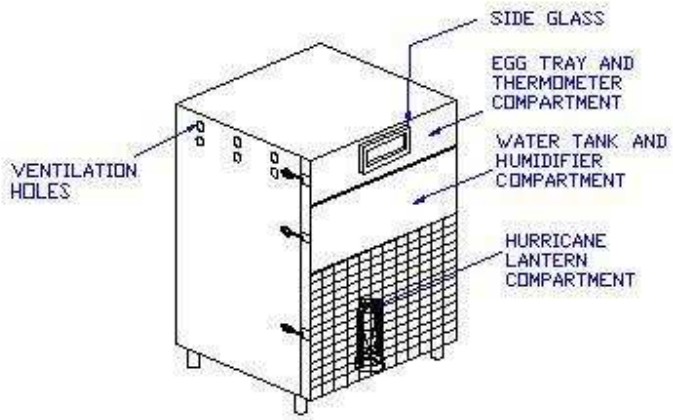

Fig 1. Hurricane Lantern Incubator (Isometric view)

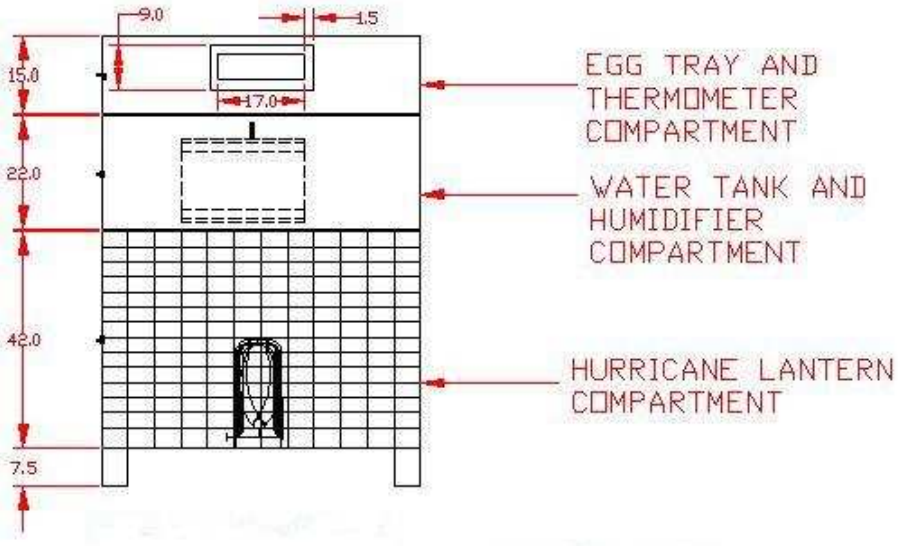

Fig. 2: Hurricane Lantern Incubator (Front View)

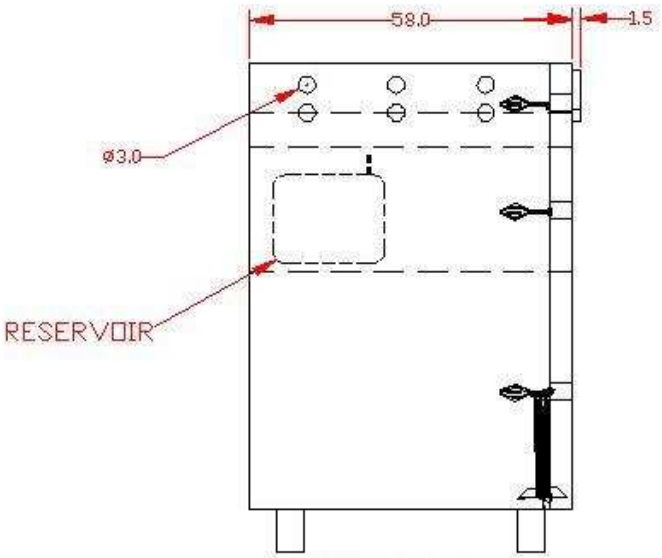

Fig. 3: Hurricane Lantern Incubator (Side View)

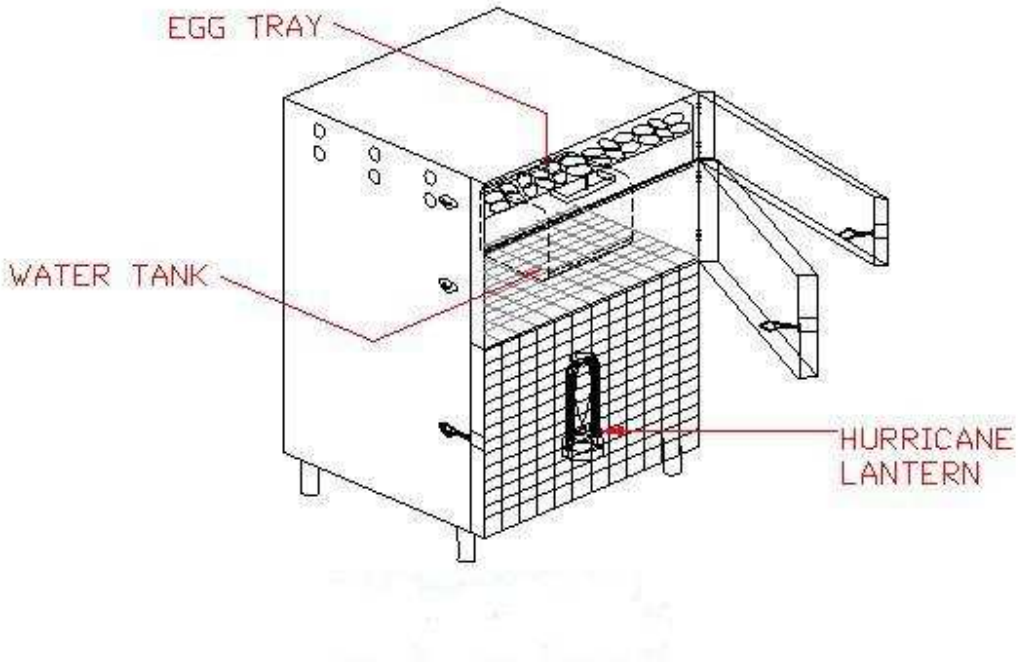

Fig. 4: Hurricane Lantern Incubator (Pictorial View)

