

**ANALYSIS OF PRODUCTION PERFORMANCE
AND PROFITABILITY OF PIG FARMS
IN ENUGU STATE, NIGERIA**

by

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**DEPARTMENT OF VOCATIONAL TEACHER EDUCATION
(AGRICULTURAL EDUCATION)
UNIVERSITY OF NIGERIA, NSUKKA**

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TITLE PAGE

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**THESIS PRESENTED TO THE DEPARTMENT OF VOCATIONAL
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JULY, 2015

APPROVAL PAGE

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ONAH FREDERICK CHINEDU, a postgraduate student in the Department of Vocational Teacher Education (Agriculture) with Registration Number PG/Ph.D/07/42712, has satisfactorily completed the requirements for the research work for the degree of Doctor of Philosophy (Ph.D) in Agricultural Education. The work embodied in this thesis is original and has not been submitted in part or full for any diploma or degree of this or any other university.

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DEDICATION

This work is dedicated to Almighty God

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Abstract

This study was carried out to analyse the production performance and profitability of pig farms in Enugu State. Eight research questions and five hypotheses were formulated based on the specific purpose of the study. Survey design was adopted for the study. The study covered the registered pig farms in the study area. The population for the study was 519 respondents comprising 162 registered rural pig farmers, 135 registered urban pig farmers and 222 agricultural extension agents in Enugu State. The entire population was used as sample. The instrument for data collection was validated and its reliability determined. Data were collected using structured questionnaire supported with pig performance recording sheets, and available farm records. The data collected were analysed using percentages and frequency counts, mean and standard deviation were used to answer the research questions while Analysis of Variance (ANOVA), Duncan's test and t-test statistic were used in testing the hypotheses at 0.05 level of significance. The most popular breed of pig in the study area was Large White. Other breeds of pig kept by farmers include Duroc Jersey, West African Dwarf pig, Land Race and Hampshire. It was also found out that farmers adopted most of the pig production technologies except such technologies that require high level skills like castration, artificial insemination and telemarketing or video merchandising. It was found that pig production business was highly profitable in the study area with mean profit margin of ₦3, 689, 267.98 per farm per year. The productivity constraints and strategies for improving physical productivity and profitability of pig farms were ascertained. There were significant differences among breeds of pig in mean birth weights, weaning weights and adult weights. There was no significant difference between the mean ratings of urban and rural pig farmers on pig production technologies adopted by farmers in most of the items presented to the pig farmers. There was no significant difference between the mean ratings of urban and rural pig farmers on the productivity constraints of pig farms in most of the items presented to the pig farmers. There was significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving profitability of pig farms in most of the items presented to both groups. It was therefore, recommended that pig farmers should always endeavour to select and keep improved, exotic breeds of pigs such as Large White in their farms due to their high production performance. All stakeholders in pig production should join hands in reducing the productivity constraints of pig farms by providing human and material resources to increase productivity. Furthermore, livestock farmers and new investors should be encouraged and motivated to establish pig farms in the state as the business was found to be highly profitable.

CHAPTER ONE

INTRODUCTION

Background of the Study

In Nigeria, human population is out growing food production resulting to food crisis in the country (F.O.S., 2007). This is a great challenge to individuals, organizations, Federal, State and Local Governments in Nigeria. In view of this, all are expected to join hands in improving the food supply of Nigerians. Food production increases at the rate of 2.8 percent while food demand increases at a rate of more than 3.8 percent due to the high rate of population growth of 2.93 percent (F.O.S., 2007). Despite this increase in food demand, the actual amount of protein consumed by average Nigerian is still very low. World Health Organisation (WHO) (2007), recommended more than 85g of protein per person per day. While Food and Agricultural Organisation (FAO) (2006), reported that the average Nigerian eats about 45g or less of protein per person per day which is far below the standard set by World Health Organisation (WHO). The level of animal protein intake by Nigerians is inadequate as they consume more of plant protein (FAO, 2011). Owing to the acute shortage of animal protein in the diet of average Nigerian, there is the need to increase domestic production of animals such as pigs. This will help to fill or at least narrow the animal protein deficit gap among Nigerian consumers.

Animal production has suffered a great set back in the recent years, due to disease outbreak, high cost of feeds and insufficient government assistance. This resulted to insufficient meat and other animal products which supply protein to man. Nigeria has a conducive environment for keeping farm animals such as sheep, goats, cattle, horses, donkeys, rabbits, camels, poultry and pigs (swine).

Pigs are among the oldest domesticated monogastric animals in the world (Holness, 2007). The origin of domestic pig is still not clear, it is probably derived from the European wild boar (*Sus Scrofa*) (Serres, 1999). Biblical writings, however, indicated that pigs were first

domesticated as early as 2000 B.C. and there are over 90 recognised breeds of pigs and an estimated 230 species of pigs in the world (Holness, 2007). These breeds and species are classified into indigenous/unimproved and modern/exotic breeds. Pigs can be reared almost anywhere given suitable housing and management. Pigs are found throughout tropical and temperate regions where religious beliefs do not prevent them from being reared (Serres, 1999).

Pigs have high survival rate, high feed conversion efficiency and high prolificacy (Karol and Krider, 2001). Pigs are known to be prolific having 20 to 30 piglets from 2 litters per year (Akinyosoye, 1999). They have the gestation period of 3 months 3 weeks and 3 days. Pigs are good and efficient feed converters. They are able to reach slaughter weight of about 80 to 90kg in about 7 to 8 months under efficient management and balanced nutrition (Adesehinwa, Aribido, Oyediji and Obiniyi, 2003). The good qualities and inherent high productive potential of pigs make their production to be economically viable (John, 2007).

In Nigeria, pig production is the lowest of all livestock sub-sector in terms of meat supply when compared with poultry, goats, sheep and cattle (CBN, 2008b). Many pig farmers and investors are not willing to enter into swine production business and those who manage to enter easily quit. Research studies have shown that pig production in Nigeria is inadequate and requires drastic measures for its improvement and sustainability. When compared with poultry and other farm animals slaughtered and consumed daily in Nigeria, pigs represented less than 1 percent (F.A.O., 2006).

Apart from pork and lard, pigs give other economically important produce such as pig skin as raw materials for making valuable leather materials. Bristles from pigs are used for making brushes, hooves for making gelatin and glue products are also obtained from pigs (Holness, 2007). Pigs also provide good source of animal feeds from blood and inedible meat tissues. The pigs provide blood, intestines and offals for making sausage and delicacies for man and animal consumption. The faeces and effluents serve as manure to increase the fertility of

farm land and to produce biogas used in domestic cooking (Rogerio and Laura, 2006). All these pig products and by-products are potential income earners for the pig farmers.

A pig farm is a place where pigs are kept or reared, raised and bred for the supply of pork and other pig products. Pig farms are also known as piggeries. Pig farms are scattered all over Enugu State. They are located in both urban and rural areas of the state. Urban areas are located inside townships or cities where there are high population density coupled with adequate social amenities. Rural areas are located outside townships where there are low population density, vast area of land with little or no social amenities. The area of land available for the farms, the type of feeds available for the animals, accessibility of the farmers to the markets, availability of agricultural extension agents and veterinary officers will determine to a large extent the location of pig farms. Agricultural extension agents assist farmers to acquire productive pig farming technologies. In Enugu State, pork is demanded more in urban centres than in rural areas (Nwobodo, 1997). Apart from location, other disparities exist among pig farmers in the study area such as literacy, gender, experience and scale of production. These affect the adoption and the application of pig production technologies.

Pig farmers are those who work and care for the pigs in the farm either as farm owners, managers or attendants. They are in charge of pig farms and co-ordinates the activities of other factors of production. Pig farmers are involved in farm budgeting and control of farm inputs and outputs.

Agricultural extension agents are staff members of the state Ministry of Agriculture who are engaged in Enugu State Agricultural Development Programmes (ENADEP). They are trained to disseminate information on new innovations, techniques, improved practices and technologies to the farmers on how to improve farm production. Agriculture extension agents

also use extension teaching methods to educate farmers such as pig farmers on how to increase physical productivity and profitability.

There are two major systems of pig production prevailing in Enugu State namely; the traditional/extensive system and the intensive system (Ezeibe, 2010). The pigs under the traditional system are left to scavenge and roam about searching for feeds. This system is characterized by the use of indigenous, unimproved breeds, low quality feeds and poor management resulting to low productivity (Akinyosoye, 1999). This extensive system appears to be the simplest and cheapest since the pig farmer does not spend much money on feeds and housing. It is usually practiced by peasant, small-scale, subsistent pig farmers.

The intensive pig production system involves total confinement of the pigs which requires huge capital investment. Intensive system is characterized by the use of improved exotic breeds, proper housing, adequate feeding and veterinary services coupled with good management practices (Ezeibe, 2010). Intensive pig production is more common in Enugu State as well as the entire South East geo-political zone of Nigeria. An intensive piggery may carry sow herds of about 40 to 100 of exotic breeds or hybrids with optimum condition of housing, feeding and other management practices in order to ensure maximum output (Ekele, 2004). The housing comprises of modern, permanent structures which encourage easy disposal of faeces and effluent, providing maximum comfort and security for the pigs.

Pig production technologies are part of agrarian technologies used in pig production which are necessitated by population growth, changing climate, markets and needs (Oladele, 2002). Technologies are described as ways of doing things that are based on modern knowledge about science. The level of technology affects output in the production process (Robert and Ben, 2009). Pig production technologies can be in form of building design, feeding system, management practices and methods of controlling diseases and parasites in pig farms

(Kelly, 2005). The adoption of production technologies by farmers usually follow a 5-step process which include, awareness, interest, evaluation, trial and adoption or rejection.

Production in agriculture involves the use of factors of production such as land, labour, capital and management as inputs to obtain output. In pig production, resources are utilized to make goods and services which have value (John, 2003). Production in this study refers to the process of rearing pigs from farrowing to finishing stages in a pig farm as well as transportation and marketing of live pigs and pork. Productivity is the amount of the output per unit of input achieved by a firm, industry or a country (Robert and Ben, 2009). It is the rate at which goods are produced and the quantity of output in relation to the work, time and utilized in producing them. Productivity in economic term is used to describe how well or how efficient an economy's resources are used in the process of production (Arene, 2008). However, productivity per worker can be increased by longer hours (man hours), more effort or improved skills on the part of labour force, more capital, equipment, improved technology and better management (John, 2003). Productivity is a broad concept comprising of physical productivity (physical output) and financial productivity (financial return) of an industry or enterprise. In pig production, physical productivity include the number of piglets, adult pigs, pork, lard, bristles, pig skin, pig manure and hooves realized from the farm per unit of input. Financial productivity refers to the amount of money (revenue) emanating from the sale of physical products. It is the difference between these sales (income) and the input (expenditure) that gives either the profit or loss in the pig production business.

The factors that may influence the productivity of pig farms include; educational level of farmers, types of pig production technologies adopted, incidence of diseases and parasites, finance, farmer education, choice of pig breeds, housing, feeds and feeding, and system of management of pig farms. All these factors influence productivity either positively or negatively thereby positively or negatively affecting the performance of the pig farms.

Constraints to pig production are the problems, hinderances and set backs experienced by pig farms which lead to low productivity and profitability. Anukwu and Ebong (2011) identified many pig production constraints in Akwa Ibom State which included: high cost of feeds, inadequate capital, high cost of medication and drugs, poor extension services, high cost of transportation, scarcity of skilled labour and poor breeding stock. Adesehinwa, Aribido, Oyediji and Obiniyi (2003) also identified some problems facing livestock production which included; weather fluctuation, diseases and parasites attack, religious beliefs, illiteracy, poverty and insufficient animal feeds. Some of these problems are likely to affect pig farms in Enugu State resulting to poor production performance of some pig farms.

Strategies are well planned series of skillful actions for achieving stated goals (Gekara, Garner and Dunbar, 2009). Every business including pig production has its own peculiar problems requiring solutions so as to be successful. Strategies are usually mapped out to improve physical productivity and profitability of pig farms. These strategies include improved methods of stocking, housing, feeding, diseases and parasites control, adoption of modern pig production technologies, effective marketing of pigs and pig products, financial aids, culling of old and unproductive pigs, and sale of pig manure. These actions can help in increasing productivity, supply of pork, other pig products and farm profit. This study sought to determine the strategies for improving the physical productivity and profitability of pig farms in Enugu State.

Performance is a measure of achievement, ability or capacity on a particular task, job or work (Olaitan and Ali, 1997). Performance in real term can be positive or negative, good or poor and high or low. Performance implies how well or badly a person, company, industry, farm, an animal does a particular job or activity. In this study, performance relates to how well or badly pig farms produce required output (pig products). Good performance will lead to high productivity and profitability while poor performance will result to low productivity as well as

low profitability. Performance indicators in pig production include; number of pigs produced per sow per year, number of litters per sow per year, number of piglets born alive, birth weight, weaning age and weight, market or adult weight, feed conversion ratio, quantity of pork and number of pigs produced per farm per year, and number of bags of manure produced per farm per year (Michael, 2003). Performance results for piglets, weaners and finishers are usefully combined to assess pig performance from farrowing to sale (Michael, 2003).

Production performance is the result of how well the pig farm has functioned either profitability or achieved a lot using available inputs (Lewins, 2007). It is really an indicator of economic progress in the pig farm with respect to this study. The record of the production performance parameters, sales and total revenue in relation to various inputs applied and their costs were computed so as to determine the performance of the pig farms in Enugu state within the period under study.

It is worthy of note that peasant pig farmers used traditional pig production technologies such as local breeds of pigs, scavenging or extensive system of pig rearing, feeding of animal with less nutritious feeds, low level of hygiene and poor management practices resulting to low productivity. Nowadays, commercial pig farmers in Enugu State are more interested in the application of pig production technologies to increase productivity. Holness (2007); John (2011); NAERLS (2010); Osaro (1995) and Serres (1999) identified various pig production technologies in terms of management practices such as stocking, housing, feeding, diseases and parasites control, record keeping and marketing of pigs and pig products. Some pig production technologies include: use of improved breeds, proper housing, artificial insemination, castration of male piglets, cleaning, washing and disinfecting pens regularly, nose ringing, teeth clipping, creep feeding, wet feeding, phase feeding, vaccinating young pigs against diseases, regular farm record keeping and improved marketing systems. These aforementioned pig production practices help to determine the amount of profit margins made in the farms.

Profit is an excess of the receipts over the spending of a business during any period (John, 2003). Profit is one of the measures of business performance. The direct opposite of profit in business is loss which is an excess of spending over receipts. Profit exists when the total revenue (TR) is greater than the total cost (TC) of production. Profitability is an indicator of the amount of gain made by a business enterprise (Ngwu, 2000). It is necessary to determine the production performance of pig farms in relation to the total inputs (cost of production), and output (revenue) through careful analysis.

Analysis is an examination of something in order to understand it better. Analysis involves thorough examination and explanation of all the component parts of something in order to have full understanding of what is being discussed (Sharma, Leung and Zaleski, 1997). In this study, analysis is the examination of all aspects of the pig production such as fixed inputs, variable inputs, their quantities and costs together with the revenue (output) accruing from the pig farms in Enugu State. Analysis of all components gives clear indication of the productivity and profitability of the pig farms. This study addressed the issue of determining physical productivity and profitability of pig farms in Enugu state as well as the factors militating against pig production and determining intervention strategies for improvement in the pig enterprise.

Statement of the Problem

In Nigeria, the daily animal protein consumption is declining due to high poverty rate, rapid population growth and the ban on importation of foreign meat since the year 2001 (F.O.S., 2007). The World Health Organisation (WHO) (2007) recommended quantity of protein (85g/person/day) to be consumed by Nigerians has not been attained. There is inadequate supply and intake of animal protein as more of plant protein are consumed. There is the need to increase domestic production of animals such as pigs to narrow the animal protein deficit gap among Nigerian consumers.

Pig production is one of the livestock programmes assisted by United Nations Development Programme (UNDP) to beef up animal protein supply in the country. Despite this assistance, Central Bank of Nigeria (CBN) (2008b) revealed that pig production is relatively less in terms of herds compared to other classes of livestock such as cattle, goats, sheep and poultry. There is therefore the need to investigate the reasons behind this downward trend in pig production, and seek ways of improvement so as to reverse this situation by analyzing the production performance of pig farms in the state.

Moreover, swine production is a policy issue in Enugu State and needs to be pursued seriously (Enugu State Government, 2009). In line with this, the current plan of Enugu State Government in the area of livestock production is to concentrate on pig and poultry production (Enugu State Government, 2009). In contrary, most livestock farmers, investors and Fadama III beneficiaries in the state prefer poultry to pig production. This has resulted to low supply of pork despite the fact that there is increased demand for pork during festivals and in hotels, restaurants and eating houses within the state.

Many livestock farmers and investors are not willing to be engaged in pig production business and many of them that managed to embark on the business failed soon after establishing the business. The reasons for the failure of the business have not been determined hence this present study. The trend needs to be changed to boost pork production and narrow the animal protein deficit gap in the state. In view of this, there is need to examine the existing pig farms in terms of physical productivity, costs and revenue so as to determine their current status.

Also there is no documented empirical research records of physical productivity and profitability of pig farms in Enugu State for use by pig farmers as previous studies on pig production in the state did not analyse the physical productivity of pig farms but only the profitability of pig farms. This study was therefore, conducted to analyse the physical

productivity and profitability of the existing pig farms in the state. The study sought to identify types of breeds of pigs kept, productive characteristics of pig breeds, pig production technologies adopted by farmers, pig production constraints and intervention strategies for improving the physical productivity and profitability of pig farms in Enugu State.

Purpose of the Study

The main purpose of this study was to analyse the production performance and profitability of pig farms in Enugu State with a view to identifying gaps, needs and constraints that should be addressed properly to improve physical productivity and farm profits.

Specifically, this study sought to:

1. identify breeds of pigs kept by rural and urban pig farmers.
2. determine the productive characteristics of pig breeds kept by farmers.
3. identify the pig production technologies adopted by pig farmers.
4. determine physical productivity of pig farms in Enugu state.
5. determine the profit margins of pig farms in Enugu State.
6. determine the productivity constraints of pig farms.
7. determine strategies for improving physical productivity of pig farms in Enugu State.
8. determine strategies for improving the profitability of pig farms in Enugu State.

Significance of the Study

The information obtained from the findings of this study will be beneficial to pig farmers, agricultural extension agents, Agricultural Education students and teachers, Ministry of Agriculture and Ministry of Education, researchers and Research Institutes, Universities and other institutions of learning, curriculum planners, National Directorate of Employment (NDE) and the general public. The information obtained can be made available to pig farmers and others through workshops, seminars, conferences, publications and training manuals.

The findings of this study on type of breeds kept by farmers and productive characteristics of pig breeds will provide a guide for other farmers and investors who want to enter into the pig business on selecting appropriate and highly productive breeds of pigs for establishing new farms and to replace already existing less productive ones.

The results of this study on the types of pig production technologies adopted by farmers will provide information and a guide which will help other pig farmers and investors to apply improved pig production technologies in their various farms with the assistance of agricultural extension agents. The information obtained by agricultural extension agents from the findings of this study on the types of pig production technologies, pig productivity constraints and strategies for improving physical productivity and profitability of pig farms will help them map out improvement strategies, design extension training packages and guidelines for training and retraining of other pig farmers and prospective investors on how to embark on profitable pig farming.

The findings of this study on pig productivity constraints and strategies for improving physical productivity and profitability of pig farms will also provide useful information for State Ministry of Agriculture, and Enugu State Agricultural Development Programme (ENADEP), to integrate the findings into training packages.

The findings of this study on pig productivity constraints and strategies for improving physical productivity and profitability of pig farms will help the National Directorate of Employment (NDE) to organize seminars, workshops and conferences on profitable pig production for sustainability. The National Directorate of Employment (NDE) will also use the findings on strategies for improving physical productivity and profitability of pig farms in the training of other farmers and prospective investors, National Directorate of Employment (NDE) beneficiaries, unemployed and interested youths (trainees) on pig production. This will enable them to acquire relevant skills on-the-job especially during apprenticeship scheme. The data on

pig breeds, costs and revenue of pig farms will guide the pig farmers on the choice of more productive breeds for stocking and the required input costs and corresponding output (revenue) in pig business. This will also show the livestock farmers and investors how viable pig business is in the state.

The study on profit margins of pig farms applied both CIPP Evaluation model and Project/Programme Evaluation model. Appropriate use of these models in this study helped in realizing the objective on profit margins of pig farms in Enugu State. The Innovation-Decision Process Theory of Adoption was applied in identifying pig production technologies adopted by pig farmers in Enugu State.

The general public will also benefit from the findings of this study because the appropriate use of the entire findings by pig farmers, agricultural extension agents, institutions, governments and non-governmental organizations will lead to more investments in pig production resulting to increased pork production, supply and consumption.

Research Questions

Eight research questions were asked in line with the specific purpose of the study as follows:

1. What breeds of pigs are kept by rural and urban pig farmers?
2. What are the productive characteristics of pig breeds kept by farmers?
3. What pig production technologies are adopted by pig farmers?
4. What are the physical productivity of pig farms in Enugu State?
5. What profit margins are realized by pig farms in Enugu State?
6. What are the productivity constraints of pig farms?
7. What are the strategies for improving physical productivity of pig farms in Enugu state?
8. What are the strategies for improving profitability of pig farms in Enugu state?

Research Hypotheses

The following null hypotheses were formulated to guide the study at 0.05 level of significance.

- H₀₁:** There is no significant difference among breeds of pigs in birth weights, weaning weights and adult weights.
- H₀₂:** There is no significant difference between the mean ratings of the urban and rural pig farmers on pig production technologies adopted by pig farmers in Enugu State.
- H₀₃:** There is no significant difference between the mean ratings of the urban and rural pig farmers on the productivity constraints of pig farms.
- H₀₄:** There is no significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving physical productivity of pig farms in Enugu State.
- H₀₅:** There is no significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving the profitability of pig farms in Enugu State.

Scope of the Study

The study was restricted to the registered rural and urban pig farmers, pig farms and agricultural extension agents in Enugu State of Nigeria. The entire three senatorial zones of the state were covered.

The study focused on the identification of breeds of pigs kept by rural and urban pig farmers, pig production technologies adopted by pig farmers, production performance of pig farms in terms of number of piglets produced per sow, birth weight, weaning weight and age, number of adult pigs produced per year, adult weight, quantity of pork produced and number of bags of pig manure produced per year. The study also determined investments (costs), the amount of profits realized by pig farms, productivity constraints of pig farms and strategies for improving physical productivity and profitability of pig farms in Enugu State of Nigeria.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The literature is organized under the following sub-headings:

Conceptual Framework:

- Farm Physical Productivity and Profitability
- Pig production, Breeds and Selection of Breeding Stock
- Pig Keeping Practices and Management Systems
- Pig Production Technologies
- Marketing of Pigs, Pig Products and Profit Margins
- Prospects of Swine Production
- Constraints in Pig Production
- Schematic Representation of Relationships of Key Variables and Expected Outcome

Theoretical Framework

- Innovation-Decision Process Theory of Adoption
- Context, Input, Process, Product Evaluation Model
- Programme/Project Evaluation Model

Related Empirical Studies

Summary of Review of Literature

Conceptual Framework

The conceptual framework focused on the broad concept of productivity of pig farms. The stakeholders in pig industry participate in different activities in the pig production process right from farrowing to finishing stages in addition to processing, marketing and consumption stages. The pig farmers with the help of other stakeholders establish pig farms by selecting

appropriate breeds, rearing the piglets with suitable housing, nutrition, good health care services and suitable marketing facilities.

Some economic management limitations and major constraints interact, resulting to reduced output, sales and revenue. Pig production technologies and other management practices adopted by farmers result to improved productivity in terms of output, sales and revenue. Production constraints, inputs and pig management practices affect each other and all are determinants of productivity/output. The cost of input applied in pig farm gives the total cost of production (including fixed costs and variable costs). The output is sold and total revenue obtained. All costs and revenue are identified and compared to get profit margin or loss. It is worthy of mention that if there is profit, then there may be a reinvestment or plough-back into the business to make for sustainability but if there is loss, the business may fold and it liquidates.

Farm Physical Productivity

Production in this study is the process of rearing pigs from farrowing to finishing stages as well as transporting and marketing of live pigs, pork and other pig products and by-products. Farm productivity is expressed in terms of yield per unit of input (factors of production) (Robert and Ben, 2009). Productivity shows the amount of output realized per unit of input achieved by a firm, industry or a country (Arene, 2008). Productivity is the rate of output in relation to the work, time and money needed to produce them. Productivity per worker can be increased by longer hours, more effort, improved technology or better management (John, 2003). Arene (2008) in his own view maintained that productivity in economic term is used to describe how well or how efficient an economy's resources are used in the process of production.

Physical products in animal production include live animals, meat, milk, wool, hides and skin, eggs, horns, hooves, bristles and manure. In pig production, physical products include live piglets, adult pigs, pork, lard, bristles, pig skin, manure and hooves (Holness, 2007).

Physical products in a pig farm are measured in terms of the number of piglets produced by a sow per litter per year, number of piglets born alive, weight gain per month, number of piglets weaned and average adult body weight (Michael, 2003). The quantity of live pigs, pork and pig products and by-products produced in a piggery per year are clear indication of physical productivity of that pig farm. The physical productivity of a pig farm can be affected by stockmanship, capital investment, pig production technologies adopted, feeds and feeding system, housing, diseases and parasites, type of pig breeds used and management practices used in the farm. These factors can affect physical productivity either positively or negatively in the production process. The sale of physical products will lead to the monetary or financial aspect of productivity which will go a long way in measuring the profitability of pig farms.

Profitability is an indication of the amount of money gained from business. It is otherwise known as the degree of benefit enjoyed by the farmer in his farm. It is the difference between these sales (income or returns) and the input costs or expenditure that gives either profit or loss in the business. Profitability is the degree to which business or activity is profitable. Profit itself is the money gained from a business transaction or selling things after all costs have been deducted or paid completely. Profit is an excess of the receipts over the expenditure of a business at given period (John, 2003). If the receipts or sales become less than expenditure, the business records loss. Loss is an excess of spending over receipts. Profit exists when the total revenue (TR) is greater than the total cost (TC) of production. There are two types of profit which include gross profit and net profit. Gross profit is obtained by subtracting total cost from total revenue before tax payment. Net profit on the other hand is obtained by subtracting the amount paid as tax from the gross profit.

The profitability of any business enterprise can be determined by the Gross profit margin analysis, Benefit- Cost Ratio, Net profit margin analysis, Net return or Net revenue (Arene, 1998). Profitability is an indicator of the amount of gain made by an enterprise. Ngwu (2000) reported that profitability is the net result of a large number of policies and decisions. The ultimate goal of any pig farm is to identify cost-effective production strategies and the best credible alternatives to reduce costs and increase profits in pig farms (Gekara, Garner and Dunbar, 2009).

Profitability is measured by analysing the various costs of production and returns from production (Sharma, Leung and Zaleski, 1997). The amount of profits made by pig farms in an area determines to a large extent the shrinkage (closure) or continuity (sustainability) of the pig enterprise in that particular area. The profitability of a pig farm shows how viable the pig business is and how successful the farmer is. Profitability is directly proportional to the physical productivity of farms.

The major aim of any farming enterprise is to make profit (Ngwu, 2000). There can be increased production performance without reasonable profit especially if the cost of production is outrageous or very high. Ezeibe (1998) pointed out that the ultimate performance measure in livestock business is the amount of profit made which depends on management practices adopted.

Pig production cannot be sustained unless it increases revenue through whatever means to those who practice it, hence there must be a profit (Serres, 1999). In order to find out whether there is profit or loss, total production costs including tax must be determined as well as the total revenue or receipts (Onah, 1998). The difference between the two gives the answer. For instance, if the production cost is greater than revenue, there is loss but if the total revenue, is greater than total production cost, then there is profit or gain. Arene (1998) argued that for agricultural based firms and other firms, it is important to project and analyse financial

statements to judge efficiency, incentive, credit worthiness and liquidity and to determine the costs and benefits that are to be included in the overall project. Production costs in pig farms include, fixed costs which are independent of the number of pigs kept and variable costs dependent on pigs reared. Fixed costs include: staff salary, cost of building and pig house maintenance, equipment purchases and miscellaneous costs which may include management charges, insurance, taxes and financial charges if applicable such as interest on loan (Peter, Owen and Sheona, 2001)

Depreciation is the amount of money set aside for tear and wear of equipment and buildings (Ijiomah, 2002). It is the loss in value of a depreciable asset due to tear and wear, old age or obsolescence (Ebirim, 2002). Depreciable items in piggeries include: land, farm machinery and tools, farm buildings and structures. There are several methods of calculating depreciation namely: straight-line method, reducing balance method, sum of the years digits method, machine hour method, annual revaluation method, sinking fund method and the annuity method (Ebirim, 2002). The straight line method is calculated by subtracting the estimated salvage value of the asset from the original cost of the asset divided by the useful life of the asset. For most farm machines and tools, the useful life is calculated at 10 years. Depreciation is calculated as 5 percentage of the value of farm buildings which are considered to last for 20 years if they are strong, 3 years for straw and thatched roofs and 10 years for wooden buildings (Serres, 1999). It is worthy of note that these facilities may also appreciate in value. Straight line method will be used in this study to calculate depreciation of assets in pig farms.

Variable costs in pig production include: cost of feeds, fuel, water, electricity, amount spent for part-time workers and Miscellaneous costs (Serres, 1999).

The sum of the fixed costs and variable costs will give the total production costs (costs of inputs). The products (output) will be sold and revenue obtained and the difference between them will give either profit or loss.

The economics of pig production deals with the complex subject of spending money wisely in terms of spending the right amount on the right areas at the right time to make meaningful profit in pig business (John, 2003). The performance terms in pig production include: litter size, daily weight gain, feed conversion ratio, weaning weight, slaughter weight carcass quality and quantity (Holness, 2007). The only major method used by pig farmers to find out total revenue or farm income is by sale of live pigs, meat (pork) and pig products.

Business enterprises can determine their profits or loss by working out the balance sheet at the end of the year preferably at 31st day of December. Balance sheet refers to the statement of account showing various costs and revenue (expenditure and income) so as to ascertain whether the business is recording gain or loss (Serres, 1999). Balance sheet helps in determining the profitability of farm business at the end of production cycle or accounting period (Arene, 1998).

The Financial Ratio Analysis indices are used to evaluate the financial position, level of profitability and performance of a farm enterprise (Ngwu, 2000). The financial Ratio Analysis indices include profitability Ratio, Gross profit margin (GPM) Ratio and Net Profit Margin (NPM) Ratio. The profitability ratio is calculated to measure the operating efficiency of the enterprise or firm (Arene, 1998). The two major types of profitability ratios are calculated in terms of profitability in relation to sales and in terms of profitability in relation to investment (Umebali, 2002). Profitability depends on the development of productivity and income distribution (Saari, 2006). The Gross Profit Margin Ratio is calculated by dividing the gross profit by sales while Net Profit Margin Ratio is measured by dividing net profit after tax by

sales (Arene, 2008). The ratio is an indication of the efficiency of the farm enterprise and it establishes a relationship between net profit and sales.

The viability or profitability of any enterprise can be determined by the gross profit margin analysis, Benefit-Cost Ratio and net return (Ezeibe, 1998). Gross margin (GM) = Total Revenue (TR) - Total Variable Costs (TVC). Net Profit (NP) = Gross Margin (GM) - Fixed Costs (FC). On the other hand, Benefits - cost Ratio (BCR) = Total Revenue (TR) divided by Total Cost (TC). When the BCR is greater than or equal to 1, is an indication that the farm is viable or profitable. Benefit-Cost Ratio (BCR) relates to the present value of net cash flows to the initial capital required for a project (Onah, 1998). Net Return (NR) = Total Revenue (TR) minus Total Cost (TC), Net Farm Income (NFI) = TR - TC.

Gross margin/profit analysis has been found to be a veritable and effective tool in determining the performance as well as profitability of agricultural business (Upton, 1996). It is a measure of the contributions of all farm inputs in determining total farm profit or loss. The productivity and profitability analytical tools such as Net Return or Net Farm Income and Gross profit analysis are more suitable for use in this study, hence they are used as the tool for the analysis of production performance of pig farms in Enugu State, Nigeria.

Pig production, Breeds and Selection of Breeding Stock

The domestic pig, *Sus Scrofa domesticus* was derived directly from the world boars of Europe (*Sus Scrofa*) and Asia (*Sus vittatus*) (Serres, 1999). In the animal kingdom, pig belongs to the order ungulate through the sub-order artiodactyla and the family suidae. Many biblical expressions show that pig production started as early as 2000 B.C. (Holness, 2007).

Pig production refers to the rearing of pigs for the purpose of supplying pork and other pig products available for the consumers. Pig production requires various factors of production such as land, labour, capital and stockownership or entrepreneur. The fixed and variable inputs are used as investment in the business to arrive at reasonable output. Pig production therefore

means the rearing of pigs from farrowing stage to finishing stage. The importance of these animals to the economy of the nation include: foreign exchange earning, supply of food (meat) and feed nutrients, source of income, source of manure and raw materials for industries. Among the various livestock species, pigs are the most potential source of meat (pork), bristles and manure (John, 2007). Pig farming provides employment opportunities to seasonally employed rural farmers and supplementary income to improve their living standard (TNAU, 2008). Pigs have the ability to convert a wide range of food materials into edible human food, producing meat which differs from the flesh of other farm animals in texture, flavour and certain nutritive properties (Akinyosoye, 1999). Pig skin, bristles and manure are by-products of pigs. Pigs are also used for research works and various scientific investigations especially in Research Institutes and institutions of learning.

In Enugu State, there are both small scale and large scale commercial pig farmers. The subsistence small scale pig farms are usually found among the rural populace and helps them to improve their rural economy and standard of living (Serres, 1999). Holness (2007) further stressed that large scale commercial pig farming has improved considerably in recent times thereby increasing pork supply and the financial base of the investors. These pigs are raised in piggeries.

Piggeries are established in both rural and urban areas of Enugu State. These piggeries help in supplying pigs slaughtered for pork during important festivals and ceremonies like Christmas, New Year celebration, Easter celebration and other traditional ceremonies. Many hotels and restaurants obtain their pork supply from these existing piggeries.

Holness (2007), identified over 90 recognized breeds and an estimated 230 varieties of pigs in the world. Some pigs may be referred to as indigenous or unimproved while others may be referred to as modern, exotic or improved breeds. The indigenous breeds include Bakosi found in Cameroun, Ashanti Dwarf pigs found in Ghana. There are some other types found in

different parts of Africa. These local or indigenous breeds are mainly reared for meat and their females perform very well with average mature weight of 40 - 120kg (Osaro, 1995; Serres, 1999). Studies have shown that indigenous sows showed excellent mothering ability, which resulted in low piglet mortality without sophisticated housing. Furthermore, the efficiency of conversion of feeds to body weight in indigenous sows is also equivalent to that of exotic types except in growth phase during which the exotic types perform better (Sundrum, Butfering, Henning and Hoppenbrock, 2007).

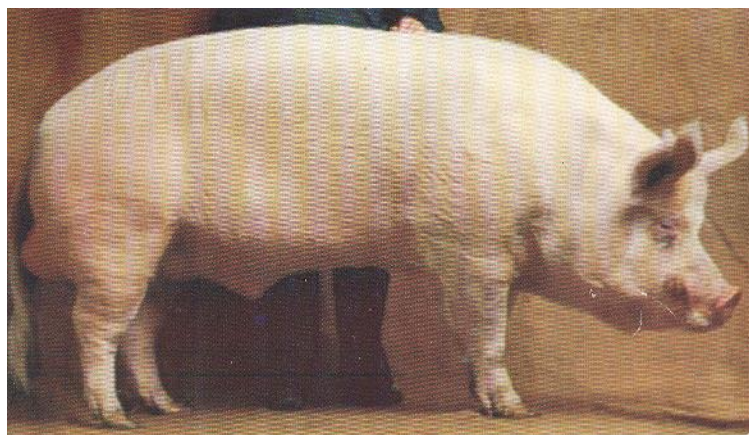
The exotic breeds are foreign breeds from such places like America, Brazil, China, Britain and other continents of the world. The exotic types of pig breed are usually improved types which have high productive performance when generally compared to local breeds in Africa (Osaro, 1995). Osaro (1995) maintained that exotic breeds perform better in terms of litter size at birth, litter size at weaning, preweaning mortality, average weaning age, average weaning mass, body weight gain, total live weight, carcass quality, slaughter weight, quantity of lean meat and feed conversion ratio. The exotic breeds of pig found in the tropical countries include: Land Race, Duroc Jersey, Large White, Berkshire, Hampshire, Tamworth, Large Black, Poland China, Chester White, British Saddle Back, Middle White Leicestershire and Pietrain (Holness, 2007 and Serres, 1999).