Results obtained on hatchability of eggs in several trials using the fabricated hurricane lantern incubator were very encouraging. The first trial produced 69% hatchability. Examination of the un-hatched incubator eggs in the laboratory revealed mal-positioning of the embryos which resulted in dead-in-shell, i.e. late embryonic mortality. The second trial investigated the effects of turning frequency of hatching eggs on hatchability, hatching sites and embryonic presentation. We observed that turning eggs 3 times daily in hurricane lantern incubator produced the highest hatchability of 72.90%. Most of the chicks hatched from the equatorial region of the egg **(Tables 8, 9 & 10)**. Estimated revenue projection indicated that broiler chicks could be hatched at a cost of ₦96 each, using Hurricane Lantern Incubator compared to the cost of ₦160-₦180 for day-old broiler chick from commercial hatchery **(Table 11)**. Research and Development Centre (RESDEC) of the University sponsored the incubator project for exhibition at the 2nd Nigerian University Research and Development Fair organized by National Universities Commission (NUC) at Abuja from 6th –8th December 2005. Hatchable eggs were incubated in Abeokuta for 19 days while hatching commenced at the exhibition ground in Abuja on the 2nd day of exhibition in spite of the transportation stress to the embryos.

Table 8: Effect of turning frequency of eggs on hatchability

	Frequency of egg turning per day			
Parameters	0	1	2	3
No. of eggs set	16	16	16	16
Fertility (%)	81.25±6.25	87.50±0.00	93.75±6.25	87.50±12.50
Hatchability (%)	23.80±9.50	50.00±7.10	48.20±23.20	72.90±10.40
Initial egg weight (g)	50.75±0.56	47.43±0.01	47.43±0.16	49.18±0.55
Chick hatching weight (g)	34.54±0.75	33.33±0.01	34.87±1.18	34.14±0.04

Table 9: Effect of turning frequency of eggs on hatching site

	Frequency of egg turning per day			
Parameters	0	1	2	3
Hatchability (%)	23.80	50.00	48.20	72.90
Hatching site:				
Narrow end (%)	-	12.50±12.50	10.00±10.00	-
Equatorial region (%)	75.00±25.00	54.15±20.85	45.00± 5.00	50.00±10.00
Broad end (%)	25.00±25.00	33.35±33.35	45.00± 5.00	50.00±10.00

Table 10: Effect of turning frequency on egg weight loss

Parameters	Frequency of egg turning/day			
	0	1	2	3
Initial egg weight (g)	50.75±0.56	47.43±0.02	47.43±0.16	49.18±0.62
Final egg weight (g)	45.81±0.48^{a}	41.89±0.13^{c}	42.16±0.19^{c}	43.84±0.48^{b}
Egg weight loss (g)	4.05±0.09^{b}	5.54±0.15^{a}	5.28±0.03^{ab}	5.34±0.14^{a}
Egg weight loss (%)	9.86±0.03^{c}	11.51±0.15^{a}	11.06±0.03^{b}	10.89±0.16^{b}

a,b,c Means in the same row with different superscripts are significantly different ($P<0.05$)

Table 11: Summary of revenue projection for broiler chick production using hurricane lantern incubator

No Hatch-able Eggs	Hatchability	*Cost of eggs & kerosene (N)	Cost of day-old Chicks (N)
200 @N70 each	75%=150 chicks	14,420	96.13
200 @N70 each	80%=160 chicks	14,420	90.13

*200 Hatch-able eggs @N70 each	N14,000
6 litres of kerosene @ N70/litre	420
TOTAL	N 14,420

The author has trained several students in UNAAB on hatchery operations at undergraduate and postgraduate levels. The students have been practically empowered to take bold steps towards self-employment or to become employers of labour. It is interesting to know that many of such students are now gainfully employed in different commercial hatcheries in Nigeria.

4.1.1 Steps to successful incubation

(a) Select eggs of excellent physical and biological integrity

(b) Subject eggs to pre-incubation storage conditions of 15-18^{0}C and 75% RH.

(c) Use eggs that are less than one week old.

(d) Provide incubation temperature of 37.5^{0}C and 75% RH

(e) Provide adequate ventilation and circulation of air

(f) Ensure regular egg turning.

4.2. Economy of poultry production

My studies focused attention on how to cut down expenses on feed in poultry production. As mentioned earlier, feeding accounts for 70% of production costs in poultry farming. To maximize profit, my nutritional studies encouraged the use of non-conventional feed resources such as hatching waste, cocoa husk and melon husk in poultry diets. This is practicable since many poultry farmers in Nigeria prefer to compound poultry diets privately as against buying commercial poultry feed. In addition, we investigated the economic benefits of beak amputation as a management practice capable of preventing feed wastage in poultry farming.