The British breeds include: Large White, Berkshire, Middle White, Tamworth, Large Black and Saddle Back. The American breeds include: Duroc Jersey, Chester White, and Poland China. Pietrain pig originated from Belgium while Land Race originated from Scandinavia (Holness, 2007). The most prominent breeds in Nigeria include: Large White, Duroc Jersey, Land Race and West African Dwarf pigs (Falusi and Adeleye, 1999).

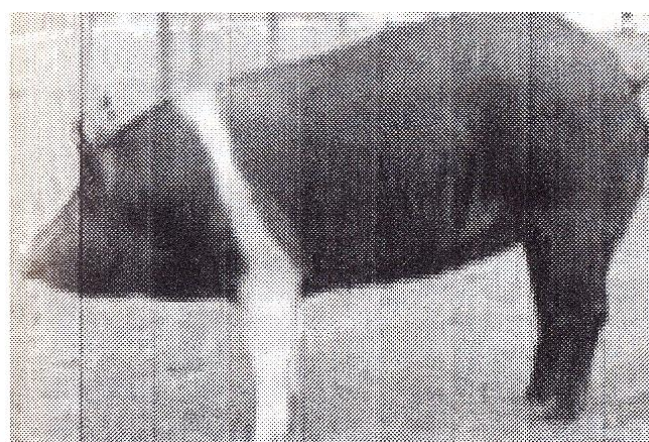
West African Dwarf pigs are resistant to stress and adapt very well to the tropical climatic condition unlike the exotic breeds (Ekele, 2004). The disadvantage here is that there is low performance in addition to parasite infestation as they are mainly reared under extensive

method. Large White breeds are very popular world wide. They adapt well to confinement, have good mothering ability, fast growing, prolific, great strength and high meat quality acceptable to the consumers (Serres, 1999). In commercial pig farms, large white is usually cross-bred with Land Race (female) for improved performance and profitability (Black, 2000). Land Race is another breed of choice by Nigerian pig farmers (Hichen, 1998). Land Race has good mothering ability, prolific and good for bacon. It is more susceptible to stress than other breeds but has good conformation (Holness, 2007). It has forward-pointing lop ears with long, smooth body, light shoulders and well developed ham (Holness, 2007). Duroc Jersey has deep red or rusty colour, fast growing, large body size, well developed muscle with less fat deposit, prolific, good mothering ability and resistant to stress (Fashanu, 1995). It is also good for meat production and it is wisely used by pig farmers to cross-breed females of white breeds (Tewe and Adesehinwa, 1995).

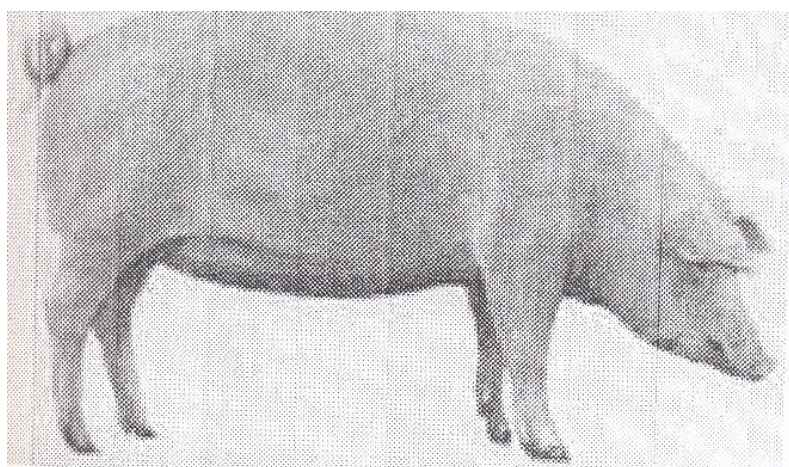
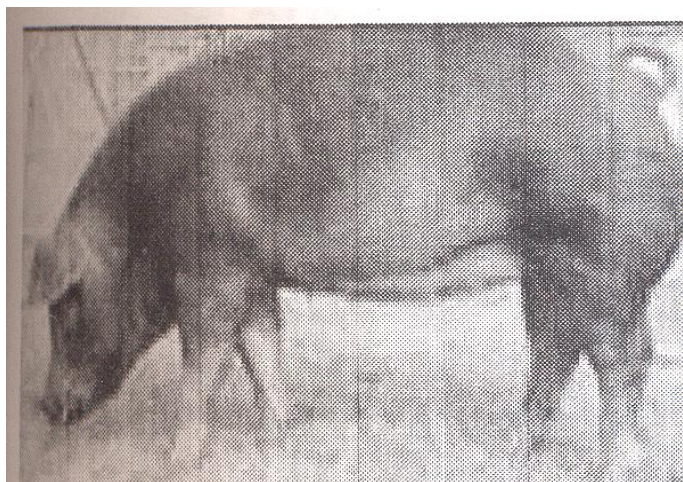
Fig 1: PICTURES OF MAJOR PIG BREEDS KEPT BY FARMERS IN ENUGU STATE



Large White



Hampshire



The selection of breeding stock of pigs is a vital operation in swine industry. Selection implies choosing from many alternatives based on a standard, guideline or criteria set up by the people involved in the selection (Black, 2000). The selection of breeding stock of pigs will focus on those traits, characteristics or qualities possessed by different breeds which help to promote increased productivity and profitability in pig business (Akinyosoye, 1999).

The basis for selection of breeding stock include growth rate, reproductive qualities, physical and genetic defects, general character, adaptation, over all farm performance, conformation, health condition and consumers' preference (Holness, 2007). Other basis of selection include; feed conversion ratio, back fat thickness, milk production, quality of meat, colour, carcass quality, mothering ability, temperament, litter size, weaning age, weaning weight, piglet mortality rate and slaughter weight.

Pig farmers would like to select those breeds that have docile temperament, good physical features, good performance record, strong legs with functional teats, high degree of vigour and longevity from birth to slaughter (Akinyosoye, 1999). The skin colour of the pig should be considered in selecting the breeding stock because white pigs have better adaptability than black pigs in the tropics. This is so because black is highly absorptive in the tropical areas when exposed to direct sunlight. This will result to increase in body temperature, heat stress and perhaps sunburn of black pigs such as Large Black (Falusi and Adeleye, 1999). However, in modern commercial pig farming with good management, shade in form of housing is usually provided. In view of this, skin colour of the pigs should not be a hindrance to the selection of a particular breed for breeding stock.

The choice of breed to be reared and the management system to a large extent determine the success or failure of piggeries in Nigeria. Serres (1999) recommended Large White and Duroc Jersey to be used by pig farmers in tropical countries and that the local breeds can only be used for crossing with other improved and more productive breeds.

Pig Keeping Practices and Management Systems

The system of pig keeping chosen by a farmer will depend on many factors which include: the choice of the farmer, the prevailing weather condition, financial capability, availability of pig feeds and the type of breeding stock (Sharma, Leung and Zaleski 1997). Some farmers embark on small scale pig farming, others on medium scale or large scale pig farming. Peasant farmers usually due to shortage of capital and inadequate vocational skills and basic knowledge keep pigs under small scale. On the other hand, commercial pig farmers who have enough financial backing and huge capital outlay, adopt large scale system of pig farming. Generally speaking, the systems of keeping pigs in Nigeria are classified into extensive, semi-intensive and intensive systems (Akinyosoye, 1999; Serres, 1999; Holness, 2007).

Extensive system is also called out door, unrestricted, free range system of keeping pigs (Honeyman and Weber, 1996). It is the traditional method of rearing pigs in many parts of Nigeria. It is the most simplest and cheapest system of pig keeping (Piot i Lepetit, Le Moing and Ulve, 2004). Here, the pigs are allowed to move freely without any restriction to search for feeds and cool spots for relaxation. The animals may move out and roam about from morning till evening without hindrances. Although the pigs here live as scavengers but the farmers usually supply extra feeds or supplementary feeds in form of grains, kitchen wastes, roots and tubers and industrial by-products (Holness, 2007). Sometimes, shades and wallows are provided for the pigs for farrowing and to reduce heat stress and sun burn (Michael, 2003).

The indigenous breeds of pigs which are adapted to the local environment are usually kept under this extensive system. The number of pigs kept in this system is always small and hardly satisfies the consumers's demand in the market (Adesehinwa, Aribido, Oyediji and Obiniyi, 2003). The extensive system of pig rearing is only suitable where there is vast area of land which is not under cultivation. The major disadvantages of extensive system include: low productivity, low quality feeds, poor growth rate, high mortality rate, heavy parasite and

disease infestation, exposure to inclement weather condition and predators (Holness, 2007).

However, rural subsistent farmers can increase their farm income through the extensive system of raising pigs at minimum production costs (Mendola, 2007).

In semi-intensive system, the pigs spend part of their time in the field searching for feeds, foraging and exercising themselves and the other parts of their time in confinement (Serres, 1999). There is provision for such facilities like buildings, pens, mud wallows, creep feeds mainly made of very simple cheap local materials (Holness, 2007). Extra feeds are provided by the farmers and animals are properly taken care of while in confinement. In addition, detection of diseases and parasites of pigs and the subsequent veterinary services are easily practiced in semi-intensive method than in extensive method (Ezeibe, 2010).

With good management, pigs reared under this semi-intensive system tend to perform higher than the same pigs reared under extensive system (Scott and Edwards, 2005). Studies have shown that semi-intensive system is more costly to embark on but has better net profit margin than extensive method (John, 2003). This system is useful in producing breeding stock in addition to preventing over fattening through proper exercises and producing strong, muscular and healthy pigs (Peter, Owen and Sheona, 2001). The size of the herds are higher and pigs are sold in the market when the need arises to solve financial problem. This system has combined the advantages of both extensive and intensive systems of pig keeping. The practice of semi-intensive system has contributed to low production cost especially in the area of feeds and housing when compared with intensive rearing (Odupelu, 1992).

Intensive system of pig rearing is associated with large scale pig production in Nigeria. It is capital-intensive. In this system, there is total confinement of the pigs from birth to finishing stage (Holness, 2007; Serres, 1999). This system is adopted mainly by commercial pig farmers with huge capital investment. The system of housing will be more sophisticated and will generally comprise a concrete or hard floor, adequate shelter, pen space, appropriate

feed and watering facilities (Holness, 2007). In it, there is intensive care of the pigs coupled with improved management practices to optimize output and increase profitability of the pig farms (Tewe and Adesehinwa, 1995). Under intensive system, the number of pigs reared per individual farm are many ranging from about 40 to 2000 pigs or more depending on the viability and financial stand of the farm. The pigs are usually separated into units on the basis of age and purpose for which they are kept. For instance, there may be units for gilts, in-pigs (sows), sows, boars, farrowing pigs, weaners, growers, breeding stock, fatteners and ready for slaughter pigs (Akinyosoye, 1999).

In intensive pig production, the pigs reared are mainly the high-yielding types, higher performance, improved exotic pigs or hybrids between exotic and local breeds of pigs (Holness, 2007). The houses used in intensive production of pigs are cost-effective, properly ventilated and spaced, have the ability to control heat stress and excessive sunlight, accessible to free movement and effective disposal of effluent (Gekara, Garner and Dunbar, 2009). It is also beneficial to feed the animals with high quality commercial feeds coupled with home-grown feeds, household and kitchen wastes and agro-industrial by-products (Serres, 1999).

In order to reduce the incidence of diseases and parasites in intensive pig farm, there is need for adequate maintenance of high level hygiene and bio-security awareness in the farm (Jason, 2005). The veterinary officers are available to detect, diagnose and treat sick pigs to avoid loss in the piggery. Infected pigs are usually culled or isolated from the rest of the animals to avoid rapid spread of the diseases within the herd (Holness, 2007).

The sale of live pigs, pig products and pig manure help to fetch the intensive pig farmers huge amount of money as their farm income. Intensive pig production can be established in both rural and urban areas. Intensive system of pig rearing is the choice of most pig farmers in Nigeria if the required resources are provided.

Pig management includes the provision of adequate housing, feeding, handling and care for boars, sows, pregnant sows, gilts, weaners, growers and the fattening herds (Akinyososye, 1999). Pig care services contribute in no small measure to the success or failure of pig enterprise. For adequate care of pigs of all types and ages, all factors of production such as land, labour, capital and stockmanship (manager) must be available (Peter, Owen and Sheona, 2001).

The farm manager co-ordinates the activities of all other factors of production. The pillars of pig production enterprise include: management, genetics, nutrition, housing, health, teamwork and stockmanship as the corner stone (Peter, Owen and Sheona, 2001). A good pig farm manager should have good character, love for pigs and must have acquired effective farmer education on complex needs of the pig, how best to meet these needs and on full range of skills required (Peter, Owen and Sheona, 2001). Pigs are better taken care of in accordance with their age, type and purpose of rearing them.

Management of Boars: Boars are male pigs which are used for meat and for mating or breeding. They need to be housed in a separate unit or pen and when they reach about 8 months of age, then they need to be introduced to sows and gilts for servicing (Serres, 1999). It is generally accepted that the ratio of boar to sow is 1:20, that is one boar to 20 sows. Black (2000), recommended that it is better to introduce boars to sows when the sows are on heat period to enable them willingly accept the boars without resistance. This will encourage the boar to have successful sexual experience devoid of frustration in the first encounter. Serres (1999) suggested that young boar should not be introduced to a group of many sows to avoid bullying and subsequent libido reduction. Serres (1999) further stated that the boar should not be over-worked and a minimum of two services per week is recommended. Boars should also be protected from high temperature to avoid reduced libido and spermatogenesis, heat stress

and sunburn. Shades or proper houses, wallows and water sprays should be provided (Honeyman and Weber, 1996).

Mating is encouraged in the morning or evening when the weather is expected to be cool. Mature boar can carry out five to six services per week and still maintain good fertility levels. The boar should not be over worked otherwise there is decline in the quantity and quality of sperm produced resulting to small litters and increased number of sows returning to service (Holness, 2007). Any boar which fails to perform for one reason or the other should be culled and sold in the market. The boar that is meant to be used primarily for meat should not be used in mating. In some farms, such boars are usually castrated (removal of testes) to encourage rapid growth and fattening. The castrated boar is known as hog, barrow or stag. This practice must be carried out by skilled personnel. In actual fact, boars should not be kept for more than four years in the piggery to avoid being too heavy and ill-tempered. Lameness also reduces productivity in boars. Scott and Edwards (2005) suggested that lameness has to be prevented by ensuring that the floors are not rough and dirty and anything that causes injury to the legs of the pigs should be avoided.

Management of Sows: Sows are mature female pigs while gilts are young female pigs. The gilts are sexually active at the age of 8 months but recently, it is observed that gilts can be served at the age of 7 months without any problem (Akinyosoye, 1999). It is a well known fact that boar odour otherwise called pheromones help in stimulating the gilt to be sexually active especially when they are on heat period (Serres, 1999).

The signs of sows on heat include restlessness, swollen and reddish vulva, mucous discharge from vagina, mounting on top of other sows, abnormal noise making or serious grunting and finally deep acceptance of boars during mating (Osaro, 1995). The gilts which show reluctance to come on heat for the first time should be mixed with strange gilts, moved into new accommodation or taken around in a motor vehicle like trailer or truck for more

stimulation of ovulation (Serres, 1999). The animals should be well cared for, fed on balanced diet and through the adlib feeding method. The major phases in the breeding cycle of a sow are mating, pregnancy, farrowing, lactation and weaning.

Farrowing is the act of giving birth to the young ones (piglets) by sows. This stage is very critical in the life of pregnant sows, therefore the stockman should take proper care of the pregnant sows and detect the various requirements of the sow during farrowing (Peter, Owen and Sheona, 2001). Few weeks to the farrowing, the sows should be properly fed, dewormed and moved into the farrowing pen or quarters a week before the actual farrowing. When the sow is under labour, there is increased restlessness, noise making and perhaps milk flow from the udder 12 hours prior to the onset of farrowing (Holness, 2007). The sow should be assisted by the farmer to reduce injury to the piglets and other problems that may arise from farrowing which lasts between 2 to 8 hours (Serres, 1999).

Immediately after birth, strong piglets struggle to reach for the mother's udder and teat to suck some milk. Lactation is the practice of feeding the piglets with the breast milk by their mothers immediately after birth. It is advisable to provide farrowing crates to reduce the incidence of crushing the piglets by sows (Serres, 1999). It is important that each piglet must share from the first milk (Colostrum) produced by the sow within the first 4 days to provide high degree of immunity or antibody (Falusi and Adeleye, 1999). The peak period of milk production in sow is between 20 to 25 days after farrowing (Holness, 2007). The sows must be checked for possible disease infection at this stage such as MMA syndrome which may affect lactation and sucking of breast milk. When milk production reduces at about 3 weeks after farrowing, it is necessary to supply solid feeds in form of creep feed. In creep feeding, the feeds are supplied in the piglets' creep or nest where they are not within the reach of the sows. Creep feeding helps the piglets to depend less on sow's breast milk, improves the digestive system of

piglets, enhances growth and enables the piglets to be detached or stay away from the sow temporarily (Adesehinwa and Ogunmodede, 1995).

Management of Weaners: Pre-weaning diet must contain at least 20 percent crude protein based upon ingredients with a good balance of amino acids such as milk and fish meal (John, 2007). Weaning is the practice of separating the piglets from their mother (sow) so that they can feed on their own. As soon as the piglets are weaned, the stockman should look after them properly by providing optimum temperature and continuation of creep feeds for at least two weeks after weaning (Peter, Owen and Sheona, 2001).

Weaned piglets may be faced with social stress of mixing with pigs from other litters, psychological trauma of separation from their mother, environmental stress, nutritional stress and loss of antibodies which provide immune protection from the sow's milk (Serres, 1999). Piglets should be weaned at about the age of seven to eight weeks or when they have attained an average live weight of 11kg (Akinyosoye, 1999). This is gradually achieved by removing the sows from the farrowing pen leaving only the piglets. The piglets are provided with conducive environmental conditions and ad libitum feeding of creep feeds coupled with fresh water (Holness, 2007). Split weaning allows the bigger piglets to be weaned first and lighter ones left with the sow and weaned later when they have added weight to enable successful weaning (Williams, 2004).

Management of Growing and Finishing Pigs (Fatteners): Growing and finishing pigs otherwise known as fatteners are the pigs found within the period from weaning to slaughter (Holness, 2007). At the age of eight or nine weeks, the growing pigs have crossed the delicate period of various stresses and have well developed digestive systems to consume a variety of feeds (Serres, 1999). In large piggeries, the growers are separated into porkers which are slaughtered at the liveweight of about 65kg, baconers which are slaughtered at the live weight of about 70 to 90kg and heavy hogs which are slaughtered at the live weight of about 90 to

140kg (Honeyman and Weber, 1996). At times, they are separated into light weights and heavy weights or males and females in different pens. In small scale peasant pig farming, there is no separation. Holness (2007) pointed out that some 80 percent of the feeds used in a pig unit is consumed by the growing and finishing pigs, therefore the efficiency of feed utilization during this phase is a crucial factor affecting profitability of pig farms. The feeding system may take the form of a combination of both adlib and restricted feeding at different stages of growth and to yield the most desirable results (Williams, 2004). A good example is where the fatteners are fed adlib up to 50kg body weight and then restricted feeding until slaughter.

Appropriate feeding troughs and other equipments must be applied while feeding the growing pigs to avoid or reduce feed wastage through soiling and contamination with urine and dung (Sharma, Leung and Zaleski 1997). In Nigeria most piggeries feed growing pigs with a view to producing large quantity of lean meat (pork) which is mostly demanded by the consumers in this part of the world. In his own contribution, Jason (2005) recommended that efficient veterinary services must be rendered to minimize disease and parasite infestation among the growing pigs. Furthermore, the stockman should maintain high level hygiene and on-farm bio-security.

Fighting and cannibalism can break out among the pigs resulting to injuries to weaker pigs and perhaps death. Tail biting, ear biting, bruises and bone fractures predispose the pigs to other infections (Holness, 2007; Serres, 1999). If these conditions are mismanaged, it may lead to low productivity and profitability of the pig enterprise. These problems can be solved through proper separation of pigs into units, provision of adequate space, bedding, proper ventilation and addition of adequate quantity of salt to feeds.

The choice of housing for swine is usually not based on greater profitability or improved animal performance but on operator's preference (Honeyman and Weber, 1996). Pigs like other domestic farm animals require proper housing for optimum performance and

improved productive efficiency. The housing for pigs is usually based on the principle of pig productivity and comfort (Holness, 2007). The most productive pigs are those that are likely to be contained in a thermally neutral environment. This is when the environmental temperature around the pigs is consistently between the pigs Lower Critical Temperature (LCT) and Upper Critical Temperature (UCT). This is when the pig's heat production for metabolic activities is at minimum and it is neither using feed energy to keep warm nor reducing feed intake to keep cool (Holness, 2007).

In intensive pig production, Honeyman and Weber (1996) reported that proper housing is unavoidable due to the following reasons:

- ❖ Pigs need to be protected from inclement weather condition.
- ❖ Protection of animals from thieves.
- ❖ Protection of pigs from wild animals and predators.
- ❖ Provision of sufficient space and proper ventilation.
- ❖ Easy management of pigs, encouragement of proper feeds and drinking without wastage.
- ❖ Protection of pigs from infectious diseases from other herds, proper identification and treatment of sick farm animals.
- ❖ Facilitation of effective and controlled disposal of pig wastes (faeces and effluent).

In Nigeria, some climatic features such as dry season, rainy season, South- West trade wind and North-East trade wind must be put into consideration in constructing appropriate pig house. The pig house is always sited east-west direction on slightly sloppy area. This encourages proper ventilation and prevents entrance of sunlight into the house. The source of good water supply is another factor which should be considered in siting a pig house. The general considerations for the building of a house for pigs: include: site, walls, floors, roofs, space (size) and provision of pens for dry sows, boars, farrowing pigs, fatteners or growing

pigs, weaners or breeding stock together with structures like wallows, gates, feeders and watering equipment (Holness, 2007; Serres, 1999).

Permanent buildings and temporary or make-shift buildings are used in intensive pig production. Permanent buildings are usually made of modern and improved building materials such as cement, corrugated iron and aluminium roofing sheets, wire mesh and netting, rods, asbestos, gravel, river sand, tiles, paints, hard wood, plastic and iron pipes (Honeyman and Weber, 1996). The temporary or make-shift buildings are made of simple low-cost local materials like, mud, stone, straw, sticks, grasses, palm leaves, palm fronds, raffia palm leaves and many others. Permanent buildings are more costly and last longer than the temporary buildings (John, 2003).

In view of the fact that over crowding leads to reduced performance of pigs of various categories, there should be proper spacing for different types of pigs at different stages of growth (Osaro, 1995). Collective pens must allow 1m^2 per pig between 20kg and 50kg, 2m^2 between 50kg and 100kg and 2.5m^2 for dry sows, therefore a pen with dimensions 4m x 5m may house 20 piglets, 10 fattening pigs, 8 sows, 1 boar while 1 lactating sow and litter must have at least 10m^2 (Serres, 1999). The pig buildings are subject to constant maintenance and repair when the need arises to avoid excessive dilapidation and collapse.

The provision of environmental enrichment for pigs is in vogue in many countries of the world especially in Europe. The pig is naturally an exploratory animal, having evolved in semi-wood land areas where it had to forage in the ground for food (Scott and Edwards, 2005). Despite many years of genetic selection, the pig still displays an inherent motivation to explore its environment. In intensive pig production within barren environments typified by concrete flooring and lack of rooting materials, Scott and Edwards (2005) stressed that pigs still display a natural tendency for exploration. However, in such cases, the behaviour is directed at the limited number of objects available especially pen mates resulting to ear and tail biting. Scott

and Edwards (2005) added that this problem is solved by using straw-bedding, hanging ñtoysò (sticks and plastic piping) suspended at pig head level and rootable materials like sugar beet pulp. These environmental enrichment materials are suitable to be provided in part or fully slatted floor of the pig house in order to keep the pig comfortable and avoid vice habits or cannibalism. High yielding pig breeds coupled with proper housing and good management practices will obviously lead to the success of pig farms in Nigeria.

The performance improvements of the past 20 years are associated with changes in feeding systems. This was realized through better understanding of the nutritional physiology of the pig which has allowed more precise definition of its nutritional needs (Williams, 2004). Feed inputs are the most important determinant of the price of pigs and pig meat hence feeding must receive considerable and constant attention.

The feed classes required by pigs include: Basal (energy) feeds, feed concentrates, feed supplements and roughages or forages (Sharma, Leung and Zaleski, 1997). Basal (energy) feeds provide high energy-yielding ingredients to enable the animals do some work and carry out other physical activities. They mainly provide carbohydrates and fats and oil. Feed concentrates are the feeds that contain all the required primary feed nutrients. On the other hand, feed supplements are given to animals in order to supply deficient nutrients. They can be fed in conjunction with other feeds or separately e.g. amino acids, vitamins, minerals, antibodies and growth hormones. Roughages or forages are feeds with high fibre content which can be given either dry, in the form of hay, silage, straw, seed hulls, maize stems or wet green pasture (Succulent feed).

Pigs being monogastric animals do not benefit very well from roughages because they cannot digest cellulose materials easily (Sundrum, Butfering, Henning and Hoppenbrock, 2007). Ruminant animals have greater advantage over other animals with respect to forages because their digestive systems utilize forages very well. Recently, in organic pig production,

forages are playing important role in pig industry. Pigs require feeds for the production of energy, growth, performance of body functions and general body repairs. The major nutrients contained in animal feeds which are required by pigs for normal growth and development include: carbohydrates, proteins, fats and oil, minerals, vitamins and water (Adesehinwa and Ogunmodede, 1995). Feeds currently account for 60 ÷ 70 percent of total pig production costs (Honeyman and Weber, 1996).

Pigs are relatively fed on cheap sources of feeds which include cereals, roots and tubers, legume seeds, tree legumes, fruits and their by-products, agro-industrial by-products, products of animal origin and kitchen wastes (Holness, 2007; Serres, 1999). Roots and tubers, agro-industrial by-products and wastes in addition to kitchen wastes form the major bulk of pig feeds in Nigeria. They are usually purchased at cheaper cost thereby reducing the cost of production and increasing the profitability of pig farms especially those situated very close to these industries or factories. There are proliferation of brewing and food processing industries in Nigeria with their by-products and wastes as pig feeds. These feeds include brewers' spent grain, molasses, pulp from citrus and pineapple, rice bran, maize bran and wheat bran.

Kitchen wastes in most cases have high nutritive value. They are fed to pigs to provide feed nutrients at little or no cost but they must be supplemented with crude protein, minerals and vitamins or conventional feeds if their potential is to be realized and satisfactory performance achieved (Anukwu and Ebong, 2011). Discussing on the issue of swine nutrition, Black (2000) strongly maintained that feeds formulated appropriately from legume help to improve both growth and productive performance of pigs.

The methods of feeding pigs varies from place to place and from farmer to farmer. Pig feeding is said to be the pivot of pig enterprise. An effective feeding plan will focus on the consumption of cheap and small quantity of nutritious feeds to achieve maximum productive performance and high profitability without feed wastage. Feeds are required by pigs for

maintenance, production and weaning. A pig feed may be found to be nutritious but the method of feeding them at various stages of growth may affect them adversely (Williams, 2004).

Generally, pigs are good converters of feeds and must always be placed on balanced diet or ration coupled with effective feeding systems to avoid malnutrition. Maintenance ration is the ration which supplies enough nutrients to maintain the supplies of energy and protein for all metabolic activities such as respiration, blood circulation, digestion, locomotion, maintenance of body temperature and repair of worn-out tissues (Serres, 1999). On the other hand, production ration is supplied in excess of maintenance requirements needed for the production or reproduction of animals e.g. production of meat, milk, wool, leather, eggs, fats or lards, giving birth to young ones and perhaps carrying out some farm operations including the transportation of goods from place to place. Weaning ration is given to the piglets that are about to be separated from their mothers and immediately after separating them from their mothers to enable them stand and feed on their own e.g. creep feeding.

Pig feeding in the tropics is influenced by a number of specific factors such as low technical expertise of farmers, poorly organized markets for both animals and feeds, almost complete absence of feed industries, wide variability in carcass quality required and high cost of all imported materials (Serres, 1999). Nutrients in feed have a direct impact on pigs' growth and thereby on feed consumption (Monica, 2003). Holness (2007) identified three means of feedings namely: scavenging, ad libitum feeding and restricted feeding. In scavenging which is mainly used in extensive pig production, the pigs are allowed to move about in search of feeds in addition to the supplementary feeds given to the pigs by the farmers. Ad libitum feeding is where the animals have free and continuous access to feeds. There is continuous feeding of animals so as to satisfy them fully without any limit or restriction.

Feeds of high dietary energy value when fed ad libitum tend to promote synthesis of body fat which is inefficient in terms of feed conversion (Williams, 2004). Nowadays, lean meat is preferred to high carcass fat in the market although some still go for it in form of lard or bacon (John, 2007). Where excessive weight gain is not required, ad lib feeding should not be recommended. Experience has shown that during fattening in intensive piggeries, ad libitum distribution of feeds through hoppers has never been associated with excessive fat carcasses (Serres, 1999).

In pig nutrition, over feeding and underfeeding are two extremes that should be avoided throughout the production process. In as much as wastage of feed by the pigs is minimized, ad libitum feeding should be highly encouraged in pig production. Restricted feeding is the system of feeding whereby the animals are fed with known feed requirements and specific quantity of feed is provided for the animals in groups or individually in three or two divided meals per day. This method reduces wastage of pig feeds especially in intensive system of pig rearing.

Phase feeding in pig production is described by Monica (2003) as the adjustment of protein content of feeds as pigs grow. Phase I involves constant protein ratios fed to pigs during the entire production period while phase II and III imply a higher protein (Stern and Simonsson, 1998).

In feeding the pigs, farmers should be guided by the following principles as recommended by Serres (1999):

- Use of simple diets
- Use of locally available feeds
- Review the possibilities of storage of pig feeds
- Use of available feed additives or supplements judiciously.

These principles if followed will reduce cost of production and the additives will help increase nutrient availability, digestibility, palatability, feed utilization, nutrient release, reduced excretion of unutilized nutrients, higher body immunity, higher yield and excellent profitability (Koeleman, 2005).

Diseases cause abnormal condition of the body of animals and lead to ill-health, reduced productivity and profitability (Serres, 1999). Diseases have adverse effect on pigs of all ages. A vast knowledge of pig diseases is a must for any pig farmer to enable him be able to identify specific diseases and map out strategies for preventing and controlling them to avoid high pig mortality in the pig farms (Ezeibe, 2010). Once a disease affects a pig herd, the impact on the economics of pig production in terms of the cost of control and decreased productivity can be enormous (Holness, 2007).

Pig diseases are caused by many pathogens such as viruses, bacteria, fungi, protozoa and parasitic organisms. There are also malnutrition or deficiency diseases which can easily be controlled by supplying the deficient nutrients. Disease infection results in poor growth, poor feed utilization, poor yield of products and even death of the animals (Akinyosoye, 1999). Many pig diseases abound in literature. They include: African swine fever, foot and mouth disease, Anthrax, Rabbits, Trypanosomiasis, Brucellosis, Coccidiosis, Enzootic Pneumonia, Erysipela, Greasy pig disease (exudative epidermitis), Mastitis- Metritis-Agalactia (MMA syndrome), Hog Cholera, Porcine babesiosis (red water), Salmonellosis, SMEDI (still birth, Mummification, Embryo Death and Infertility) swine dysentery, swine influenza, swine pox, Transmissible gastroenteritis (TGE), Abscesses, Gastric ulcers, Intestinal haemorrhage syndrome (Red gut) and some minor injuries sustained through cannibalism (Holness, 2007; Serres, 1999).

Koeleman (2005) noted that the major problems of pig production was diseases and parasites. Nwobodo (1997) observed that the pigs had a bad reputation right from the

Babylonian days when it was openly condemned by the laws of Hamurabbi, to the time of Jesus Christ when Our Lord Jesus Christ considered the pigs the only suitable animal to carry demons cast out from a demoniac. Since then, the pigs had been known to carry a disproportionate amount of diseases.

There are frequent reports of disease out-break in piggeries all over the country. This has led to the closure of many pig farms with its attendant losses in terms of capital, labour and output. Diseases also reduce both the quality and quantity of pig products. Generally, animals are born free of diseases or parasites but usually acquire these maladies either through contact with diseased animals or improper sanitation, feeding, care and management except congenital diseases (Emedo, Maduka and Oranekwulu, 1995). In his own contribution, Holness (2007) prepared easy diagnostic chart for easy identification of pig diseases as follows shown in chart 1.

Chart 1
Diagnostic Chart for Identification of Pig Diseases

Symptoms	Possible diseases or condition
Abortion	Brucellosis, Red water, Any disease causing a high body temperature.
Agalactia	MMA, Ergot in feed
Anaemia	Round worms, Red water, Iron deficiency, Trypanosomiasis.
Loss of Appetite	African swine fever, Hog cholera, Red water, ulcers, swine fever, swine influenza.
Distressed, rapid breathing	African swine fever, swine influenza
Constipation	Red water
Coughing	Round worms, Lung worms, Enzootic pneumonia, swine influenza.
Dehydration	Coccidiosis, Enteric colibacillosis
Diarrhoea (scours)	Round worms, Coccidiosis, Enteric colibacillosis, Hog cholera, swine dysentery, salmonellosis, Gastro enteritis
Discharges	
Anus	Anthrax, Intestinal haemorrhage syndrome

Eyes	Hog cholera
Vulva	Mastitis, metritis, Agalactia.
Emaciation	Round worms, ulcers, coccidiosis, Tapeworm, salmonellosis
Infertility	Brucellosis, SMEDI
Nervous signs	African swine fever, Hog cholera, Rabies.
Salivation	Foot and mouth disease, Rabies
Skin conditions	Mange, lice, ticks, fleas, erysipelas, swine pox, Greasy pig disease, African swine fever.
Sudden death	Anthrax, Acute Trypanosomiasis, Acute erysipelas, Intestine heamorrhage syndrome.
Swellings/blisters	
Face	Foot and mouth disease, Abscesses.
Body	Abscesses, Anthrax, Gut Oedema.
Feet	Foot and mouth disease.
Udder	MMA
Temperature elevated	All bacterial, viral and protozoan diseases.
Coloured urine	Cystitis, Red water.

Sick pigs should be examined and tested thoroughly to aid proper diagnosis and subsequent treatment. Under serious case, veterinary officers should be invited into the farm to take care of the sick animals appropriately. Bacterial infections are treated with antibiotics while viral infections are treated with anti viral drugs and dieting to boost the immunity of the infected animal. Worms are usually treated with antihelminthic drugs or dewormers.

However, losses due to disease infections can be prevented by vaccination, quarantine, isolation or separation and treatment of the disease, culling, pen resting, disinfection, burial of dead animals, treatment of animals with veterinary drugs and good management practices (Ezeibe, 2010). With the high pig density in most modern hog farms, proper bio-security is essential to protect swine against the transmission of diseases between or among herds (Jason, 2005). Bio-security decisions should be based on facts from practical scientific data rather than

relying on speculations. Pig producers should devise means of reducing the risk of exposure to diseases to the barest minimum. Jason (2005) further stressed that further considerations should include ways of minimizing the risk of exposure to disease transmission by biological vectors, mechanical vectors and area spread. Jason (2005) went on to explain that any living organism that can carry a pathogen and allows it to replicate is said to be a biological vector while mechanical vector carries only the pathogens and does not replicate. Area spread may include wind current as well as unknown biological and mechanical vectors.

Many pig farms make use of boot bath containing disinfectant solution. Recent research works have shown that improper use of boot baths are a waste of time and money. It is established that bacterial contamination is not reduced by stepping through a pan of disinfectant solution when boots are soiled with manure. This is because manure and other organic materials prevent decontamination by encasing and protecting pathogens from disinfectant exposure in addition to inactivating the active ingredients contained in most disinfectants (Jason, 2005).

In order to solve this problem associated with boot bathing, all manure and organic materials should be removed manually prior to contact with disinfectants. The use of animal dips, crushes and chemical sprays also help in reducing the transmission of infectious diseases in various pig farms (William, 1995). It is also recommended that high level hygiene should be maintained by the stockman in different practices like teeth clipping, tail docking, castration, artificial insemination, nose ringing, ear notching and during farrowing (Holness, 2007). Serious health problems in piggeries should be referred to qualified veterinary officers or doctors. Some sick animals may even be admitted and treated in veterinary clinics or veterinary Teaching Hospitals.

The parasites of pigs are those living organisms which live on or inside the body of the pigs and derive nourishment from their hosts (Holness, 2007). Some parasites are pathogenic

while others are not but the host does not derive any benefit from the association. The parasites that live on the body of the animals are called ecto-parasites and they include ticks, mange-mites, lice, fleas and flies (Sharma, Leung and Zaleski, 1997). Mites damage the skin of the pigs and cause irritation and itching. *Sarcoptes scabiei* is the most common species which causes sarcoptic mange leading to a crusty, dry-looking skin around the eyes, ears and snout. Ticks infest pigs and cause damage to the skin, suck blood and cause irritation and discomfort. They also transmit serious pig disease called babesiosis or red water disease. Lice, fleas and flies also attack pigs especially in dirty and unhygienic environment. They may also suck blood, cause irritation, bite and feed on fresh wounds on the animals (Holness, 2007)

All these ectoparasites reduce the performance of pigs, quantity and quality of pig products and generally bring about loss in pig business if not check-mated and controlled effectively (Serres, 1999). Ectoparasites are controlled by spraying with insecticides or acaricides, dipping the pigs in disinfectant solution, using baits or attractants which are poisonous to them. Ecto-parasites are also controlled physically by handpicking and maintaining high level hygiene among the herds and within pig pens. Effective control of pig parasites will go a long way to increasing the productivity and profitability of pig farms (Akinyosoye, 1999).

The parasites that live inside the body of the animals are referred to as endo-parasites. Some endo parasites include: round worms (*Ascaris lumbricoides*), Tape worms (*Taenia solum*), Trypanosome (*Trypanosoma simiae*). The damage caused by these endo-parasites on the host include: anaemia, weakness, loss of weight, liver and lung tissue damage, cause wounds for secondary infections, obstruction of the gut, malnutrition, reduced immunity, increased appetite, oedema, abdominal pains and discomfort and in severe cases, death may occur (Holness, 2007).

These will adversely affect productive performance and profitability of pig farms if they remain unabated. However, the endo-parasites can be controlled by clearing the breeding places of vectors like in trypanosome, deworming, proper sanitation and good hygiene, proper cooking of meat, treatment of infected animals with antihelminthic drugs, rotational grazing, adequate feeding, preventing the parasites from infecting the secondary and intermediate hosts so as to terminate their life cycle (Serres, 1999). In this direction, Oladele (2002) in his study, identified effective control of mange and ecto-parasites, vaccination and deworming as very important production technologies applied by pig farmers in Kwara State for keeping the pigs healthy. With improvement in the system of pig rearing, nutrition and health care delivery, many pig farms especially under intensive system do not experience much parasite infestation (Jason, 2005). This has led to improvement in the production performance of pig farms.

Record Keeping in Pig Farms

Record keeping is indispensable in piggeries. It is absolutely essential to keep some basic records in order to monitor both the technical and economic efficiency of a pig enterprise (Serres, 1999). Farm records should cover all aspects of pig enterprise, so that evaluations can be made of boar performance, sow productivity, weaner growth and grower/finisher efficiency (Holness, 2007). The nature of the business demands that there should be proper record of all phases of production to ascertain their strengths and weaknesses and help in mapping out strategies for improvement. There should be day-to-day recording of various activities in the farm including the record of inputs and outputs, income and expenditure, balance sheet and records of profit and loss (Ebirim, 2002).

The farm records could be used in compiling individual pig and herd performance sheets for assessment or evaluation. The important records kept in the farm include boar performance record, sow service record, health record, culling and sales records and the entire herd performance record (John, 2003).

The overall performance of pig farms and their profitability level are usually determined through appropriate record keeping. The information on this may be obtained from government advisory staff or other advisory agencies like ministry of Agriculture, Agricultural Extension Departments and Research Institutes. This will enable the pig farmers in an area to compare the performance of their pigs with the performance of other pigs within the same area.

Falusi and Adeleye (1999) enumerated the advantages of keeping accurate farm records as follows:

- They give an account of what has happened on the farm for the period during which they are kept;
- They are used to keep a close check on whether or not things are going according to plan on the farm;
- Making plans to modify farm needs;
- Knowing what yields to expect from livestock and what costs and receipts the farmer is likely to get;
- Telling the farmers how much they are earning as their farm income;
- Giving information to farmers on whether they are making profit or loss;
- Serving as a guide for tax assessment of farmers;
- Ascertaining the value or worth of the farm so as to help in obtaining loan as well as sale of the farm.

Record keeping is based on the principle that all records, to be useful, must be accurate, neat and filled as soon as possible after the operation (Ebirim, 2002). The keeping of accurate records in pig farms comprising of both financial and non-financial records is a must for all modern pig farmers.

Pig Production Technologies

Livestock production technologies are part of agrarian technologies, which are necessitated by population growth, changing climate, markets and needs (Oladele, 2002). Technologies are described as ways of doing things that are based on modern knowledge about science. Technology is also the application of scientific knowledge in doing things and in producing what are needed with the available resources. The level of technology affects output in the production process (Robert and Ben, 2009). Robert and Ben (2009) also observed that economists generally agree that modern technologies are the most important single source of improvements in productivity.

Farmers must first of all identify the needs and values of various production technologies before the adoption and application of the technologies. Any production technology that does not encourage increased agricultural productivity and profitability should be ignored completely. However, Oladele (2002) observed that the development of agricultural technologies require among other inputs, a timely and systematic transmission of useful and relevant agricultural information (message). Oladele (2002) further observed that this is achieved through relatively well educated technology dissemination (extension) from formal technology generation systems (research) via various communication media (channels) to the intended audience (farmers).

All over the world, pig production is rapidly developing into a technology driven business (Pieter, 2004). Pig production technologies involve techniques, ideas, innovations and methods of rearing and managing pigs to improve farmers' productivity (Holness, 2007). In her research work on the Economics of Technologies in Swedish pig production, Monica (2003) found out that when a farmer selects a technology, he must simultaneously take into account:

- Effects on biological performance

- Prescribed regulations on animal welfare and production externalities
- Profitability

Monica (2003) added that a technology which improves animal welfare may have positive effects on biological performance. Appropriate use of pig production technologies will obviously increase productivity and profitability of pig farms.

Pig production technologies can be in form of building design, feeding system, management practices and methods of controlling diseases and parasites in pig farms (Kelly, 2005). In the past, peasant pig farmers used traditional pig production technologies such as use of local breeds of pigs, scavenging or extensive system of pig rearing, feeding of less nutritious feeds, low level of hygiene and poor management practices resulting to low productivity.

Nowadays, commercial pig farmers are more interested in the application of pig production technologies to increase productivity. Holness (2007); John (2011); NAERLS (2010); Osaro (1995) and Serres (1999) identified various modern pig production technologies in terms of stocking, housing and management, feeding, disease and parasite control, farm record keeping and marketing of pigs.

Stocking Technologies: The success of pig farms starts with appropriate stocking at the beginning of production. Space requirements for various categories of pigs as recommended by Osaro (1995) are as follows: 20 ÷ 50kg (Growers) require floor area of 1m² per pig, 50 ÷ 100kg (finishers) require 2m² per pig, Dry sow requires 2.5m², lactating sow and (finisher) require 10m² and boar requires floor area of 9m². Dry sow needs a space of 3 ÷ 4m², boar 9m², farrowing sow 6 ÷ 10m², weaner 0.7 ÷ 0.9m², porker, baconer and heavy pig 0.7 ÷ 1.20m² (Holness, 2007; Serres, 1999). The semi-intensive and intensive pig rearing using exotic, improved breeds such as Large White, Land Race, Duroc Jersey, Hampshire and Berkshire are recommended in Nigeria by NAERLS (2010).

Management Technologies: Serres (1999) identified artificial insemination, natural mating, castration, nose ringing, providing environmental enrichment or rooting materials, provision of wallow, teeth clipping and identification of pigs. Modern pig production technologies identified by John (2011) and NAERLS (2010) include; daily routine inspection of pigs, cleaning the pig pens regularly, washing and disinfecting pens vacated and allowing to rest for at least one to two weeks before new batch of animals are introduced, early weaning, provision of wallows, encouraging daily exercise for especially breeding stock, grouping of pigs according to age, size, condition and grouping gilts, and boars separately, keeping daily weekly and monthly farm records concerning the number of pigs in herd, feed consumption, mortality, medication, inputs, sales and performance of pigs. The location of pig unit and housing should ensure free air movement and good ventilation (Monica 2003). Piggery building should be sited by facing it North-South to avoid excessive penetration of sunlight. Hard concrete floors, strong walls with cement blocks, wood or mud, roofing with aluminium or corrugated iron sheets are recommended in piggery (Holness 2007; NAERLS, 2010; Serres, 1999).

Feeding Technologies: Feed automatisation is a sort of advanced livestock technology which offers more nutritional diet, thereby reducing feed wastage (Monica, 2003). Some recommended pig feeding technologies include: phase feeding, creep feed, wet feed, formulation of balanced diet, ad lib feeding system, restricted, controlled feeding, feeding pigs with kitchen and industrial wastes and other cheap sources of feeds, feeding with commercial, conventional feeds, flushing and provision of clean drinking water with additives (Holness, 2007; Holness, 2007; Monica, 2003; NAERLS, 2010; Serres, 1999). Feed is one of the limiting factors in pig production, contributing up to 60 percent of the total cost of production (Monica, 2003), therefore anything that will reduce both wastage of feeds and cost of feeds is a welcome innovation.

Diseases and Parasites Control Technologies: Oladele (2002) identified control of mange and ecto-parasites, improved feeding, vaccination and deworming as prominent pig production technologies adopted by pig farmers in Kwara State of Nigeria. Kelly (2005) identified vaccination, disinfection, dipping, boot bathing, hand picking of ectoparasites and bio-security awareness in the farm as modern pig production technologies. Other diseases and parasites control technologies include: pen cleaning, disposal of faeces and effluent, isolation, quarantine and provision of veterinary services (Holness, 2007; John, 2011; Kelly, 2005; NAERLS, 2010; Serres, 1999).

Farm Record Keeping Technologies: NAERLS (2010) recommended accurate farm record keeping on daily, weekly and monthly basis. Pig performance sheets should be filled as at when due. Both the pigs at various stages and feeds should be weighed to determine weight gain, weight of the pigs and the quantity of feeds consumed. The record of inputs, costs, output, sales and revenue should be kept so as to be able to determine the over all farm performance (John, 2011). Computers are used in modern pig farms nowadays to keep farm records.

Marketing Technologies: The ability to market pigs at the right time is a major determining factor for the success of commercial pig production (NAERLS, 2010). There are basically four market outlets recommended by Holness (2007), NAERLS (2010) and Serres (1999) namely, private sales, public sales, direct sales to butchers and contract sales. It is also advised that pigs should be transported late in the evening or early hours of the day to avoid heat stress. Pigs to be transported should not be fed 12 hours before loading and sprayed with cold water before loading. The vehicle used for transportation should be well covered but adequate ventilation and bedding should be provided (Serres, 1999). The pigs to be transported should be handled with care. Burton (2004) recommended the following marketing technologies; forward contracting, options trading, futures trading, video merchandising and telemarketing. Internet trading is another marketing technology.

Decisions on production technologies applied by farmers have implications for the production performance in livestock production (Monica, 2003). Monica (2003) further stressed that farmers need appropriate technologies in pig production in order to improve production performance and profitability. This current study will determine various pig production technologies applied by pig farmers in Enugu State so as to ascertain whether the farmers actually apply the right types of pig production technologies in their farms to boost pig production or not.

Marketing of Pigs and Pig Products

Production is incomplete until the goods and services produced reach the hands of the final consumers (Nweze, 2002). The farm products have to be delivered through different marketing channels or systems to the consumers. An agricultural market exists where there is selling and buying of farm products. Nigerian pig farmers produce pigs and sell them and their end products including effluent or wastes to the consumers either on-farm or in the market (Ajala, Adesehinwa and Mohammed, 2007).

The marketing of pigs and pig products in Nigeria is not as organized as in developed countries like China, Brazil, Spain, America and Britain. Nigerian pig farmers usually sell their live pigs direct to wholesalers, retailers, local butchers or consumers at on-farm-gate or in local markets. The wholesalers or middlemen transport them from areas of abundance to areas of scarcity and distribute to retailers or butchers who eventually sell the pork, lard, sausages or bacon in small pieces to consumers and hoteliers (Nwobodo, 1997).

Pigs can also be sold in the form of live pigs, fresh meat or pork cured products sausages, pies, luncheon meat, and meat pastes, lard (pig fat), pig skin, bristles, intestines, offals, blood, hoofs, slaughter house by-products and pig manure (Holness, 2007). All these attract appreciable prices in the market and add to the farmers' profit.

In a study conducted by Nwobodo (1997), it was revealed that in Enugu State, pigs and pork are found mainly in rural markets than in urban markets. Nwobodo (1997) further maintained that in urban markets, pork is highly demanded but is always in short supply. Marketing includes all of business activities involved in moving the agricultural products from the producers to the consumers. It includes buying, processing and selling of raw materials and consumer goods. Marketing also extends to transportation, advertising and promotion of products (Burton, 2004).

The market efficiency of pig farms is an indication of their capacity to get a good price for their inputs and outputs. Wharton (1995) has suggested that efficiency in communication, agricultural education and extension may improve the market efficiency of farmers. The major aim of improving market efficiency is to obtain the highest net sale price for the outputs and obtain the lowest net purchase price for the inputs.

Effective systems of communication and information devices have been developed for disseminating agricultural information. Telephone, internet, radio, teletype, FAX, E-mail and television communication play important roles in providing agricultural marketing information to producers, middlemen and consumers (Burton, 2004). Recently, modern Information and Communication Technology (ICT) through computer internet, websites and electronic banking services are doing nice jobs in providing adequate agricultural marketing strategies (Phillippe, 2004). Publications like newspapers are widely distributed to provide agricultural market information.

The major systems for marketing pigs include: private sales, public sales, direct sales to an abattoir or butcher and contract sales (Serres, 1999). Private sales is a method where one or more pigs are sold to the local consumers, middlemen, other producers and butchers. This is common in Nigeria among small scale pig farmers. In it, the live pigs are sold at a negotiable price equilibrium. This system has the advantage of being simple but in rural areas, the pig

farmers are usually cheated by the pig traders and speculators. In view of this problem, marketing co-operatives and pig farmers Association of Nigeria have been formed to ensure adequate and stable prices for their products.

In public sales, the pigs are taken to urban or local markets where the live pigs are sold by auction to the highest bidder. In some markets in Nigeria, veterinary fees per pig are usually collected from the pig sellers by the market masters as part of government revenue. In Kaduna State, there is popular Kafanchan pig market while in the South Eastern Nigeria, the notable markets include Eke, Oye, Afor and Nkwo where pigs are usually sold. Pigs are also sold in other Christian areas of Lagos, Ondo, Benue, Plateau and Taraba States. Some markets operate on daily basis while others operate on the basis of native weeks. Some pig farmers during festivals like Christmas, Easter, New year celebration and some local festivals kill their pigs and sell the pork in the market to the consumers on expectation of higher prices. In some places, pig dealers or traders and butchers do not allow this practice of selling pork in the market by the producers rather they monopolise the sale of pork.

Direct sales to an abattoir or butcher is where the large scale pig producers sell their animals direct to the butchers who keep them in lairage waiting to be slaughtered in abattoir or slaughter house. In this system, there is price fluctuation because prices rise when pigs are in short supply and producers are motivated to produce more. Consequently, more pigs are supplied to the market and the price falls. The instability of market price for pigs in Nigeria and lack of reasonable net profit are the major reasons why pig producers go in and out of pig production (Ajala and Sanni, 2002). The method does not give room for proper negotiation of prices due to the monopolistic tendency of butchers.

Contract sales is a system whereby there is contract agreement between a pig producer and a butcher having an abattoir on the ground that the producer will supply a specific number of pigs to the butcher within a specific period of time at stipulated prices. There is a clear term

of agreement with respect to the size, number and price of the pigs to be supplied. There is price stabilization here and the producer is able to plan ahead for his enterprises. Contract sales is always favourable to the producer but it is a rare opportunity.

The most recent innovative selling technologies or marketing approaches include: forward contracting, options trading or trading in options, futures trading, video merchandising or video marketing and telemarketing (Burton, 2004). Forward contracting allows the buyer and the seller or producer to know the selling price of a product before it is ready for sale. With the cost of production in mind, the producer determines the selling price of the item being produced. The risk of the producers selling below the cost of production is highly reduced in forward contracting system. Under the contract agreement, the description of the product and quantity to be supplied must be clearly specified.

Options trading is a form of marketing in which a producer buys an option giving him or her the right to purchase a future contract for a pig at a specific price by a specific future date. A favourable option period will enable the farmer to exercise the option to buy or sell.

Futures trading is a marketing technology in which contracts for farm products like boars, hogs, piglets, sow, and other farm products are bought and sold for delivery at a future date. When the farm products are available for sale, they are sold on cash market and a futures contract is bought immediately. The contract to sell is cancelled by a contract to buy and no obligation exists to deliver the products.

Video merchandising or marketing is an innovative approach to selling livestock that allows buyers in distant places to view the sale offering without actually visiting the farm or ranch. The video tape is recorded in such a way that the animals or other products meant for sale are clearly shown to the buyers on the screen for proper inspection and purchases.

Telemarketing is a type of auction sale conducted over the telephone. The farm products meant for sale are properly arranged, weighed, graded for quality and size. In it, prospective

buyers are invited for a telephone conference call before the sales proper. The farm products are sold by auction over the telephone to the highest bidder for immediate delivery.

In the year 2010, e-presence technology was developed by Mobile Telecommunication Network (MTN) for business transaction. This e-presence is an innovative marketing strategy where businessmen and women or marketers in different locations can come together within few seconds and see each other face to face on the screen to discuss matters concerning their business transaction. This service is provided by Telecommunication companies like Mobile Telecommunication Network (MTN).

The practicing of some of these approaches depends on the farmers' mastery of Agricultural education and extension and the availability of social amenities and modern Information and Communication Technology (ICT) facilities in the rural areas.

In marketing, pigs are distributed with the help of motor vehicles like trucks and pick-up, motor cycles, bicycles and wheel barrows (Whetham, 1998). Adequate care should be taken to avoid any injury to the pigs on transit (Serres, 1999). In addition, proper ventilation and cool environment should be provided within the truck or vehicle to avoid asphyxiation and heat stress (Holness, 2007).

The relationship is that in the present study, the marketing technologies applied by pig farms will be determined. This will help to ascertain whether the pig farmers are applying appropriate modern marketing technologies in pig production or not.

Prospects of Swine Production

Animal husbandry has developed over the years to become a highly profitable industry in Nigeria (Oni and Yusuf, 1999). In spite of the fact that there are many constraints in livestock production in Nigeria, there is still hope in the industry. The prevailing climatic condition in Nigeria is conducive for livestock production. Furthermore, there is availability of necessary factors of production including both human and material resources.

The positive contributions of livestock industry include:

- Provision of income (money);
- Source of food (meat and milk) supply;
- Provision of foreign exchange earnings;
- Source of manure;
- Provision of raw materials for industries;
- Used for research and scientific investigation
- Provision of means of transportation and
- Source of farm power used for different farm operations.

Pig production will go a long way to supplying large quantity of nutritious pork (meat) so as to fill the animal protein gap in the diet of Nigerian citizens. Some animal products like hides and skins (leather) are exported to other countries to earn us foreign exchange thereby increasing Nigeria's capital base and gross domestic product. Farm animals provide good source of manure (waste products) which help to increase the fertility of the soil. It has been reported by Rogerio and Laura (2006) that in some developed countries like Brazil, China, Britain and United States of America, pig effluents and faeces (waste) have been recycled through bio-digesters to generate energy (gas) used for both domestic and industrial activities. This is a source of net income as well as solution to environmental problem in piggeries.

The prospects of pig production enumerated by Holness (2007) include:

- Pigs produce white meat without contributing to the deterioration of the natural grazing lands as is the case in ruminant production. Nowadays, white meat is more preferred to red meat in the world market, because of its low content of cholesterol;
- They convert concentrated feeds to meat twice as efficiently as ruminants;

- They possess the potential to be highly productive because they are capable of producing large litter size after a relatively short gestation period. Their output in terms of yield of meat per tonne of live weight of breeding female per year is in this region of six times that of cattle;
- If confined, maximum use can be made of their manure (faeces and effluent);
- Their relatively small size when compared with cattle provides for flexibility in marketing and consumption;
- They have quicker rate of turnover on investment compared with cattle;
- The pig meat (pork) is particularly suitable for processing and some of the processed products have a longer shelf life than fresh meat.

Owing to these huge benefits derived from pig production, Nigeria needs to encourage and motivate farmers to go into intensive pig production which is gradually being abandoned especially in Enugu State of Nigeria. The potential for increased pork production is enormous and should be pursued vigorously in all its ramifications.

Constraints to Pig Production

Pig production in Nigeria is constrained by many factors. Adesehinwa, Aribido, Oyediji and Obiniyi (2003) identified some problems facing livestock production which included weather fluctuation, poor vegetation growth, diseases and parasites, religious beliefs, illiteracy leading to poor skills, poverty and shortage of animal feeds. In his own contribution, Holness (2007) enumerated the constraints in pig production as follows:

- There is religious and social constraints because Moslems and believers in Jewish faith are forbidden from producing and eating pig meat (pork).
- As simple-stomached animals, they may compete with human beings for food.
- Pigs are not used as draught animals.

- Their faeces and effluents cause environmental pollution if not properly handled.
- As co-hosts of man to a number of parasites, pigs not confined can spread these parasites to man.

These hindrances have contributed to low productivity of livestock in Nigeria, resulting to little or no farm income for livestock farmers in most cases.

Farm animals require optimum temperature and clement weather condition coupled with good management, in order to attain the highest productive capacity. In line with this, any condition below this results to low profitability. For instance, pigs are highly sensitive to temperature changes especially during hot weather condition due to heavy fat deposit in their body tissues. Generally, pigs require cool weather condition and this is the main reason why they are usually provided with wallow during hot weather condition to buffer the effect of hot environment on pigs (Serres, 1999).

Insufficient nutritious feeds is a great problem in animal production especially in piggeries. Feeds are needed from both organic and inorganic sources (Sundrum, Butfering, Henning and Hoppenbrock 2007). The production performance of pigs depends on sufficient right type of feeds, increase in nutrient digestibility and feed conversion efficiency (John, 2011). Ruminants benefit more from vegetation than non-ruminants. However, recently in organic pig production, foraging is now receiving great attention due to its high nutritive value (Sundrum, Butfering, Henning and Hoppenbrock, 2007). In terms of conventional feeds, pig feeds account for the greater percentage of the total pig production costs (Holness, 2007). There is scarcity of vegetation during dry season and abundance of it during rainy season.

Ezeibe (2010) lamented that diseases and parasites increase production costs and reduce the quantity and quality of animal products. True Moslems, in accordance with their religion, believe that rearing pigs, eating or handling pork or any pig product is an abomination and sin

against Allah (God). This is the main reason why in Moslem communities, little or no pig farming is practiced.

Illiteracy had led to poor basic knowledge, attitude and practical skills in livestock production. The skilled staff or labourers employed either on part-time or full-time basis are heavily paid and this increases production costs and reduces farmers' income and profit.

Poverty or insufficient capital is a great hindrance to pig production in Nigeria. Ezeibe (2010) stressed that most livestock production in Nigeria due to poverty, are carried out under extensive, peasant, nomadic, traditional, small-scale and unimproved form. Capital is an indispensable factor of production and is greatly required for the procurement of many agricultural facilities, tools, equipment and other inputs needed in the production process.

Pig production constraints vary from place to place and from farmer to farmer. Constraints negatively affect production performance and profitability of pig farms. It is therefore necessary to identify specific pig production constraints affecting pig farmers in Enugu State and map out strategies for solving these problems. This will help to increase productivity and profitability in pig industry.

Schematic Representation of Relationships of Key Variables and Expected Outcome

PRODUCTIVITY OF PIG FARMING ENTERPRISE

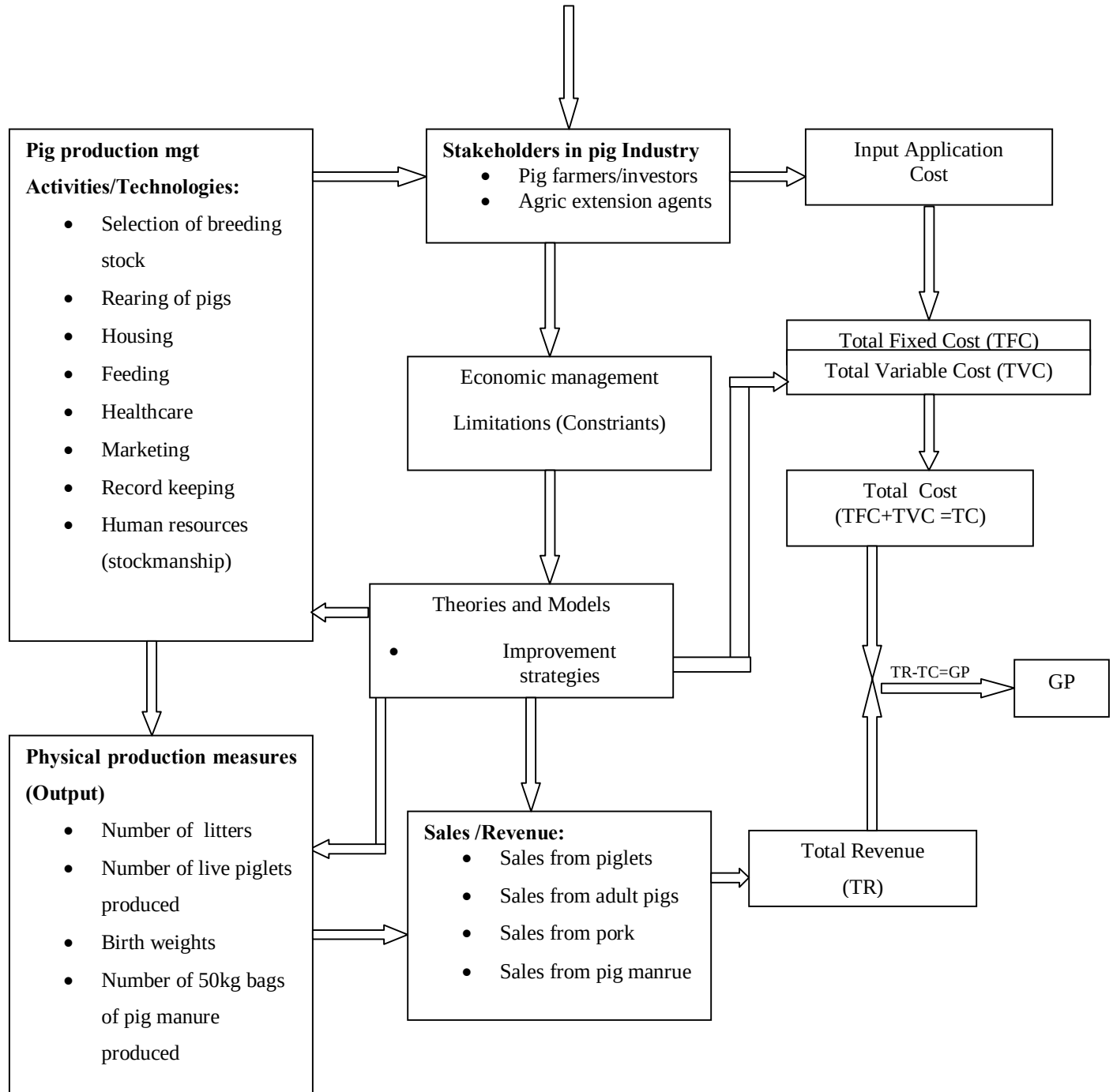


Fig. 2: Conceptual Framework on the Productivity of Pig Farming Enterprise

The conceptual framework hinges on the broad concept of productivity of pig farms.

The stakeholders in pig business engage in different activities during the pig production process right from budgeting, provision of materials and stock of pigs, farrowing to finishing stages in addition to transporting, processing, marketing and consumption stages.

The schematic representation of relationships of key variables and expected outcome is clearly shown in the conceptual framework of the study. The major stakeholders in pig industry include pig farmers, investors and agricultural extension agents. These stakeholders embark on many activities geared towards high production performance and profitability of various pig farms. The stakeholders engage in pig production management activities including pig production technology adoption process. The major management activities include: selection of breeding stock, rearing of pigs in terms of providing housing, feeding and healthcare for pigs. There are many economic limitations (constraints) encountered in the production process which needed improvement strategies. The effort of the stakeholders will result to the production of physical products including live pigs, number of 50kg bags of pig manure and other products. The products are sold and farm revenue obtained.

The profitability index has to be calculated to find out whether the pig business is viable or not. In the calculation of profit or loss, the total cost (TC) of inputs and total revenue (TR) for the pig farms are obtained. The total (TC) is subtracted from total revenue (TR) and the difference will give either profit or loss in the pig farm business. It is good to note that profit may lead to reinvestment or plough-back in the business to make for sustainability but loss may lead to the failure of the pig business.

Theoretical Framework

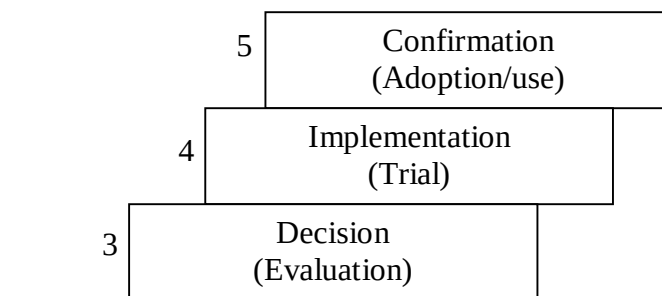
All theories relating to production seek to reduce negative production externalities and encourage greater productivity and profitability (Monica, 2003). The present study focuses on the analysis of pig farms in Enugu state with a view to determining their production performance, profitability, production technologies adopted, constraints in pig production and intervention strategies to improve productivity.

A theory and two models were used in this present study on the Analysis of production performance and profitability of pig farms in Enugu State. They include: Innovation-Decision Process Theory of Adoption, Context, Input, Process and Product Evaluation model and Programme/Project Evaluation model.

Innovation-Decision Process Theory of Adoption

This theory was propounded by Rogers, Everett in 1995. This theory seeks to explain how, why and at what rate new ideas and technologies spread through cultures or among a group of farmers such as rural and urban pig farmers. Diffusion is the process by which an innovation is communicated through certain channels over time among the participants in a social system (Rogers, 1995). Innovations are new ideas, practices and techniques used by farmers that are aimed at increasing productivity of farms such as pig farms. Adoption process is the mental process through which an individual passes through from first hearing about an innovation to final adoption/use or its rejection (Rogers, 1995).

Owing to the fact that decisions are not authoritative or collective, each member of the social system faces his/her own innovation-decision that follows a 5-step process as shown below:



1. Knowledge (awareness): A person becomes aware of an innovation and has some idea of how it functions, its advantages and disadvantages. This is where the pig farmers hear about the existence of new innovations such as pig production technologies.
2. Persuasion (interest): This is the second stage which involves the development of interest on new innovations after being aware of the existence of the innovations. More pieces of information are needed by the farmers on the production technologies so as to find out whether the innovation will yield better result in solving their problems. In this adoption this stage is characterized by the attitude toward the innovations.
3. Decision (evaluation): Here a person engages in activities that lead to a choice to adopt or reject the innovation. The pig farmers after gathering the information about the innovations shall mentally assess the new pig production technologies to find out pig production usefulness and perceived ease of use.
4. Implementation (trial): This is a very critical stage in which the adoption process may be made or marred. Here the farmers put the innovations into use in a pilot farm. In implementing or testing the new innovations in pilot farms, the farmers are able to

determine the effects of the innovations on pig production so as to help them adopt or reject the technologies.

5. Confirmation (adoption/use): In this stage, farmers evaluate the results of innovation-decision already made. If the trial is convincingly positive, then the innovations are confirmed to be used in large scale production continuously hence the production technologies are therefore adopted.

The innovation-decision process theory of adoption describes clearly the processes through which the rural and urban pig farmers undergo before finally adopting any pig production technology. In this theory, the innovation-decision of most members of a social system like pig farmers depends heavily on the innovation-decision of the other members of the system. The innovation-decision is made through a cost-benefit analysis where the major obstacle is uncertainty. People will adopt an innovation if they believe that it will enhance their utility. Some people have higher degree of innovativeness than others hence they are grouped into: (1) innovators (2) early adopters (3) early majority (4) late majority and (5) laggards.

The personal characteristics and degree of interaction among members of these groups affect the rate of adoption of new innovation. This theory was found useful in this present study because pig farmers went through this innovation-decision of adoption or non-adoption of pig production technologies presented in the study. This adoption theory was utilized by the pig farmers in Enugu State as a framework and guide in the process of adoption or rejection of pig production technologies presented to them.

The Context, Input, Process and Product Evaluation Model: Stufflebeam, Daniel, a Professor at Western Michigan University, United States of America, in 1971 propounded The Context, Input, Process and Product (CIPP) Evaluation model of appraisal of projects and programmes from the beginning to the end of each cycle (Stufflebeam, 2007). This model has four main stages of evaluation namely: context evaluation, input evaluation, process evaluation

and product evaluation. Context evaluation helps in the diagnosis of the programme problems in relation to the determination of programme objectives (Olaitan and Ali, 1997).

The specific objectives of context evaluation include: definition of relevant environment, identification of unmet needs and unused opportunities, problem identification and solution to such problems.

The methodology of context evaluation utilizes conceptual analysis, empirical studies and decision making, inference or judgment (Stufflebeam, 2007). Input evaluation provides information on how resources are used to achieve project objectives. Its specific objectives include identification of relevant strategies and assessment of project designs so as to be able to achieve stated objectives. Process evaluation provides project implementation and monitoring services so as to obtain feedback for interpreting project outcomes. The specific objectives include instrument and design validation, collection and analysis of information, undertaken throughout the period of evaluation. Methodology involves the use of evaluators and assistant evaluators (staff) and professionals who discuss on the subject matter and distribute instrument for data collection. The overall purpose of product evaluation is to measure and interpret attainments at the end of a project cycle (Olaitan and Ali, 1997). The specific objectives include providing information for decision making, using set standards which may result to continuation, termination or modification of project activities. The achievement of stated objectives with the cumulative information from context, input and process. This is the evaluation of programme outcome.

The present study shares many features in common with the CIPP model of evaluation of projects in terms of specific objectives, scope, and methodology. This study titled, Analysis of Production Performance and Profitability of Pig Farms in Enugu State, has the main purpose and specific objectives expected to be achieved at the end of the research work. Just like the evaluator and other personnel, the researcher and the assistants designed instruments,

distributed them to the pig farmers and agriculture extension agents, collected, analysed data based on laid down standards. The population of the study is also determined to have a limited number of people to be served. There is also clearly observed problems existing in pig production in the state which need to be solved and improvement strategies mapped out. Farm inputs are used in the production process and their costs determined. At the end of the production cycle, pig products were obtained and sold to get revenue. The total costs and total revenue were analysed to determine profit or loss. The answering of research questions and testing of research hypotheses helped in verifying whether the set objectives were achieved or not. The CIPP evaluation model was employed in this study to analyse the existing pig farms in Enugu state with a view to determining farm inputs, production performance, profitability, constraints and strategies for improvement of pig production.

Programme/Project Evaluation Model: This project evaluation model is used for determining the value of a project or enterprise. It helps in determining whether the enterprise is productive and profitable or not. In this model, all costs and all revenue are identified and compared (Olaitan, Ali, Eyo and Sowande, 2000). There is break-even point if the Total Cost (TC) is equal to Total Revenue (TR). There is profit if the Total Cost (TC) is less than Total Revenue (TR) while loss is incurred when the Total Cost (TC) is greater than Total Revenue (TR). Project Evaluation Model is also used to determine the worth of a farm and is therefore used in this research study to achieve end results.

The programme/project Evaluation model was suitable for determining the productivity and level of profit made in pig farms in Enugu State of Nigeria. It helped to a large extent in the realisation of the main purpose of this research work. The model was used to analyse the production performance and profitability of pig farms in Enugu State of Nigeria. This helped to determine their physical productivity and amount of profits realized in these farms. All data on input application, production costs and output (revenue) of the farms were collected and the

amount of profits made by different farms were calculated hence the value or worth of each pig farm in the state was properly determined. This showed that there was high degree of relationship between this model and the present study. This helped to determine the productivity and profitability of pig farms.