4.2.1 Re-cycling of hatching waste as animal protein source in poultry nutrition

The hatchery industry in Nigeria experienced rapid growth in the production of commercial day-old chicks following the ban on importation of parent stock and day-old chicks into the country by the Federal Government. Although there is dearth of information on the number of commercial hatcheries in the country at the moment, a recent survey showed that there were 14 commercial hatcheries in Oyo state alone with capacity for over 4 million hatchable eggs. With full capacity utilization, several tonnes of hatching wastes (e.g. egg shells, dead chicks, un-salable chicks and un-hatched incubator eggs) are produced weekly from the hatcheries which sometimes constitute nuisance because of problems of disposal. It is clear from the Holy Bible that Jesus Christ would not subscribe to any form of wastage, hence, He ordered His disciples to collect fragments that remained after feeding 5,000 people in the desert (Matthew 14:20; Luke 9:17). Abiola *et al*, (2003) in a study of reproductive wastage in breeders indicated that strain of breeders could influence the yield of hatching waste. The authors determined the yield of un-hatched incubator eggs in Anak and Harco breeders in 12 months and concluded that Harco breeders produced more hatching waste (44.04%) than Anak breeders (29.17%) **(Table 12)**. It is very difficult to eliminate waste, but we can reduce its

environmental impact by preventing waste wherever possible and making more sustainable use of the waste that is produced.

In an earlier study, Abiola (1999a) observed that hatching wastes are potential protein supplement in poultry diet as replacement for expensive protein sources such as soybean. The study showed that cockerels fed HWM diets were superior in body weight gain and feed intake than those fed soybean meal (SBM) diet. Highest daily feed intake of 38.69 g/bird was recorded when HWM replaced SBM in starter diet **(Table 13)**. In a related study, haematological values (PCV, Hb, RBC and WBC) were generally higher in birds fed with HWM diets than those fed control diet (Abiola, 1999b). Although Nigeria produced 465,000 tonnes of soybeans in 2005, SBM was not available in commercial quantities for poultry diets through out the year. Hence the need to use alternative protein source such as hatching wastes in poultry diets.

HWM also replaced groundnut cake at 0, 10, 15 and 20% levels in the finisher diets of cockerels. At the end of the study, it was observed that the best result of daily weight gain was obtained at 20% replacement level of groundnut cake with HWM (Abiola, 2001). Another experiment was conducted by Abiola and Onunkwor (2004) in which HWM replaced fish meal (protein for protein) in layer diets. We observed that layers fed with HWM diets were superior in performance and egg quality characteristics compared with layers on control diet. Highest values for egg weight (65.59g), Yolk weight (16.91g), Albumen weight (40.93g), Haugh unit (78.72) were recorded for layers fed with diet in which 100% fish meal was replaced with HWM **(Table 14)**. The study concluded that HWM could replace fish meal completely in layer diets without adverse effect on the birds. The use of this new animal protein source in animal nutrition will assist in solving the disposal problem of hatching waste in Nigeria.

Table 12: Yield of un-hatched incubator eggs in Anak and Harco breeders

Months In lay	No of Eggs set		No of chicks Hatched		% Un-hatched Incubator eggs	
	Anak	Harco	Anak	Harco	Anak	Harco
1	4853	3664	3315	2387	31.69	34.85
2	8668	3154	6314	1676	27.16[b]	46.86[a]
3	7945	5467	5676	2912	28.16	46.73
4	13201	11298	9139	6426	30.77	43.12
5	12035	5104	8925	3110	25.84	39.07
6	19186	5382	13994	3213	27.06	40.30
7	15151	13993	11069	7515	26.94	46.29
8	14279	5111	10241	3087	28.28	39.60
9	22641	6517	15080	3908	33.40	40.03
10	9400	7338	6885	3478	26.76[b]	52.60[a]
11	4800	3682	3468	1810	27.75[b]	50.84[a]
12	9600	4723	6120	2442	36.25	48.19
Total	141759	75433	100226 (70.70%)	41969 (55.64%)	_	_
Mean	11813.25	6286.08	83521.17	3497.42	29.17	44.04

a,b Means in the same row with different superscripts are significantly different (P<0.05)

Table 13: Performance of cockerels fed diets containing dried unhatched incubator eggs

Parameters	Replacement levels (%) of SBM with DUIE			
	0	5	10	15
Initial body weight (g/bird)	47.34± 0.94	43.33± 0.05	40.33± 4.24	46.67± 0.05
Final body weight (g/bird)	621.62± 22.11	787.27± 20.09	737.15± 25.25	779.78± 65.24
Daily body weight gain (g/bird)	10.08± 0.37	13.05± 0.36	12.37± 1.78	12.86± 1.14
Daily feed intake (g/bird)	36.50± 0.14	38.07± 3.22	35.97± 1.24	38.69± 0.10
Feed conversion ratio	3.64± 0.15	2.92± 0.17	2.95± 0.06	3.00± 0.26
Daily protein intake (g/bird)	7.55± 0.01	7.87± 0.66	7.39± 0.26	7.86± 0.02
Protein efficiency ratio	1.33± 0.07	1.66± 0.09	1.68± 0.06	1.64± 0.14
Mortality (%)	-	-	-	-

a,b, Means with different superscripts in the same row are significantly (P<0.05) different

Table 14: Egg quality characteristics of layers fed HWM diets

	Replacement levels (%) of Fish Meal with HWM			
Parameters	0%	33%	66%	100%
Egg weight (g)	58.67± 1.60	59.27± 1.31	58.96± 1.94	65.59± 1.02
Egg width (cm)	3.45± 0.04	3.44± 0.04	3.44± 0.05	3.56± 0.01
Egg length (cm)	4.75± 0.13	4.72± 0.05	4.69± 0.05	4.95± 0.05
Egg shape index	0.73± 0.02	0.73± 0.00	0.73± 0.01	0.72± 0.01
Shell weight (g)	5.90± 0.31^{b}	6.81± 0.07^{a}	6.68± 0.03^{ab}	7.15± 0.39^{a}
Shell thickness (mm)	0.32± 0.00	0.33± 0.00	0.33± 0.00	0.33± 0.00
Shell (%)	10.05± 0.51	11.50± 0.28	11.34± 0.32	10.91± 0.59
Yolk weight (g)	14.57± 0.19^{b}	14.45± 0.66^{b}	14.79± 0.32^{b}	16.91± 0.30^{a}
Yolk height (mm)	1.92± 0.03	2.00± 0.11	1.91± 0.33	2.01± 0.03
Yolk (%)	24.85± 0.41	24.36± 0.74	25.15± 1.20	25.79± 0.38
Albumen weight (g)	36.41± 0.81	37.21± 0.92	36.81± 1.90	40.93± 0.82
Albumen height (mm)	46.37± 0.78	47.34± 1.32	42.35± 1.86	42.53± 0.97
Albumen (%)	62.07± 0.34	62.78± 0.51	62.35± 1.38	62.40± 0.59
Haugh unit	59.15± 7.80	56.65± 6.31	73.62± 6.22	78.72± 3.30

a,b, Means within the same row with different superscripts are statistically significant (P<0.05).