Related Empirical Studies

Ogunniyi and Omoteso (2011) carried out a study on the Economic Analysis of swine production in Nigeria: A case study of Ibadan Zone of Oyo State. The main objectives were to: (i) examine the factors influencing swine production in Ibadan metropolis; (ii) calculate the costs and returns in pig production; (iii) determine the elasticity of production and return to scale and (iv) examine the problems faced by pig farmers. There were five research questions. Survey research design was used. The sample of the study was 80 pig farmers out of a population of 100 registered pig farmers in the 10 Local Government Areas in Ibadan Zone. A survey research design was used in the study. Structured questionnaire was used to collect data and analysed using frequency count, mean percentages, profitability Ratio, Gross margin Analysis, Benefit-cost Ratio and Cobb Douglas production function. The findings of the study revealed that 68.8 percent of the respondents were between 31 to 50 years of age with a mean age of 41.4 years, less than 10 percent of the respondents had no formal education, 80 percent were married, more than 70 percent had more than 5 years experience in pig farming, 98.8 percent were Christians, the average capital invested was ₦15, 187. 80k while 85 percent of the respondents financed their business from their personal savings. The findings further showed that variable costs represented 93.5 percent while fixed costs accounted for 6.5 percent of the total cost of production; the average net farm income per respondent was ₦81,470.81k while the average net income per pig was ₦1,198.10k. The rate of return on investment was 57 percent. Benefit-Cost Ratio was 1:1.53 showing that swine production was profitable in the area. Gross margin ratio was 2.87. The mean fixed cost per farm was ₦9996.47 while the mean

variable cost per farm was ₦142,518.59. Total mean cost of production per farm was ₦152,515.36 while the mean Gross margin per farm was ₦91,467.28. The mean Net Farm Income per farm was ₦81,470.81. The mean Revenue or Returns per farm was ₦233, 986.17. The result of this study showed that pig enterprise was viable in Ibadan metropolis of Oyo State. The study shares similar characteristics with this current study on the Analysis of Production Performance and Profitability of Pig Farms in Enugu State. They are related in terms of title, scope, research design, objectives, method of data collection and data analysis. The difference is that the study in Ibadan, Oyo State failed to analyse the physical productivity of pig farms. It had also ignored pig manure as source of income in pig farms. The mean Total Revenue or Returns Per farm was obtained only from the sales of pork and live pigs and no sales from pig manure which is now an important income-generating aspect of pig production. The application of pig production technologies was not also analysed in the study thereby leaving an important aspect of modern pig production practices hence the need for this present study.

Hubbard, Mullaney and Dunkin (2006) conducted a research work on survey of Reproductive Performance of sows in pig farms (Herds) in Victoria. In the study, the breeding records of sows from seven pig farms (farms either commercial or used for teaching and research purposes) were analysed to determine levels of reproductive performance. A survey research design was used. Data were collected from seven pig farms for a period of 4 years. The available farm records were used by the three researchers. Although factors such as breeds of sows, parity structure and methods of mating undoubtedly affected performance of each herd, there was considerable variation in herd performance. Total sow productivity (pigs weaned per sow per year) varied from 12.4 to 21.8. The major causes of variation were litter size at birth, lactation length, and average age of gilts at first mating. The purpose of the study was to analyse the breeding records of sows in a number of herds to determine levels of

performance of components of reproductive rate and to assess the relative importance of these to overall level of sow productivity. In the seven farms studied, average number of pigs born, weaned and number of litters per sow per year were obtained. The pigs born alive per sow per year varied from 15.8 to 23.45. This showed high productivity or reproductive performance of the pig farms studied. The result showed sow productivity, in terms of the number of pigs produced per sow per year which is one of the main determinants of profitability in raising pigs. The study is similar to the present study in terms of topic, objectives, research design, method of data collection and analysis. The study analysed the physical productivity of pig farms in Victoria but failed to analyse the financial productivity (profitability) of pig farms. The present study seeks to analyse both the physical and financial aspects of productivity as well as other variables of interest.

In a research study conducted by Chabo, Malope and Babusi (2000) titled "Pig Productivity: A Case Study for Southern Botswana", there was evaluation of the pig enterprise at the Botswana College of Agriculture (BCA) farm using sow productivity and gross margin analysis. The objective of the study was to determine pig productivity using the college farm as a model. The physical performance as well as the financial performance of the pig enterprise were also determined. The Botswana College of Agriculture (BCA), pig unit was used as experimental site. An interview was carried out with the farm management staff to document pig management practices and verify the records kept. The data were collected from January 1997 to December 1999 from production records of Duroc Jersey and Land Race breeds. Litter size at birth influenced litter size at weaning and both traits decreased with an increase in parities. A positive correlation of 0.70 was observed between litter size at birth and litter size at weaning. A negative gross margin was realized due to the high feed costs and low market price of pigs which did not cover production costs. Land Race and Duroc Jersey breeds were compared in terms of average physical productivity. With respect to litter size at birth, Land

Race had 11.4 while Duroc Jersey had 10.2. In terms of litter weight at birth in (kg), Duroc Jersey had 13.8 while Land Race had 12.8. In terms of number of litters per sow per year, Duroc Jersey had 2 while landrace also had 2. The weaning age (in weeks) for both breeds was 4 weeks respectively. The litter size at weaning was 6.5 for Duroc Jersey and for landrace it was 7.6 while the litter weight (kg) at weaning was 62.4 for Duroc Jersey while landrace was 78.8. With respect to the financial productivity of the pig farm, gross margin analysis showed an income of 33,191 Botswana pula (BWP)#, total income per sow was 3319 (BWP)#, total gross income (Revenue) was 28691 (BWP)#, total gross income per sow was 2869 (BWP)#. The total variable costs were 29437 (BWP)#, Gross margin was i 746 (BWP)# while average gross margin per sow was i 74 (BWP)#. The negative gross margin at Botswana College of Agriculture (BCA) for a 10 i sow unit with 2 litters per year and 8 piglets per sow, was mainly due to low market price of pigs and high feed costs. It is worthy of note that the average currency exchange rate during the study was 1.00 U. S. dollar to 4.30 Botswana Pula. The study is highly related to this present study in terms of topic, objectives, research designs, method of data collection and analysis. In the study, both the physical and financial productivity or performance were analysed in the pig farm just like the present study. The difference lies on location and the fact that pig manure was ignored in the study in Botswana during the analysis of gross margin for the financial performance of the farm. In addition, pig production technologies applied in the farm were not analysed in Botswana College of Agriculture farm as was analysed in this present study in Enugu State.

A research study was conducted by Anukwu and Ebong (2011) on Analysis of the Performance of Piggery Loan Beneficiaries in the Integrated Farmers scheme of Akwa Ibom State: A case of Uyo Agricultural Zone. The objectives of the study were to: (i) determine the profitability of the enterprise; (ii) examine both the credit providers's lending risk in the piggery enterprise and the piggery owners's financial risk; (iii) and analyse the factors influencing pig

production. It was a survey research design used with structured questionnaire as data collection instrument. sixty respondents were sampled for the study and the data analysed using budgetary analysis, gross margin analysis, Return on capital employed and production function analysis. Pig production on the average was found to be profitable. The result of analysis of costs and returns of the piggery farms in the study area revealed an average total cost of production to be ₦533,894.00 per farm comprising average variable costs of ₦307,026.00 per farm and average fixed costs of ₦226,868.00 per farm constituting about 76% was the highest of the average variable cost component amounting to ₦900,542.00 per farm, it gives an average profit margin of ₦366,648.00 per farm thus making the piggery enterprise worthwhile venture. The study in Akwa Ibom State is similar to this current study in Enugu State in terms of the topic, objectives of the study and research design. The method of data collection and analytical tools used in both studies are also highly related. The difference lies on the fact that the study conducted in Akwa Ibom State failed to analyse the physical productivity or performance of the pig farms. Pig manure was also not considered in the study as a source of farm income as it did not appear in the list of sales that gave average total farm revenue or returns. The pig production technologies adopted by farmers were not discussed or examined in the study. There was therefore the need to carry out a study on analysis of production performance and profitability of pig farms in Enugu State.

Adesehinwa, Aribido, Oyediji and Obiniyi (2003) carried out a study on production strategies for coping with the demand and supply of pork in some peri-urban areas of South western Nigeria. The primary objective of the study was to identify production strategies employed by pig farmers in some peri-urban areas of South Western Nigeria (Lagos and its environs) to cope with production constraints and soaring demand for pork. The survey research design was used. The population for the study comprised of all pig farmers in the area out of which 60 were randomly selected. Responses were elicited from the farmers with the aid

of structured questionnaire. Frequency and percentages were used for data analysis. The results showed that herd size of the majority (70 percent) of farms was below 100 heads of pigs. 26.7 percent of the farms had more than 100 heads of pigs while 3.3 percent of the pig farms was not classified in terms of herd size according to the respondents. Large white was the most common breed of pigs found in Lagos since 53 percent of the respondents showed preference for Large White over Duroc Jersey and Land Race. Weaning weight ranged from 6 to 10kg for most farms as reported by more than 70 percent of the respondents. Mean weaning weight and average daily weight gain have been reported to be significantly influenced by litter size, maturity, maternal parity, sex and period of birth. Only the frequency and percentages were used in data analysis without any tool for inferential statistics such as t-test statistic, ANOVA and Chi-square. The study focused on pig production constraints and coping strategies without analyzing the physical and financial productivity or performance of pig farms. In coping strategies, there were no pig production technologies discussed. This present study however, sought to fill all these gaps by determining the pig production technologies, physical and financial production performance and profitability of pig farms. The similarities are based on topic, objectives, research design, method of data collection and analysis. The breeds of pigs used, pig production constraints and coping strategies were also determined in this present study.

In a research study titled "Appraisal of Pig Production in Songhai Redemption Farm, Nekede, Imo State, Nigeria", Emenyonu, Odii, Chilaka, Onyemauwa and Anaeto (2006) evaluated the productivity of Songhai Redemption Farm with a view to determining its profitability. The objectives of the study were to estimate the costs and revenue of pig production in the enterprise and isolate the factors militating against enhanced production performance of the pig enterprise. The survey research design was used in the study. The data were collected through well structured questionnaire and personal interview on the piggery

units, costs and revenue items in the farm. The data were analysed using percentages, t-test statistic, Gross margin analysis and Net farm income. The results showed that piggery production in the study area was a profitable venture. Feeding cost accounted for the largest proportion of the total variable cost incurred in this enterprise. The findings also revealed that such variables like number of pigs in stock, labour cost, medication cost and depreciated value of capital implements were positively related to output and statistically significant. The study is related to the present study in terms of topic, objectives, research design, method of data collection and analysis. The study failed to analyse the physical production performance but only focused attention on the financial aspect of production performance.

Lewis (2007) carried out a research work on financial performance of specialist pig farms in England. The objectives of the study were to: (i) examine the influence of size on financial performance of specialist pig farms.

(ii) determine mean costs and returns in specialist pig farms (iii) determine the average amount of profits realized by specialist farms. 54 specialist pig farms were selected as sample for the study. Direct farm observation, interviews and structured questionnaire were used to collect data which were analysed using gross margin and profit analysis, Net Farm Income (NFI), Management and Investment Income (MII) and Farm Business Income (FBI). The results showed that mean total output amounted to ₦294,268, total variable costs were ₦156,124, farm gross margin was ₦138,143, total fixed costs were ₦131,460, Management and Investment Income was ₦6683, Net Farm Income was ₦24,974 and Farm Business Income was ₦24706 per farm. The average number of pigs per sow per year was 19.1 in specialist farms. Although the research focused on financial performance, it also briefly treated an aspect of physical performance relating to number of pigs per sow per year which is one of the major indications of pig farm profitability. The study is related to the present study in terms of topic, methodology and findings. The difference is that the study did not determine anything about

factors affecting productivity of pigs, pig production technologies adopted, pig production constraints and strategies for improvement hence the need for this work.

Gekara, Garner and Dunbar (2009) carried out a study on Evaluating Production Techniques to Improve Efficiency and Profitability of Hog Farms in South East Arkansas. The aim of the project was to address constraints related to hog production strategies to improve profits through improved management and feeding. The specific objectives included: (i) surveying and evaluating the current hog production practices for small, limited resource farmers in Southeast Arkansas (ii) identifying and evaluating feeds used by hog farmers in Southeast Arkansas (iii) identifying and evaluating locally produced energy and protein feed ingredients for use by hog farmers. A descriptive research method was used to assess the feeding/management practices, financial burden/profitability and market arrangements. Enterprise budgets that fitted the small farm situation were developed and used to compute cost of production, breakeven price and yield while measurements of body weights and feed were used to calculate average daily body gain, average daily feed intake and feed efficiency. The results showed that pigs fed brewers grade rice had faster gains (0.96 vs 0.79 kg/d), had greater feed efficiency 0.33 vs 0.25 kg gain per kg feed) and had lower cost per kg gain (\$ 1.21 vs 1.58) compared with pigs fed conventional feeds (use of corn and/or Milo as energy sources). This helped hog farmers to stay in business as a result of reduced feed cost and greater profitability in the study area. The study is related to the present study in Enugu state with respect to research title, objectives, methodology and expected results. The study in Southeast Arkansas was not well detailed as in the present study in productivity and financial performance.

A study on pig production and marketing in Enugu State was conducted by Nwobodo (1997). The objectives of the study were to: (i) determine the present level of pig production; (ii) determine the present mode of marketing and consumption of pork; (iii) find out the

economic and technical problems associated with pig production and marketing in Enugu state; (iv) evaluate the profitability of pig production; and (v) identify areas that need improvement both in production and marketing. A sample size of 90 self-employed pig farmers operating commercial or government farms were studied. 10 markets were equally selected for survey in each zone. Data were collected by means of structured questionnaire and oral interviews. The data were analysed using frequencies, percentages, ranges and means. The profitability of the pig enterprise was evaluated using Gross margin analysis. The result showed that pig production was still a very small enterprise in Enugu state. The average total variable costs was ₦331, 496. 00. The mean Gross margin was found to be ₦59,100.00. The finding showed a fairly profitable venture and should be encouraged. The research study and the present study share similar qualities and characteristics with respect to the research topic, area of study, method of data collection and analysis. The difference lies on the fact that the research ignored fixed costs and depreciation during data collection and analysis. Furthermore, the study is outdated and needs to be updated with current empirical data. The study focused on financial productivity and marketing, leaving the second vital aspect of pig productivity which is physical productivity. All these vital issues ignored in the study were determined in the present study on production performance and profitability of pig farms in Enugu state.

Ezeibe (1998) conducted a research study on the Economic Analysis of pig production in University of Nigeria, Nsukka veterinary farm. The study was designed to: (i) investigate the nature of pig production and management practices employed; (ii) compare costs and returns associated with pig production; (iii) identify the problems encountered in pig production; and three research questions were formulated. Survey research design was used. The population was 30 farm attendants which also served as sample. The instrument for data collection was validated by three experts from the Faculty of Veterinary Medicine, University of Nigeria, Nsukka. The overall reliability of 0.72 was obtained. The data were collected through personal

observations, interviews and questionnaire for pig attendants. The data were analysed using means, percentages, Benefit-Cost Ratio, and gross margin analysis. The result showed that the major problems militating against pig production in the study area were high cost of feed, poor quality feed and marketing of the products. In the analysis of costs and returns, it was found that the variable cost was ₦95,5650, fixed cost was ₦65,722, the total cost was ₦1,021,372 while total revenue was ₦1,309,500, Gross margin was ₦353,850, that is $TR - TVC$. The Benefit - Cost Ratio (BCR) was 1:1.3, that is TR/TC . The Net Revenue was ₦288,128, that is $TR - TC$ showing that the enterprise was profitable and economically viable. The study and the present study shared many things in common such as research topic, scope, area of study, method of data collection and analysis. The major difference is that the present study seeks to analyse the physical productivity of pig farms as well as the financial productivity. Ezeibe (1998) did not analyse the physical productivity of the veterinary pig farm in University of Nigeria, Nsukka. The present study in addition sought to identify pig production technologies adopted by pig farmers. The present study had a wider coverage in terms of number of pig farms covered or studied.

Sharma, Leung and Zaleski (1997) conducted a research on Economic Analysis of size and Feed Type of Swine Production in Hawaii. The purpose of the study was to examine the profitability of Hawaii swine production and the industry's potential for future expansion. Specifically, the study attempted to: (i) compare production economics of different types of swine operations including different farm sizes, and grain and garbage feeding; (ii) determine factors that significantly affect farm profitability, and (iii) compare the economics of swine enterprises in Hawaii and the United States mainland. Sixty farms were surveyed during August to December 1994 to collect detailed information on the various costs and returns from different swine operations. Direct observation, interview and questionnaire were used for data collection and the data was analysed using mean, frequency, percentages, gross margin analysis

and profitability Ratios. The average capital investment varied from about \$34,000 in small farms to about \$345,000 in large farms. However, the capital investment per sow for grain feeders was more than twice as high as for garbage feeders. The average net return per 100 lb (45.4kg) live hog produced was \$11.60 for larger herds and - \$63.70 for medium and small herds. Hawaii producers received \$77.3 per 100lb (45.4 kg) of live pig versus the national average of \$48.9. It was found that out of farm sizes of large (> 75 sows) herds, medium (25 ÷ 75 sows), and small (< 25 sows) herds, large herds tend to be more profitable. The poorer average performance on smaller herds was attributed to wide variability in their costs and returns. The study identified high production costs, growing urbanization, and encroachment on agricultural land, increasing environmental concerns, retirement of older producers, high capital investment and a negative permitting environment for new producers as major factors responsible for the shrinkage of the swine industry in Hawaii. The results of the study also revealed the potentials for improving profitability on smaller herds by using labour more efficiently, paying less for feeds and weaning more pigs per sow per year. Furthermore, swine production in Hawaii and Iowa were compared and it was found out that pig production was more profitable in Iowa than in Hawaii probably due to high cost of feeds and use of more labour in Hawaii as seen in the total economic cost and net returns for pig production in both areas. The average net return per 45.4kg of live pig produced was \$12.20 for Hawaii and \$1.00 for Iowa. The study is very much related to the present study in terms of research topic, objectives, methodology and results. The physical productivity was not stressed as in the present study because the economic analysis in the study focused on farm size and feed type in swine production.

A study titled "Analysis of Integrated Animal ÷ fish production system under subtropical Hill Agro-Ecosystem in India: Growth performance of Animals, Total Biomass Production and Monetary Benefit", was conducted by Kumaresan, Pathak, Bujarbaruah and

Vinod (2008). The objectives of the study were to: (i) examine the productivity of different integrated farms; (ii) estimate the growth performance of each animal within the integrated farms; (iii) determine financial benefit or returns from these farms; and (iv) compare input/output ratio of different farms in terms of total biomass production per unit land. Pigs and ducks were integrated with composite fish culture. This was an experimental study in which direct observation and available farm records were used in data collection and analysed with input/output ratio or Benefit-Cost Ratio and weight measurement. The pig and duck excreta were directly allowed into fish pond and no supplementary feed was given to the fish during the period of study. The average body weight of pig and duck at 11 months age was 90 and 1.74kg with an average daily weight gain of 333.33 and 6.44g respectively. The fish production in pig-fish and duck-fish systems were 2209 and 2964kg/ha respectively while the productivity in control pond was only 820kg/ha. The total biomass was higher in commercial feeding system compared to the traditional system, however the input/output ratio was 1:1.2 and 1:1.5 for commercial and traditional systems respectively. It was inferred that the total biomass production per unit land was high when animal and fish were integrated together and the venture was highly profitable. The study is related to the present study in terms of research topic, objectives, methodology and analytical tool. The analysis of physical productivity and financial productivity are not detailed and did not focus on pig production only. The present study focused on the physical and financial performance of pig farms.

Ogunniyi (2009) conducted a research study on Economic Analysis of snail production in Ibadan, Oyo state. The objectives of the study were to: (i) examine the socio-economic characteristics of the snail farmers; (ii) determine the costs and returns of snail production; (iii) identify the factors influencing snail production and (iv) examine the problems faced by snail farmers in the study area. In terms of methodology, a survey research design was used. All

snail farms in Ibadan zone constituted the population of the study while multistage random sampling technique was used to select 53 respondents.

The instrument for data collection was face validated by three experts, two from Department of Agricultural Economics and Extension, Ladoke Akintola University of Technology, Ogbomosho, Oyo State while one was from Department of Agricultural Economics and Farm Management, University of Ilorin, Ilorin, Kwara State. Cronbach Alpha method and Pearson product moment correlation coefficient were used in the computation of the reliability of the instrument. An overall reliability index of 0.82 was obtained showing that the instrument was highly reliable. The data were collected using well structured questionnaire and interviews. The data were analysed using frequency, mean, percentages, budgetary techniques and stepwise regression analysis. Budgetary techniques were used to determine the gross margin and net farm income obtained from snail production in the study area. Straight line method was used in calculating depreciation of all depreciable inputs. Profitability ratio analysis such as Benefit i Cost Ratio (BCR), Gross Revenue Ratio (GRR) were used to measure the profitability of the snail production. In the study, it was found out that 73.6 percent of the snail farmers were males while 26.4 percent were females. In each farming season, the snail farms had an average total fixed costs of ₦3,334.75, mean total variable costs of ₦12,204.35, mean total revenue was ₦39,628.13 and mean total cost was ₦15,539.10. The Gross margin was ₦ 27,423.78 while Net Farm Income (NFI) $TR - TC$ was ₦24,089.03. The profitability ratios of the snail business were as follows: Benefit i Cost Ratio (TR/TC) was 1:2.574, Expenses Ratio (FC/TC) was 0.181 while the Rate of Returns (NR/TC) was 1:1.574. All these results showed that snail production in the study area was a lucrative business. The study is similar to the present study in Enugu State in terms of research title, objectives, research design, method of data collection, analysis and analytical tools used. The difference lies on the fact that the study did not analyse the physical productivity or performance of the

snail farms to determine the mean number of snails produced per farm per year (farming season). The present study sought to fill this missing gap.

Suwari (2010) conducted a research work on Snail Production in Bayelsa State: Technologies, Productivity and Enhancement Measures. The objectives of the study were to: determine snail production technologies that are adopted by snail farmers in different management practices, respective rates and costs of inputs, productivity (yield/profit) of farmers in snail production, constraints of farmers and measures for enhancing farmers' productivity. The study adopted an evaluation survey research design. The population for the study comprised of 173 snail farmers in Bayelsa State while the sample was 153. A structured questionnaire, direct observation and available farm records were used to collect data. The data were analysed using percentages, frequency, mean, standard deviation, t-test statistic and Gross Margin Analysis. In the study, the fixed inputs included land, snailery fence, food/shelter plants, parent-stock, water sprinkler, weighing scale, maintenance and telephone charges, wheel barrow, feeders, drinkers, spade, rake, permanent labour, Garden fork, basin, bucket, cutlass, knife, tray and plastic drums. The variable inputs included feeds, lime, substrate, fertilizer, disinfectant, engine oil, marker, transportation cost, pen, torch light, plastic spoon, battery, packer, broom and litter bins. The average farm size per year, from the 150 farms surveyed, was 24.77m^2 and parent stocks were stocked at 252 snails per farm/per year or 10 snails per m^2 per year while feeds were applied at the rate of 44,184kg/farm/year or 1,784kg/ m^2 /year with a corresponding average cost of ₦122,752/farm/year or ₦4,956.34/ m^2 /year respectively. An average capital cost of ₦94,701.33 per farm or ₦3,823.74/ m^2 were incurred annually. The sum of ₦129,704.43 per farm or ₦5,237.06 per m^2 were spent on variable inputs annually. An average yield of 8,096 adult snails/farm/year or 327 adult snails/ m^2 /year were produced. Average net profits of ₦326,014/farm/year or ₦13,163.42/ m^2 /year, were made. However, lack of heliculture extension services, inadequate

improved snail species, seasonal flooding of snail farms, among others were identified as the major constraints of farmers. The overall assessment of snail production in Bayelsa State showed that the enterprise is viable in the study area. The study has a high degree of relationship with the present study on pig productivity in Enugu State with respect to research topic, objective, methodology and analytical tools. The difference lies on the fact that the study was conducted in Bayelsa State on snail production while the present study is on pig production in Enugu State.

Unang (2003) conducted a research work on Profitability and Efficiency of the Broiler Industry in Tasikmalaya. The objectives of the research were to evaluate whether the existing production systems are profitable and economically efficient. The primary and secondary data collected were both qualitative or quantitative. Survey research design was used. Data were collected by directly recording inputs, costs and revenue for one production cycle/period during July, August, and September 2002. The data analysis tool used was Policy Analysis Matrix (PAM) introduced by Monke and Pearson in 1989. The result of the study showed that both autonomous and partnership broiler enterprises, and both large and small production systems were profitable and economically efficient. An autonomous broiler industry which was rearing less than 2000 birds incurred total cost of production of Rp 8, 925, 614, total revenue of Rp 10, 049, 684 and made a profit of Rp 1, 124, 070. Another autonomous broiler enterprise keeping more than 2000 birds had the cost of inputs as Rp 8,878, 435, output was Rp 10175020 while the profit was Rp 1,296,585. In the same research another broiler farm which was a partnership enterprise keeping less than 2000 birds, spent Rp 9268370 on inputs and Rp 1050 9103 realized as revenue with a profit of Rp 1240 733. Unang also reported that in another broiler partnership farm raising more than 2000 birds, the inputs took Rp 9,286,093, output was Rp 10,811,968 and the profit made was Rp 1,525,875. All these results from the study showed that broiler industries in Tasikmalaya were profitable and needed to be sustained. The study failed to

analyse the physical productivity of the broiler farms and factors that affect broiler production in the study area. The analytical tool used in the study is different from the analytical tool employed in the present study in Enugu State. The similarity lies on the research topic, objectives and financial results of the study. The present study in Enugu State definitely filled the missing gap although in pig production and not in broiler production.

Tobby (2002) carried out a study on Economic Analysis of Broiler Production in Port Harcourt City of Rivers State. The main objective of the study was to determine the profitability of broiler industry in Port Harcourt city and identify the major factors that increase broiler productivity. The farm used fixed inputs such as building, land, stove/lanterns, electric bulbs, wheel barrows, feeders and drinkers which were valued at ₦97,445.75 as total fixed costs. The variable inputs of 5500 parent stocks, chemicals, drugs, veterinary services, feeds and labour took the sum of ₦744,825.00 as total variable costs. It was found out that the poultry farm incurred a total production cost of ₦842,270.75 and earned a revenue of ₦1,760,000.00 from selling 55,500 broilers at ₦320 per bird. There was a profit margin of ₦83,430 per farmer with a Benefit-Cost Ratio of 1:2.09 that was greater than 1. This showed that broiler production business was profitable in Port Harcourt City of Rivers State. The study resembles this current study on pig productivity in terms of research title, objectives, methodology and analytical tools. The study focused on financial performance of broiler farm and nothing was discussed about the physical productivity of the broiler farm. The present study focused on both physical and financial performance of the pig farms as well as pig production technologies adopted by pig farmers.

A close look at these related empirical studies showed that they were similar to this present study on pig production performance and profitability in Enugu State. The analytical tools used for data analysis in these aforementioned studies were also highly related to the analytical tools employed in this present study. The related empirical studies so far reviewed in

this literature shared common features with the present study in terms of research topic, objectives, technologies and methodology. However, the physical productivity or performance and the current profitability level of pig farms have not yet been ascertained in Enugu State. The study therefore, sought to examine the breeds of pigs used by farmers, productive characteristics of pig breeds used by farmers, pig production technologies adopted by farmers, physical productivity of pig farms, amount of profits realized by pig farms, productivity constraints and strategies for improving physical productivity and profitability of pig farms in Enugu State of Nigeria.

Summary of Review of Literature

The literature revealed that pig production started as early as 2000 B. C. and that pig production has been going on since time immemorial. Pigs are reared in most parts of the world except thickly populated Moslem communities. In many countries of the world, pig production has helped to increase the Gross Domestic Product (GDP), farmers's income and meat (pork) supply.

It was presented in literature that Enugu State has conducive environment for rearing pigs and other livestock. Livestock farms in developed countries usually perform better than those found in developing countries like Nigeria hence there is an observed inadequacy in the supply and consumption of animal protein in Nigeria. Despite the fact that pig production is constrained in many ways, there is still hope in the industry. Pig production technologies adopted by pig farmers were also presented in the literature. Application of appropriate pig production technologies by pig farmers were expected to reduce production costs, improve management practices and increase profits.

Economists have formulated theories about production and these theories helped to analyse and explain clearly the concept of production, production process and production function in relation to inputs and outputs. The Innovation-Decision Process Theory of

Adoption, Programme/Project Evaluation Model and Context, Input, Process and Product (CIPP) Evaluation Model of evaluating projects like pig farms were also presented in literature. These models show similar features with the present study in terms of data collection and analysis and were therefore applied in this study.

The systems of rearing pigs were also reviewed. These systems included extensive, semi-intensive and intensive systems although intensive system has been hailed for its greater advantage enjoyed by the commercial, large scale pig farmers. The management of pigs right from farrowing to finishing stages was discussed in literature. Record keeping in the farm was also presented as it was the basis for finding out the worth or value of any farm.

The related empirical studies reviewed in this literature had similar features with the present study. These empirical studies hinged on the performance of livestock including pigs. The difference was only on the scope of the studies. The production performance and profitability of pig, poultry, snail, cattle and other livestock farms discussed under the related empirical studies and the present study on production performance and profitability of pig farms in Enugu State shared common characteristics in terms of research topics, objectives, scope, technology and methodology. Most of these empirical studies reviewed focused on financial productivity and ignored the physical productivity of pig farms which the current study of pig production in Enugu State sought to examine.

This study therefore examined and analysed the existing pig farms in Enugu State so as to identify: types of pig breeds kept by farmers, the productive characteristics of pig breeds kept by farmers, pig production technologies adopted by farmers, physical productivity of pig farms, amount of profits realized by pig farms and strategies for improving physical productivity and profitability of pig farms in Enugu State of Nigeria. The current productivity level of pig farms and profits made in Enugu State which have not been determined recently were addressed in this study.

CHAPTER THREE

METHODOLOGY

This chapter described the procedures used in this study. It focused on research design, area of the study, population for the study, Sample and sampling technique, instrument for data collection, validation of the instrument, reliability of the instrument, method of data collection and method of data analysis.

Research Design

Survey design was used in this study. It is generally done by collecting detailed descriptions of existing phenomena with the intent of using the data to justify current conditions and practices or make better plans for improving phenomena. The use of survey research design in this study is appropriate and justified because the data or information elicited by this study were based on the use of questionnaire, data from farm records and opinion of pig farmers and agricultural extension agents.

Area of the Study

The area of the study was Enugu State of Nigeria. The state is located in the South East geo-political zone of Nigeria. It is bounded in the North by Benue and Kogi states, in the South by Anambra and Abia states, in the East by Ebonyi State and in the West by Anambra and Kogi States (Iwena, 2008).

The climate has two distinct seasons namely wet and dry seasons. The vegetation is Guinea savanna with tall grasses, trees and shrubs. This zone is good for livestock production. The farm animals reared in this area include, pigs, cattle, goats, sheep, poultry, fishes and snails. There is clement weather condition to encourage pig production in Enugu State. In addition, most of the residents of Enugu State are Christians whose religion does not forbid the rearing of pigs and consumption of pork. Enugu State is made up of three senatorial zones with 17 Local Government Areas. The senatorial zones are Enugu North, Enugu East and Enugu

West. Enugu North senatorial zone has Nsukka, Igbo-Eze North, Igbo-Eze South, Igbo-Etiti, Udenu and Uzo-Uwani Local Government Areas. Enugu East senatorial zone has Enugu East, Enugu North, Isi-Uzo, Nkanu East, Nkanu West and Enugu South Local Government Areas. Enugu West Senatorial zone comprises of Awgu, Aninri, Ezeagu, Oji-River and Udi Local Government Areas. The study covered all these senatorial zones of the State.

Population for the Study

The population for this study comprised 297 registered pig farmers in Enugu State and 222 agricultural extension agents of Enugu State Agricultural Development Programme (ENADEP) totaling 519 respondents. The data available in the office of Enugu State Agricultural Development Programme (ENADEP) showed that Enugu North Senatorial Zone had 120 registered pig farmers, Enugu East senatorial zone had 74 registered pig farmers while Enugu West Senatorial Zone had 103 registered pig farmers. The data in the office of Enugu State Agricultural Development Programme (ENADEP) also showed that there were 222 agricultural extension agents in the State. The total population was therefore made up of 297 pig farmers and 222 agricultural extension agents in which Enugu North had 62, Enugu East had 98 while Enugu West had 62.

Sample and Sampling Technique

There was sample size but no sampling technique for this study. The sample size was 297 for pig farmers and 222 for agricultural extension agents totaling 519 which was the same as population size.

Instrument for Data Collection

A structured questionnaire was used in this study for data collection. The structured questionnaire was accompanied with pig performance recording sheets and farm records available in piggeries for data collection from pig farmers in this study. The questionnaire was divided into two parts. Part 1 of the questionnaire comprised section A on background

information and section B made up of eight sections, I, II, III, IV, V, VI, VII and VIII designed mainly to elicit information from pig farmers to answer the research questions asked in the study. The part 2 of the questionnaire for agricultural extension agents comprised of section A on background information and section B made up of two sections, VII and VIII.

Section I was structured to obtain information on the pig breeds kept by rural and urban pig farmers. Section II was designed to elicit information on the productive characteristics of pig breeds kept by pig farmers. Section III was structured to obtain information on the pig production technologies adopted by farmers. Section IV focused on data collection about physical productivity of pig farms. Section V sought for data on the amount of profits realized by pig farms in Enugu State. Section VI solicited for data on productivity constraints of pig farms. Section VII dealt with information on strategies for improving physical productivity of pig farms. Section VIII was designed to obtain data on strategies for improving profitability of pig farms.

In section I, the respondents were required to check (ã) against Yes or No based on the type of pig breeds kept in their farms. In sections II, IV and V, pig performance record sheets and available pig farm records were used in conjunction with questionnaire to obtain data on productive characteristics of pig breeds, physical productivity and profitability of pig farms in Enugu State.

In section III, the questionnaire was coded with nominal values assigned to each expected response from the respondents. Each of the questionnaire items was provided with a five-point Rogers adoption scale used to determine stages of adoption of pig production technologies in the adoption process by pig farmers as follows:

Adoption (AD)	5 points
Trial (T)	4 points
Evaluation (E)	3 points
Interest (I)	2 points
Awareness (AW)	1 point

In section VI, a four-point response options was provided as follows:

Very serious problem	(VSP)	5 points,
Serious problem	(SP)	4 points,
Moderate problem	(MP)	3 points
Little problem	(LP)	2 points,
Not A problem	(NAP)	I point.

In sections VII and VIII, each of the questionnaire items was assigned as follows:

Strongly Agree	(SA)	5 points
Agree	(A)	4 points
Undecided	(UD)	3 points
Disagree	(D)	2 points
Strongly Disagree	(SD)	1 point

Validation of the Instrument

The instrument for data collection was subjected to face validation by three experts, one from Agricultural Education section of the Department of Vocational Teacher Education, one from Agricultural Economics Department and one from Agricultural Extension Department, all from University of Nigeria, Nsukka. The total number of items before validation was 226 and 200 after validation.

Reliability of the Instrument

The internal consistency of the instrument was determined using Cronbach alpha Reliability Method in sections I, IIIA, IIIB, IIIC, IIID, IIIE, IIIF, VI, VII and VIII while Pearson product moment correlation coefficient was used in sections II, IV and V.

The reliability test was carried out in Awka North Local Government Area of Anambra State. Fifteen members of Pig Farmers Association of Nigeria and five agricultural extension agents in Awka North Local Government Area of Anambra State were used in determining the reliability of the instrument. The area was chosen as it has similar characteristics with the study

area in terms of historical and socio-cultural backgrounds. The reliability indices were determined separately for each of the eight sections as follows:

Section I = 0.53, Section II = 0.75, Section IIIA = 0.93, Section IIIB = 0.91, Section IIIC = 0.93, Section IIID = 0.78, Section IIIE = 0.93, Section IIIF = 0.85, Section IV = 0.80, Section V = 0.70, Section VI = 0.50, Section VII = 0.81, Section VIII = 0.78. The overall reliability index of the instrument was 0.79 showing that the instrument was highly reliable.

Method of Data Collection

The questionnaire was administered to the respondents by direct personal contacts with the help of six research assistants. The available farm records and pig performance recording sheets were used in data collection on pig productivity and profitability. There were two sets of the questionnaire, one for pig farmers and the other for agricultural extension agents.

The six research assistants were instructed by the researcher so as to enable them understand the instrument and how to conduct the administration. Two research assistants covered one senatorial zone while the researcher supervised the research assistants in their assignments.

The pig performance recording sheets were used to obtain data from pig farmers for measuring productivity and profitability. The sheets were sent to the pig farmers in advance to enable them fill in the required data about the performance of their pig farms. Any of the pig farmers that needed assistance was assisted by the researcher and the assistants. The researcher and the assistants visited the pig farms every six months for data collection to collect data from pig farmers on physical productivity of pigs, inputs, production costs, output, and revenue for a period of two years starting from 1st January 2011 to 31st December, 2012. This period covered more than two production cycles.

A total of 297 copies of the questionnaire and attached pig performance recording sheets for pig farmers were distributed and 265 copies returned out of which 142 were located

in the rural areas and 123 were located in the urban areas. A total of 222 copies of questionnaire for agricultural extension agents were distributed and 200 copies returned. Data for answering research questions 2, 4 and 5 were collected from 55 out of 265 pig farms which supplied the required data correctly.

Method of Data Analysis

The data collected for the study were analysed using frequency counts and percentages, for answering research question 1. Means were used to answer the research questions 3, 6, 7 and 8. Pig farms with similar characteristics such as type of pig breeds kept were grouped together for easy analysis of data in answering research question 2. The mean quantities of products (yield) obtained for a period of two years were used to answer the research questions 2 and 4; while the budgeting technique ($TFC + TVC = TC$, Total sales = TR, Profit = TR - TC) and amount of profits realized by pig farms were used to answer research question 5. Analysis of Variance (ANOVA), Duncan's test and t-test statistic were used in testing the hypotheses at 0.05 level of significance.

In answering research question 3, a five-point Rogers adoption scale in the adoption process was used as follows: awareness = 1, interest = 2, evaluation = 3, trial = 4, adoption = 5. Any item on pig production technologies with a weighted mean value of 3.0 and above was regarded as adopted while any item with a weighted mean value of less than 3.0 was regarded as not adopted.

In sections VI, VII and VIII, the real limits were used in the determination of scale point of the rating statements. In section VI of the instrument, the mean values obtained for each item was interpreted in relations to the real limits of the nominal values of the scale points used for data collection as follows:

Rating statement	Scale point	Real limit	Decision
Very serious problem (VSP)	5	4.50 ï 5.00	Very serious problem (VSP)
Serious problem (SP)	4	3.50 ï 4.49	Serious problem (SP)
Moderate problem (MP)	3	2.50 ï 3.49	Moderate problem (MP)
Little problem (LP)	2	1.50-2.49	Little problem (LP)
Not a problem (NAP)	1	1.00-1.49	Not a problem (NAP)

For sections VII and VIII, the real limits were used in determining the scale point of the rating statements as follows:

Rating statement	Scale point	Real limit	Decision
Strongly Agree (SA)	5	4.50 ï 5.00	Strongly Agree (SA)
Agree (A)	4	3.50 ï 4.49	Agree (A)
Undecided (UD)	3	2.50 ï 3.49	Undecided (UD)
Disagree (D)	2	1.50-2.49	Disagree (D)
Strongly Disagree (SD)	1	1.00-1.49	Strongly Disagree SD

Hypothesis one (H_{01}) was tested at 0.05 level of significance using one-way Analysis of Variance (ANOVA) and Duncan's test while Hypotheses Two (H_{02}), Three (H_{03}), Four (H_{04}) and Five (H_{05}) were tested at 0.05 level of significance using t-test statistic.

The null hypothesis of no significant difference was accepted for any item whose P-value was greater than 0.05 level of significance ($P > 0.05$) and alternative hypothesis rejected. The null hypothesis of no significant difference was rejected for any item whose P-value was less than 0.05 level of significance ($P < 0.05$) and the alternative hypothesis of significant difference was accepted.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

This chapter deals with the presentation and analysis of data collected for this study. The methods of data analysis described in chapter three were used. The results are presented in accordance with the research questions and hypotheses.

Research Question 1

What breeds of pigs are kept by rural and urban pig farmers?

Data for answering research question 1 are presented in table 1

Table 1

Distribution of Respondents (Pig Farmers) Based on Breeds of Pigs Kept

N = 265

Item No	Breeds of Pigs	Frequency	Percentage (%) Respondents
1	Large White	179	67.5
2	Duroc Jersey	19	7.2
3	West African Dwarf Pig	6	2.3
4	Land Race	51	19.2
5	Large Black	0	0
6	Berkshire	0	0
7	British Saddle Back	0	0
8	Bakosi	0	0
9	Pietrain	0	0
10	Hampshire	10	3.8
Total		265	100.0

Source: Field survey data, 2013

Table 1 revealed that Large White recorded 67.5 percent of respondents, Land Race 19.2 percent, Duroc Jersey 7.2 percent, Hampshire 3.8 percent and West African Dwarf Pigs 2.3%. These values indicated that most farmers (67.5 percent) kept Large White while few kept Land Race, Duroc Jersey, Hampshire or West African Dwarf Pigs. However, data in Table 1 further showed that items 5, 6, 7, 8 and 9 recorded zero percent indicating that non of the farmers reared (kept) these breeds like Large Black, Berkshire, British Saddle Back, Bakosi and

Pietrain. The most popular breed of pigs kept by farmers in Enugu State was Large White while the least popular was West African Dwarf Pigs.

Research Question 2

What are the productive characteristics of pig breeds kept by farmers?

Data used to answer research question 2 are presented in Table 2.

Table 2
Mean Value of Productive Characteristics of Pig Breeds kept by Farmers

Item No	Productive characteristics of pig breeds	N = 21 Large White		N = 10 Duroc Jersey		N = 6 West African Dwarf Pig		N = 12 Land Race		N = 6 Hampshire		N = 55 Total	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
141	No of litters/sow/yr	2.81	0.30	2.10	0.21	2.08	0.20	2.21	0.26	2.92	0.20	2.42	0.43
142	Litter size at birth	11.98	4.99	11.88	0.89	5.67	0.52	8.88	3.00	13.21	0.80	10.32	5.60
143	No of piglts born alive/sow/yr	31.17	7.64	16.10	4.03	10.42	1.02	17.04	2.80	37.50	2.66	22.50	10.47
144	No of piglets born dead/sow/yr	2.41	1.11	2.45	0.44	1.33	0.61	2.38	1.11	1.04	0.56	1.92	1.03
145	% mortality	13.48	5.37	24.84	4.45	20.77	9.50	23.84	11.95	5.29	1.98	17.64	9.73
146	Birth weight (kg)	2.44	0.12	2.18	0.06	0.93	0.20	1.52	0.05	2.51	0.04	1.92	0.55
147	Wt gain per month (kg)	8.58	0.22	6.52	0.21	4.72	0.17	7.77	0.27	8.12	0.94	7.14	1.29
148	Weaning wt (kg)	8.59	0.27	7.16	0.08	5.72	0.26	8.35	0.12	9.46	0.17	7.86	1.07
149	Adult wt (kg)	95.91	4.35	83.29	0.27	59.97	1.01	94.19	1.41	101.10	1.70	86.9	12.14
150	No of live pigs produced/far m/yr	508.5	537.8	281.5	153.5	99.1	51.81	259.3	167.2	232.1	129.0	276.1	368.67

Table 2 showed the following:

Mean Number of Litters per Sow per Year: Hampshire was the highest with a mean of 2.92 followed by Large White with a mean of 2.81. Land Race had a mean of 2.21, Duroc Jersey 2.10 and West African Dwarf Pig had the least mean of 2.08. The analysis showed that on the average, sows of Hampshire and Large White produced three (3) litters in a year. Land Race, Duroc Jersey and West African Dwarf Pig produced approximately two (2) litters in a year.

Mean Litter Size at Birth: Hampshire also had the highest litter size at birth with a mean of 13.21 followed by Large White with a mean of 11.98, Duroc Jersey 11.88, Land Race 8.88 and the least was West African Dwarf Pig with a mean of 5.67. Hampshire was more prolific than other breeds while West African Dwarf Pig was the least prolific breed in the study area.

Mean Number of piglets born alive per Sow per Year: Hampshire had a mean of 37.50, Large White 31.17, Land Race 17.04, Duroc Jersey 16.10 and West African Dwarf pig 10.42. The analysis showed that Hampshire had the highest mean number of piglets born alive per sow per year followed by Large White while West African Dwarf Pig was still the least.

Mean Number of Piglets Born Dead per Sow per Year: Hampshire, West African Dwarf Pig, Land Race, Large White and Duroc Jersey had on average the mean of 1.04, 1.33, 2.38, 2.41 and 2.45 respectively. The analysis revealed that Duroc Jersey had the highest number of piglets born dead per sow per year. The analysis also showed that Hampshire recorded the least number of piglets born dead per sow per year followed by West African Dwarf Pig, Land Race, Large White and Duroc Jersey in that order.

Mean Percentage (%) Mortality: The analysis revealed that Hampshire had a mean of 5.29, Large White 13.48, West African Dwarf pig 20.77, Land Race 23.84 and Duroc Jersey 24.84. Percentage (%) mortality was highest in Duroc Jersey and lowest in Hampshire.

Mean Birth Weight (kg): Table 2 revealed that Hampshire had the highest mean birth weight of 2.51kg followed by Large White with a mean of 2.44kg, Duroc Jersey 2.18kg and Land Race 1.52kg. West African Dwarf pig had the least mean birth weight of 0.93kg.

Mean Weight gain per Month (kg): The analysis showed that Large White had the highest mean weight gain per month with the mean value of 8.58kg followed by Hampshire with 8.12kg. Land Race had 7.77kg, Duroc Jersey had 6.52kg while West African Dwarf pig had the lowest mean weight gain per month of 4.72kg.

Mean Weaning Weight (kg): Hampshire had the mean weaning weight of 9.46kg, Large White 8.59kg, Land Race 8.35kg, Duroc Jersey 7.16kg and West African Dwarf pig 5.72kg. The analysis showed that Hampshire had on the average the highest mean weaning weight followed by Large White, Land Race, Duroc Jersey and West African Dwarf pig had the lowest mean weaning weight.

Mean Adult Weight (kg): Hampshire had the highest adult weight with 101.10kg followed by Large White with 95.91kg, Land Race had 94.19kg, Duroc Jersey 83.29kg while West African Dwarf Pig had the lowest mean adult weight of 59.97kg.

Mean Number of Live Pigs Produced per Farm per Year: In the study of 21 pig farms keeping Large White, the analysis revealed that the number of live pigs produced per farm per year was 508.5 pigs. In 10 farms keeping Duroc Jersey, the number of live pigs produced per farm per year was 281.5 pigs. In respect of the 12 farms keeping Land Race, the number of live pigs produced per farm per year was 259.3 pigs. The 6 farms keeping Hampshire had 232.1 pigs as the mean number of live pigs produced per farm per year. Furthermore, the analysis revealed that in the study of 6 farms keeping West African Dwarf pigs, the mean number of live pigs produced per farm per year was 99.1 pigs. Large White produced the highest mean number of live pigs per farm per year followed by Duroc Jersey, Land Race, Hampshire and West African Dwarf pig was the least productive breed.

Hypothesis 1

H_{01} : There is no significant difference among breeds of pigs in their mean birth weights, weaning weights and adult weights.

Data used in answering hypothesis 1 are presented in Table 3.

Table 3

One-way ANOVA for Comparing the Mean Birth Weights, Weaning Weights and Adult Weights among Pig Breeds

Source of variance		Sum of Squares	df	Mean Square	F-ratio	P-value	Level of Sig. 0.05	Decision
Birth Weight (kg)	Between Groups	15.50	4	3.87	350.02	.000	0.05	S
	Within Groups	0.55	50	0.01				
	Total	16.05	54					
Weaning Weight (kg)	Between Groups	59.62	4	14.91	340.12	.000	0.05	S
	Within Groups	2.19	50	0.04				
	Total	61.81	54					
Adult Weight (kg)	Between Groups	7545.06	4	1886.26	224.63	.000	0.05	S
	Within Groups	419.86	50	8.40				
	Total	7964.92	54					

S = Significant ($P < 0.05$); NS = Not Significant ($P > 0.05$)

Table 3 showed that the F-ratio value for birth weight (kg) was 350.02, P-value was 0.000 at 0.05 level of significance. P-value was less than the level of significance ($P < 0.05$) therefore the obtained F-ratio value of 350.02 was significant. This showed that there was significant difference among West African Dwarf Pig, Land Race, Duroc Jersey, Large White and Hampshire breeds of pigs in mean birth weights.

With respect to mean weaning weights, the obtained F-ratio was 340.12 and $P < 0.05$ which showed that it was significant. This implied that there was significant difference among West African Dwarf pig, Land Race, Duroc Jersey, Large White and Hampshire breeds of pigs in mean weaning weights.

Furthermore, the F-ratio value under adult weights was 224.63 and $P < 0.05$ which showed that it is significant. The analysis showed that there was significant difference among West African Dwarf Pigs, Land Race, Duroc Jersey, Large White and Hampshire breeds of pigs in mean adult weights. The result showed that the null hypothesis which states that there is no significant difference among breeds of pigs in mean birth weights, weaning weights and

adult weights was rejected and alternate hypothesis accepted. Table 3 also showed that there was significant difference among West African Dwarf pig, Land Race, Duroc Jersey, Large White and Hampshire breeds of pigs in mean birth weights, weaning weights and adult weights at 0.05 level of significance.

Duncan's test was further conducted to ascertain which breed had the highest mean weight. Duncan's test was also used in ascertaining which breed had the lowest mean birth weight, weaning weight and adult weight. This helped to give clearer difference among West African Dwarf Pig, Land Race, Duroc Jersey, Large White and Hampshire breeds of pigs with respect to their mean birth weights, weaning weights and adult weights. Duncan's test was presented in Table 4.

Table 4

Duncan's Test Result showing Clearer Relationship in Mean Birth Weights, Weaning Weights and Adult Weights among Pig Breeds

		Subset for alpha = 0.05					
S/N	Breeds of Pigs						
		Birth Weights (kg)					
		N	1	2	3	4	5
1	West African Dwarf pigs	6	0.93				
2	Land Race	12		1.52			
3	Duroc Jersey	10			2.18		
4	Large White	21				2.44	
5	Hampshire	6				2.51	
	P-value (sig.)		1.00	1.00	1.00	0.12	
		Weaning Weight (kg)					
	Breeds of Pigs	N	1	2	3	4	5
1	West African Dwarf pigs	6	5.72				
2	Land Race	10		7.16			
3	Duroc Jersey	12			8.35		
4	Large White	21				8.59	
5	Hampshire	6					9.45
	P-value (sig.)		1.00	1.00	1.00	1.00	1.00
		Adult Weights (kg)					
	Breeds of Pigs	N	1	2	3	4	5
1	West African Dwarf pigs	6	59.97				
2	Land Race	10		83.29			
3	Duroc Jersey	12			94.19		
4	Large White	21			95.91		
5	Hampshire	6				101.10	
	P-value (sig.)		1.00	1.00	0.22	1.00	

Duncan's test displaying means for groups in homogenous subsets.

The Duncan's test as presented in Table 4 indicated that Hampshire and Large White had equal and highest mean birth weights. West African Dwarf pig had the lowest mean birth weight followed by Land Race and Duroc Jersey. Their mean birth weights were as follows: West African Dwarf 0.93kg, Land Race 1.52kg, Duroc Jersey 2.18kg, Large White 2.44kg and Hampshire 2.51kg.

Hampshire had the highest mean weaning weight with 9.46kg followed by Large White with 8.59kg. West African Dwarf had the lowest mean weaning weight of 5.72kg followed by Duroc Jersey with 7.16kg and Land Race with 8.35kg.

The analysis on mean adult weight revealed that Hampshire had the highest mean adult weight with 101.10kg followed by Large White with 95.91kg. Land Race had 94.19kg, Duroc Jersey had 83.29kg while West African Dwarf had the lowest mean adult weight of 59.97kg.

Research Question 3

What pig production technologies are adopted by farmers?

Data used to answer research question 3 are presented in table 5.

Table 5
Mean Ratings of Farmers on Pig Production Technologies Adopted

Item No	Pig Production Technologies	$\bar{X}$	SD	Decision
A	Stocking Technologies			
11	Using improved, productive pig breeds.	4.75	0.71	Adopted
12	Introducing pigs to the piggeries in the morning or evening.	4.35	1.08	Adopted
13	Cleaning the piggery with disinfectants before stocking.	4.58	0.91	Adopted
14	Selecting breeding stock from the market.	4.27	1.09	Adopted
15	Stocking dry sow at 3 ÷ 4m ² per dry sow.	4.27	1.10	Adopted
16	Rearing pigs in separate pens based on age, size and condition.	4.47	1.17	Adopted
17	Stocking boars at 9m ² per boar.	4.19	1.30	Adopted
18	Stocking farrowing sows at 6 ÷ 10m ² per sow.	4.29	1.29	Adopted
19	Stocking weaners at 0.7 ÷ 0.9m ² per weaner.	4.17	1.31	Adopted
20	Keeping porkers, baconers and heavy pigs at a spacing of 0.7 ÷ 1.10m ² per pig.	4.37	1.10	Adopted
B	Housing Technologies			
21	Providing hard concrete slated floor.	4.31	1.14	Adopted
22	Encouraging natural mating.	4.60	1.00	Adopted
23	Providing wallows for pigs.	4.08	1.22	Adopted
24	Constructing clay or cemented walls.	4.45	1.04	Adopted
25	Roofing with aluminium, zinc, asbestos sheets or grasses.	4.53	0.91	Adopted

26	Castrating male piglets.	1.48	1.27	Not Adopted
27	Carrying out artificial insemination in the farm.	1.56	1.40	Not Adopted
28	Using of intensive system of pig rearing.	4.19	1.19	Adopted
29	Using semi-intensive system of pig rearing.	4.18	1.17	Adopted
30	Using extensive system of pig keeping.	2.09	1.43	Not Adopted
31	Culling of old and unproductive pigs.	4.36	0.95	Adopted
32	Employing the services of veterinary officers to treat sick pigs.	4.39	1.13	Adopted
33	Sorting the piglets according to sex and weight.	4.38	1.14	Adopted
34	Nose ringing.	1.52	1.32	Not Adopted
35	Teeth clipping or trimming.	1.74	1.33	Not Adopted
36	Providing feeding troughs and drinkers.	4.57	1.09	Adopted
37	Siting pig houses at east-west direction and at right angle to the direction of prevailing wind to ensure proper ventilation.	4.21	1.06	Adopted
38	Providing separate pens for pigs based on age, size and condition.	4.17	1.25	Adopted
39	Supplying of water in piggery.	4.38	1.11	Adopted
40	Disinfecting piggery between batches.	4.12	1.16	Adopted
C	Feeding Technologies			
41	Compounding pig feeds on farm.	4.31	1.17	Adopted
42	Using creep feeds and phase feeding system.	4.06	1.20	Adopted
43	Using wet feeds and flushing.	4.31	1.11	Adopted
44	Providing clean drinking water with additives.	4.50	1.01	Adopted
45	Feeding pigs according to age, size and condition.	4.26	1.11	Adopted
46	Weighing pigs monthly to determine weight and weight gain.	4.30	1.11	Adopted
47	Using ad libitum systems of feeding.	4.24	1.01	Adopted
48	Using controlled, restricted feeding system.	4.22	1.01	Adopted
49	Feeding pigs with kitchen wastes and industrial by-products.	4.43	0.88	Adopted
50	Feeding pigs with conventional, commercial feeds.	4.23	1.00	Adopted
D	Diseases and Parasites Control Technologies			
51	Dipping foot or boot in disinfectant before entering piggery.	4.35	1.00	Adopted
52	Utilizing veterinary services.	4.34	0.77	Adopted
53	Vaccinating piglets between 4 and 6 weeks to prevent diseases.	4.34	0.96	Adopted
54	Using quarantine practice.	4.07	1.01	Adopted
55	Isolating infected pigs.	4.42	0.93	Adopted
56	Handpicking of ectoparasites.	4.42	0.99	Adopted
57	Deworming pigs.	4.48	0.92	Adopted
58	Spotting out and treating sick pigs on daily basis.	4.23	0.95	Adopted
59	Cleaning of pig pens and farm premises daily.	4.40	0.94	Adopted
60	Disposing pig manure on daily basis.	4.24	0.99	Adopted
E	Farm Record Keeping Technologies			
61	Making daily, weekly and monthly entries of service, farrowing and vaccination.	4.31	1.14	Adopted
62	Keeping record of inventories, farm diary and labour summary.	4.29	1.15	Adopted
63	Filling the herd performance form or sheet as at when due.	4.30	1.06	Adopted
64	Keeping daily, weekly and monthly record of quantity and cost of feeds consumed in the farm.	4.48	1.04	Adopted
65	Measuring the weight of pigs at various stages of growth.	4.26	1.11	Adopted
66	Recording all farm sales daily.	4.28	1.09	Adopted
67	Keeping record of all farm output like live pigs.	4.33	0.94	Adopted

68	Keeping record of all farm inputs and their costs.	4.57	0.93	Adopted
69	Calculating overall profit or loss in pig farm on yearly basis.	4.40	0.97	Adopted
70	Auditing the account of the farm	4.03	1.28	Adopted
F	Marketing Technologies			
71	Conducting market survey for prices of pigs and pig products.	4.33	1.05	Adopted
72	Spraying pigs with cold water before loading in trucks to the market.	4.18	1.08	Adopted
73	Transporting pigs to the market late in the evening or early hours of the day.	4.20	1.13	Adopted
74	Selling direct to an abattoir or butchers on farm.	4.40	1.03	Adopted
75	Bagging of pig manure for sale.	4.37	1.05	Adopted
76	Telemarketing or video merchandising of pigs and pig products.	0.66	1.37	Not Adopted
77	Futures trading in pig business.	0.71	1.25	Not Adopted
78	Selling pigs and pig products in the market.	4.31	1.17	Adopted
79	Forward contracting in swine enterprise.	0.83	1.37	Not Adopted
80	Slaughter, dressing the carcass and refrigeration of pork for sale.	4.11	1.21	Adopted

$\bar{X}$ = Mean; SD = Standard Deviation; N = 265

Table 5 showed that items 11 – 20 had the means ranging from 4.17 – 4.75 which were above the cut-off point of 3.0. Therefore, all these items were adopted as stocking technologies by pig farmers. These stocking technologies adopted by pig farmers in Enugu State include: using improved, productive pig breeds, introducing pigs to the piggeries in the morning or evening, cleaning the piggery with disinfectants before stocking, selecting breeding stock from the market, stocking dry sow at 3 – 4m² per dry sow, rearing pigs in separate pens based on age, size and condition, stocking boars at 9m² per boar, stocking farrowing sows at 6 – 10m² per sow, stocking weaners at 0.7 – 0.9m² per weaner and keeping porkers, baconers and heavy pigs at a spacing of 0.7 – 1.10m² per pig.

With respect to housing technologies, 14 items had respective mean scores ranging from 4.08 – 4.60 which were above the cut-off point of 3.0 showing that all these items were the housing technologies adopted by pig farmers in Enugu State. These housing technologies adopted by pig farmers in Enugu State include: providing hard concrete slated floor, encouraging natural mating, providing wallows for pigs, constructing clay or cemented walls,

roofing with aluminium, zinc, asbestos sheets or grasses, using of intensive system of pig rearing, using of semi-intensive system of pig rearing, culling of old and unproductive pigs, employing the services of veterinary officers to treat sick pigs, sorting the piglets according to sex and weight, providing feeding troughs and drinkers, siting pig houses at east-west direction and at right angle to the direction of prevailing wind to ensure proper ventilation, providing separate pens for pigs based on age, size and condition, supplying of water in piggery and disinfecting piggery between batches.

Table 5 also showed that six items had the mean scores ranging from 1.48 to 2.09. These means were below the cut-off point of 3.0 and the corresponding items were regarded as not adopted as housing technologies in pig production in Enugu State. The housing technologies that are not adopted by pig farmers in Enugu State include: castrating male piglets, carrying out artificial insemination in the farm, using extensive system of pig keeping, nose ringing and teeth clipping or trimming.

Table 5 showed that 10 items on feeding technologies had the means ranging from 4.06 to 4.50 which were above the cut-off point of 3.0. This showed that all these items were adopted as feeding technologies by pig farmers in Enugu State. The feeding technologies adopted by pig farmers in Enugu State included: compounding pig feeds on the farm, using creep feeds and phase feeding system, using wet feeds and flushing, providing clean drinking water with additives, feeding pigs according to age, size and condition weighing pigs monthly to determine weight and weight gain, using ad libitum system of feeding, using controlled or restricted feeding system, feeding pigs with kitchen wastes and industrial by-products and feeding pigs with conventional, commercial feeds.

The analysis on diseases and parasites control technologies in Table 5 showed that 10 items had the mean scores ranging from 4.07 to 4.48 which were above the cut-off point of 3.0. This indicated that all the 10 items were adopted by pig farmers. The diseases and parasites

control technologies adopted by pig farmers in Enugu State included: dipping foot or boot in disinfectant before entering piggery, utilizing veterinary services, vaccinating piglets between 4 and six weeks to prevent diseases, using quarantine practice, isolating infected pigs, handpicking of ectoparasites, deworming pigs, spotting out and treating sick pigs on daily basis, cleaning of pig pens and farm premises daily and disposing pig manure on daily basis.

The analysis also showed that in the area of farm record keeping technologies, 10 items had the mean scores ranging from 4.03 to 4.57 which were also above the cut-off point of 3.0. This showed that all these 10 items were applied by pig farmers. The farm record keeping technologies adopted by pig farmers included: making daily, weekly and monthly entries of service, farrowing and vaccination, keeping record of farm inventories, farm diary and labour summary, filling the herd performance form or sheet as at when due, keeping daily, weekly and monthly quantity and cost of feeds consumed in the farm, measuring the weight of pigs at various stages of growth, recording all farm sales daily, keeping record of all farm output like live pigs produced, keeping record of all farm inputs and their costs, calculating overall profit or loss in pig farm on yearly basis and auditing the account of the farm.

The responses of pig farmers on marketing technologies covered items 71 to 80 in Table 5. Seven items had the mean scores ranging from 4.11 to 4.40 showing that these mean values were above the cut-off point of 3.0. These items were therefore adopted by pig farmers as marketing technologies in pig production. The marketing technologies adopted by pig farmers included: conducting market survey for prices of pigs and pig products, spraying pigs with cold water before loading in trucks to the market, transporting pigs to the market late in the evening or early hours of the day, selling direct to an abattoir or butchers on farm, bagging of pig manure for sale, selling of pigs and pig products in the market and slaughter, dressing the carcass and refrigeration of pork for sale.

The analysis further showed that three items had the mean scores ranging from indicating that these mean values were below the cut-off point of 3.0. These three items were therefore not adopted as marketing technologies by pig farmers. The marketing technologies that were not adopted by pig farmers included: telemarketing or video merchandising of pigs and pig products, futures trading in pig business and forward contracting in swine enterprise. The standard deviation values ranged from 0.71 to 1.31 for items that were adopted. This showed that the respondents were not far from each other in their responses and they were not too far from the mean.

Hypothesis 2

H₀₂: There is no significant difference between the mean ratings of urban and rural pig farmers on pig production technologies applied by pig farmers in Enugu State.

Data used in answering hypothesis 2 are presented in Table 6.

Table 6
Calculated t-values of Urban and Rural Pig Farmers' Mean Scores on Pig Production Technologies Adopted by Pig Farmers in Enugu State ($P \leq 0.05$)

Item No	Pig Production Technologies	N ₁ = 142 Rural		N ₂ = 123 Urban		t-cal.	P-value	Decision
		$\bar{X}_1$	SD ₁	$\bar{X}_2$	SD ₂			
A	Stocking Technologies							
11	Using improved, productive pig breeds.	4.87	0.56	4.60	0.84	3.15	0.002	S
12	Introducing pigs to the piggeries in the morning or evening.	4.28	1.19	4.44	0.94	-1.24	0.22	NS
13	Cleaning the piggery with disinfectant before stocking.	4.70	0.93	4.44	0.87	2.32	0.02	S
14	Selecting breeding stock from the market.	4.25	1.15	4.29	1.03	-0.29	0.77	NS
15	Stocking dry sow at 3 to 4m ² per dry sow.	4.19	1.21	4.37	0.94	-1.30	0.20	NS
16	Rearing pigs in separate pens based on age, size and condition.	4.51	1.21	4.42	1.12	0.69	0.49	NS
17	Stocking boars at 9m ² per boar.	4.15	1.33	4.24	1.26	0.60	0.55	NS
18	Stocking farrowing sow at 6 to 10m ² per sow.	4.04	1.39	4.57	1.10	-3.39	0.00	S
19	Stocking weaners at 0.7 to 0.9m ² per weaner.	4.04	1.33	4.33	1.28	-1.80	0.07	NS
20	Keeping porkers, baconers and heavy pigs at a spacing of 0.7 to 1.10m ² per pig.	4.24	1.40	4.51	0.86	-1.87	0.06	NS
B	Housing Technologies							
21	Providing hard concrete slated floor	4.20	1.03	4.43	1.25	-1.62	0.11	NS
22	Encouraging natural mating.	4.76	0.74	4.41	1.21	2.85	0.01	S
23	Providing wallows for pigs.	4.27	0.95	3.87	1.45	2.68	0.01	S
24	Constructing clay or cemented walls.	4.55	1.04	4.34	1.03	1.63	0.10	NS

25	Roofing with aluminium, zinc, asbestos sheets or grasses.	4.44	1.01	4.43	0.75	-1.72	0.09	NS
26	Castrating male piglets.	1.49	1.38	1.47	1.13	0.14	0.89	NS
27	Carrying out artificial insemination in the farm.	1.57	1.57	1.54	1.17	0.20	0.84	NS
28	Using of intensive system of pig rearing.	4.17	1.20	4.20	1.17	-0.23	0.82	NS
29	Using semi-intensive system of pig rearing.	4.12	1.17	4.24	1.17	-0.86	0.39	NS
30	Using extensive system of pig keeping.	2.20	1.44	1.96	1.42	1.35	0.81	NS
31	Culling of old and unproductive pigs.	4.46	0.86	4.25	1.04	1.76	0.08	NS
32	Employing the services of veterinary officers to treat sick pigs.	4.56	1.10	4.18	1.14	2.80	0.01	S
33	Sorting the piglets according to sex and weight.	4.32	1.22	4.44	1.03	-0.82	0.41	NS
34	Nose ringing.	1.51	1.23	1.53	1.43	-0.09	0.93	NS
35	Teeth clipping or trimming.	1.67	1.21	1.18	1.45	-0.88	0.38	NS
36	Providing feeding troughs and drinkers.	4.28	1.21	4.48	0.94	-1.56	0.13	NS
37	Sitting pig house at east-west direction and at right angle to the direction of prevailing wind to ensure adequate ventilation.	4.13	1.14	4.30	0.97	-1.33	0.18	NS
38	Providing separate pens for pigs based on age, size and condition.	4.00	1.34	4.37	1.10	-2.41	0.02	S
39	Supplying of water in piggery.	4.63	0.84	4.08	1.30	4.16	0.00	S
40	Disinfecting piggery between batches.	4.04	1.25	4.21	1.05	-1.23	0.22	NS
C Feeding Technologies								
41	Compounding pig feeds on the farm.	4.30	1.33	4.32	0.97	-0.15	0.88	NS
42	Using creep feeds and phase feeding system.	4.00	1.28	4.14	1.11	-0.93	0.35	NS
43	Using wet feeds and flushing.	4.15	1.26	4.50	0.87	-2.64	0.01	S
44	Providing clean drinking water with additives.	4.50	1.06	4.50	0.95	-0.03	0.97	NS
45	Feeding pigs according to age, size and condition.	4.27	1.23	4.25	0.96	0.11	0.91	NS
46	Weighing pigs monthly to determine weight and weight gain.	4.23	1.24	4.37	0.94	-1.04	0.30	NS
47	Using of ad libitum system of feeding.	4.17	1.00	4.31	1.03	-1.120	0.26	NS
48	Using controlled or restricted feeding system.	4.14	1.08	4.30	0.91	-1.29	0.20	NS
49	Feeding pigs with kitchen wastes and industrial by-products.	4.45	0.80	4.40	1.01	0.47	0.64	NS
50	Feeding pigs with conventional commercial feeds.	4.15	0.94	4.33	1.06	-1.44	0.15	NS
D Diseases and Parasites Control Technologies								
51	Dipping foot or boot in disinfectants.	4.23	1.07	4.49	0.90	-2.15	0.03	S
52	Utilizing veterinary services.	4.25	0.83	4.44	0.69	-1.96	0.06	NS
53	Vaccinating piglets between 4 and 6 weeks to prevent diseases.	4.30	0.96	4.40	0.97	-0.86	0.39	NS
54	Using quarantine practice.	3.89	1.13	4.28	0.82	-3.11	0.00	S
55	Isolating infected pigs.	4.47	0.95	4.37	0.91	0.79	0.43	NS
56	Handpicking of ectoparasites.	4.34	1.01	4.51	0.95	-4.44	0.15	NS
57	Deworming pigs.	4.59	0.78	4.37	1.05	1.94	0.06	NS
58	Spotting out and treating sick pigs on daily basis.	4.18	0.98	4.29	0.93	-0.92	0.36	NS
59	Cleaning of pig pens and farm premises daily.	4.37	0.95	4.45	0.93	-0.70	0.49	NS
60	Disposing pig manure on daily basis.	4.18	0.96	4.31	1.02	-1.090	0.28	NS
E Farm Record Keeping Technologies								
61	Making daily, weekly and monthly entries of service, farrowing and vaccination.	4.26	1.20	4.37	1.07	-0.81	0.42	NS
62	Keeping records of inventories, farm diary and labour summary.	4.23	1.32	4.37	0.93	-0.94	0.35	NS
63	Filling the herd performance form or sheet as at when due.	4.20	1.15	4.42	0.95	-1.61	0.11	NS

64	Keeping daily, weekly and monthly record of quantity and cost of feeds consumed in the farm.	4.52	1.15	4.44	0.91	0.64	0.52	NS
65	Measuring the weight of pigs at various stages of growth.	4.00	1.26	4.57	0.82	-4.28	0.00	S
66	Recording all farm sales daily.	4.23	1.21	4.33	0.92	-0.81	0.42	NS
67	Keeping record of all farm output like live pigs produced.	4.34	0.97	4.32	0.91	0.18	0.86	NS
68	Keeping record of all farm inputs and their costs.	4.63	0.90	4.49	0.95	1.28	0.20	NS
69	Calculating overall profit or loss in pig farm on yearly basis.	4.37	1.10	4.45	0.80	-0.68	0.50	NS
70	Auditing the account of the farm	3.82	1.41	4.27	1.06	-2.87	0.00	S
F	Marketing Technologies							
71	Conducting market survey for prices of pigs and pig products.	4.33	1.00	4.33	1.10	0.05	0.96	NS
72	Spraying pigs with cold water before loading in trucks to the market.	4.12	1.09	4.24	1.08	-0.93	0.35	NS
73	Transporting pigs to the market late in the evening or early hours of the day.	4.12	1.22	4.29	1.01	-1.19	0.24	NS
74	Selling direct to an abattoir or butchers on farm.	4.39	1.02	4.41	1.06	-0.15	0.88	NS
75	Bagging of pig manure for sale.	4.46	1.02	4.26	1.08	1.53	0.13	NS
76	Telemarketing or video merchandising of pigs and pig products.	0.59	1.33	0.73	1.42	-0.83	0.41	NS
77	Futures trading in pig business.	0.66	1.22	0.79	1.29	-0.61	0.54	NS
78	Selling pigs and pig products in the market.	4.32	1.15	4.29	1.19	0.17	0.87	NS
79	Forward contracting in swine enterprise.	0.84	1.38	0.82	1.36	0.10	0.92	NS
80	Slaughter, dressing the carcass and refrigeration of pork for sale.	3.89	1.36	4.36	0.94	-3.17	0.00	S

$N_1 = 142$; $N_2 = 123$; $\overline{X}_1$ = Mean score of rural pig farmers, SD_1 = Standard Deviation of rural pig farmers; $\overline{X}_2$ = Mean score of urban pig farmers; SD_2 = Standard Deviation of urban pig farmers; S = Significant ($P < 0.05$); NS = Not Significant ($P > 0.05$); $df = 263$.

Table 6 showed that the calculated t-values of the mean scores of rural and urban pig farmers on the pig production technologies adopted by pig farmers in Enugu State. The t-test results revealed that no significant difference ($P > 0.05$) existed in the opinions of rural and urban pig farmers in 56 items. This implied that the null hypothesis, that there is no significant difference between the responses of rural and urban pig farmers in respect of these 56 items was accepted.

The t-test results also showed that significant difference existed between the mean responses of the rural and urban pig farmers in respect of 14 items. Owing to the fact that significant difference existed in these 14 items, the null hypothesis that there is no significant

difference between the mean responses of the rural and urban pig farmers on these 14 items was therefore rejected.

The overall result showed that the location of pig farmers whether in the rural or urban areas had no influence on pig production technologies adopted by pig farmers with respect to 56 items.

Research Question 4

What is the physical productivity of pig farms in Enugu State?