4.2.2 Crop residues in poultry nutrition

The most limiting factor in the improvement of poultry production systems in Nigeria is the feed supply. Consequently there is the need to match the production system with available resources in a way that aims for economic optimization. Many researchers have recommended the use of non-conventional feed resources in the formulation of poultry diets with the aim of reducing production cost. Although such feed resources may not be available in commercial quantities for now, harnessing crop residues, which are not directly utilizable by man will reduce feed cost in poultry production.

We identified cocoa husk (CH) and melon husk (MH) as crop residues, which usually constitute nuisance on the farm after harvest. Noticing the annual increase in the price of wheat offal/bran arising from increase in the importation of wheat, we then introduced the use of CH as replacement of wheat offal/bran in poultry diet. The aim was to reduce production cost because Nigeria spends average of $400 million per year to import wheat to meet local demand for flour for the baking industry. Abiola and Tewe (1992 and 2003) used CH successfully to replace 25% of wheat offal in the starter and finisher diets of

cockerels without adverse effects on performance and carcass quality. In the same trial, we observed that feed cost decreased with increase in the levels of CH in the diet **(Tables 15 & 16)**. Mr. Vice Chancellor sir, distinguished ladies and gentlemen, it is gratifying to note that Nigeria's cocoa production has recorded 300% growth in the last 7 years. Production in the 14 cocoa producing states improved from 100,000 metric tonnes in 1999 to 400,000 metric tonnes in 2006, whereas Ivory Coast produces about 1.3 million metric tonnes of cocoa annually. However, with the increase in the output of cocoa in Nigeria, several tonnes of CH will always be available as crop residues which can serve as alternative feed resources in poultry diets.

My interest in the use of MH is due to the popularity of melon in Nigeria. Melon is a widely cultivated creeping plant because it serves as weed control while the seeds are used as condiment in stew and soup or can be used in the production of "robo" because they are rich sources of protein and oil. After harvesting and manual extraction of the seeds, the outer covering of the fruit which is the MH, is usually allowed to rot away on the farm. For my preliminary studies, I obtained samples of MH from the teaching and research farm of the university (FPY plots) in 1998.

Although experimental investigation of the nutritive value of MH is very scanty, results of preliminary study on elemental analysis revealed high content of calcium and phosphorus in MH. In a feeding trial, Akinola and Abiola (1999) confirmed that maize could be replaced with 10% MH in the starter diet of cockerels without adverse effects on chick performance **(Table 17)**. Because of the fibrous nature of MH, Abiola *et al*, (2002) used alkali-treatment to reduce the crude fibre content of MH from 29-14%. The authors reported that up to 20% maize could be replaced with alkaline-treated melon husk (ATMH) in broiler diets to produce good quality poultry carcasses and chicken meat with favourable shelf life. Such studies will minimize competition for maize by man and livestock, a situation which has been on for several years. This trend must be reversed since world grain production has fallen by 8% since 1984 primarily due to decreased availability of land, water and fertilizers (World Watch Inst. 1993). The output of melon in Nigeria increased from 404,000 tonnes in 2001 to 512,000 tonnes in 2005.

Consequently, this trend will result in massive production of MH as non-conventional feed resources for animal nutrition.

Table 15: Performance of cockerels fed different levels of cocoa husk in starter ration

	Replacement levels (%)of wheat offal with CH					
Parameters	0	25	50	75	100	Mean (±SE)
Initial body weight (g/bird)	28.70	26.06	28.14	24.32	29.91	27.40± 0.89
Daily body weight gain (g/bird)	14.54[a]	14.77[a]	13.71[ab]	10.96[bc]	10.08[c]	12.81± 0.70
Daily feed intake (g/bird)	73.93	71.74	77.75	59.75	57.92	68.22± 5.32
Daily protein intake (g/bird)	12.70[a]	11.54[ab]	11.80[ab]	8.98[b]	8.50[b]	10.70± 0.79
Protein efficiency ratio	1.15	1.28	1.17	1.22	1.22	1.21± 0.11
Feed conversion	5.08	4.86	5.67	5.46	5.75	5.37± 0.52
Efficiency of feed utilization	0.20	0.20	0.18	0.18	0.17	0.19± 0.13
Mortality (%)	-	-	1.57	4.72	2.36	2.88± 0.79

a,b: Means in a row accompanied by the same or no letters are not significantly different (P>0.05)

Table 16: Performance of cockerels fed different levels of cocoa husk in finisher ration

	Replacement levels (%) of wheat offal with CH					
Parameters	0	25	50	75	100	Mean (±SE)
Initial body weight (g/bird)	900.72	915.77	874.83	513.20	637.89	768.48± 18.24
Daily body weight gain (g/bird)	13.63	12.33	11.97	10.86	10.04	11.77±2.77
Daily feed intake (g/bird)	134.08	128.50	145.57	126.71	107.93	128.56± 10.73
Daily protein intake (g/bird)	21.67[a]	20.77[a]	21.35[a]	16.97[ab]	14.19[b]	18.95± 1.49
Protein efficiency ratio	0.63	0.59	0.56	0.65	0.66	0.62± 0.10
Feed conversion	9.84	10.42	12.16	11.67	10.76	11.68± 2.92
Efficiency of feed utilization	0.10	0.10	0.08	0.09	0.09	0.9± 0.26
Mortality (%)	-	-	-	-	0.88	0.88

a,b: Means in a row accompanied by the same or no letters are not significantly different (P>0.05)

Table 17: Carcass yield and organ weights of cockerels fed melon husk diets

	Replacement levels of Maize with MH			
Parameters	0%	10%	20%	30%
Liveweight (g/bird)	422.87±50.50	491.37±22.80	451.43±7.40	414.37±16.60
Dressed weight (%)	54.95±0.90	55.06±1.30	55.38±1.90	51.93±2.50
Abdominal fat (%)	0.14±0.08	0.16±0.02	0.03±0.00	0.08±0.04
Heart (%)	0.73±0.05	0.69±0.02	0.69±0.02	0.69±0.05
Liver (%)	3.05±0.53	2.50±0.14	2.58±0.14	2.73±0.13
Gizzard (%)	3.87±0.48	3.75±0.59	3.43±0.16	4.13±0.38
Small intestine (%)	7.36±0.52	7.72±0.83	7.91±1.27	9.63±1.11
Large intestine (%)	0.69±0.11	0.86±0.10	0.78±0.14	1.26±0.29
Caeca (%)	1.28±0.06	1.47±0.10	1.40±0.10	1.75±0.08

Means in the same row are not significantly different (P>0.05)

4.2.3 Beak Amputation in egg-type chickens

My interest in beak amputation is due to the economic losses usually associated with feed wastage and behavioural problems, often called vices, such as egg pecking, feather pecking/pulling, vent pecking, which can result in cannibalism. The term ‘‘feather pecking’’ was adopted by Hughes and Duncan (1972) in describing feather loss and hemorrhaging of skin seen in chickens. Although the egg industry claims that beak amputation is needed to decrease aggressive tendencies among birds, reduce feed intake and wastage, reduce mortality and improve feed conversion, some welfare groups believe the practice should be banned or at least not carried out routinely. The major objection has been the perception that beak amputation may induce chronic pain through the formation of traumatic neuromas (bundles of tangled nerve fibres) in the beak stump. However, research studies have confirmed that the severed nerves partially re-grow in the birds’ beak after sometime while beak amputation has been estimated to reduce bird deaths from aggressive pecking by 25%. At the moment, beak amputation is probably the only management practice in poultry production that will reduce the incidence of these vices.

We obtained ‘Yarkon Tint’ egg-type chickens (produced by Anak Breeders Ltd. in Israel) from a commercial hatchery in Abeokuta for beak amputation study. This strain of birds is noted for cannibalistic pecking. There were 4 treatments in which upper and lower

beaks were amputated using different dimensions (mm). We observed that beak amputation had significant effects (P<0.05) on performance pre-laying and in the laying period. Most of the parameters measured for egg quality traits were in favour of amputated birds **(Tables 18-21)**. Highest revenue from sale of eggs (₦7,177.50K) was obtained in treatment 3 (U_8L_3) as indicated in **Table 22.** The study recommended amputation of 8mm of upper beak and 3mm of lower beak (U_8L_3) for egg-type chickens.

Table 18: Effect of beak amputation on performance (pre-laying)

	Treatments				
Parameters	U_0L_0	U_8L_0	U_8L_3	U_8L_6	SEM
Body weight gain (g/bird/day)	9.74	8.90	9.24	9.39	0.28
Feed intake (g/bird/day)	86.98^a	76.90^c	80.70^b	85.76^a	1.56
Feed: gain	9.01	8.67	8.95	9.19	0.13

a,b,c Means in the same row with different superscripts differ significantly (P<0.05)

Table 19: Effect of beak amputation on pecking rate

	Treatments				
Parameters	U_0L_0	U_8L_0	U_8L_3	U_8L_6	SEM
Pecking rate/min. (pre-laying)	3.30^a	1.53^c	1.17^d	2.07^b	0.25
Pecking rate/min. (laying period)	2.43^a	1.10^b	0.86^c	1.10^b	0.16

a,b,c,d Means in the same row with different superscripts differ significantly (P<0.01)

Table 20: Effect of beak amputation on beak re-growth

			Treatments		
Parameters	U_0L_0	U_8L_0	U_8L_3	U_8L_6	SEM
Upper beak (mm)	36.69^a	32.35^b	30.97^c	30.76^c	0.13
Lower beak (mm)	34.02^b	35.06^a	32.27^c	30.07^d	0.19

a,b,c,d Means in the same row with different superscripts differ significantly (P<0.01)

Table 21: Effect of beak amputation on egg quality characteristics

	Treatments				
Parameters	U_0L_0	U_8L_0	U_8L_3	U_8L_6	SEM
Age at 1st egg (day)	147.67	154.00	145.67	151.67	26.21
Weight of 1st egg (g)	42.26	42.23	41.98	42.49	1.76
Body weight at 1st egg (kg)	1.43	1.47	1.36	1.45	2.62
Hen Day Egg production (%)	69.06	64.11	62.97	56.02	3.37
Yolk (%)	23.17^{c}	23.50^{bc}	25.23^{ab}	25.78^{a}	0.40
Albumen (%)	67.24^{a}	67.30^{a}	65.80^{b}	65.54^{b}	0.38
Haugh unit	90.84	90.87	95.65	92.49	3.22
Cracks (%)	0.95^{c}	1.27^{b}	0.93^{c}	1.63^{a}	0.01
Shell thickness (mm)	0.33	0.34	0.34	0.33	0.01

a,b,c, means in the same row with different superscripts differ significantly ($P<0.05$)

Table 22: Economic benefit of beak amputation in egg-type chicken (laying period)

	Treatments			
Parameters	U_0L_0	U_8L_0	U_8L_3	U_8L_6
Total feed consumed (kg)	187.55	166.89	174.74	168.85
Cost of feed consumed (₦)	4,983.20	4,434.27	4,642.84	4,486.34
Crate of eggs produced	27.97	23.52	28.71	22.47
Revenue from eggs (₦)	6,992.50	5,880.00	7,177.50	5,617.50
Net Profit (₦)	2,009.30	1,280.73	2,369.66	966.16

4.3 Poultry meat processing

My first venture into meat processing started in 1977 at Thomas Danby College, Leeds, United Kingdom where I studied Meat Technology as a Federal Government scholar. Initially it was very rough because I was the only 'Black person" in the whole class. However, the prizes and other incentives which I received from the college for two consecutive academic sessions strengthened my interest in meat processing.