Data analysis for answering research question 4 is presented in Table 7

Table 7
Mean Physical Productivity of Pig Farms

S/N	Pig Farms	Pig breed kept	Number of stock	Number of sows	Mean number of live piglets produced/yr	Mean No of piglets sold/yr	Mean No of adult pigs sold or slaughtered /yr	Mean No of 50kg bags of manure produced/yr	Mean No of 50kg bags of manure sold/yr
1	Mustard seed	Ham p	11	10	$\bar{X}$ 390	$\bar{X}$ 63.5	$\bar{X}$ 328.5	$\bar{X}$ 56	$\bar{X}$ 53
2	Sopuruchukwu farm	Ham p	13	10	390	81	309	54.5	51.5
3	Udoka farm	Ham p	7	6	195	47.5	147.5	37	33.5
4	Nwaji farm	Ham p	6	5	183	38.5	144	34.5	31
5	God's own farm	Ham p	3	2	79	13	66	17	15.5
6	Idu farm	Ham p	5	4	154	33.5	120.5	28.5	26
7	Charly farm	DJ	13	12	198	57.5	140.5	49.5	48
8	Chukwudi farm	DJ	14	13	202	50.5	151	66	62.5
9	Chiamaka	DJ	7	6	96	23	73	32	30.5
10	Uchenna	DJ	27	25	513	98	414.5	141.5	37
11	Ayara ogu	DJ	30	28	532	90.5	441.5	148	144
12	Emily piggery	DJ	24	22	363	82	281	123.5	121
13	Hilson	DJ	14	13	208	48.5	159.5	70.5	68.5
14	Onyeze farm	DJ	26	23	368	82.5	285.5	119.5	116
15	City farm	DJ	8	8	132	28	104	43.5	42
16	Nwaeke farm	DJ	12	11	204	55.5	148	69.5	68
17	Okechukwu	LR	7	6	87	15	72	11.5	11
18	Francis								
	Chukwu	LR	12	11	198	44	154	46.5	41.5
19	Chime and Co.	LR	33	30	525	134	391	181	175.5

20	Onah and Co.	LR	22	20	390	88.5	301.5	114.5	112
21	First farm	LR	6	6	84	14	70	18.5	15.5
22	Gofra farm	LR	11	10	190	48	142	47	42.5
23	Peace farm	LR	17	15	218	63	154.5	43	39.5
24	Okechukwu farm	LR	25	22	418	78	341	109.5	108
25	Chukwueme ka	LR	22	20	450	91.5	358.5	103	98
26	Enechi farm	LR	9	8	112	18	94	26.5	24
27	Tony farm	LR	4	3	42	5.5	36.5	19.5	18.5
28	Hypo-Belly	LR	25	22	396	59	337	88.5	84
29	Nwangwu farm	WA D	20	18	180	50.5	129.5	31	29.5
30	Barth piggery	WA D	5	4	40	4.5	35.5	8.5	7.0
31	Igwebuike piggery	WA D	10	8	80	23	57	21	18
32	Ngene piggery	WA D	11	10	125	30	95	43	37.5
33	Abugwu farm	WA D	6	5	50	9.5	40.5	13	12
34	Eze farm	WA D	11	9	90	19.5	70.5	18.5	16
35	Alloy farm	LW	11	9	171	12	159	20.5	19
36	Charly piggery	LW	10	9	333	75	257	86.5	82
37	Nwaobodo	LW	14	13	416	123.5	292.5	131	128.5
38	Nze farm	LW	7	6	237	59.5	177.5	54.5	53
39	Edems farm	LW	12	11	440	144	296	123.5	120
40	Eziokwu bu ndu	LW	8	7	277	82	194.5	128.5	125.5
41	Marist Brothers	LW	22	20	670	116.5	553.5	155.5	139.5
42	Obinwanne	LW	2	2	38	3	35	13.5	12
43	Akaama farm	LW	8	6	138	23	115	31.5	31.5
44	Chukwuasok am	LW	73	61	2165.5	391.5	2079	272	257
45	C. E. Ogwomba	LW	20	18	612	141	471	186.5	181
46	Ngozika Association	LW	20	16	600	141	459	155	143
47	Ekperechi	LW	4	3	72	11	61	13.5	12.5
48	God is Great	LW	3	3	66	15	51	22	20.5
49	Agbedo farm	LW	4	3	66	13.5	52.5	19	18
50	Sopuruchuw ku	LW	20	16	600	141	459	155	143
51	Ike farm	LW	9	7	151	19	131.5	30.5	28
52	Kris farm	LW	12	11	325	92.5	232	92	88
53	Mike Agro	LW	11	10	305	43.5	261.5	88.5	84.5
54	Royal piggery	LW	18	16	608	106	502	126.5	120
55	Vital farm	LW	48	44	1760	497.5	1262.5	362.5	358.5
	Total		812	716	17932.5	3939.9	14296.2	4303.2	4103
	Mean		14.8	13.02	326.05	71.63	259.93	78.24	74.6

Hamp = Hampshire; DJ = Duroc Jersey; LR = Land Race;

WAD = West African Dwarf Pigs; LW = Large White

Chukwumasokam pig farm had the highest mean number of piglets sold per year with 391.5, mean number of adult pigs sold or slaughtered per year with 2079, mean number of 50kg bags of manure produced per year with 272 and the mean number of 50kg bags of manure sold per year with 257. Obinwanne pig farm had the least performance in terms of physical productivity with mean number of piglets sold per year as 3 piglets, mean number of adult pigs sold or slaughtered per year as 35 adult pigs, mean number of 50kg bags of manure produced/year as 13.5, mean number of 50kg bags of manure sold per year as 12.

Research Question 5

What profit margins are realized by pig farms in Enugu State?

Data for answering research question 5 are presented in Table 8

Table 8
Mean Profit Margins of Pig Farms

S/N	Pig Farms	Yr 1 Profit (₦)	Yr 2 Profit (₦)	Total Profit (₦)	Mean Profit per yr (₦)
1	Mustard seed	2715943	5246298	7962241.67	3981120.83
2	Sopuruchukwu farm	3117369	5931484	9048852.86	4524426.43
3	Udoka farm	1620033	3075887	4695920	2347960
4	Nwaji farm	2058199	3891478	594967.67	2974838.33
5	God's own farm	1444875	2741300	4186175	2093087.5
6	Idu farm	2787782	5269227	8057008.33	4028504.17
7	Charly farm	1608125	3058237	4666361.67	2333180.83
8	Chukwudi farm	1825450	3468902	5294351.67	2647175.83
9	Chiamaka	1248153	2372588	3620740	1810370
10	Uchenna	3822462	7248458	11070920	5535460
11	Ayara ogu	4275386	8123583	12398968.6	6199484.29
12	Emily piggyery	3153246	5982276	9135521.67	4567760.83
13	Hilson	1907527	3624767	5532293.33	2766146.67
14	Onyeze farm	3442202	6529170	9971371.9	4985685.95
15	City farm	1792592	3401423	5194014.93	2597007.46
16	Nwaeke farm	1744592	3317495	5062086.86	2531043.43
17	Okechukwu	1251950	2373619	3625568.81	1812784.41
18	Francis Chukwu	1768872	3359549	5128420.71	2564210.36
19	Chime and Co.	4256609	8086162	12342771.4	6171385.71
20	Onah and Co.	3633041	6907146	10540186.9	5270093.45
21	First farm	1571216	3010699	4581914.76	2290957.38
22	Gofra farm	1635298	3110998	4746296.67	2373148.33
23	Peace farm	2479045	4706767	7185811.67	3592905.83
24	Okechukwu farm	3153918	5995002	9148919.17	4574459.58
25	Chukwuemeka	3871759	7366688	11238446.7	5619223.33
26	Enechi farm	1208522	2855061	34935882.5	1746791.25
27	Tony farm	422057.6	786985.5	1209043.1	604521.55
28	Hypo-Belly	3192906	6077846	9270751.67	4635375.83
29	Nwangwu farm	1632157	3098299	4730456.19	2365228.10
30	Barth piggyery	1101177	2087987	3189163.33	1594581.67
31	Igwebuike piggyery	1624212	3084763	4708975	2354487.5

32	Ngene piggery	2309710	4358020	6697730	3348865
33	Abugwu farm	763058.3	1436667	2199725	1099862.5
34	Eze farm	1256952	2388480	3645431.67	1822715.84
35	Alloy farm	1967825	3714018	5681843.33	2840921.67
36	Charly piggery	3631353	6893480	10524833.3	5262416.67
37	Nwaobodo	3808254	7206811	11015064.6	5507532.32
38	Nze farm	2109878	4002233	6112111.67	3056055.83
39	Edems farm	3692199	7038729	10730927.4	5365463.69
40	Eziokwu bu ndu	3301536	6278452	9579987.71	4789993.86
41	Marist Brothers	4649606	8830586	13480192.4	6740096.22
42	Obinwanne	328223.3	614465	942688.33	471344.17
43	Akaama farm	1720734	3272565	4993299.29	2496649.69
44	Chukwuasokam	11850477	22522258	34372735.1	17186367.56
45	C. E. Ogwomba	3361889	6414355	9776243.82	4888121.91
46	Ngozika Association	3420421	6512307	9932728.1	4966364.05
47	Ekperechi	322630.6	603205.1	925835.73	462917.86
48	God is Great	323709.2	598004.2	921713.33	460856.67
49	Agbedo farm	697070.8	1305673	2002744.17	1001372.08
50	Sopuruchuwku	3262760	6188431	9451190.48	4725595.24
51	Ike farm	1430971	2723921	4154891.85	2077445.92
52	Kris farm	3229786	6122796	9352582.14	4676291.07
53	Mike Agro	3140937	5954032	9094968.33	4547484.17
54	Royal piggery	3454743	6574409	10029152.6	5014576.3
55	Vital farm	4554715	8659328	13214043.3	6607021.67

Table 8 showed that the mean profit margin per farm per year was ₦3,689,267.98. All the 55 pig farms studied in Enugu State made reasonable profits. Chukwuasokam pig farm made the highest mean profit per year of ₦17,186,367.56. God is Great pig farm made the lowest mean profit per year of ₦460856.67 (See Appendix I).

Research Question 6

What are the productivity constraints of pig farms?

Data for answering research question 6 are presented in Table 9.

Table 9

Mean Responses of Pig Farmers on the Productivity Constraints of Pig Farms

Item No	Productivity Constraints of Pig Farms	N = 265		
		$\bar{X}$	SD	Decision
81	Limited Land	2.59	0.93	SP
82	Unfavourable weather condition	3.32	0.81	SP
83	Poor housing	3.42	0.71	SP
84	Religious beliefs	1.57	0.90	LP
85	Inadequate livestock extension and farmer education services	3.38	0.87	SP
86	Ignorance of right feeding system	3.30	0.82	SP
87	High cost of animal feeds	3.57	0.76	VSP
88	Diseases and parasites attack	3.65	0.67	VSP
89	Huge capital investment required	3.31	0.81	SP
90	Poor farm management	3.37	0.70	SP
91	Poor agricultural research on pigs and pig production	3.23	0.67	SP
92	High cost of veterinary drugs	3.57	0.74	VSP
93	Scarcity of veterinary doctors and officers	2.26	0.76	LP
94	Use of local, unimproved breeds as stock	1.36	0.97	NAP
95	Shortage of competent farm labour	3.06	0.85	SP

96	Unskilled pig farmers	3.13	0.85	SP
97	Insufficient credit facilities and subsidies	3.45	0.74	SP
98	Low application of modern and innovative production technologies in pig farming	3.44	0.85	SP
99	Scarcity of water during dry season	3.12	0.84	SP
100	Poverty	3.51	0.72	VSP

VSP = Very Serious Problem; SP = Serious Problem; LP = Little Problem; NAP = Not A Problem.

Table 9 showed that four items had the mean scores ranging from 3.51 ÷ 3.65 which were within the real limit of 3.50 ÷ 4.00 and were therefore regarded as very serious problems facing pig production in Enugu State. The analysis shows that high cost of animal feeds, diseases and parasite attack, high cost of veterinary drugs and poverty were among the productivity constraints of pig farms in Enugu State.

Table 9 also showed that 13 items had their mean scores ranging from 2.59 ÷ 3.45 which were within the real limit of 2.50 ÷ 3.49. This implied that the 13 items were serious problems facing pig production in Enugu State. The productivity constraints of pig farms in Enugu State include: limited land, unfavourable weather condition, poor housing, inadequate livestock extension and farmer education services, ignorance of right feeding system, huge capital investment required, poor farm management, poor agricultural research on pigs and pig production, shortage of competent farm labour, unskilled pig farmers, insufficient credit facilities and subsidies, low application of modern and innovative production technologies in pig farming and scarcity of water during dry season.

Table 9 also revealed that items 84 and 93 had mean values of 1.57 and 2.26 respectively which were within the real limit of (1.50 ÷ 2.49) indicating that these items were little problems facing pig farms. The analysis showed that religious beliefs and scarcity of veterinary doctors and officers were among the productivity constraints of pig farms in Enugu State but they were just little problems. Item 94 which is using local, unimproved breeds as

stock had a mean score of 1.36 showing that it was not a problem in pig production in Enugu State. The standard deviation values ranged from 0.67 to 0.93 which showed that respondents were not far from each other in their responses.

Hypothesis 3

H₀₃: There is no significant difference between the mean ratings of the rural and urban pig farmers on the productivity constraints of pig farms.

Data used to answer hypothesis 3 are presented in Table 10.

Table 10
Calculated t-values of Rural and Urban Pig Farmers' Mean Ratings on the Productivity Constraints of Pig Farms ($P \leq 0.05$)

Item No	Productivity Constraints of Pig Farms	N ₁ = 142 Rural		N ₂ = 123 Urban		t-cal.	P-value	Decision
		$\bar{X}_1$	SD ₁	$\bar{X}_2$	SD ₂			
81	Limited land.	2.41	0.98	2.79	0.84	-3.370	0.00	S
82	Unfavourable weather condition.	3.32	0.78	3.31	0.84	0.15	0.88	NS
83	Poor housing.	3.38	0.65	3.46	0.78	-0.85	0.39	NS
84	Religious beliefs.	1.47	0.89	1.68	0.90	-1.84	0.07	NS
85	Inadequate livestock extension and farmer education services.	3.37	0.86	3.38	0.87	-0.08	0.93	NS
86	Ignorance of right feeding system.	3.21	0.83	3.38	0.81	-1.69	0.09	NS
87	High cost of animal feeds.	3.66	0.66	3.47	0.84	2.06	0.04	S
88	Diseases and parasites attack.	3.68	0.67	3.62	0.67	0.71	0.48	NS
89	Huge capital investment required.	3.28	0.78	3.34	0.85	-0.67	0.51	NS
90	Poor farm management.	3.30	0.82	3.45	0.76	-1.56	0.12	NS
91	Poor agricultural research on pigs and pig production.	3.32	0.60	3.13	0.74	2.36	0.02	S
92	High cost of veterinary drugs.	3.61	0.68	3.52	0.80	1.01	0.31	NS
93	Scarcity of veterinary doctor and officers.	2.19	0.75	2.33	0.75	-1.54	1.12	NS
94	Using local, unimproved breeds as stock.	3.16	0.88	3.42	0.83	-2.47	0.02	S
95	Shortage of competent farm labour.	2.89	0.79	3.27	0.87	-3.74	0.00	S
96	Unskilled pig farmers.	3.00	0.84	3.28	0.83	-2.68	0.01	S
97	Insufficient credit facilities and subsidies.	3.39	0.73	3.51	0.75	-1.29	0.24	NS
98	Low application of modern and innovative production technologies in pig farming.	3.42	0.84	3.46	0.87	-0.46	0.65	NS
99	Scarcity of water during dry season.	3.03	0.79	3.23	0.88	-1.95	0.06	NS
100	Poverty.	3.43	0.74	3.60	0.69	-1.96	0.06	NS

N₁ = 142; N₂ = 123; $\bar{X}_1$ = Mean scores of rural pig farmers; $\bar{X}_2$ = Mean scores of urban pig farmers;
SD₁ = Standard Deviation of rural pig farmers; SD₂ = Standard Deviation of urban pig farmers;
S = Significant ($P < 0.05$); NS = Not Significant ($P > 0.05$); df = 263.

The t-test results in Table 10 showed that the p-values in 14 items were greater than 0.05, the level of significance. This indicated that there was no significant difference between the mean responses of rural and urban pig farmers on the productivity constraints of pig farms with respect to these 14 items. The stated null hypothesis was therefore accepted in these 14 items. On the other hand, t-test results in Table 10 also showed that in six items the P-values were less than the level of significance ($P < 0.05$). This implied that there was significant difference between the mean responses of rural and urban pig farmers on the productivity constraints of pig farms in these six items.

It was inferred from the t-test results that the location of pig farmers did not influence 14 items as productivity constraints of pig farms in Enugu State. The t-test results also showed that the location of pig farms had influence on six items.

Research Question 7

What are the strategies for improving physical productivity of pig farms in Enugu State?

Data for answering research question 7 are presented in Table 11.

Table 11

Mean Responses of Farmers and Agricultural Extension Agents on the Strategies for Improving Physical Productivity of Pig Farms

Item No	Strategies for Improving Physical Productivity of Pig Farms	N = 465		
		$\bar{X}$	SD	Decision
101	Using good management practices like caring for pigs at all stages of growth	3.37	0.79	A
102	Educating pig farmers to be proficient and skillful in pig production	3.33	0.84	A
103	Use of improved resistant breeds of pigs as stock	3.39	0.77	A
104	Provision of adequate housing and ventilation	3.32	0.90	A
105	Provision of sufficient facilities and equipment	3.42	0.78	A
106	Adequate financing of pig production business	3.27	0.86	A
107	Use of suitable pig production technologies	3.48	0.76	A
108	Use of appropriate feeds and feeding system	3.38	0.87	A
109	Effective diseases and parasites control measures	3.53	0.72	SA
110	Frequent disposal of pig wastes (effluent and faeces)	3.30	0.80	A
111	Increasing biosecurity awareness in piggeries	3.37	0.78	A
112	Provision of environmental enrichments for pigs	1.78	1.01	D
113	Protection of pigs from inclement weather condition	3.40	0.82	A
114	Provision of adequate livestock extension services	3.32	0.87	A
115	Good stockmanship	3.41	0.79	A
116	Upgrading of local, indigenous breeds with improved, exotic breeds of pigs	3.43	0.77	A
117	Attending workshops, conferences, exhibitions and on-the-job training on pig production by pig farmers	3.37	0.83	A
118	Carrying out relevant research studies on pigs and utilizing the results in pig production	3.33	0.81	A
119	Employing the services of veterinary personnels by farmers	3.39	0.81	A
120	Participating actively in Pig Farmers Association of Nigeria	3.41	0.72	A

$\bar{X}$ = Mean; SD = Standard Deviation;

SA = Strongly Agree; A = Agree; D = Disagree

Table 11 showed that item no 109 had a mean score of 3.53 which was within the real limit of 3.50 to 4.00. indicating that this item no 109 which is effective diseases and parasites control measures was therefore strongly agreed as a strategy for improving physical productivity of pig farms in Enugu State. Eighteen items had the mean scores ranging from

3.27 ÷ 3.48 which were within the real limit of 2.50 ÷ 3.49 indicating that these 18 items were agreed as strategies for improving physical productivity of pig farms.

The strategies for improving physical productivity of pig farms in Enugu State included: proper management practices like caring for the pigs at all stages of growth, educating pig farmers to be proficient and skillful in pig production, use of improved resistant breeds of pigs as stock, proper housing and ventilation, provision of necessary facilities and equipment, adequate financing of pig production business, use of suitable pig production technologies, use of appropriate feeds and feeding system, effective diseases and parasites control measures, frequent disposal of pig wastes (effluent and faeces), increasing biosecurity awareness in piggeries, protection of pigs from inclement weather condition, provision of adequate livestock extension services, good stockmanship, upgrading of local, indigenous breeds with improved exotic breeds of pigs, attending workshops, conferences, exhibitions and on-the-job training on pig production by pig farmers, carrying out relevant research studies on pigs and utilizing the results in pig production, employing the services of veterinary personnels and participating actively in Pig Farmers Association of Nigeria.

Item 112 had a mean value of 1.78 which was within the real limit of 1.50 ÷ 2.49 indicating that the respondents disagreed to item 112 as a strategy for improving physical productivity of pig farms in Enugu State. The standard deviation values ranged from 0.72 ÷ 0.90 for items that were agreed. This showed that the respondents were not far from each other in their responses.

Hypothesis 4

Ho₄ There is no significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving physical productivity of pig farms in Enugu State.

Data used for answering hypothesis 4 are presented in Table 12.

Table 12
Calculated t-values of Pig Farmers and Agricultural Extension Agents' Mean Responses on the Strategies for Improving Physical Productivity of Pig Farms ($P \leq 0.05$)

Item No	Strategies for Improving Physical Productivity of Pig Farms	N ₁ = 265 Pig Farmers		N ₂ = 200 Livestock Officers		t-cal.	P-value	Decision
		$\overline{X}_1$	SD ₁	$\overline{X}_2$	SD ₂			
101	Using good management practices like caring for the pigs at all stages of growth.	3.37	0.78	3.38	0.81	-0.19	0.85	NS
102	Educating pig farmers to be proficient and skillful in pig production.	3.39	0.81	3.25	0.87	1.83	0.07	NS
103	Use of improved, resistant breeds of pigs as stock.	3.33	0.78	3.46	0.77	-1.82	0.07	NS
104	Provision of adequate housing and ventilation.	3.42	0.83	3.19	0.97	2.80	0.01	S
105	Provision of sufficient facilities and equipment.	3.37	0.76	3.49	0.79	-1.60	0.11	NS
106	Adequate financing of pig production business.	3.37	0.74	3.13	0.99	3.00	0.00	S
107	Use of suitable pig production technologies.	3.45	0.77	3.53	0.74	-1.14	0.25	NS
108	Use of appropriate feeds and feeding system.	3.48	0.82	3.24	0.93	2.95	0.00	S
109	Effective diseases and parasites control measures.	3.53	0.70	3.53	0.74	0.05	0.96	NS
110	Frequent disposal of pig wastes (effluent and faeces).	3.32	0.76	3.27	0.86	0.68	0.50	NS
111	Increasing biosecurity awareness in piggeries.	3.40	0.72	3.32	0.86	1.09	0.28	NS
112	Provision of environmental enrichments for pigs.	1.66	0.92	1.94	1.11	-3.01	0.00	S
113	Protection of pigs from inclement weather condition.	3.46	0.77	3.32	0.88	1.90	0.06	NS
114	Provision of adequate livestock extension services.	3.46	0.77	3.14	0.96	4.05	0.00	S
115	Good stockmanship.	3.58	0.71	3.19	0.85	5.36	0.00	S
116	Upgrading of local, indigenous breeds with improved exotic breeds of pigs.	3.37	0.75	3.52	0.80	-1.96	0.04	S
117	Attending workshops, conferences, exhibitions and on the job training on pig production by pig farmers.	3.51	0.74	3.18	0.90	4.29	0.00	S
118	Carrying out relevant research studies on pigs and utilizing the results in pig production.	3.46	0.70	3.15	0.92	4.27	0.00	S
119	Employing the services of veterinary personnels by pig farmers.	3.54	0.63	3.18	0.97	4.90	0.00	S
120	Participating actively in Pig Farmers's Association of Nigeria.	3.36	0.68	3.48	0.76	-1.80	0.07	NS

N₁ = 265; N₂ = 200; $\overline{X}_1$ = Mean scores of pig farmers; $\overline{X}_2$ = Mean scores of agricultural

extension agents; SD₁ = Standard Deviation of pig farmers; SD₂ = Standard Deviation of

agricultural extension agents; S = Significant ($P < 0.05$); NS = Not Significant ($P > 0.05$);

df = 463.

The t-test results in Table 12 showed that respective P-values were greater than the level of significance ($P > 0.05$) in 10 items. This showed that there was no significant difference between the mean scores of the pig farmers and agricultural extension agents in their opinion on strategies for improving physical productivity of pig farms in these 10 items. Owing to the fact that $P > 0.05$ in these 10 items, the null hypothesis was accepted. In contrary, respective P-values were less than the level of significance ($P < 0.05$) in 10 items. This implied that significant difference exists in the mean scores of pig farmers and agricultural extension agents in their opinion on strategies for improving physical productivity of pig farms. The null hypothesis in respect of these 10 items were therefore rejected because $P < 0.05$.

The type of group of respondents had therefore no influence on the selection of strategies for improving physical productivity of pig farms in respect of 10 items while the type of group of respondents influenced the selection of strategies for improving physical productivity of pig farms in respect of 10 items in the study area.

Research Question 8

What are the strategies for improving profitability of pig farms in Enugu State?

Data for answering research question 8 are presented in Table 13.

Table 13
Mean Responses of Pig Farmers and Agricultural Extension Agents on the Strategies for Improving Profitability of Pig Farms

Item No	Strategies for Improving Profitability of Pig Farms	N = 465		
		$\bar{X}$	SD	Decision
121	Increasing herd size or scale of operation.	3.48	0.74	A
122	Effective marketing strategies such as supplying pigs or pork to big companies and hotels.	3.29	0.88	A
123	Sound consumer education and public enlightenment campaign on increasing pork consumption.	3.34	0.82	A
124	Paying less for feeds and other farm inputs.	3.35	0.81	A
125	Use of cheap, nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers' spent grain.	3.49	0.78	A
126	Payment of less tax by farmers.	3.24	0.74	A
127	Obtaining loans at cheaper interest rates.	3.29	0.83	A
128	Weaning more pigs per sow per year.	3.36	0.83	A
129	Keeping accurate farm records and accounts.	2.11	0.86	D

130	Culling of old and unproductive pigs.	3.49	0.77	A
131	Sale of pigs and pork at appropriate time especially during important festivals.	3.47	0.77	A
132	Sale of pig wastes (manure).	3.25	0.93	A
133	Recycling of pig wastes to produce biogas.	1.78	1.01	D
134	Financial aids from government in form of incentives, subsidies and interest free loans to pig farmers.	3.27	0.85	A
135	Effective supervision and monitoring of pig farms.	3.33	0.88	A
136	Rearing pigs under intensive system.	3.53	0.78	SA
137	Sound livestock extension services and farmer education for pig farmers.	3.28	0.86	A
138	Efficient use of experienced labourers.	3.47	0.80	A
139	Selecting breeds that conform to the taste of consumers.	3.46	0.81	A
140	Banning the importation of meat and fish from other countries by Nigerian government.	3.34	0.85	A

$\bar{X}$ = Mean; SD = Standard Deviation; SA = Strongly Agree;

A = Agree; D = Disagree.

Table 13 showed that item 136 (rearing pigs under intensive system) had a mean score of 3.53 which was within the real limit of 3.50 ÷ 4.00 indicating that it was strongly agreed by respondents as a strategy for improving profitability of pig farms in Enugu State. Seventeen items had the mean scores ranging from 3.24 ÷ 3.49 which were within the real limit of 2.50 ÷ 3.49. It implied that the respondents agreed to the 17 items as strategies for improving profitability of pig farms. These strategies for improving profitability of pig farms in Enugu State included: increasing herd size or scale of operation, effective marketing strategies such as supplying pigs or pork to big companies and hotels, proper consumer education and public enlightenment campaign on increasing pork consumption, paying less for feeds and other farm inputs, use of cheap nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers' spent grain, payment of less tax by farmers, obtaining loans at cheaper interest rates, weaning more pigs per sow per year, culling of old and unproductive pigs, sale of pigs and pork at appropriate time especially during important festivals, sale of pig wastes (manure), financial aids from government in form of incentives, subsidies and interest-free loans to pig farmers, proper supervision and monitoring of pig farms, sound livestock extension services and farmer education for pig farmers, efficient use of experienced labourers, selecting

breeds that conform to the taste of consumers and banning the importation of meat and fish from other countries by Nigerian government.

Items 129 and 133 had the mean scores of 2.11 and 1.62 respectively which were within the real limit of (1.50 ÷ 2.49). This implied that keeping accurate farm records and accounts and recycling of pig wastes to produce biogas were not perceived by both the pig farmers and agricultural extension agents as strategies for improving profitability of pig farms in Enugu State. The standard deviation values ranged from 0.74 ÷ 0.93 for items that were strongly agreed and agreed. This showed that the respondents were not far from one another in their responses and they were not very far from the mean.

Hypothesis 5

Ho₅ There is no significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving the profitability of pig farms in Enugu State.

Data used to answer hypothesis 5 are presented in Table 14.

Table 14
Calculated t-values of Pig Farmers' and Agricultural Extension Agents' Mean Responses on the Strategies for Improving the Profitability of Pig Farms ($P \leq 0.05$)

Item No	Strategies for Improving the Profitability of pig farms	N ₁ = 265 Pig Farmers		N ₂ = 200 Livestock Officers		t-cal.	P-value	Decision
		$\bar{X}_1$	SD ₁	$\bar{X}_2$	SD ₂			
121	Increasing herd size or scale of operation.	3.42	0.73	3.56	0.75	2.09	0.04	S
122	Effective marketing strategies such as supplying pigs or pork to big companies and hotels.	3.39	0.77	3.16	0.98	2.83	0.01	S
123	Sound consumer education and public enlightenment campaign on increasing pork consumption.	3.43	0.78	3.22	0.87	2.75	0.01	S
124	Paying less for feeds and other farm inputs.	3.51	0.75	3.15	0.83	4.52	0.00	S
125	Use of cheap nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers spent grain.	3.51	0.75	3.47	0.81	0.61	0.54	NS
126	Payment of less tax by farmers.	3.22	0.65	3.26	0.85	-0.59	0.56	NS
127	Obtaining loans at cheaper interest rates.	3.42	0.75	3.13	0.90	3.84	0.00	S
128	Weaning more pigs per sow per year.	3.38	0.83	3.32	0.83	0.79	0.43	NS
129	Keeping accurate farm records and accounts.	1.98	0.72	2.28	0.98	-3.71	0.00	S

130	Culling of old and unproductive pigs.	3.52	0.75	3.41	0.80	1.55	0.12	NS
131	Sale of pigs and pork at appropriate time especially during important festivals.	3.50	0.74	3.44	0.81	0.80	0.42	NS
132	Sale of pig wastes (manure).	3.35	0.84	3.12	1.02	2.69	0.01	S
133	Recycling of pig wastes to produce biogas.	1.68	0.90	1.96	1.11	-3.01	0.00	S
134	Financial aids from government in form of incentives, subsidies and interest free loans to pig farmers.	3.35	0.80	3.17	0.89	2.36	0.02	S
135	Effective supervision and monitoring of pig farms.	3.43	0.84	3.19	0.92	3.04	0.00	S
136	Rearing pigs under intensive system.	3.53	0.80	3.54	0.75	-0.14	0.89	NS
137	Sound livestock extension services and farmer education for pig farmers.	3.37	0.81	3.18	0.91	2.39	0.02	S
138	Efficient use of experienced labourers.	3.56	0.77	3.35	0.83	2.79	0.01	S
139	Selecting breeds that conform to the taste of consumers.	3.57	0.80	3.32	0.82	3.38	0.00	S
140	Banning the importation of meat and fish from other countries by Nigerian government.	3.42	0.80	3.23	0.92	2.42	0.02	S

$N_1 = 265$; $N_2 = 200$; $\bar{X}$ = mean response of pig farmers; $\bar{X}_2$ = mean response of agricultural extension agents; SD_1 = Standard Deviation of pig farmers; D_2 = Standard Deviation of agricultural extension agents; S = Significant ($p < 0.05$); NS = Not Significant ($p > 0.05$); $df = 463$.

The t-test results in Table 14 showed that respective P-values were greater than the level of significance ($P > 0.05$) in six items. This implied that pig farmers and agricultural extension agents did not differ in their respective opinions on strategies for improving profitability of pig farms in these six items. The null hypothesis was accepted in these six items. On the other hand, respective P-values were less than the level of significance ($P < 0.05$) in 14 items. This analysis showed that there was significant difference between the mean responses of the pig farmers and agricultural extension agents in their opinion on strategies for improving the profitability of pig farms in these 14 items. The null hypothesis that there is no significant difference between the two groups was therefore rejected.

The type of respondents therefore did not have influence on the selection of strategies for improving the profitability of pig farms in respect of six items while type of respondents had influence on the selection of strategies for improving the profitability of pig farms in respect of 14 items in the study area.

Findings of the Study

Based on the result of data analysis, the following findings were made in the analysis of production performance and profitability of pig farms in Enugu State:

A. Breeds of pigs kept by farmers in Enugu State

1. The breeds of pigs kept by farmers in Enugu State were Large White (67.5 percent) followed by Land Race (19.2 percent), Duroc Jersey (7.2 percent), Hampshire (3.8 percent) and West African Dwarf Pigs (2.3 percent).
2. The most popular breed in the study area was Large White.

B. Productive characteristics of pig breeds kept by farmers

3. Hampshire and Large White breeds produced approximately 3 litters in a year while Land Race, Duroc Jersey and West African Dwarf Pig breeds produced piglets approximately 2 litters in a year.
4. Hampshire had the best performance in all the productive characteristics (items 141 ÷ 149) followed by Large White except in item 150, which was the mean number of live pigs produced/farm/year where Large White took the lead with the mean of 508.5 pigs. Duroc Jersey came second with 281.5 pigs followed by Land Race with 259.3 pigs. Hampshire came fourth with 232.1 pigs followed by West African Dwarf pigs with 99.1 pigs.
5. West African Dwarf Pig had the poorest performance in terms of all the productive characteristics of pig breeds (items 141 ÷ 150).
6. The total mean number of live pigs produced per farm per year was 276.1 pigs in Enugu State.

C. Pig Production Technologies Adopted by Farmers

Table 5 revealed the following:

(A) Stocking Technologies Adopted by Farmers

7. Using improved, productive pig breeds.

8. Introducing pigs to the piggeries in the morning or evening.
9. Cleaning the piggery with disinfectants before stocking.
10. Selecting breeding stock from the market.
11. Stocking dry sow at 3 ĩ 4m² per dry sow.
12. Rearing pigs in separate pens based on age, size and condition.
13. Stocking boars at 9m² per boar.
14. Stocking farrowing sows at 6 ĩ 10m² per sow
15. Stocking weaners at 0.7 ĩ 0.9m² per weaner.
16. Keeping porkers, baconers and heavy pigs at a spacing of 0.7 ĩ 1.10m² per pig.

(B) Housing Technologies Adopted by Farmers

17. Providing hard concrete slated floor.
18. Encouraging natural mating.
19. Providing wallows for pigs.
20. Constructing clay or cemented walls.
21. Roofing with aluminium, zinc, asbesto sheets or grasses.
22. Using intensive system of pig rearing.
23. Using semi-intensive system of pig rearing.
24. Culling of old and unproductive pigs.
25. Employing the services of veterinary officers to treat sick pigs.
26. Sorting the piglets according to sex and weight.
27. Providing feeding troughs and drinkers.
28. Siting pig houses at east-west direction and at right angle to the direction of prevailing wind to ensure adequate ventilation.
29. Providing separate pens for pigs based on age, size and condition.
30. Supplying of water in piggery.

31. Disinfecting piggery between batches.

(C) Feeding Technologies Adopted by Farmers

32. Compounding pig feeds on the farm.

33. Using creep feeds and phase feeding system.

34. Using wet feeds and flushing.

35. Providing clean drinking water with additives.

36. Feeding pigs according to age, size and condition.

37. Weighing pigs monthly to determine weight and weight gain.

38. Using of ad libitum system of feeding.

39. Using of controlled or restricted feeding system.

40. Feeding pigs with kitchen wastes and industrial by-products.

41. Feeding pigs with conventional, commercial feeds.

(D) Diseases and Parasites Control Technology Adopted by Farmers

42. Dipping foot or boot in disinfectant before entering piggery.

43. Utilizing veterinary services.

44. Vaccinating piglets between 4 and 6 weeks to prevent diseases.

45. Using quarantine practice.

46. Isolating infected pigs.

47. Handpicking of ectoparasites.

48. Deworming pigs.

49. Spotting out and treating sick pigs on daily basis.

50. Cleaning of pig pens and farm premises daily.

51. Disposing pig manure on daily basis.

(E) Farm Record Keeping Technologies Adopted by farmers

52. Making daily, weekly and monthly entries of service, farrowing and vaccination.

53. Keeping record of inventories, farm diary and labour summary.
54. Filling the herd performance form or sheet as at when due.
55. Keeping daily, weekly and monthly record of quantity and cost of feeds consumed in the farm.
56. Measuring the weight of pigs at various stages of growth.
57. Recording all farm sales daily.
58. Keeping record of all farm output like live pigs.
59. Keeping record of all farm inputs and their costs.
60. Calculating overall profit or loss in pig farm on yearly basis.
61. Auditing the account of the farm.

(F) Marketing Technologies Adopted by Farmers

62. Conducting market survey for prices of pigs and pig products.
63. Spraying pigs with cold water before loading in trucks to the market.
64. Transporting pigs and pig products to the market late in the evening or early hours of the day.
65. Selling direct to an abattoir or butchers on farm.
66. Bagging of pig manure for sale.
67. Selling pigs and pig products in the market.
68. Slaughter, dressing the carcass and refrigeration of pork for sale.

(D) The Physical Productivity of Pig Farms in Enugu State

69. The total mean number of piglets sold per farm per year was 71.63.
70. The total mean number of adult pigs sold or slaughtered per farm per year was 71.63.
71. The total mean number of 50kg bags of manure produced per farm per year was 78.24.
72. The total mean number of 50kg bags of manure sold per farm per year was 74.6.

73. Chukwuasokam pig farm had the highest production performance in terms of physical productivity of pig farms in the study area while Obinwanne pig farm had the least production performance in terms of physical productivity.
74. The mean value of physical productivity of each of the pig farms studied was high and encouraging.

(E) Profit Margins Realised by Pig Farms in Enugu State

75. The mean profit margin for all the pig farms studied in Enugu State was ~~N~~3, 689, 267.98.
76. Chukwuasokam pig farm made the highest mean profit per year of N17,367.56 while God is Great pig farm made the lowest mean profit per year of ~~N~~460856.67.
77. Pig production business in Enugu State was found to be highly profitable.