Mr. Vice Chancellor Sir, before I highlight my major contributions to the meat industry in Nigeria with particular reference to poultry meat utilization, it seems pertinent to explain the concept of meat processing for the benefit of my audience.

Meat processing includes all processes involved in the alteration of fresh meat such as curing, smoking, freezing, dehydrating and the use of certain additives and enzymes. The original basis for meat processing was preservation by inhibiting microbial decomposition. This concept has resulted in the production of flavorful and nutritious products and more recently provides value added components such as convenience, variety, health and safety. Initially pork was the only meat processed in quantity. This was the basis for the preliminary study by Abiola and Adegbaju (2001) when rind was used as fat replacer in pork sausage. But today, beef, mutton and boneless poultry meat are been used in processed meat products by the fast-food industry.

The epidemiological studies that looked at the health effects of meat consumption categorized poultry meat as **'white meat'** while beef, pork and mutton are referred to as **'red meat'.** My choice of poultry meat for research is based on 2 main reasons:

(a) Poultry meat is superior to red meat or other meat types since there are few if any social or religious stigmas attached to the use of poultry meat in the diet as mentioned earlier. Because of its high meat yield, low shrinkage during cooking, ease of cooking and low cost, poultry meat fits well into the menu items in fast-food establishments all over the world and it's sometimes used to make low-fat meat products.

(b) Many research studies have associated higher consumption of red meat with increased risk of colorectal cancer (CRC), breast cancer and coronary heart disease (CHD). This was attributed to the high contribution of red meat to fat intakes and its perceived high content of saturated fatty acids (Hu *et al*., 1999a).

Most of the published literature on meat in relation to cancer development focused on CRC which is the third most common cancer in the world, accounting for over a million new cancer cases worldwide (9.4% of all cancer cases) in 2002. The European Prospective Investigation into Cancer and Nutrition (EPIC) study which compared daily intake of different types of meat and CRC incidence in 10 European countries, reported that incidence rates for CRC are approximately 10-fold higher in developed compared to

developing countries (Ferlay *et al*, 2004). In a related study on red meat consumption in seven European countries, men were found to consume more red meat than women **(Table 23)**. In Nigeria, the statistical data of mean daily intake of meat (g/day) indicated that Nigerians consume more red meat than white meat **(Table 24)**.

Table 23: Mean daily intake (g/day) of total meat, red meat and processed meat in selected countries participating in the EPIC calibration study

Countries	Total meat*		Red meat		Processed meat	
	Men	Women	Men	Women	Men	Women
Greece	78.8	47.1	45.3	25.5	10.0	5.8
Spain	170.4	99.2	74.0	37.8	52.8	29.6
Italy	140.1	86.1	57.8	40.8	33.5	19.6
Germany	154.6	84.3	52.2	28.6	83.2	40.9
Netherlands	155.6	92.7	63.8	41.0	72.4	37.9
UK	108.1	72.3	40.0	24.6	38.4	22.3
Denmark	141.1	88.3	69.6	44.1	51.9	25.3

*Total meat includes pork, beef, veal, lamb/mutton, poultry, game, rabbit, horse, goat and offal.
Source: Linseisen *et al.* (2002)

Table 24: Mean daily intake (g/day) of white and red meat in some African countries

Countries	Poultry Meat	Pork	Sheep & Goat	Beef
Nigeria	3.0	4.0	5.0	6.0
Ghana	9.0	1.0	3.0	3.0
Cameroon	7.0	2.0	5.0	14.0
Liberia	11.0	5.0	1.0	1.0
South Africa	63.0	10.0	10.0	35.0
Ethiopia	1.0	0.0	1.0	13.0

Source: FAOSTAT (2005).

In order to increase animal protein intake, satisfy the growing demand of consumers for low-fat meat products, and because we want consumers of meat products to celebrate more birthdays, we successfully manufactured low- fat chicken sausages and burgers for tropical countries since the composition of fat in the human diet is becoming increasingly important. We used local feed resources such as Melon Seed Meal (MSM) and edible mushroom as fat replacers in poultry meat processing.

4.3.1 Melon Seed Meal in chicken sausage

Our choice of MSM in chicken sausage is because of its popularity in Nigeria as condiment in stew and soup (Abiola *et al.*, 2006). Its high nutritional value has been documented in other studies. Girgis and Said (1968) indicated that melon seeds contain high amount of unsaturated fatty acid and linoleic acid thereby indicating possible hypocholesteronic effect. Since we are concerned about the health of consumers, Abiola *et al*, (2004) manufactured low-fat chicken sausages by replacing fat with MSM at 0, 33, 66 and 100% levels. In this study, we observed that MSM increased the ash and protein, but decreased the ether extract content of chicken sausage. During refrigerated storage for 24 hours, lowest refrigeration loss of 3.04% was obtained on MSM sausage **(Table 25)**. All sensory traits evaluated had highest scores for MSM sausage at 100% replacement level **(Table 26)**.