(F) Productivity Constraints of Pig Farms

78. Limited land.
79. Unfavourable weather condition.
80. Poor housing.
81. Religious beliefs.
82. Inadequate livestock extension and farmer education services.
83. Ignorance of right feeding system.
84. High cost of animal feeds.
85. Diseases and parasites attack.
86. Huge capital investment required.
87. Poor farm management.
88. Poor agricultural research on pigs and pig production.
89. High cost of veterinary drugs.
90. Scarcity of veterinary doctors and officers.
91. Shortage of competent farm labour.

- 92. Unskilled pig farmers.
- 93. Insufficient credit facilities and subsidies.
- 94. Low application of modern and innovative production technologies in pig farming.
- 95. Scarcity of water during dry season.
- 96. Poverty.

(G) Strategies for Improving Physical Productivity of Pig Farms

- 97. Using good management practices like caring for the pigs at all stages of growth.
- 98. Educating pig farmers to be proficient and skillful in pig production.
- 99. Use of improved, resistant breeds of pigs as stock.
- 100. Provision of adequate housing and ventilation.
- 101. Provision of sufficient facilities and equipment.
- 102. Adequate financing of pig production business.
- 103. Use of suitable pig production technologies.
- 104. Use of appropriate feeds and feeding system.
- 105. Effective diseases and parasites control measures.
- 106. Frequent disposal of pig wastes (effluent and faeces).
- 107. Increasing biosecurity awareness in piggeries.
- 108. Protection of pigs from inclement weather condition.
- 109. Provision of adequate livestock extension services.
- 110. Good stockmanship.
- 111. Upgrading of local, indigenous breed with improved exotic breeds of pigs.
- 112. Attending workshops, conferences, exhibitions and on-the-job training on pig production by pig farmers.
- 113. Carrying out relevant research studies on pigs and utilizing the results in pig production.
- 114. Employing the services of veterinary personnels by farmers.

115. Participating actively in Pig Farmers Association of Nigeria.

(H) Strategies for Improving Profitability of Pig Farms

116. Increasing herd size or scale of operation.

117. Effective marketing strategies such as supplying pigs or pork to big companies and hotels.

118. Proper consumer education and public enlightenment campaign on increasing pork consumption.

119. Paying less for feeds and other inputs.

120. Use of cheap, nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers spent grain.

121. Payment of less tax by farmers.

122. Obtaining loans at cheaper interest rates.

123. Weaning more pigs per sow per year.

124. Culling of old and unproductive pigs.

125. Sale of pigs and pork at appropriate time especially during important festivals.

126. Sale of pig wastes (manure).

127. Financial aids from government in form of incentives, subsidies and interest free loans to pig farmers.

128. Effective supervision and monitoring of pig farms.

129. Rearing pigs under intensive system.

130. Sound livestock extension services and farmer education for pig farmers.

131. Efficient use of experienced labourers.

132. Selecting pig breeds that conform to the taste of consumers.

133. Banning the importation of meat and fish from other countries by Nigerian government.

Findings of the Hypotheses

The findings of the hypotheses revealed that:

1. There was significant difference among breeds of pigs in their mean birth weights, weaning weights and adult weights.
2. Duncan's test showed that Hampshire and Large White had equal and highest mean birth weights followed by Duroc Jersey, Land Race and the least was West African Dwarf Pigs. In terms of weaning weights and adult weights, Hampshire was the highest followed by Large White, Land Race, Duroc Jersey and West African Dwarf Pig was the lowest.
3. There was no significant difference in the mean ratings of rural and urban pig farmers on pig production technologies adopted by pig farmers in 56 items. The findings also showed that there was significant difference in the mean ratings of rural and urban pig farmers on pig production technologies adopted by pig farmers in 14 items.
4. There was no significant difference between the mean responses of rural and urban pig farmers on the productivity constraints of pig farms in 14 items. The findings also showed that there was significant difference between the mean responses of rural and urban pig farmers on the productivity constraints of pig farms in six items.
5. There was no significant difference between the mean ratings of the pig farmers and agricultural extension agents in their opinion on strategies for improving physical productivity of pig farms in 10 items. The findings also showed that there was significant difference between the mean scores of the pig farmers and agricultural extension agents in their opinion on strategies for improving physical productivity of pig farms in 10 items.
6. Pig farmers and agricultural extension agents did not differ in their respective opinions on strategies for improving profitability of pig farms in six items. The findings also

revealed that there was significant difference between the mean responses of pig farmers and livestock extension officers in their opinion on strategies for improving the profitability of pig farms in 14 items.

Discussion of the Findings

The findings of this study were organized and discussed in accordance with research questions and hypotheses.

Breeds of Pigs kept by Farmers

The breeds of pigs kept by farmers in Enugu State were Large White, Duroc Jersey, West African Dwarf Pigs, Land Race and Hampshire. The most predominant breed in the study area was found to be Large White with 67.5 percent followed by Land Race with 19.2 percent, Duroc Jersey 7.2 percent, Hampshire 3.8 percent and West African Dwarf Pigs with 2.3 percent. The findings of this study were in consonance with the findings of Adesehinwa, Aribido, Oyediji and Obiniyi (2002) that large white was the most common breed of pigs found in Lagos State.

Productive Characteristics of Pig Breeds kept by Farmers

Hampshire and Large White produced piglets approximately 3 litters per year while Land Race, Duroc Jersey and West African Dwarf Pigs produced approximately 2 litters per year. This is in line with the finding of Chabo, Malope and Babusi (2000) in which they found out that Large White produced 3 litters in a year while Duroc Jersey and Land Race produced 2 litters in a year.

The mean litter size at birth for Hampshire was found to be 13.21, Large White 11.98, Duroc Jersey 11.88, Land Race 8.88 and West African Dwarf Pigs 5.67. The percentage mortality for Large White was 13.48 percent, Duroc Jersey 24.84 percent, West African Dwarf Pigs 20.77 percent, Land Race 23.84 percent and Hampshire 5.29 percent. A contrary figure was reported by Chabo, Malope and Babusi (2000) in their study on the productivity of Duroc

Jersey and Land Race in South East Botswana. They found out that the mean litter size at birth for Duroc Jersey and Land Race were 10.2 and 11.4 respectively while mean% mortality were 36.4 and 33.4 respectively showing great differences between the two reports. The differences may be attributed to differences in the areas of the studies. This study was carried out in Enugu State of Nigeria but their own study was carried out in South-East Botswana with different climatic condition and pig management practices.

The mean weaning weights in this study ranged from 5.72kg ÷ 9.46kg as shown in Table 2. This is in agreement with the study carried out by Adesehinwa, Aribido, Oyediji and Obiniyi (2002) in which it was revealed that the weaning weights at six weeks for all the pig breeds studied were found to be within the range of 6kg ÷ 10kg for most farms. Weaning weight and average daily gain (weight gain per month) have been reported to be significantly influenced by litter size, maternal parity, sex and period of birth (Osinowo, 2000). Hampshire and Large White are known to be highly prolific but in terms of group performance according to pig farms in Enugu State, Large White had the highest number of live pigs produced per farm per year. Hampshire was found in the fourth position. This may be due to pig farmers' choice of breed and poor adaptation or acclimatization of Hampshire to the prevailing climatic condition in the state resulting to its rejection by most of the pig farmers as breed of choice for stock.

Large White was the most popular pig breed in Enugu State perhaps due to its outstanding high performance, mothering ability, docile temperament, white skin colour, lean meat, hardiness (resistance to diseases and parasites) and its acclimatization to both confinement and prevailing weather condition in Enugu State. West African Dwarf Pig was the least popular breed in Enugu State due to its poor production performance and profitability. This is in line with the findings of National Agricultural Extension and Research Liaison

Services (NAERLS) (2010) which showed that the use of indigenous, local, unimproved pig breeds as stock resulted in low production performance and profitability.

Pig Production Technologies Adopted by Farmers

- a. **Stocking Technologies:** The stocking technologies adopted by pig farmers as identified in this study included: Using improved productive pig breeds, introducing pigs to the piggeries in the morning or evening, cleaning the piggery with disinfectants before stocking, selecting breeding stock from the market, stocking dry sow at 3-4m² per dry sow, rearing pigs in separate pens based on age, size and condition, stocking boars at 9m² per boar, stocking farrowing sows at 6-10m² per sow, stocking weaners at 0.7-0.9m² per weaner and keeping porkers, baconers and heavy pigs at a spacing of 0.7-1.10m² per pig. This implied that pig farmers in Enugu State easily apply these stocking technologies in pig production. This finding is in agreement with the recommendations made by Holness (2007); John (2011); NAERLS (2010) and Serres (1999).
- b. **Housing Technologies:** The housing technologies adopted by farmers were: providing hard concrete slated floor, encouraging natural mating, providing wallows for pigs, constructing clay or cemented walls, roofing with aluminum, zinc, asbestos sheets or grasses, using intensive system of pig rearing, using semi-intensive system of pig rearing, culling of old and unproductive pigs, employing the services of veterinary officers to treat sick farm animals, sorting the piglets according to sex and weight, providing feeding troughs and drinkers, siting pig house at east-west direction and at right angle to the direction of prevailing wind to ensure proper ventilation, providing separate pens for pigs based on age, size and condition, supplying of water in piggery and disinfecting piggery between batches. All these 15 housing technologies adopted by farmers are in agreement with the recommendations made by Holness (2007); John (2011); NAERLS (2010) and Serres (1999). However, the pig farmers did not adopt the following housing technologies:

castrating male piglets, carrying out artificial insemination in the farm, using extensive system of pig keeping, nose ringing and teeth clipping or trimming. The reason why pig farmers did not adopt these technologies may be due to the fact that some of these technologies require basic skills and technical know-how in application and practice and farmers may not have such skills and knowledge. Another obvious reason may be that the pig farmers may not see the need and values for adopting these production technologies (Monica, 2003).

- c. **Feeding Technologies:** The feeding technologies adopted by farmers in Enugu State were compounding pig feeds on the farm, using creep feeds and phase feeding system, using wet feeds and flushing, providing clean drinking water with additives, feeding pigs according to age, size and condition, weighing pigs monthly to determine weight and weight gain, using ad libitum system of feeding, using controlled or restricted feeding system, feeding pigs with kitchen wastes and industrial by-products and feeding pigs with conventional commercial feeds. All these 10 feeding technologies were adopted by pig farmers showing their readiness to adopt new technologies in feeding their pigs. These adopted feeding technologies were in consonance with the findings and recommendations of Holness (2007); Monica (2003); NAERLS (2010); and Serres (1999).
- d. **Diseases and Parasites Control Technologies:** The diseases and parasites control technologies adopted by pig farmers in Enugu State were: dipping foot or boot in disinfectant before entering piggery, utilizing veterinary services, vaccinating piglets between 4 and 6 weeks to prevent diseases, using quarantine practice, isolating infected pigs, handpicking of ectoparasites, deworming pigs, spotting out and treating sick pigs on daily basis, cleaning of pig pens and farm premises daily and disposing pig manure on daily basis. All these 10 production technologies were adopted to help in producing healthy and clean pigs. In line with these findings, Oladele (2002) identified control of mange and

ectoparasites, improved feeding, vaccination and deworming as prominent pig production technologies adopted by pig farmers in Kwara State. In the same direction, Kelly (2005) identified vaccination, disinfection, dipping, boot-bathing, handpicking of ectoparasites and biosecurity awareness in the farm as pig production technologies. In agreement with these findings, Holness (2007), John (2011) and NAERLS (2010) also reported that pen cleaning, disposal of faeces and effluent, isolation, quarantine and provision of veterinary services are important diseases and parasites control technologies in pig farms.

- e. **Farm Record Keeping Technologies:** The farm record keeping technologies adopted by pig farmers in Enugu State were: making daily, weekly and monthly entries of service, farrowing and vaccination, keeping record of inventories, farm diary and labour summary, filling the herd performance form or sheet as at when due, keeping daily, weekly and monthly record of quantity and cost of feeds consumed in the farm, measuring the weight of pigs at various stages of growth, recording all farm sales daily, keeping record of all farm inputs and their costs, calculating over all profit or loss in pig farm on yearly basis and auditing the account of the farm. The adoption may be due to the fact that the pig farmers found them easy to apply and very useful in pig production. The application of these technologies are in line with the findings and recommendations of John (2011) and NAERLS (2010) on the need to use many of the above adopted farm record keeping technologies.
- f. **Marketing Technologies:** The marketing technologies adopted by pig farmers in Enugu State were: conducting market survey for prices of pigs and pig products, spraying pigs with cold water before loading in trucks to the market, transporting pigs to the market late in the evening or early hours of the day, selling direct to an abattoir or butchers on farm, bagging of pig manure for sale, selling pigs and pig products in the market and slaughter,

dressings the carcass and refrigeration of pork for sale. The findings of this study in the area of marketing technologies adopted by pig farmers are in support of the earlier identification of the above mentioned marketing technologies by Monica (2003), NAERLS (2010) and Serres (1999).

However, the pig farmers did not adopt the following marketing technologies: telemarketing and video merchandising of pigs and pig products, futures trading in pig business and forward contracting in swine enterprise. These technologies were not adopted by pig farmers may be due to highly sophisticated and computerized machines, gadgets, accessories and sources of power supply needed in their application and perhaps, the high level technical know-how involved. Non-application of these marketing technologies is contrary to the report by Burton (2004) who recommended that these three (3) marketing technologies must be adopted in every modern livestock business.

Physical Productivity of Pig Farms

The total mean number of piglets sold per farm per year was found to be 71.63 while the total mean number of adult pigs sold or slaughtered per farm per year was found to be 259.93. Both the number of piglets sold and adult pigs sold or slaughtered formed the major sources of pig farm revenue in every pig farm. This finding is similar to an earlier finding reported by Nwobodo (1997) on pig production and marketing in Enugu State. The total mean number of 50kg bags of manure produced per farm per year was 78.24 while 74.6 (50kg) bags of manure were sold per farm per year. The difference in the number of 50kg bags of manure produced and the number sold may be due to the quantity used by the farmers in their own crop farms and the quantity lost through wastage. However, manure also contributed to the farm revenue.

Profit Margins Realized by Pig Farms

The total mean profit margin for all the pig farms studied in Enugu State was ₦3,689,267.98 per farm per year. This showed that pig business in Enugu State was highly profitable. This finding is in line with the findings of Ezeibe (1998) and Nwobodo (1997) who earlier reported that swine business in Enugu State was viable and very profitable. It is now clear that the perceived exit of many pig farmers from pig production business in the state is not due to unprofitability of the business but due to other circumstances beyond the control of some pig farmers.

Productivity Constraints of Pig Farms

The productivity constraints of pig farms in Enugu State as found in this study were: limited land, unfavourable weather condition, poor housing, religious beliefs, inadequate livestock extension and farmer education services, ignorance of right feeding system, high cost of animal feeds, diseases and parasites attack, high capital investment required, poor farm management, poor agricultural research on pigs and pig production, high cost of veterinary drugs, scarcity of veterinary doctors and officers, shortage of competent farm labour, unskilled pig farmers, insufficient credit facilities and subsidies, low application of modern and innovative production technologies in pig farming, scarcity of water during dry season and poverty. These findings are in agreement with the findings of Anukwu and Ebong (2011) who lamented that inadequate capital, high cost of feeds, high cost of foundation stock, poor extension services, high cost of medication, disease outbreak, scarcity of skilled labour, high wages, low product demand, high cost of transportation and high percentage mortality were pig production constraints affecting pig farmers in Uyo, Akwa-Ibom State. Ajala and Adesehinwa (2008) also identified similar problems facing pig farmers in Zango-Kataf local government area of Kaduna State. These aforementioned constraints may have contributed in no small measure to the exit of many pig farms in Enugu State as reported earlier.

Strategies for Improving Physical Productivity of Pig Farms

The strategies for improving physical productivity of pig farms identified in this study included: using good management practices like caring for the pigs at all stages of growth, educating pig farmers to be proficient and skillful in pig production, use of improved, resistant breeds of pigs as stock, provision of adequate housing and ventilation, provision of sufficient facilities and equipment, adequate financing of pig production business, use of suitable pig production technologies, use of appropriate feeds and feeding system, effective disease and parasites control measures, frequent disposal of pig wastes (effluent and faeces), increasing biosecurity awareness in piggeries, protection of pigs from inclement weather condition, provision of adequate livestock extension services, good stockmanship, up-grading of local, indigenous breeds with improved exotic breeds of pigs, attending workshops, conferences, exhibitions and on-the-job training on pig production by pig farmers, carrying out relevant research studies on pigs and utilizing the results in pig production, employing the services of veterinary personnel by farmers and participating actively in Pig Farmers Association of Nigeria. Most of the above mentioned strategies identified in this study are in agreement with the earlier findings in the studies carried out by Dodson (1994), Jason (2005), Kelly (2005), Monica (2003) and Osaro (1995). Each of these strategies had been found to improve the production performance of pig farms.

The provision of environmental enrichments for pigs was disagreed by both the pig farmers and agricultural extension agents as a strategy for improving physical productivity of pig farms. This is contrary to the findings of Scott and Edward (2005) who identified environmental enrichment materials to be provided in part or fully slatted floor of the pig house in order to keep the pigs comfortable and avoid vice habits or cannibalism.

Strategies for Improving Profitability of Pig Farms

The strategies identified for improving profitability of pig farms in Enugu State were: increasing herd size or scale of operation, effective marketing strategies such as supplying pigs or pork to big companies and hotels, sound consumer education and public enlightenment campaign on increasing pork consumption, paying less for feeds and other inputs, use of cheap, nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers' spent grain, payment of less tax by farmers, obtaining loans at cheaper interest rates, weaning more pigs per sow per year, culling of old and unproductive pigs, sale of pigs and pork at appropriate time especially during important festivals, sale of pig wastes (manure), financial aids from government in form of incentives, subsidies and interest-free loans to pig farmers, effective supervision and monitoring of pig farms, rearing pigs under intensive system, sound livestock extension services and farmer education for pig farmers, efficient use of experienced labourers, selecting pig breeds that conform to the taste of consumers and banning the importation of meat and fish from other countries by Nigerian government. Both the pig farmers and agricultural extension agents agreed that all these strategies help to improve the profitability of pig farms in Enugu State. This is in support of earlier findings from the studies carried out by Emenyonu, Odii, Chilaka, Onyemauwa and Anaeto (2006); Gekara, Garner and Dunbar (2009) and Lewis (2007) that weaning more piglets per sow per year, improved management and feeding, sale of pig wastes, technical and financial aid from government will increase farm profit. However, the pig farmers and agricultural extension agents disagreed that keeping accurate farm records and accounts and recycling of pig wastes to produce biogas were strategies for improving profitability of pig farms in Enugu State. The respondents did not see any reason why keeping accurate farm records and accounts would improve the profitability of pig farms. This finding is contrary to an earlier report by Oguniyi and Omoteso (2011) in which they found that keeping of accurate farm records and accounts will go a long way in improving the profitability

of pig farms in Ibadan Zone of Oyo State of Nigeria. Although, keeping accurate farm records and accounts does not directly improve profit but will invariably guide the pig farmers on how to combine the factors of production and detect when the law of diminishing returns has set in during production. This helps in reducing wastage of some farm inputs especially the variable factors of production such as feeds. Recycling of pig wastes to produce biogas was disagreed by the respondents as a strategy for improving profitability of pig farms in Enugu State. This may be due to the fact that the study area is not highly industrialized coupled with the fact that Nigeria is not yet a developed nation like Brazil where Rogerio and Laura (2006) reported that pig farms in Brazil made a lot of money through recycling of pig wastes (manure) to produce biogas for both domestic and industrial uses.

Difference among Breeds of Pigs in Mean Birth Weights, Weaning Weights and Adult Weights

There was significant difference among breeds of pigs in birth weights, weaning weights and adult weights. This implied that the type of pig breed influences mean birth weights, weaning weights and adult weights. This is in contrast with the findings of Chabo, Malope and Babusi (2000) in their study in which they found out that there was no significant difference between Land Race and Duroc Jersey in their mean birth weights. In line with the findings of this study, they also reported that Land Race and Duroc Jersey differed in their weaning weights and adult weights. The contrast in the two findings may be attributed to differences in the study areas, type of feeds and method of feeding and other management practices used in the farm.

Effect of Location of Pig Farmers on Adoption of Pig Production Technologies

There was no significant difference between the mean ratings of the urban and rural pig farmers on the pig production technologies adopted by pig farmers on 56 items. The two groups differed on 14 items. This showed that location of pig farmers had no influence on their

opinions on 56 items while it influenced their opinions on 14 items. This finding is in agreement with the finding of Monica (2003) which revealed that the rate of adoption of pig production technologies in both urban and rural areas by pig farmers are the same provided all negative externalities are removed through extension information.

Effect of Location of Pig Farmers on the Productivity Constraints of Pig Farms

There was no significant difference between the mean ratings of urban and rural pig farmers on the productivity constraints of pig farms on 14 items. There was significant difference between the two groups of respondents group of items 81, 87, 91 and 94-96. This revealed that the location of farms did not influence the opinion of the two groups of respondents on 14 items while it had influence on six items. The finding is contrary to the report of Okpala (2008) who lamented that rural farmers predominate the farming population but their participation in agriculture activities are mostly at the subsistence level with little or no access to modern inputs since the availability of productivity inputs and services are concentrated in the urban centres. The situation is not the same in Enugu State perhaps due to equitable dissemination and distribution of agricultural information and inputs coupled with enabling environment for pig production in the rural areas of the state.

Relationship between the Responses of Pig Farmers and Agricultural Extension Agents on the Strategies for Improving Physical Productivity of Pig Farms

There was no significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving the physical productivity of pig farms on items 101-103, 105, 107, 109-11, 113 and 120. This finding agreed with the report of Akinyemi, Ojo and Akintomide (2007) that the opinion of both farmers and extension agents are always the same in respect of production intervention strategies. There was significant difference between the two groups on items 104, 106, 108, 112 and 114-119.

Relationship between the Responses of Pig Farmers and Agricultural Extension Agents on the Strategies for Improving Profitability

There was no significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving profitability of pig farms on items 125, 126, 128, 130, 131, 133 and 136. This showed that both respondents accepted these strategies as having the ability to improve profitability of pig farms. This is in agreement with the report of Akinyemi, Ojo and Akintomide (2007) that the productivity enhancement measures as perceived by farmers were also considered as same solutions to the production set backs by agricultural extension agents. The two groups of respondents were capable of mapping out strategies for improvement of both physical productivity and profitability of pig farms. On the other hand, the extension agents by virtue of their training can have more farming experience than the farmers and this can bring about disagreement in their opinions. There was significant difference between the two groups on items 121-124, 127, 129, 132, 134, 135 and 137-140. The pig farmers and agricultural extension agents had the same view in seven items while they had different opinions in 13 items.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Re-statement of the Problem

There is enormous shortage of dietary animal protein in the country. The daily animal protein consumption is declining due to high poverty rate, rapid population growth and the ban on importation of foreign meat since the year 2001. The recommended quantity of protein to be consumed by Nigerians has not been attained. In order to narrow the animal protein deficit gap among Nigerian consumers, there is great need to increase domestic production of animals such as pigs. Despite the fact that pig production in Nigeria is one of the UNDP assisted livestock programmes to beef up animal protein supply, pig production is still lagging behind other classes of livestock such as cattle, goats, sheep and poultry. Thus there was a need to analyse production performance of pig farms, to seek ways of improvement. In order to encourage animal protein production, Enugu State Government in her 2009 centenary celebration articulated policy initiatives on livestock production which provided that farmers should concentrate on pig and poultry husbandry (Enugu State Government, 2009).

In contrary, most livestock farmers, investors and Fadama III beneficiaries in the state prefer poultry production to pig production resulting to low production and supply of pork. Moreover, many livestock farmers and investors are not willing to enter into swine production business and many who entered into the business easily close down. The reasons for the failure of the business have not been ascertained. There was therefore the need to examine the existing pig farms in terms of physical productivity, costs and returns so as to determine their current status.

Summary of the Procedures Used

Eight research questions were developed and answered in accordance with the specific objectives of the study. Five null hypotheses were formulated and tested at 0.05 level of

significance. Survey research design was used for this study. A structured questionnaire was developed for both pig farmers and agricultural extension agents. The questionnaire for pig farmers was accompanied with pig performance recording sheets.

The population for the study was 519, comprising of 162 registered rural pig farmers, 135 registered urban pig farmers and 222 agricultural extension agents. The questionnaire for pig farmers was administered on 297 respondents out of which 265 copies were returned. The part of the questionnaire for agricultural extension agents was administered on 222 respondents out of which 200 copies were returned. There was no sample and sampling for this study as the entire population for the study was used. The questionnaire was face validated by three experts and the internal consistency of the instrument determined by Cronbach Alpha Reliability Method and Pearson's product moment correlation coefficient.

The pig performance record sheets were sent to pig farmers in advance for eliciting information on productivity and profitability of pig farms. The researcher and the assistants visited the pig farms every six months for data collection, on physical productivity of pig farms, production costs (inputs), output, and revenue for a period of two years starting from 1st January 2011 to 31st December, 2012.

Percentages and frequency counts and mean were used to answer the research questions in this study while ANOVA, Duncan's test and t-test statistic were used to test hypotheses at 0.05 level of significance.

The real limit of the rating statement was used in taking decision on mean values in this study. The null hypothesis of no significant difference was accepted for any item whose p-value was greater than 0.05 level of significance ($P > 0.05$) but rejected for any items whose P-value was less than 0.05 level of significance ($P < 0.05$).

Major Findings of the Study

Based on the specific purpose of the study, the following principal findings were presented:

1. The breeds of pigs kept by farmers in Enugu State were found to be Large White (67.5 percent), Duroc Jersey (7.2 percent), West African Dwarf Pigs (2.3 percent), Land Race (19.2 percent) and Hampshire (3.8 percent).
2. The pig breeds kept by farmers were productive, with mean number of litters/sow/year of 2.42, mean litter size at birth of 10.32 and mean number of piglets born alive/sow/year of 22.50.
3. The most important pig production technologies adopted by pig farmers were; the use of improved and productive pig breeds, encouragement of natural mating, using intensive system of pig rearing, compounding pig feeds on the farm, provision of clean drinking water with additives, feeding with kitchen wastes and industrial by-products, deworming pigs, using quarantine practice, cleaning of pig pens and farm premises daily, keeping record of all farm inputs (costs) and outputs (revenue), keeping daily, weekly and monthly record of quantity and cost of feeds consumed in the farm, calculating overall profit or loss in pig farm on yearly basis, selling direct to an abattoir or butchers on farm, and conducting market survey for prices of pigs and pig products.
4. The study revealed high physical productivity of pig farms, with mean number of live pigs produced/farm/year of 276.1 and mean number of 50kg bags of manure produced/farm/year was 78.24.
5. Pig production business was highly profitable in Enugu State with mean profit margin/farm/year of ₦3, 689, 267.98.
6. The major productivity constraints of pig farms were diseases and parasites attack, high cost of animal feeds, high cost of veterinary drugs, insufficient credit facilities and subsidies, and poor farm management.

7. The study revealed that the major strategies for improving physical productivity of pig farms included: effective diseases and parasites control measures, use of suitable pig production technologies, use of appropriate feeds and feeding system, good stockmanship, and attending workshops, conferences, exhibitions and on-the-job training on pig production by pig farmers.
8. The major strategies for improving profitability of pig farms included: rearing pigs under intensive system, use of cheap, nutritious local feeds, selecting breeds that conform to the taste of the consumers, sale of pigs and pork at appropriate time especially during important festivals and increasing herd size or scale of operation.
9. There was significant difference among breeds of pigs in birth weights, weaning weights and adult weights in the study area.
10. There was no significant difference between the mean ratings of the urban and rural pig farmers on the pig production technologies adopted by pig farmers in most of the items presented to the pig farmers in the study area.
11. There was no significant difference between the mean ratings of urban and rural pig farmers on the productivity constraints of pig farms in most of the items presented to pig farmers in Enugu State.
12. There was no significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving the physical productivity of pig farms in 10 items while the two groups differed in 10 items out of 20 items presented to the respondents in the study area.
13. There was significant difference between the mean ratings of pig farmers and agricultural extension agents on the strategies for improving profitability of pig farms in most of the items presented to both groups in Enugu State.

Conclusions

Eight conclusions were drawn based on the findings of the study as follows:

- 1 The breeds of pig kept by farmers in Enugu State were mainly improved, exotic breeds with only one indigenous breed
- 2 The pig breeds kept by farmers in the study area were very productive.
- 3 Many pig production technologies including stocking, housing, feeding, diseases and parasites control, farm record keeping and marketing technologies were adopted by farmers in pig production in Enugu State except castrating male piglets, carrying out artificial insemination in the farm, nose ringing, teeth clipping or trimming, telemarketing or video merchandising of pigs and pig products and futures trading in pig business.
- 4 The pig farms in the state recorded high physical productivity hence the physical products such as piglets, adult pigs and 50kg bags of manure obtained from pig farms in Enugu State were encouraging.
- 5 Pig production business in Enugu State was highly profitable.
- 6 Many pig production constraints of pig farms were identified in Enugu State and these constraints must have contributed to the low productivity, failure and closure of some pig farms in the state.
- 7 Physical productivity of pig farms in the state could be improved through effective diseases and parasites control measures, provision of sufficient facilities and equipment, good stockmanship, adequate financing of pig production business, attending workshops, conferences, exhibitions and on-the-job training on pig production by pig farmers, employing the services of veterinary personnels by farmers, participating actively in Pig Farmers Association of Nigeria, use of suitable pig production technologies, using good management practices like caring for pigs at all stages of growth and use of appropriate feeds and feeding system.

- 8 Profitability of pig farms could be improved by rearing pigs under intensive system, selecting breeds that conform to the taste of consumers, banning the importation of meat and fish from other countries by Nigerian government, sale of pigs and pork at appropriate time especially during important festivals, sale of pig wastes (manure), use of cheap, nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers' spent grain, increasing herd size or scale of operation, culling of old and unproductive pigs, financial aids from government in form of incentives, subsidies and interest-free loans to pig farmers and efficient use of experienced labourers.

Implications for the Study

The findings of this study have obvious socio-economic implications for food supply/sustainability, poverty alleviation and farmer education.

Implications for Food Supply/Sustainability

The findings of the study indicated some productive breeds of pigs reared, strategies employed in improving the physical productivity and profitability of pig farms. The findings of the study also indicated that some pig production technologies were adopted by pig farms and all these might have contributed to improved pig production in the study area.

The result of successes in physical productivity and profitability of pig farms indicates that investment in pig production has the potential for increasing animal protein food supply, farmers' income and standard of living. Policy provisions for motivating investors' interest in pig production will pay all stakeholders including the government in the area of pork production, supply, consumption and sustainability.

Implications for Poverty Alleviation

The improvement in physical productivity and profitability of pig farms will go a long way in alleviating poverty among the inhabitants of the state and country in general. The study identified productivity constraints of pig farms which shows that the farmers have not yet

attained maximum output. This finding has serious implications for the current poverty alleviation programmes of various governments. The federal and state governments have introduced many programmes geared towards alleviating poverty in the country through provision of interest-free loans, grants, subsidies, credits and on-the-job skill acquisition training to both small-scale, medium scale and large-scale farmers. The implementation of various strategies for improving physical productivity and profitability and the reduction of pig production constraints to the barest minimum will go a long way in supplying more food thereby reducing poverty. The findings of this study when properly disseminated to the stakeholders in pig production through workshops, seminars and conferences, will help to beef up pig production, pork supply and consumption in the state.

Implications for Farmer Education

The findings on the pig production technologies applied by farmers revealed that some important pig production technologies such as castration, artificial insemination, nose ringing, teeth clipping or trimming, telemarketing or video merchandising, futures trading and forward contracting in swine enterprise have not been adopted by farmers. The non-adoption of these pig production technologies have far-reaching implications for farmer education. This causes a hindrance to optimum pig production which calls for effective farmer education service delivery. Farmer education provides basic knowledge and vocational skills to both adult and prospective farmers to enable them become skillful and proficient in agriculture field such as pig production. Farmer education for pig farmers is better achieved through agricultural extension teaching methods such as individual or personal contact method, group contact method and mass media. Pig farmers receive on-the-job training on how to improve pig production under the auspices of agricultural extension agents. This will help the farmers to understand how to adopt those technologies previously rejected. The utilization of strategies for improving physical productivity and profitability of pig farms and the application of these

production technologies previously not adopted will enhance productivity and profitability.

Consequently, farmers will embark on aggressive increase in herd size and large scale pig production resulting to improved production performance in the study area.

Recommendations

The researcher made the following recommendations based on the findings of the study.

1. Pig farmers should always endeavour to keep improved, exotic pig breeds such as Large White in their various farms due to their high production performance and avoid keeping traditional indigenous, unimproved, less productive breeds of pigs such as West African Dwarf Pigs in their farms as they have low production performance.
2. The pig breeds with high productive characteristics should be selected as stock by pig farmers as these breeds are prolific and produce more piglets born alive, litter size at birth and mean number of litters/sow/year.
3. Government should provide specialist training programmes for pig farmers and agricultural extension agents on pig production technologies such as castration, artificial insemination, nose ringing and teeth clipping or trimming to enable them become proficient in these techniques and be able to train the pig farmers and prospective investors.
4. Governments at all levels should establish pig farms as well as assist the existing pig farms in order to improve the physical productivity of pig farms thereby narrowing the animal protein deficit gap in Enugu State
5. The beneficiaries of National Directorate of Employment (NDE), pig farmers, new investors, Fadama III beneficiaries and agricultural loan beneficiaries should be encouraged and motivated by the government and non-governmental organisations to increase investment in pig production because the business is highly profitable in the state.

6. All stakeholders in pig production, the government and non-governmental organizations should join hands in reducing the productivity constraints of pig farms to the barest minimum by providing human and material resources to pig farmers in order to improve physical productivity and profitability of pig farms.
7. The ministry of agriculture, agricultural extension agents and subject matter specialists in livestock production should organize workshops, seminars and conferences for pig farmers on strategies for improving physical productivity of pig farms to enhance physical productivity of pig farms.
8. Government and non-governmental organizations should assist pig farmers through financial aids, provision of equipment, technical support and organizing workshops, seminars, and conferences on strategies for improving the profitability of pig farms to boost pig production and increase farmers' income in the state.

Suggestions for Further Studies

The following suggestions are made for further studies:

1. Strategies for improving the work skills of pig farmers in Enugu State.
2. Analysis of pig marketing in South-East Geo-political Zone of Nigeria.
3. The effects of socio-economic characteristics of pig farmers on pig production in Enugu State.
4. Evaluation of level of adoption of modern pig production technologies across urban and rural pig farmers in Enugu State.

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APPENDIX A

Department of Vocational Teacher Education,
(Agricultural Education Section),
University of Nigeria,
Nsukka.
Date:-----

Dear Sir/Madam,

REQUEST FOR VALIDATION OF RESEARCH INSTRUMENT

I am a Postgraduate student in the Department of Vocational Teacher Education (Agricultural Education Section), University of Nigeria, Nsukka. I am conducting a study on ANALYSIS OF PRODUCTION PERFORMANCE AND PROFITABILITY OF PIG FARMS IN ENUGU STATE.

Please, I would like you to kindly validate the attached instrument for data collection, for its suitability and relevance in terms of its content, statements and rating scales. I further request that you write down your suggestions, modifications and corrections in the blank spaces provided.

Thanks and God bless you.

Yours faithfully,

**Onah Frederick Chinedu,
PG/Ph.D/07/42712.**

APPENDIX B

Department of Vocational Teacher Education,
(Agricultural Education Section),
University of Nigeria,
Nsukka.
Date:-----

To Whom It May Concern

REQUEST FOR ASSISTANCE

I am a postgraduate student of Agricultural Education in the Department of Vocational Teacher Education, University of Nigeria, Nsukka. I am conducting a study on ANALYSIS OF PRODUCTION PERFORMANCE AND PROFITABILITY OF PIG FARMS IN ENUGU STATE.

Please, complete the attached questionnaire honestly, independently and without fear because the information sought from you is strictly for research purpose and will be treated confidentially.

Thanks for your anticipated co-operation.

Yours faithfully,

**Onah Frederick Chinedu,
(Researcher).**

APPENDIX C

QUESTIONNAIRE FOR REGISTERED PIG FARMERS

Part One

Background Information

Instruction: please, fill in the blank spaces provided and in some cases check (✓) in the spaces provided against the statement below as it applies to you.

1. Name of farm é é é é é é é é é é é .
2. Herd size é é é é é é é é é é é é ..
3. Location of farm é é é é é é é é é é . (Urban, Rural)
4. Local Government Area é é é é é é .
5. Senatorial zone é é é é é é é é é é ...
 - (a) Enugu North ()
 - (b) Enugu East ()
 - (c) Enugu West ()
6. Gender of operator é é é é é é é é
 - (a) Male ()
 - (b) Female ()
7. Main occupation é é é é é é é é é ..
8. Age of farmer é é é é é é é é é é
 - (a) 40 years and below ()
 - (b) 41-60 years ()
 - (c) 61 years and above ()
9. Marital status é é é é é é é é é ..
10. Educational level:
 - (a) No formal education ()
 - (b) Primary education ()
 - (c) Post primary education ()
 - (d) Polytechnic education ()
 - (e) College of education ()
 - (f) University education ()
11. Pig farming experience
 - (a) 1-5 years ()

(b) 6 to 10 years ()

(c) 11 to 15 years ()

(d) 16 years and above ()

12. Sources of capital for pig business:

(a) Commercial bank ()

(b) Government ()

(c) Personal savings ()

(d) Co-operative society ()

(e) Money lenders ()

(f) Non-governmental organization ()

Part two

Section I: Breeds of pigs kept by farmers in Enugu State

Instruction: Please check (✓) against the type of pig breed kept in your farm under "Yes" and check (✓) against the type of pig breed not kept in your farm under "No".