Table 25: Refrigeration and cooking weight losses in chicken sausages produced with MSM

	Batch number			
Parameters	1	2	3	4
Refrigeration				
Initial weight (g)	50.00±0.00	50.00±0.00	50.00±0.00	50.00±0.00
Final weight (g)	47.37±0.22	47.91±0.11	48.49±0.50	48.06±0.15
Weight loss (g)	2.63±0.22	2.09±0.11	1.52±0.50	1.95±0.15
Weight loss (%)	5.25±0.45^{a}	4.18±0.21^{ab}	3.04±0.29^{b}	3.89±0.31^{b}
Cooking				
Initial weight (g)	50.00±0.00	50.00±0.00	50.00±0.00	50.00±0.00
Final weight (g)	49.07±0.13	48.94±0.23	49.26±0.18	48.62±0.22
Weight loss (g)	0.93±0.13	1.06±0.23	0.74±0.18	1.38±0.22
Weight loss (%)	1.87±0.27	2.12±0.46	1.47±0.36	2.77±0.44

$^{a,b;}$ Means in the same row with different letters are significantly different (P<0.05)

Table 26:Sensory properties of chicken sausages produced with MSM

	Batch number			
Parameters	1	2	3	4
Colour	4.40±0.12	4.33±0.07	4.27±0.18	4.67±0.27
Juiciness	4.13±0.07^{b}	4.60±0.23^{ab}	4.60±0.12^{ab}	5.07±0.29^{a}
Flavour	4.87±0.18^{a}	4.27±0.07^{b}	4.67±0.07^{a}	4.73±0.18^{a}
Tenderness	4.53±0.24	4.67±0.41	4.33±0.13	5.00±0.20
Acceptability	4.53±0.24^{b}	4.40±0.12^{b}	4.40±0.23^{b}	5.53±0.29^{a}

$^{a,b;}$ Means in the same row with different letters are significantly different (P<0.05)

4.3.2. Edible mushroom in chicken Burger

My choice of mushroom was informed because it effectively supplements or replaces meat and fish in the local diet. In addition, there are several varieties of edible mushroom in the forests in Nigeria, which either grow on dead tree trunks or sprout from the ground. The medicinal properties of mushrooms have been documented in many studies. Their extracts are capable of treating certain types of cancer, boost immune system and reduce the risk of certain types of coronary heart disease. Skincare experts also claim that *Hypsizgus ulmarius* mushrooms have anti-inflammatory benefits, so are ideal for people with sensitive, puffy, dry and lined skin. We manufactured low-fat chicken burgers by replacing fat in the burger with graded levels of edible mushroom. We observed that fat content of the chicken burger decreased while the protein content increased with increase in the levels of mushroom in the burger. In addition cooking losses decreased with increase in the levels of edible mushroom in the burger.

Mr. Vice Chancellor Sir, the main health benefits associated with consumption of poultry meat have been highlighted in this lecture, consumers should therefore eat more of poultry meat while red meat should be consumed in moderation.

4.4 Poultry egg processing

The “egg glut” syndrome is one of the problems militating against the poultry industry in Nigeria because of non-availability of egg processing industry. Many poultry farmers have folded up as a result of this ugly situation. To minimize the incidence of egg glut and provide employment opportunities in the poultry sector for our youths, we need to find a way of processing surplus eggs into egg powder, which can then be used to make omelette, for baking or to enrich other food products such as baby foods. Egg powder can also be consumed directly by lacto-ovo-vegetarians (i.e. those who consume milk, egg but no meat). In the production of egg powder in the laboratory, the author first determined the “freshness of eggs” using brine solution. This was followed by breaking

the fresh eggs, homogenizing the liquid content (i.e. yolk and albumen) with Kenwood mixer for 5 minutes, oven drying using temperature- time combination and finally milling with hammer mill to produce egg powder. Three crates of eggs (90 pieces) produced approximately 1 kg whole egg powder. Sample of the egg powder from our first trial was used for the manufacture of some meat products which were exhibited at the first Nigerian Universities Research and Development Fair organized by NUC at Abuja from 22nd-26th November 2004. At this exhibition, the author received Research Participation award from NUC for the presentation of a research project of high standard and with relevance to national development.

5.0 LIMITATIONS OF POULTRY PRODUCTION

The problems militating against the poultry industry in Nigeria include among others, scarcity of bank loans and high interest rates, high cost of poultry equipment, high cost of feed ingredients and sudden outbreak of diseases. Disease outbreak is perhaps the major problem affecting the poultry industry at the moment. For example, the highly pathogenic Avian Influenza, which began in South East Asia in mid - 2003, and has affected more than 20 countries worldwide, has a mortality rate that can approach 100% within 48 hours.

Mr. Vice-Chancellor sir, distinguished ladies and gentlemen, the reaction of Nigerians and the Federal government to the outbreak of avian flu in February 2006 was a clear demonstration of the potential of poultry industry in our society, an industry that creates jobs for many Nigerians. The discovery of the outbreak in Nigeria was Africa's first documented case, which was reported on Wednesday 8th February 2006 when the highly pathogenic strain of avian flu H5N1 was found in chickens at Sambawa Farms, Kaduna State, Nigeria. Within 4 weeks, the outbreak spread to 7 states of the Federation. Six other African countries with confirmed cases of avian flu in poultry in 2006 include Egypt 17th February, Niger 27th February, Cameroon 12th March, Burkina Faso 3rd April, Sudan 18th April and Ivory Coast 26th April 2006.

United Nations Food and Agriculture Organization experts justified the spread of the disease in Nigeria by saying that Africa, the world's poorest continent where millions live with domestic poultry in their homes and backyards is ill-equipped in terms of health resources and funds to combat avian flu. Prior to the outbreak, the organization in 2005, cautioned Nigeria and its neighbors to act swiftly by stopping the spread of the disease because of the weak veterinary infrastructure in most African countries.

Migratory birds and illegal importation of hatchable eggs and day old chicks were suspected to be the possible causes of the outbreak of avian flu in Nigeria. When the outbreak eventually occurred, stakeholders whose livelihoods were tied to poultry industry were thrown out of business while the sale of fish and beef increased during the trying period. The industry suffered great set back with grave economic consequences for all stakeholders. In spite of all odds, Nigerian poultry industry has finally recovered from the shock. The ugly incidence brought about by avian flu must not be allowed to resurface again in our country. At the moment, the Federal government took the following steps as part of its preparedness for the likelihood of an avian influenza human pandemic:

(a) Commissioning of Avian Influenza Inter-Ministerial Steering Committee
(b) Establishment of Avian Influenza Crisis Management Centre
(c) Establishment of 8 federal rapid response teams

6.0 CONCLUSION AND RECOMMENDATIONS

Mr. Vice Chancellor Sir, in the course of this lecture, I have identified various employment opportunities in poultry farming that can alleviate poverty in our society. The audience will agree with me that poultry farming is a worthy and economically viable occupation. It will be recalled that prior to the outbreak of Avian Flu in Nigeria, the poultry industry engaged over 25 million Nigerians, pig industry over 500, 000 while sheep and goat industry engaged over 10 million Nigerians. I have also explained how poultry production can contribute to sustainable food security in many developing countries by providing income particularly to poor farmers. It makes good use of local

resources and provides economic, social and cultural contributions to household livelihoods. Linking poultry production, processing and marketing means employment, food security, foreign exchange, poverty alleviation and as a consequence of all this, SOCIAL TRANSFORMATION. We can end hunger, famine and poverty in Nigeria if we process and market what we produce.

Although there are some problems presently militating against poultry farming in Nigeria, the solutions to these problems are not far fetched. Mr. Vice-Chancellor Sir, distinguished ladies and gentlemen, I'm hereby suggesting the following recommendations for the advancement of poultry industry in Nigeria.

6.1 Role of Poultry Farmers

(a) Poultry farmers should endeavour to attend seminars and workshops in order to update their knowledge of poultry farming. This will ensure that poultry and poultry products continue to occupy their traditional place in feeding and providing social enjoyment for people.

(b) There is the urgent need for large scale- poultry farmers to set up processing plants for the production of egg powder to prevent the annual incidence of egg glut. This will provide employment opportunities for many Nigerians who have no steady source of income.

6.2 Role of Fast-Food Industry

(a) Fast-food restaurants should popularize the use of chicken meat from different poultry species (e.g. duck, guinea fowl, turkey etc) in the manufacture of meat products. This approach will provide variety of taste and create employment opportunities in the fast-food chain for the youths.

(b) The use of local ingredients, e.g. melon seed meal or edible mushroom as alternative to fat in the manufacture of meat products will satisfy consumer demand and minimize the incidence of coronary heart disease in our society. This practice will enhance industrial development and youth employment. In addition, it will encourage large- scale

cultivation of melon and edible mushroom and provide additional source of income to crop farmers thereby improving their living standard.

(c) Quality control laboratory should be available for the analysis of samples of meat products. Some scientists from Nigerian Institute for Medical Research have observed that sugar and fat contents in the fast foods could cause obesity, which could accelerate kidney damage.

(d) Meat processors should attend conferences and seminars in order to know more about the latest research findings in the meat industry.

6.3 Role of consumers

(a) Consumers should patronize locally produced poultry and poultry products. Investigations have revealed that imported frozen poultry products are usually preserved with chemical used for the preservation of human corpses. Besides, such products are usually from doubtful sources.

6.4 Role of Government

Although the Federal government placed embargo on importation of poultry products in 2002, several cases of illegal importation were reported between 2003 and 2005. For instance, a total of 156,800 cartons of frozen chicken and turkey in 49 containers valued at N501.8 million were impounded on 11th January 2003 in Warri, Delta State. This was considered as the "mother of all seizures" for the year. However, the seized items miraculously "developed wings" by January 14th 2003. Also, a truck load of 1,700 contaminated cartons of imported turkey impounded by the operatives of the Nigerian Customs Service in September 2004 disappeared from their custody and filtered into the markets in Lagos and other nearby state capitals. Ogun State Command of the Nigeria Customs Service also seized 209 cartons of frozen turkey from smugglers in June 2005. The turkeys were later found to be poisonous.

The illegal importation of poultry products is not peculiar to Nigeria alone, many African countries experienced the same problem. For example in Senegal where poultry farming

has dropped by 30% since 2000, imports now supply half of total demand. Poultry farmers claimed that poultry imports are a glaring example of the effects of deregulated markets on agricultural products caused by the liberalization of international trade. In 2003, statistics from Food and Agriculture organization of the United nations (FAO) confirmed that Africa imported 182,000 tonnes of chickens from the European Union, mostly from Belgium, France and The Netherlands. In the light of above situation, it is hereby recommended that Government should among other things:

(a) Continue to prevent the importation of the frozen poultry products in order to encourage local production and conserve country's foreign exchange.

(b) Support the poultry industry financially in order to improve poultry production and poultry consumption pattern of the populace. The national capacity for poultry production can be expanded with a corresponding increase in job opportunities by the application of subsidy. This is necessary because poultry industry is one of the major sectors of the food production chain.

(c) Provide sufficient funds for poultry research that will enable Nigeria to export poultry and poultry products to other African countries.

(d) Pursue youth empowerment with extra vigor to drastically reduce level of prevalent unemployment in our society. This approach will enable the Federal Government to meet the target of reducing poverty by 30% in 2011 and generate productive employment for at least 6 million people every year.

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"I'M PRESSING ON THE UPWARD WAY. NEW HEIGHTS I'M GAINING EV'RY DAY; STILL PRAYING AS I ONWARD BOUND, LORD PLANT MY FEET ON HIGHER GROUND. '' Thanks for listening and God bless you all.

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