S/N	THE BREEDS OF PIGS KEPT IN YOUR FARM	YES	NO
1	Large White		
2	Duroc Jersey		
3	West African Dwarf pig		
4	Land Race		
5	Large Black		
6	Berkshire		
7	British Saddle Back		
8	Bakosi		
9	Pietrain		
10	Hampshire		

Section III: The determination of pig production technologies adopted by pig farmers

Instruction: Please check (ã) against the scale that best describes your opinion. The scale points are as follows:

Adoption (AD) 5points

Trial (T) 4 points

Evaluation (E) 3 points

Interest (I) 2 points

Awareness (A) 1 point

S/N	The Pig Production Technologies are:	AD	T	E	I	AW
	(A) Stocking Technologies:	5	4	3	2	1
11	Using improved, productive pig breeds					
12	Introducing pigs to the piggeries in the morning or evening.					
13	Cleaning the piggery with disinfectants before stocking					
14	Selecting breeding stock from the market					
15	Stocking dry sow at 3-4m ² per dry sow					
16	Rearing pigs in separate pens based on age, size and condition					
17	Stocking boars at 9m ² per boar					
18	Stocking farrowing sows at 6-10m ² per sow					
19	Stocking weaners at 0.7-0.9m ² per weaner					
20	Keeping porkers, baconers and heavy pigs at a spacing of 0.7-1.10m ² per pig.					
	(B) Housing Technologies:					
21	Providing hard concrete slated floor					
22	Encouraging natural mating					
23	Providing wallows for pigs					
24	Constructing, clay or cemented walls					
25	Roofing with aluminium, zinc, asbesto sheets or grasses					
26	Castrating male piglets					
27	Carrying out artificial insemination in the farm					
28	Using of intensive system of pig rearing					
29	Using semi-intensive system of pig rearing					
30	Using extensive system of pig keeping					
31	Culling of old and unproductive pigs					
32	Employing the services of veterinary officers to treat sick pigs					

33	Sorting the piglets according to sex and weight					
34	Nose ringing					
35	Teeth clipping or trimming					
36	Providing feeding troughs and drinkers					
37	Siting pig house at east-west direction and at right angle to the direction of prevailing wind to ensure adequate ventilation					
38	Providing separate pens for pigs based on age, size and condition					
39	Supplying of water in piggery.					
40	Disinfecting piggery between batches.					
	(C) Feeding Technologies					
41	Compounding pig feeds on the farm					
42	Using creep feeds and phase feeding system					
43	Using wet feeds and flushing					
44	Providing clean drinking water with additives					
45	Feeding pigs according to age, size and condition					
46	Weighing pigs monthly to determine weight and weight gain					
47	Using of ad libitum system of feeding					
48	Using of controlled or restricted feeding system					
49	Feeding pigs with kitchen wastes and industrial by-products.					
50	Feeding pigs with conventional, commercial feeds					
	(D) Diseases and Parasites Control Technologies					
51	Dipping foot or boot in disinfectant before entering piggery					
52	Utilizing veterinary services					
53	Vaccinating piglets between 4 and 6 weeks to prevent diseases					
54	Using quarantine practice					
55	Isolating infected pigs.					
56	Handpicking of ectoparasites					
57	Deworming pigs.					
58	Spotting out and treating sick pigs on daily basis					
59	Cleaning of pig pens and farm premises daily					
60	Disposing pig manure on daily basis					
	(E) Farm Record Keeping Technologies					
61	Making daily weekly and monthly entries of service, farrowing and vaccination					
62	Keeping record of inventories, farm diary and labour summary					

63	Filling the herd performance form or sheet as at when due					
64	Keeping daily, weekly and monthly record of quantity and cost of feeds consumed in the farm					
65	Measuring the weight of pigs at various stages of growth					
66	Recording all farm sales daily					
67	Keeping record of all farm output like live pigs produced					
68	Keeping record of all farm inputs and their costs					
69	Calculating overall profit or loss in pig farm on yearly basis					
70	Auditing the account of the farm					
	(F) Marketing Technologies					
71	Conducting market survey for prices of pigs and pig products					
72	Spraying pigs with cold water before loading in trucks to the market					
73	Transporting pigs to the market late in the evening or early hours of the day					
74	Selling direct to an abattoir or butchers on farm					
75	Bagging of pig manure for sale					
76	Telemarketing or video merchandising of pigs and pig products					
77	Futures trading in pig business					
78	Selling pigs and pig products in the market					
79	forward contracting in swine enterprise					
80	Slaughter, dressing the carcass and refrigeration of pork for sale					

Section VI: Productivity constraints of pig farms.

Instruction: Please check (✓) against the option that best describes your opinion. The scale points are as follows:

Very Serious Problem (VSP) 5 points

Serious Problem (SP) 4 points

Moderate Problem (MP) 3 points

Little Problem (LP) 2 points

Not A Problem (NAP) 1 point.

S/N	The Productivity Constraints of Pig Farms include:	VSP 5	SP 4	MP 3	LP 2	NAP 1
81	Limited land					
82	Unfavourable weather condition					
83	Poor housing					
84	Religious beliefs					
85	Inadequate livestock extension and farmer education services					
86	Ignorance of right feeding system					
87	High cost of animal feeds					
88	Diseases and parasites infestation					
89	Huge capital investment required					
90	poor farm management					
91	Poor agricultural research on pigs and pig production					
92	High cost of veterinary drugs					
93	Scarcity of veterinary doctors and officers					
94	Using of local, unimproved breeds as stock					
95	Shortage of competent farm labour					
96	unskilled pig farmers					
97	Insufficient credit facilities and subsidies					
98	Low application of modern and innovative production technologies in pig farming					
99	Scarcity of water during dry season					
100	Poverty					

Section VII: Strategies for improving physical productivity of pig farms.

Instruction: Please check (✓) against the option that best describes your opinion. The scale points are as follows:

Strongly Agree (SA) ï 5 points

Agree (A) ï 4 point

Undecided (UD) ï 3 ponts

Disagree (D) ï 2 point

Strongly Disagree (SD) ï 1 point

S/N	Strategies for Improving Physical Productivity of Pig Farm include:	SA 5	A 4	UD 3	D 2	SD 1
101	Using good management practices like caring for the pigs at all stages of growth					
102	Educating pig farmers to be proficient and skillful in pig production					
103	Use of improved, resistant breeds of pigs as stock					
104	provision of adequate housing and ventilation					
105	Provision of sufficient facilities and equipment					
106	Adequate financing of pig production business					
107	Use of suitable pig production technologies					
108	Use of appropriate feeds and feeding systems					
109	Effective disease and parasite control measures					
110	Frequent disposal of pig wastes (effluent and faeces)					
111	Increasing bio security awareness in piggeries					
112	Provision of environmental enrichments for pigs					
113	Protection of pigs from inclement weather condition					
114	Provision of adequate livestock extension services					
115	Good stockmanship					

116	Upgrading of local, indigenous breeds with improved, exotic breeds of pigs					
117	Attending workshops, conferences, exhibitions and on-the-job training on pig production by pig farmers					
118	Carrying out relevant research studies on pigs and utilizing the results in pig production					
119	Employing the services of veterinary personnel by farmers					
120	Participating actively in Pig Farmers's Association of Nigeria					

Section VIII: Strategies for improving the profitability of pig farms

Instruction: Please check (✓) against the scale that best describes your opinion. The scale points are as follows:

Strongly Agree (SA) 5 points

Agree (A) 4 points

Undecided (UD) 3 points

Disagree (D) 2 points

Strongly Disagree (SD) 1 point

S/N	Strategies for improving the profitability of pig farms include	SA 5	A 4	UD 3	D 2	SD 1
121	Increasing herd size or scale of operation by more investment					
122	Effective marketing strategies such as supplying pigs or pork to big companies and hotels					
123	Sound consumer education and public enlightenment campaign on increasing pork consumption					
124	Paying less for feeds and other farm inputs					
125	Use of cheap nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers spent grain					
126	Payment of less tax by farmers					
127	Obtaining loans at cheaper interest rates					

128	Weaning more pigs per sow per year					
129	Keeping accurate farm records and accounts					
130	Culling of old and unproductive pigs					
131	Sale of pigs and pork at appropriate time especially during important festivals					
132	Sale of pig wastes (manure)					
133	Recycling of pig wastes to produce biogas					
134	Financial aids from government in form of incentives, subsidies and interest-free loans to pig farmers					
135	Effective supervision and monitoring of pig farms by farm managers					
136	Rearing pigs under intensive system					
137	Sound livestock extension services and farmer education for pig farmers					
138	Efficient use of experienced labourers					
139	Selecting breeds that conform to the taste of consumers					
140	Banning the importation of meat and fish from other countries by Nigerian government					

Section II: Data on productive characteristics of pig breeds kept by farmers.

Instruction: Fill in the preliminary information and against each productive characteristics or traits listed below, there are blank columns provided. You are requested to fill in the respective quantities of these traits or productive characteristics produced by the type of breed you keep on monthly basis for two consecutive years.

APPENDIX D

PIG PERFORMANCE RECORDING SHEETS FOR PIG FARMERS

(a) Type of Breed Reared..... (b) No. of Boars.....
(c) No. of Sows..... (d) Herd size.....

[illegible]

[illegible]

MONTHLY COSTS PER INPUT (₦)

[illegible]

OUTPUT/PRODUCTS: QUANTITY OF PIGLETS, ADULT PIGS, PORK, BAGS OF MANURE PRODUCED/SOLD AND REVENUE OBTAINED PER MONTH.

[illegible]

Recording sheet for pig farmers																											
Herd Performance Form																											
(a) Location of Farm.....												(b) Type of Breed Reared: -.....												(c) Herd size.....			
(d) No of sows.....												(e) No of Boars.....															
TRAITS	YR 1												Total	YR 2												Total	Average
	J	F	M	A	M	J	J	A	S	O	N	D		J	F	M	A	M	J	J	A	S	O	N	D		
No of litters																											
Liter size at birth																											
No of piglets born alive																											
No of piglets born dead																											
% mortality																											
Birth weight (Kg)																											
Weight gain/month (Kg)																											
Weaning weight (Kg)																											
Adult weights (Kg)																											
No of adult pigs produced																											
No of piglets sold																											
Revenue (₦)																											
No of adult pigs sold																											
Revenue (₦)																											
No of bags of manure produced																											
No of bags manure sold																											
Revenue (₦)																											

Source: NAERLS, ABU, Zaria, 2010.

APPENDIX E

QUESTIONNAIRE FOR AGRICULTURAL EXTENSION AGENTS

Part One

Background Information

Instruction: Please, fill in the blank spaces provided and in some cases check (ã) in the spaces provided against the statement below as it applies to you.

1. Local Government Area:-----
2. Location of Duty Station:-----
 - (a) Headquarters ()
 - (b) Enugu North ()
 - (c) Enugu East ()
 - (d) Enugu West ()
3. Highest Educational Qualification:-----
4. Area of Specialization:-----
5. Working Experience:-----
 - (a) 1 ï 5 years
 - (b) 6 ï 10 years
 - (c) 11 ï 15 years
 - (d) 16 years and above

Part two

Section VII: Strategies for improving physical productivity of pig farms.

Instruction: Please check (√) against the option that best describes your opinion. The scale points are as follows:

Strongly Agree	(SA)	ï	5 points
Agree	(A)	ï	4 points
Undecided	(UD)	ï	3 points
Disagree	(D)	ï	2 point
Strongly Disagree	(SD)	ï	1 point

S/N	Strategies for improving physical productivity of pig farms include:	SA 5	A 4	UD 3	D 2	SD 1
101	Using good management practices like caring for the pigs at all stages of growth					
102	Educating pig farmers to be proficient and skillful in pig production					
103	Use of improved, resistant breeds of pigs as stock					
104	Provision of adequate housing and ventilation					
105	Provision of sufficient facilities and equipment					
106	Adequate financing of pig production business					
107	Use of suitable pig production technologies					
108	Use of appropriate feeds and feeding systems					
109	Effective diseases and parasites control measures					
110	Frequent disposal of pig wastes (effluent and faeces)					
111	Increasing bio security awareness in piggeries					
112	Provision of environmental enrichments for pigs					
113	Protection of pigs from inclement weather condition					
114	Provision of adequate livestock extension services					
115	Good stockmanship					
116	Upgrading of local, indigenous breeds with improved, exotic breeds of pigs					
117	Attending workshops, conferences, exhibitions and on-the-job training on pig production by pig farmers					
118	Carrying out relevant research studies on pigs and utilizing the results in pig production					
119	Employing the services of veterinary personnel by farmers					
120	Participating actively in Pig Farmers Association of Nigeria.					

Section VIII: Strategies for improving the profitability of pig farms

Instruction: Please check (✓) against the option that best describes your opinion. The scale points are as follows:

Strongly Agree (SA) 5 points

Agree (A) 4 points

Undecided (UD) 3 points

Disagree (D) 2 points

Strongly Disagree (SD) 1 point

S/N	Strategies for improving the profitability of pig farms include	SA 5	A 4	UD 3	D 2	SD 1
121	Increasing herd size or scale of operation					
122	Effective marketing strategies such as supplying pigs or pork to big companies and hotels					
123	Sound consumer education and public enlightenment campaign on increasing pork consumption					
124	Paying less for feeds and other farm inputs					
125	Use of cheap nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewer's spent grain					
126	Payment of less tax by farmers					
127	Obtaining loans at cheaper interest rates					
128	Weaning more pigs per sow per year					
129	Keeping accurate farm records and accounts					
130	Culling of old and unproductive pigs					
131	Sale of pigs and pork at appropriate time especially during important festivals					
132	Sale of pig wastes (manure)					
133	Recycling of pig wastes to produce biogas					
134	Financial aids from government, in form of incentives, subsidies and interest-free loans to pig farmers					
135	Effective supervision and monitoring of pig farms					
136	Rearing pigs under intensive system					
137	Sound livestock extension services and farmer education for pig farmers					
138	Efficient use of experienced labourers					
139	Pig breeds that conform to the taste of consumers					
140	Banning the importation of meat and fish from other countries by Nigerian government					

APPENDIX F

DISTRIBUTION OF REGISTERED PIG FARMERS AND

AGRICULTURAL EXTENSION AGENTS IN ENUGU STATE

S/N	Senatorial Zone	Pig Farmers			Agricultural Extension Agents		
		Population	No Used	No Returned	Population	No Used	No Returned
1	Enugu North	120	120	106	62	62	57
2	Enugu East	74	74	69	98	98	88
3	Enugu West	103	103	90	62	62	55
	Total	297	297	265	222	222	200

Source: ENADEP, Enugu, 1994; PFAN, Enugu State Chapter, 2009.

APPENDIX G

FREDRICK ONAH'S DATA

Computation of Reliability Coefficients

Section I: Breeds of pigs kept by farmers

Section II: Productive characteristics of pig breeds kept by farmers

Section III A: Stocking technologies adopted by farmers

Section III B: Housing technologies adopted by farmers

Section III D: Diseases and parasites control technologies adopted by farmers

Section III E: Farm record keeping technologies adopted by farmers

Section III F: Marketing technologies adopted by farmers

Section IV: Physical productivity of pig farms

Section V: Profit margins realized by pig farms

Section VI: The productivity constraints of pig farms

Section VII: Strategies for improving physical productivity of pig farms

Section VIII: Strategies for improving the profitability of pig farms

Reliability of the Instrument for Data Collection

Reliability for Section I

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded ^a	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.529	10

Item Statistics

	Mean	Std. Deviation	N
item1	1.0000	.00000	20
item2	1.0500	.22361	20
item3	1.7000	.47016	20
item4	1.0000	.00000	20
item5	1.9500	.22361	20
item6	2.0000	.00000	20
item7	2.0000	.00000	20
item8	2.0000	.00000	20
item9	2.0000	.00000	20
item10	1.5000	.51299	20

Correlations for Section II**Correlations**

		Pretest	Posttest
Pretest	Pearson Correlation	1	.75438
	Sig. (2-tailed)		.0276
	N	20	20
Posttest	Pearson Correlation	.75438	1
	Sig. (2-tailed)	.0276	
	N	20	20

Reliability for Section IIIA**Reliability Statistics**

Cronbach's Alpha	N of Items
.933	10

Item Statistics

	Mean	Std. Deviation	N
item11	1.0000	.00000	20
item12	5.0500	.22361	20
item13	5.2000	.41039	20
item14	5.1000	.30779	20
item15	5.4000	.50262	20
item16	5.1000	.30779	20
item17	5.1000	.30779	20
item18	5.1000	.30779	20
item19	5.1500	.36635	20
item20	5.1500	.36635	20

Reliability for Section IIIB

Reliability Statistics

Cronbach's Alpha	N of Items
.908	20

Item Statistics

	Mean	Std. Deviation	N
item21	5.1000	.30779	20
item22	5.0000	.00000	20
item23	5.0500	.22361	20
item24	5.0500	.22361	20
item25	5.0500	.22361	20
item26	5.0500	.22361	20
item27	4.6500	1.08942	20
item28	5.0500	1.05006	20
item29	5.1000	.30779	20
item30	5.1000	.30779	20
item31	5.1500	.36635	20
item32	5.1000	.30779	20
item33	5.3000	.47016	20
item34	5.1500	.36635	20
item35	4.1500	1.42441	20
item36	4.1000	1.51831	20
item37	5.2000	.41039	20
item38	5.1500	.36635	20
item39	5.1000	.30779	20
item40	5.0000	.00000	20

Reliability for section IIIC

Reliability Statistics

Cronbach's Alpha	N of Items
.931	10

Item Statistics

	Mean	Std. Deviation	N
item41	5.0500	.22361	20
item42	5.1000	.30779	20
item43	5.0500	.22361	20
item44	5.1000	.30779	20
item45	5.0500	.22361	20
item46	5.1000	.30779	20
item47	5.0500	.22361	20
item48	5.1500	.36635	20
item49	5.0000	.00000	20
item50	5.0000	.00000	20

Reliability for Section IIID**Reliability Statistics**

Cronbach's Alpha	N of Items
.775	10

Item Statistics

	Mean	Std. Deviation	N
item51	5.0000	.00000	20
item52	5.1000	.30779	20
item53	5.1000	.30779	20
item54	5.0000	.00000	20
item55	5.0500	.22361	20
item56	5.0000	.00000	20
item57	5.0000	.00000	20
item58	5.0500	.22361	20
item59	5.0000	.00000	20
item60	5.0000	.00000	20

Reliability for Section IIIE**Reliability Statistics**

Cronbach's Alpha	N of Items
.929	10

Item Statistics

	Mean	Std. Deviation	N
item61	5.1000	.30779	20
item62	5.1500	.36635	20
item63	5.1000	.30779	20
item64	5.1000	.30779	20
item65	5.0000	.00000	20
item66	5.1000	.30779	20
item67	5.0000	.00000	20
item68	5.0500	.22361	20
item69	5.0000	.00000	20
item70	5.1000	.30779	20

Reliability for Section IIIF

Reliability Statistics

Cronbach's Alpha	N of Items
.845	10

Item Statistics

	Mean	Std. Deviation	N
item71	5.1500	.36635	20
item72	5.2000	.41039	20
item73	5.2000	.41039	20
item74	5.0500	.22361	20
item75	5.0500	.22361	20
item76	5.0500	.22361	20
item77	3.4000	1.63514	20
item78	3.2500	1.06992	20
item79	5.1000	.30779	20
item80	3.8500	1.18210	20

Correlations for Section IV

Correlations

		Pretest	Posttest
Pretest	Pearson Correlation	1	.8028
	Sig. (2-tailed)		.006
	N	20	20
Posttest	Pearson Correlation	.8028	1
	Sig. (2-tailed)	.006	
	N	20	20

Correlations for Section V

Correlations

		Pretest	Posttest
Pretest	Pearson Correlation	1	.70102
	Sig. (2-tailed)		.001
	N	20	20
Posttest	Pearson Correlation	.70102	1
	Sig. (2-tailed)	.001	
	N	20	20

Reliability Section VI**Reliability Statistics**

Cronbach's Alpha	N of Items
.500	20

Reliability for Section VII**Reliability Statistics**

Cronbach's Alpha	N of Items
.814	20

Reliability for Section VIII**Reliability Statistics**

Cronbach's Alpha	N of Items
.778	20

APPENDIX H

Data on mean physical productivity of pig farms in Enugu State

S/N	Farms	Pig breed kept	Number of stock	Number of sows	No of Piglets produced		No of Piglets sold		No of Adult pigs sold and slaughtered		No of 50kg bags of manure produced		No of 50kg bags of manure sold	
					YR 1	YR 2	YR 1	YR 2	YR 1	YR 2	YR 1	YR 2	YR 1	YR 2
1	Mustrad seed	Hamp	11	10	189	201	74	53	330	327	57	55	56	50
2	Sopuruchukwu farm	Hamp	13	10	200	190	78	84	292	326	53	56	50	53
3	Udoka farm	Hamp	7	6	88	107	36	59	120	175	38	36	32	35
4	Nwaji farm	Hamp	6	5	90	93	34	43	135	152	35	34	32	30
5	Godô's own farm	Hamp	3	2	38	41	11	15	63	69	15	19	15	16
6	Idu farm	Hamp	5	4	72	82	32	35	120	121	27	30	25	27
7	Charly farm	DJ	13	12	102	96	60	55	156	125	53	46	51	45
8	Chukwudi farm	DJ	14	13	103	99	42	59	140	162	64	68	61	64
9	Chiamaka	DJ	7	6	46	50	22	24	74	72	31	33	30	31
10	Uchenna	DJ	27	25	250	263	89	107	361	468	125	158	122	152
11	Ayara ogu	DJ	30	28	271	261	71	110	405	478	134	162	129	159
12	Emily piggery	DJ	24	22	181	182	85	79	311	251	148	99	145	97
13	Hilson	DJ	14	13	113	95	44	53	151	168	62	79	61	76
14	Onyeze farm	DJ	26	23	169	199	75	90	316	255	122	117	119	113
15	City farm	DJ	8	8	72	60	22	34	98	110	34	53	34	50
16	Nwaeke farm	DJ	12	11	97	107	54	57	155	141	72	67	72	64
17	Okechukwu	LR	7	6	55	32	18	12	90	54	14	9	13	9
18	Francis Chukwu	LR	12	11	86	112	48	40	150	158	44	49	39	44
19	Chime and Co	LR	33	30	260	265	110	158	400	382	178	184	168	183
20	Onah and Co	LR	22	20	224	166	80	97	300	303	113	116	110	114
21	First farm	LR	6	6	33	51	12	16	48	92	13	24	12	19
22	Gofra farm	LR	11	10	104	86	42	54	148	136	49	45	46	39
23	Peace farm	LR	17	15	112	106	46	80	119	190	28	58	25	54
24	Okechukwu farm	LR	25	22	200	218	75	81	345	337	101	118	99	117
25	Chukwuemeka	LR	22	20	196	254	98	85	422	295	89	117	85	111
26	Enechi farm	LR	9	8	60	52	18	18	110	78	31	22	29	19
27	Tony farm	LR	4	3	22	20	7	4	35	38	19	20	19	18
28	Hypo-Belly	LR	25	22	204	192	58	60	360	314	92	85	86	82
29	Nwangwu farm	WAD	20	18	88	92	55	46	143	116	36	26	34	25
30	Barth piggery	WAD	5	4	16	24	3	6	45	26	11	6	9	5
31	Igwebuike piggery	WAD	10	8	50	30	22	24	58	56	21	21	19	17
32	Ngene piggery	WAD	11	10	56	69	27	33	83	107	37	49	29	46
33	Abugwu farm	WAD	6	5	28	22	9	10	46	35	14	12	13	11
34	Eze farm	WAD	11	9	47	43	15	24	57	84	15	22	13	19
35	Alloy farm	LW	11	9	85	86	9	33	144	174	23	18	20	18
36	Charly piggery	LW	10	9	223	110	68	82	290	224	90	83	85	79
37	Nwaobodo	LW	14	13	200	216	125	122	239	346	111	151	107	150
38	Nze farm	LW	7	6	142	95	62	57	184	171	52	57	51	55
38	Edems farm	LW	12	11	150	290	155	133	296	296	133	114	127	113
40	Eziokwu bu ndu	LW	8	7	173	104	62	102	204	185	120	137	118	133
41	Marist Brothers	LW	22	20	300	370	85	148	575	532	142	169	133	146
42	Obinwanne	LW	2	2	20	18	2	4	38	32	13	14	12	12
43	Akaama farm	LW	8	6	65	73	28	18	116	114	33	30	33	30
44	Chukwuasokam	LW	73	61	1099	1067	422	361	2384	1774	282	262	271	243
45	C. E. Ogwomba	LW	20	18	286	326	184	98	554	388	223	150	220	142
46	Ngozika Assoc.	LW	20	16	309	291	158	124	434	484	145	165	141	145
47	Ekperochi	LW	4	3	42	30	10	12	53	69	11	16	11	14
48	God is Great	LW	3	3	27	39	14	16	40	62	21	23	20	21
49	Agbedo farm	LW	4	3	35	31	16	11	62	43	22	16	22	14
50	Sopuruchukwu	LW	20	16	280	320	124	158	484	434	165	145	145	141
51	Ike farm	LW	9	7	78	73	18	20	150	113	34	27	32	24
52	Kris farm	LW	12	11	215	110	78	107	186	278	78	106	76	100
53	Mike Agro	LW	11	10	99	206	52	35	308	215	108	69	105	64
54	Royal pig	LW	18	16	311	297	118	94	490	514	130	123	125	115
55	Vital farm	LW	48	44	824	936	501	494	1215	1310	359	366	355	362
	Total		812	716	8885	9048	3863	4016	14632	13959	4270	4336	4091	4115
	Mean		14.8	13.02	161.55	164.51	70.25	73.02	266.04	253.8	77.64	78.84	74.38	74.82

Hamp = Hampshire; DJ = Duroc Jersey; LR = Land Race;
WAD = West African Dwarf Pigs; LW = Large White

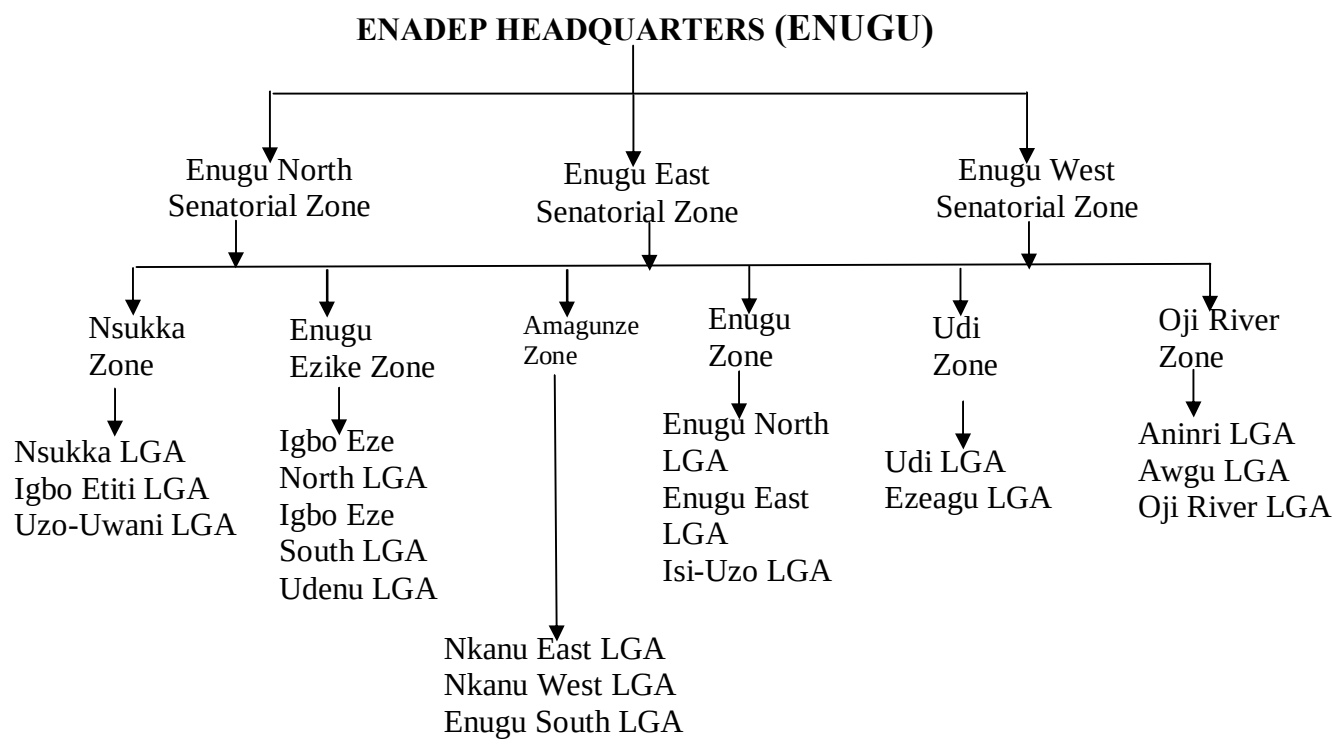
APPENDIX I
Data on profit margins obtained by pig farms in
Enugu State for a period of 2 years

	Total Fixed Cost		Total Variable Cost		Total Cost		Total Revenue		Profit Margin	
Farm	Year1	Year2	Year1	Year2	Year1	Year2	Year1	Year2	Year1	Year2
Mustard Seed	266681.7	221410	499816.7	997358.3	766498.3	1218768	3482442	6465067	2715943	5246298
Sopuruchukwu Farm	272670	282711.4	567631.4	1133513	840301.4	1416224	3957670	7347709	3117369	5931484
Udoka Farm	139086.7	148833.3	294720	588240	433806.7	737073.3	2053840	3812960	1620033	3075887
Nwaji Farm	171285.8	195303.3	372839.2	745028.3	544125	940331.7	2602324	4831809	2058199	3891478
God's Own Farm	123250	133050	262675	524575	385925	657625	1830800	3398925	1444875	2741300
Idu Farm	230593.3	263565	505433.3	1009392	736026.7	1272957	3523808	6542183	2787782	5269227
Charly Farm	140320	146716.7	292511.7	584448.3	432831.7	731165	2040957	3789402	1608125	3058237
Chukwudi Farm	157885	167066.7	332326.7	663028.3	490211.7	830095	2315662	4298997	1825450	3468902
Chiamaka	108562.5	114390	226952.5	453405	335515	567795	1583668	2940383	1248153	2372588
Uchenna	325708.3	356186.7	694295	1385990	1020003	1742177	4842465	8990635	3822462	7248458
Ayara Ogu	370340	393164.3	777604.3	1552309	1147944	1945473	5423330	10069056	4275386	8123583
Emily Piggery	270584.2	294600	572359.2	1143143	842943.3	1437743	3996189	7420019	3153246	5982276
Hilson	164233.3	173060	347693.3	693386.7	511926.7	866446.7	2419453	4491213	1907527	3624767
Onyeze Farm	294693.3	321464.3	624807.6	1247965	919501	1569430	4361703	8098599	3442202	6529170
City Farm	153860.5	166710.8	325446.2	650217.5	479306.7	816928.3	2271899	4218351	1792592	3401423
Nwaeke Farm	151996.5	159393.3	317539.8	633829.6	469536.3	793222.9	2214129	4110717	1744592	3317495
Okechukwu	105466.7	114373.6	227965.2	454805.5	333431.9	569179	1585382	2942798	1251950	2373619
Francis Chukwu	152970	163832.9	321477.9	641780.7	474447.9	805613.6	2243320	4165162	1768872	3359549
Chime and Co.	368255	392405.7	773960.7	1545121	1142216	1937527	5398825	10023689	4256609	8086162
Onah and Co.	317320	334627.6	660172.6	1319120	977492.6	1653748	4610533	8560894	3633041	6907146
First Farm	144858.3	134795.7	287704	574358.1	432562.4	709153.8	2003778	3719853	1571216	3010699
Gofra Farm	143081.7	149240	297671.7	594193.3	440753.3	743433.3	2076052	3854432	1635298	3110998
Peace Farm	213650	228986.7	450261.7	899898.3	663911.7	1128885	3142957	5835652	2479045	4706767
Okechukwu Farm	274210	288446.7	573285.8	1146093	847495.8	1434539	4001413	7429541	3153918	5995002
Chukwuemeka	339145.8	352388.3	704634.2	1407368	1043780	1759757	4915539	9126444	3871759	7366688
Enechi Farm	100310.8	114046.7	219120	437677.5	319430.8	551724.2	1527953	2836785	1208522	2285061
Tony Farm	30261.67	41945.71	76232.38	151939.8	106494	193885.5	528551.7	980871	422057.6	786985.5
Hypo-Belly	280654.2	290110	581489.2	1160653	862143.3	1450763	4055049	7528609	3192906	6077846

Nwangwu Farm	140301.7	151058.1	296659.8	592219.5	436961.4	743277.6	2069118	3841577	1632157	3098299
Barth Piggery	93353.33	101760	200263.3	399576.7	293616.7	501336.7	1394793	2589323	1101177	2087987
Igwebuike Piggery	139613.3	148136.7	295525	590275	435138.3	738411.7	2059350	3823175	1624212	3084763
Ngene Piggery	199120	211760	420730	838610	619850	1050370	2929560	5438390	2309710	4388020
Abugwu Farm	60666.67	72958.33	138150	275975	198816.7	348933.3	961875	1785600	763058.3	1436667
Eze Farm	108663.3	114593.3	228681.7	456838.3	337345	571431.7	1594297	2959912	1256952	2388480
Alloy Farm	162085	190633.3	355618.3	710786.7	517703.3	901420	2485528	4615438	1967825	3714018
Charly Piggery	313146.7	337686.7	659333.3	1317167	972480	1654853	4603833	8548333	3631353	6893480
Nwaobodo	319400	360348.6	690536.1	1378685	1009936	1739033	4818190	8945844	3808254	7206811
Nze Farm	180516.7	196570	383111.7	765098.3	563628.3	961668.3	2673507	4963902	2109878	4002233
Edems Farm	328133.3	330251.2	672859.5	1344544	1000993	1674795	4693192	8713524	3692199	7038729
Eziokwu bu ndu	289262.4	304141.5	599795.6	1198800	889058	1502941	4190594	7781393	3301536	6278452
Marist Brothers	400550.3	425488.3	845213.6	1689452	1245764	2114941	5895370	10945527	4649606	8830586
Obinwanne	24481.67	31831.67	59388.33	118501.7	83870	150333.3	412093.3	764798.3	328223.3	614465
Akaama Farm	150543.8	157623.3	312792.1	625159.3	463336	782782.6	2184070	4055348	1720734	3272565
Chukwuasokam	1028099	1083273	2154653	4306276	3182752	5389549	15033230	27911807	11850477	22522258
C E Ogwomba	301162.8	300043.3	612811.2	1224517	913974	1524561	4275863	7938915	3361889	6414355
Ngozika Assoc.	300883.3	308409	622742.4	1244635	923625.7	1553044	4344047	8065351	3420421	6512307
Ekperechi	23492.13	31024.17	58524.63	116540.9	82016.76	147565.1	404647.4	750770.2	322630.6	603205.1
God is Great	21008.33	33811.25	58219.58	115839.2	79227.92	149650.4	402937.1	747654.6	323709.2	598004.2
Agbedo Farm	52581.67	68250	126019.2	251400.8	178600.8	319650.8	875671.7	1625324	697070.8	1305673
Sopuruchukwu	278541.7	302565.2	592326.9	1183934	870868.6	1486499	4133628	7674930	3262760	6188431
Ike Farm	126082.2	130476.7	260358.9	520067.7	386441.1	650544.4	1817412	3374465	1430971	2723921
Kris farm	275510	302993.6	585728.6	1170532	861238.6	1473526	4091025	7596321	3229786	6122796
Mike Agro	266998.3	293920	570393.3	1138312	837391.7	1432232	3978328	7386263	3140937	5954032
Royal Pigs	301545	309736.4	629381.4	1257813	930926.4	1567549	4385670	8141958	3454743	6574409
Vital Farm	393745	411423.3	830318.3	1656487	1224063	2067910	5778778	10727238	4554715	8659328

APPENDIX J

STRUCTURE OF ENUGU STATE AGRICULTURAL DEVELOPMENT PROGRAMME (ENADEP)



Source: Enugu State Agricultural Development Programme (ENADEP), Enugu, 2011.